Project Report

Dillon Beach Village 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

QUESTA ENGINEERING CORP.

October 2022

Project Report

Dillon Beach Village 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. 2000170

October 2022

Norman N. Hantzsche, P.E.
Principal/Managing Engineer

Funding for this project has been provided in full or in part through an agreement with the California Department of Water Resources. The contents of this document do not necessarily reflect the views and policies of the Department of Water Resources, nor does mention of trade names or commercial products constitute endorsement or recommendation for use.

TABLE OF CONTENTS

APPENDICES

LIST OF FIGURES

LIST OF TABLES

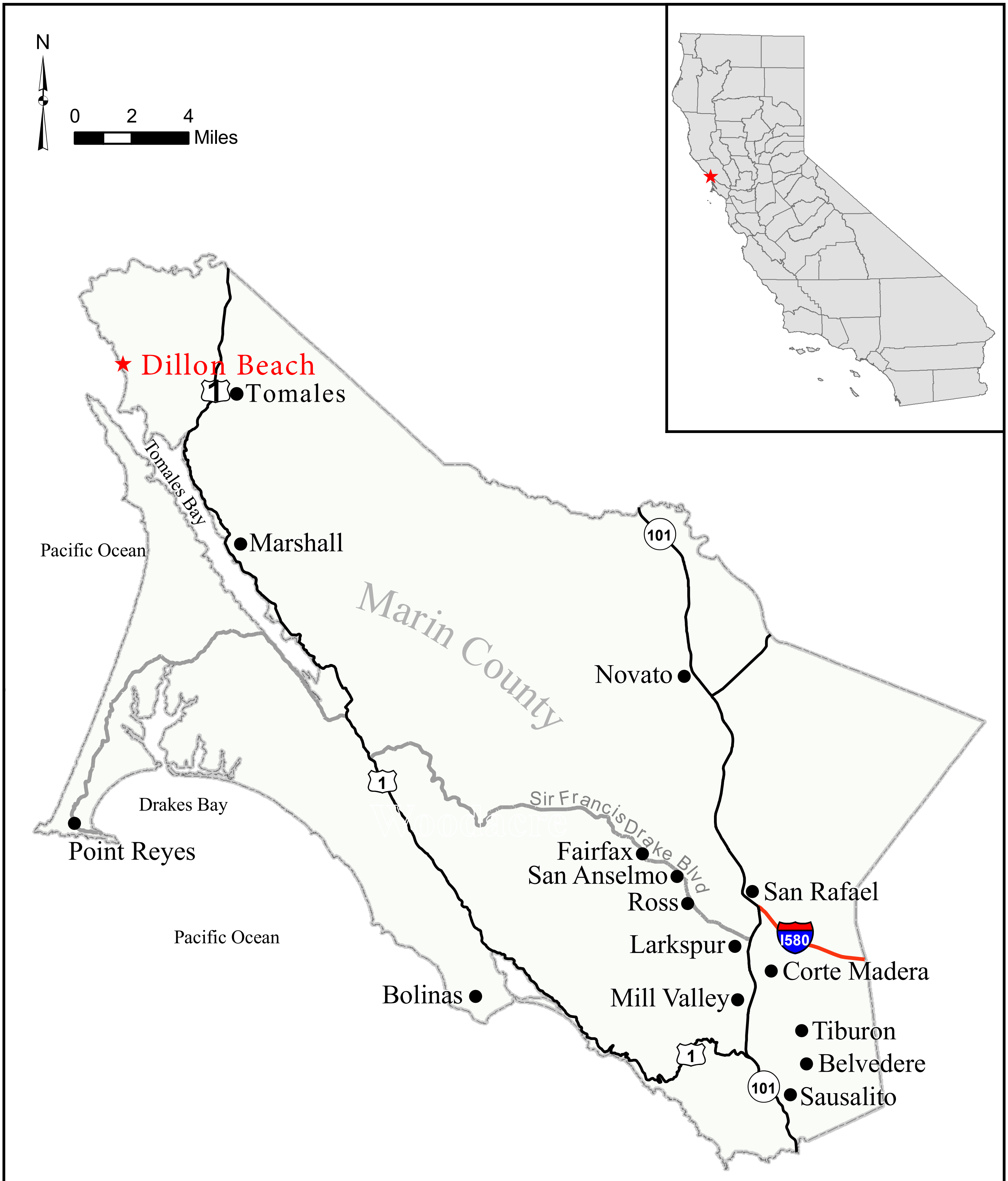
SECTION 1: INTRODUCTION

This report presents the results of a feasibility study regarding community wastewater improvements for the Dillon Beach area located in western Marin County (**Figure 1-1**).

In 2018, Marin County Community Development Agency (CDA) initiated a community engagement project in Dillon Beach Village to discuss various water resource issues of local concern, including water supply, onsite wastewater treatment, sea level rise, drainage, flooding, and water quality among others. A series of three community meetings were held in November 2018, January 2019, and April 2019 for staff presentations, group discussions and survey of community views on various water-related topics. Through the engagement process the attendees voiced the greatest level of concern regarding the town's aging septic systems relied on for handling domestic wastewater, and strongly supported conducting a feasibility study to identify and evaluate community wastewater alternatives. The CDA pursued and was successful in receiving grant funds from the Association of Bay Area Governments in summer 2021 to support a wastewater feasibility study for Dillon Beach Village. County of Marin contracted with Questa Engineering Corporation in October 2021 to conduct the study, which is presented in this report.

The particular geographical focus of the study ("Study Area") encompasses the Dillon Beach Village and neighboring areas on Oceana Dr and Bay Dr/Cliff Street Extension, which are all served by onsite septic systems. The Study Area encompasses approximately 150 parcels, primarily single family residences located on very small lots, with a small number of commercial uses. Properties in the Village are dependent on individual onsite septic systems for sewage disposal, many pre-dating modern codes and practices. Bordering Dillon Beach Village on the north is the Oceana Marin development, which is served by a community wastewater system. There are twelve residences within the Village area on Ocean View Dr. that have previously been annexed and connected to the neighboring Oceana Marin Wastewater System. The Oceana Marin wastewater system is included in the study as a potential community sewerage alternative for Dillon Beach Village. The purpose of the study was to identify, evaluate and compare various alternatives for improving wastewater treatment and disposal in the community, including options ranging from onsite septic system upgrades to community sewerage facilities.

In terms of the organization of this report, following the Introduction and Executive Summary, background information on the general study area conditions, existing wastewater practices and concerns are covered in **Sections 3** and **4**. **Section 5** presents wastewater flow estimates corresponding to the various project alternatives identified for evaluation. The project alternatives for wastewater collection, treatment and disposal facilities are presented and described in **Section 6**, including facility requirements and estimated costs for construction and ongoing operation and maintenance. This is followed by a comparative analysis and review of the alternatives in **Section 7,** including identification of the "apparent best alternative(s)". **Section 8** addresses management requirements and options for implementation of the various alternatives. A**ppendices** include supporting reference data, results of homeowner questionnaire survey, cumulative water balance-nitrate loading analysis, onsite wastewater technology literature, review of wastewater collection system technologies, supporting cost information, and existing Waste Discharge Requirements (permit) for Oceana Marin Wastewater System.



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

Dillon Beach Village
Wastewater Feasibility Study
Dillon Beach, CA

Figure 1-1
Location Map

SECTION 2: EXECUTIVE SUMMARY

In October 2021 the County of Marin contracted with Questa Engineering Corporation to conduct a wastewater feasibility study for the Dillon Beach Village area. This followed a community outreach and engagement process organized by Marin County Community Development Agency (CDA), in which participating residents identified aging septic systems and domestic wastewater management as an issue of significant local concern. The Village encompasses approximately 150 parcels, primarily single family residences with a small number of commercial occupancies. Properties in the Village are dependent on individual onsite septic systems for sewage disposal, many pre-dating modern codes and practices. The purpose of the feasibility study was to identify, evaluate and compare various alternatives for improving wastewater treatment and disposal in the community, including options ranging from onsite septic system upgrades to community sewerage facilities.

STUDY AREA CHARACTERISTICS

Dillon Beach is located in northwest Marin County adjacent to Bodega Bay, approximately four miles west of Highway 1 and the town of Tomales. The community is comprised of a Village core with small-scale commercial uses and a neighborhood of tightly clustered beach cottages and homes. The Village is bordered on the east and north by the Oceana Marin development, which consists of about 225 larger, modern homes served by a community wastewater treatment system. Lawson’s Landing campground and expansive dune lands lie to the south.

For the purposes of this study, the Dillon Beach Village Study Area encompasses the following properties, all of which are served by onsite wastewater treatment systems (OWTS): (a) Village area which includes 127 residences and several commercial properties; (b) Bay Road-Cliff Street Extension which includes a separate cluster of 16 houses located south of Dillon Creek; and (c) Oceana Drive which includes a group of six (6) larger lot, residential properties within the Oceana Marin development.

Watershed. Dillon Beach Village lies at the base of the Dillon Creek watershed, which encompasses an area of approximately 430 acres, including: (a) grazing lands; (b) a portion of the developed Village area; and (c) a small area of undeveloped, well-vegetated sand dunes on the south side of the creek. There is a freshwater aquifer at the mouth of Dillon Creek formed from an accumulation of beach sands and alluvial stream deposits, overlain and bounded by aeolian (dune) sands. This aquifer is estimated to have a storage capacity of approximately 10 million gallons.

Water Supply. The community water supply is provided by the Coast Springs Water System (owned and operated by California Water Services Company). The system includes a series of bedrock wells and springs located in the northeastern portion of the Dillon Creek watershed and a shallow well (Well No. 4”) that draws from alluvial deposits adjacent to Dillon Creek. Well No. 4 has historically provided the majority of the water supply for the Coast Springs Water System. Coast Springs is required to treat all raw water to meet with surface water treatment standards.

Geology, Soils and Groundwater. Regional geologic maps indicate the Dillon Beach Village area is underlain by Pleistocene-aged marine terrace deposits (dune sands) with sandstone of the Franciscan Complex mapped in the surrounding areas to the north and east, and beach sand and a large expanse of dune deposits to the west and south. According to the Soil Survey of Marin County, the soils in the Dillon Beach Village region, including properties along Oceana

Drive, are very deep, sands of the Sirdrak Series. Sand and loamy sand are the most common soil textures in the top 4 to 5 feet, while sands predominate below that level. Several dozen soil borings completed in conjunction with septic system upgrade projects confirm unsaturated sandy soil depths ranging from about 10 to 30 feet throughout the Village area, with groundwater generally observed near the contact with underlying clay and sandstone bedrock. Groundwater depths and flow directions determined from numerous soil borings indicate a little over half of the Village area (east side) drains toward Dillon Creek and the alluvial aquifer, and the remainder drains westerly and northwesterly toward the beach and ocean.

Water Quality. Water quality issues of primary interest and concern in Dillon Beach are those affecting recreational activities, drinking water supplies and public health in general. This includes: (a) ocean water; (b) Dillon Creek; and (c) Dillon Creek groundwater basin.

Routine bacteriological testing of ocean waters at Dillon Beach conducted by Marin County EHS over the past 20 years shows a consistent record of compliance with State standards.

The outflow from Dillon Creek creates surface water flow across the beach during normal winter rainfall conditions. With declining outflow during spring and summer, the stream is reduced to a semi-stagnant “pond” or pooling area just west of the box culvert on Cliff Street. Limited (once or twice a year) spot sampling of the “pond” in the past few years has shown high bacteriological readings (total coliform and fecal indicator bacteria), in excess of water contact recreation standards. The source appears most likely (although not confirmed) to be related to dogs and other animal activity.

Groundwater quality in the Dillon Creek alluvial aquifer is monitored regularly at Coast Springs Well No. 4 and occasionally at a second well (“Cline”/Dillon Beach well). The sampling data indicate conformance with primary drinking water quality standards, i.e., constituents that can have health effects. Although not found in excess of the drinking water maximum contaminant level, the one principal groundwater quality constituent of potential concern is nitrate. Monitoring data for Well No. 4 shows seasonal fluctuations in nitrate concentrations, commonly reaching elevated levels significantly above background during the dry season. This is indicative of influence from land use activities in the Dillon Creek watershed, the likely sources being septic systems in the adjacent Village area and possibly animal grazing in the upper watershed area.

EXISTING ONSITE WASTEWATER PRACTICES

Dillon Beach Village was developed in the early 1900s, long before there were any codes or regulations pertaining to onsite sewage disposal systems. Cesspools and seepage pits formed by redwood boxes were a common practice. Given the state of knowledge regarding sewage treatment and disposal at the time, the presence of deep well drained sandy soils, and the limited seasonal occupancy the homes, redwood cesspools and seepage boxes served their purpose adequately for many years.

Since the 1950s, new construction, as well as replacement of many of the original cesspools and seepage boxes, has included more modern septic tanks and separate drainfields of some type. An unknown number of redwood cesspools are believed to still exist, as they are discovered from time-to-time in connection with septic system and building improvements documented in County files.

Parcel information on file with Marin County Environmental Health Services (EHS) indicates about 60 to 70 septic system upgrades have been completed in Dillon Beach Village over the past 35 to 40 years, most of them for replacement of cesspools and other older, non-conforming installations. The replacement systems commonly include new 1,200-gallon septic tanks, documentation of soils and groundwater depth, and gravity or pump-up leachfields, in accordance with requirements for Class II Repairs under the EHS "Residential Improvement Policy for Septic Systems". Nearly all OWTS upgrades include waivers or variances to standard setback distances, e.g., from property lines, buildings, utilities, driveways, etc. Based on review of EHS files, the current status of OWTS in Dillon Beach Village can be categorized approximately as follows:

- Class I and II (new and repair permits): 45%
- Class III (permitted under former code, prior to 1984): 10%
- Class IV (undocumented, no permit records on file): 45%

SUITABILITY, SITING CONSTRAINTS AND WATER QUALITY IMPACTS

Soils and Groundwater. Deep well drained sand and loamy sand soils underlie nearly the full extent of Dillon Beach Village area, providing generally 10 to 20 feet or more of unsaturated soil depth for absorption and dispersal of septic tank effluent. Percolation rates are fast, which is helpful for drainfield operation, but limiting from the standpoint of filtering and removing contaminants contained in percolating effluent.

Proximity to Water Courses and Wells. All septic systems meet the standard minimum 100-foot lateral setback requirement from Dillon Creek and 150-foot setback from the Coast Springs public water supply well (No. 4) located on the south side of the Village. However, there is a potential question as to whether or not a 400-foot setback to Dillon Creek may be required under the 2012 State Water Board OWTS Policy. This is because Dillon Creek is the main source of recharge for Well No. 4, which is classified as "under the direct influence of surface water" and consequently could be considered a "surface water intake" for purposes of applying setback requirements.

Site Limitations and Setbacks. A major constraint for OWTS is the extremely limited space on individual parcels (averaging less than 2,500 ft^2 in size) to accommodate code-compliant septic tanks and disposal fields. This results in encroachment within standard setback distances from buildings, property lines, paved areas and utilities on nearly every site.

Cumulative Impacts on Groundwater. Separate from standard siting and design criteria, another consideration is the cumulative effect of the large number of septic systems in a relatively small area. This is an issue especially on the eastern side of the Village, where septic system discharges contribute to the local recharge of groundwater affecting the Coast Springs water supply wells and alluvial aquifer of Dillon Creek. Water sampling data, along with nitrate loading calculations, indicate the high density of septic systems combined with the rapidly permeable sandy soils results in elevated concentrations of nitrate in the groundwater adjacent to Dillon Creek. Although monitoring data shows that drinking water nitrate limits have not yet been exceeded at the wells, future increases in occupancy and wastewater generation in the Village could pose a threat to the community drinking water supply.

HOMEOWNER QUESTIONNAIRE SURVEY

An anonymous and voluntary homeowner questionnaire survey was conducted in spring of 2022 to solicit community knowledge, concerns and opinions on existing wastewater practices in Dillon Beach Village and potential long-term management options. Survey forms were distributed by mail to approximately 160 property owners, with completed forms returned from about one-third of the community (52 responses). The following highlight some of the key information from the survey.

- **OWTS Status.** Of those completing the survey about 80% were owners of properties having a relatively "modern" septic system including a septic tank and leachfield, indicating the responses were mostly from those having documented Class II or Class III systems.

- **Septic Tank Pumping**. Reported septic tank maintenance pumping frequency was fairly typical, with the majority indicating pump-outs every 2 to 10 years, a few indicating annual or greater frequency, and a few indicating "never".

- **Graywater**. There is currently very little diversion of graywater (laundry, showers, hand sinks) for irrigation or separate dispersal; about 40% of respondents indicated an interest in pursuing this option.

- **OWTS Operational Concerns**. A very high percentage of respondents (85% to 90%) indicated low level of concern about the functioning, code compliance or impacts of their OWTS.

- **Water Quality Impact Concerns**. Regarding septic system impacts on local surface water and groundwater quality, about half of the respondents indicated a low level of concern, one-third a moderate level of concern, and about 10% to 20% a moderately-high to high level of concern. The indicated level of concern about other water quality factors in the Dillon Creek watershed (agriculture and street runoff) and other septic systems in general was similar.

- **Wastewater Management Approach**. Preferences among the various wastewater management approaches is summarized below, showing the percentage of respondents indicating a particular approach as their highest level of interest:

  - No preference indicated: 35%
  - Status Quo: 13%
  - OWTS Upgrade & Management 6%
  - Community Sewerage 21%
  - Hybrid – Combination of Above 25%

- **Comments.** Other comments added at the end of the questionnaire included more specific information regarding OWTS components (e.g., tank/leach field size), emphasis on how well their system has operated for many years, caution against trying to fix what isn't broken, concerns about impacts from rentals and commercial properties, uncertainties about the functioning of the Oceana Marin wastewater system, cost impacts to homeowners, and appreciation for the survey and overall effort to study OWTS issues.

PROJECT ALTERNATIVES

Based on review of existing wastewater practices, environmental conditions, and potential opportunities and means for community sewerage, the following community wastewater alternatives for Dillon Beach Village were formulated and evaluated in this study.

Alternative 1 - No project: The "No Project" alternative would maintain the status quo, where individual property owners would remain responsible for ongoing maintenance, repair, upgrading and replacement of existing OWTS in accordance with current practices and Marin County onsite sewage disposal regulations and policies. There would be no set schedule for upgrading any existing septic systems, and no mandatory inspection or maintenance work.

Alternative 2 – OWTS Upgrades and Management Program: This alternative would provide for systematic evaluation and as needed upgrade of onsite systems to be done in conjunction with the formation of an OWTS maintenance/management "zone" or district. The program would be operated under the authority of a wastewater maintenance district, County Service Area or similar public entity covering the boundaries of the selected service area. Financing of individual septic system improvements would be accomplished with grant assistance to bring all currently developed properties into conformance with minimum acceptable "repair" standards. Two options were identified under this alternative, which differ according to the target level of OWTS upgrade and treatment requirements to be achieved as follows:

- **Alternative 2a**: The objective of this alternative would be to evaluate and upgrade all OWTS to meet Marin County Class II septic system repair criteria in a manner generally consistent with the repair and replacement practices that have been followed over the past 25 to 30 years.

- **Alternative 2b:** This alternative would follow the same approach as **Alternative 2a**, but with the additional step of designating the east side of the Village as an advanced water quality protection management sub-area, due to its close proximity and recharge contribution to the Dillon Creek water supply aquifer. It would include requirements for supplemental treatment for nitrogen removal to be incorporated for existing and replacement OWTS in the designated management area.

Alternative 3 – Community Sewerage Connection to Oceana Marin: This alternative provides for the installation of sanitary sewers and connection to the neighboring Oceana Marin Wastewater System, which is operated by North Marin Water District (NMWD). Based on a review of alternative wastewater collection methods, it was determined that conventional gravity sewers would be the preferred and least cost option. Two variations of this alternative were defined and evaluated:

- **Alternative 3a** would extend sewer service to all developed residential and commercial properties in the Study Area, including the Village, Bay Dr/Cliff St Extension, and properties using OWTS on Oceana Dr.

- **Alternative 3b** would extend sewer service to the Village area only, including all residential and commercial properties with the exception of the RV Park, which is in the process of implementing an advanced OWTS. Areas not included in the sewer service area would remain under the status quo.

In **Alternatives 3a** and **3b**, the collection system would consist of conventional gravity sewers leading to a central sanitary lift station, tentatively proposed to be located adjacent to the beach restroom at the foot of Beach Avenue. A 4" diameter sewer force main would convey the sewage back uphill through the Village for connection to the existing Oceana Marin sewer system at the manhole located near the intersection of Oceana Dr and North Street. From there, the sewage would combine with all other sewage flows in the Oceana Marin system, to be pumped uphill to the two wastewater treatment ponds on the hilltop area above the Oceana Marin development. Through the payment of connection fees these alternatives would provide funding to implement high and medium priority capital improvements to the Oceana Marin Wastewater System for improved reliability and redundancy of the main lift station, force main, and wastewater ponds. Expansion of existing Oceana Marin leachfield capacity is also included as a required element of these alternatives.

Alternative 4 – Hydrid - Village Sewerage and OWTS Upgrades/Management: This alternative consists of a combination of Alternatives 1, 2a and 3b. It would: (a) prioritize the east side of the Village (plus the beach restroom) for community sewerage and connection to the Oceana Marin Wastewater System; (b) establish an OWTS upgrade and management program for the west side of the Village; and (c) leave Bay Dr, Cliff St Extension, and Oceana Drive areas under the status quo. It would also include connection fees for implementation of recommended capital improvements to the Oceana Marin system, along with leachfield capacity expansion as indicated for **Alternatives 3a** and **3b**.

Table 2-1 summarizes how the each of the different neighborhoods in the Study Area would be addressed under each alternative.

Table 2-1. Summary of Project Alternatives

Alternative	Service Sub-Areas			
	Village		Bay Dr & Cliff St Ext.	Oceana Dr
	East	West		
Alternative 1: No Project	Status Quo	Status Quo	Status Quo	Status Quo
Alternative 2a: OWTS Mgt	OWTS Mgt	OWTS Mgt	OWTS Mgt	OWTS Mgt
Alternative 2b: OWTS Mgt w/N Mitigation	OWTS Mgt w/N Mitigation	OWTS Mgt	OWTS Mgt	OWTS Mgt w/N Mitigation
Alternative 3a Full Sewerage	Sewerage	Sewerage	Sewerage	Sewerage
Alternative 3b: Village Sewerage	Sewerage	Sewerage	Status Quo	Status Quo
Alternative 4: Hybrid: Village-East Sewerage Village-West OWTS Mgt	Sewerage	OWTS Mgt	Status Quo	Status Quo

ESTIMATED WASTEWATER FLOWS

Estimated wastewater flows were developed for the community sewerage alternatives (**3a**, **3b** and **4**) to evaluate capacity and potential impacts on the Oceana Marin wastewater collection, transmission, treatment and disposal facilities. Factors considered in estimating flows for the Dillon Beach Village area included the following:

- **Existing Oceana Marin wastewater system flows and projections**. The 2015 Master Plan Update report the Oceana Marin Wastewater System by Nute Engineering projected an average dry weather unit flow 70 gpd per residence for future build-out of the existing Oceana Marin service area, or 21,000 gpd for 300 projected connections.

- **Infiltration and Inflow**. Due to the deep well drained sands and lack of shallow groundwater, infiltration and inflow of extraneous water into a gravity sewer system in the Village area can be considered negligible.

- **Historical water use information for Dillon Beach Village residences**. Water use data for Dillon Beach Village properties for the 5-year period (2016-2020) indicates average residential water usage of less than 40 gpd during the winter season, increasing to 45 to 55 gpd/residence during the peak summer season.

- **Design flows and historical water use for commercial facilities**. Water use data for 2016-2020 for commercial wastewater facilities (Dillon Beach Resort) were reviewed to develop preliminary estimates of average dry weather flows for the Store-deli-café, RV Park, rental cabins and Beach Restrooms.

- **Marshall Community Wastewater System**. Recent wastewater flow data for the Marshall Community Wastewater System (~ 60 connections) were reviewed to provide a nearby point of comparison; data indicate and average dry weather and wet flows of 94 gpd and 87 gpd, respectively.

Using the above information, **Table 2-2** presents the estimated wastewater flows for the different levels of community sewerage under **Alternatives 3a**, **3b** and **4**.

Table 2-2. Wastewater Flow Estimates – Community Sewerage (gallons per day, average dry weather flow)

Wastewater Source	Unit Flow[1] (gpd)	Alternative 3a Entire Study Area		Alternative 3b Village Only		Alternative 4 Hybrid – East Village	
		No. of Units	Total Flow to Sewers	No. of Units	Total Flow to Sewers	No. of Units	Total Flow to Sewers
Village Residential – East	75	71	5,325	71	5,325	71	5,325
Village Residential – West	75	56	4,200	56	4,200	56	0
Bay Rd-Cliff St Extension	75	16	1,200	16	0	16	0
Oceana Dr	75	6	450	6	0	6	0
Commercial							
Beach Restroom (per use)	2	500	1,000	500	1,000	500	1,000
Rental Cottages	50	3	150	3	150	3	150
RV Park	50	25	1,250	25	0	25	0
Store-Deli-Café (all uses)	650	1	650	1	650	1	650
Post Office (all uses)	25	1	25	1	25		25
Total Estimated Flow, gpd			**14,250**		**11,350**		**7,150**

1 Per dwelling, except as noted.

The total combined wastewater flows for the Oceana Marin Wastewater System at build-out under **Alternatives 3a**, **3b** and **4** would be:

- **Alternative 3a**: Oceana Marin at 21,000 gpd + 14,250 gpd = 35,250 gpd
- **Alternative 3b**: Oceana Marin at 21,000 gpd + 11,350 gpd = 32,350 gpd
- **Alternative 4**: Oceana Marin at 21,000 gpd + 7,150 gpd = 28,150 gpd

COST ESTIMATES

Estimated capital cost and annual operation and maintenance (O&M) cost for the various wastewater project alternatives are summarized in **Table 2-3.** Total project costs are not estimated for the No Project Alternative; however, the costs for an individual property requiring OWTS upgrade can be approximated by the costs indicated for **Alternatives 2a** and **2b**.

- **Capital Costs.** Capital costs include estimates for construction, 15% contingency allowance, and 30% allowance for planning, engineering, permitting and project administration. Costs for OWTS upgrades were based on a range of costs for each category of OWTS (Class I through IV) combined with the estimated number of systems in each category. Costs for community sewerage were based on preliminary layout of sewers, pump stations and other facilities, and engineering estimates of unit costs for each item; they also include current Oceana Marin connection fees of $30,000 per residence, which would be available for necessary capital improvements to wastewater system. The average cost per residential parcel or "ESD" (which stands for "equivalent single-family dwelling") is calculated and shown for each alternative. The cost for commercial connections would be a multiple number of ESDs based on wastewater flow comparison with that from a single family residence.

- **Operation and Maintenance.** Estimated costs for OWTS upgrades and management were estimated based on equivalence to the typical annual costs incurred by properties in Marin County for OWTS under an EHS-issued operating permit. This includes an annual administrative fee, system inspection/servicing, and septic tank pump-outs. For community sewerage alternatives, estimated annual cost of $1,296 was based on the existing annual NMWD sewer fee for properties connected to the Oceana Marin Wastewater System. This cost is subject to adjustment by NMWD from year-top-year, and a detailed fee study would be conducted to determine whether or not sewer extension to serve Dillon Beach Village would result in an increase or decrease in annual fees.

COMPARATIVE ANALYSIS OF ALTERNATIVES

A comparative analysis was made of the various alternatives for the Dillon Beach Village study area considering such factors as regulatory compliance, environmental impacts, reliability, energy demand, land use, and costs. Some of the factors are represented by objective data (e.g., cost), while others required exercise of professional judgment by the consultant team based on more subjective information.

The results are displayed in **Table 2-3**, showing **Alternative 3b** to have the highest ranking, with **Alternative 3a** the next highest. These would be considered the "apparent best" alternatives; they both include community sewerage for a majority of the Village area. This ranking is for informational purposes and does not represent the selection of a project.

Table 2-3. Summary of Estimated Project Costs

Project Alternative	Capital Costs ($)		Annual O&M Costs ($)
	Total Cost	**Ave Cost Per Parcel – ESD***	**Per Parcel – ESD***
1 - No Project	N/A	$0 - $60,000+	$200 - $1,000+
2a - OWTS Upgrades & Management Program	$ 5,882,650	$ 33,615	$900
2b - OWTS Upgrades & Management Program w/Nitrogen Removal	$ 7,742,275	$ 44,241	$900 - $1,200
3a - Community Sewerage to Oceana Marin, Entire Study Area	$ 10,337,425	$ 54,407	$1,296
3b - Community Sewerage to Oceana Marin, Village Area	$ 7,813,000	$ 51,401	$1,296
4 - Hybrid – Partial Village Sewerage, Partial OWTS Management Program	$ 7,178,775	$ 46,315	$900 - $1,296

* ESD = equivalent single family dwelling

Table 2-4. Ranking of Project Alternatives

Comparison Factor	Alternative 1	Alternative 2 OWTS Upgrade and Management Program		Alternative 3 Community Sewerage to Oceana Marin		Alternative 4
	No Project Status Quo	2a Class II Repairs	2b w/ Nitrogen Removal Systems	3a Entire Study Area	3b Village Area Only	-- Hybrid-- East Village Sewer; Remainder OWTS
Regulatory Compliance	1	2	3	6	5	4
Environmental Impacts	1	2	3	5	6	4
Reliability	1	2	3	6	6	4
Energy Demand	6	5	4	1	2	3
Land Use	3	2	1	6	5	4
Capital Cost	5*	6	4	1	2	3
O&M Costs	5*	6	4	1	2	3
TOTAL	**22**	**25**	**22**	**26**	**28**	**25**
RANKING	**5**	**3**	**5**	**2**	**1**	**3**

*Costs for Alternative 1 are not known, but are estimated to be generally similar to Alternative 2 on average, but with larger uncertainty; costs for individual property owners would vary widely depending on individual circumstances.

PUBLIC MANAGEMENT ALTERNATIVES

The implementation of a community wastewater project in Dillon Beach will require the formation of or annexation to a public district that has suitable powers and authority for operation and management of public sewers or oversight of onsite wastewater treatment systems. This would be required as a matter of public policy and also to enable the community to obtain and utilize various forms of public financial assistance available from the State and Federal government.

The following briefly summarizes the apparent best or logical management/organizational options for each alternative.

Alternative 1 - Status Quo. No change or action required. Onsite wastewater treatment systems continue to be managed individually and regulated by Marin County Environmental Health Services.

Alternative 2a – OWTS Upgrades and Management Program. Formation of an OWTS Zone under the governance of the Marin County Board of Supervisors, administered through Environmental Health Services.

Alternative 2b – OWTS Upgrade Program with Supplemental Nitrogen Removal Systems. Formation of an OWTS Zone under the governance of the Marin County Board of Supervisors, administered through Environmental Health Services.

Alternative 3a – Community Sewerage and Connection to Oceana Marin Wastewater System. Annexation of the entire Study Area to NMWD for design, construction and management of sewer collection, treatment and disposal.

Alternative 3b – Community Sewerage and Connection to Oceana Marin Wastewater System. Annexation of the entire Village area to NMWD for design, construction and management of sewer collection, treatment and disposal.

Alternative 4 – Hybrid: Village Eastside Sewerage, Village Westside OWTS Upgrade Program
Two options:

- Annexation of the Village east side for sewerage by NMWD, and formation of a County-governed OWTS Zone for the remaining portion (per **Alternative 2a**).

  or
- Formation of an OWTS Zone under the governance of the Marin County Board of Supervisors for the entire Village, with management authority over both sewer collection and onsite systems. Outside service agreement with NMWD for wastewater conveyance, treatment and disposal for the east side (sewered) portion of the Village.

North Marin Water District has indicated that they see the potential project as an opportunity to revise its role in providing sewer services to a remote portion of the County in light of its primary mission to provide water. NMWD is open to discussions with the County, other established Sewer Agencies, and/or LAFCO to review alternative governance for his area and perhaps beyond (e.g., Tomales and Marshall, etc.).

SECTION 3: STUDY AREA CONDITIONS

GEOGRAPHICAL SETTING AND DEVELOPMENT CHARACTERISTICS

The community of Dillon Beach is located in northwest Marin County adjacent to Bodega Bay. It is situated at the end of Dillon Beach Road, approximately four miles west of Highway 1 and the town of Tomales. Dillon Beach is comprised of a Village core with small-scale commercial uses and a neighborhood of tightly clustered beach cottages and homes. The village is bordered on the east and north by the Oceana Marin development, which consists of about 225 larger, modern homes served by a community wastewater treatment system. Lawson's Landing campground, resort and expansive dune land lie south of the Village. According to the Dillon Beach Community Plan, about one-third of the properties are occupied by full-time residents, with the remainder used on weekends, vacations and for short-term rentals. The area to the east between Dillon Beach and Tomales consists primarily of open countryside and agricultural lands used for dairy, sheep and cattle grazing (**Figure 3-1**).

For the purposes of this wastewater feasibility study, the Dillon Beach Village Study Area encompasses the Village and neighboring areas served by onsite wastewater treatment system (OWTS), or simply "septic systems" (**Figure 3-2**). It is comprised of the following:

Dillon Beach Village. The Village comprises about 90 percent of the development and wastewater generation in the study area. It includes 127 residential properties and several commercial properties utilizing OWTS. There are also twelve (12) residential properties in the Village (located on Ocean View Avenue) currently connected to the Oceana Marin sewer system; these are not included in the Village service area for the purpose of this study. The Village residential properties are all very small lots, averaging about 2,400 ft^2, with some homes dating back to the early 1900s. Commercial properties include: General Store & Deli, Coastal Kitchen (café), 25-unit RV Park, (3) rental cabins, and beach restroom, plus a US Post Office.

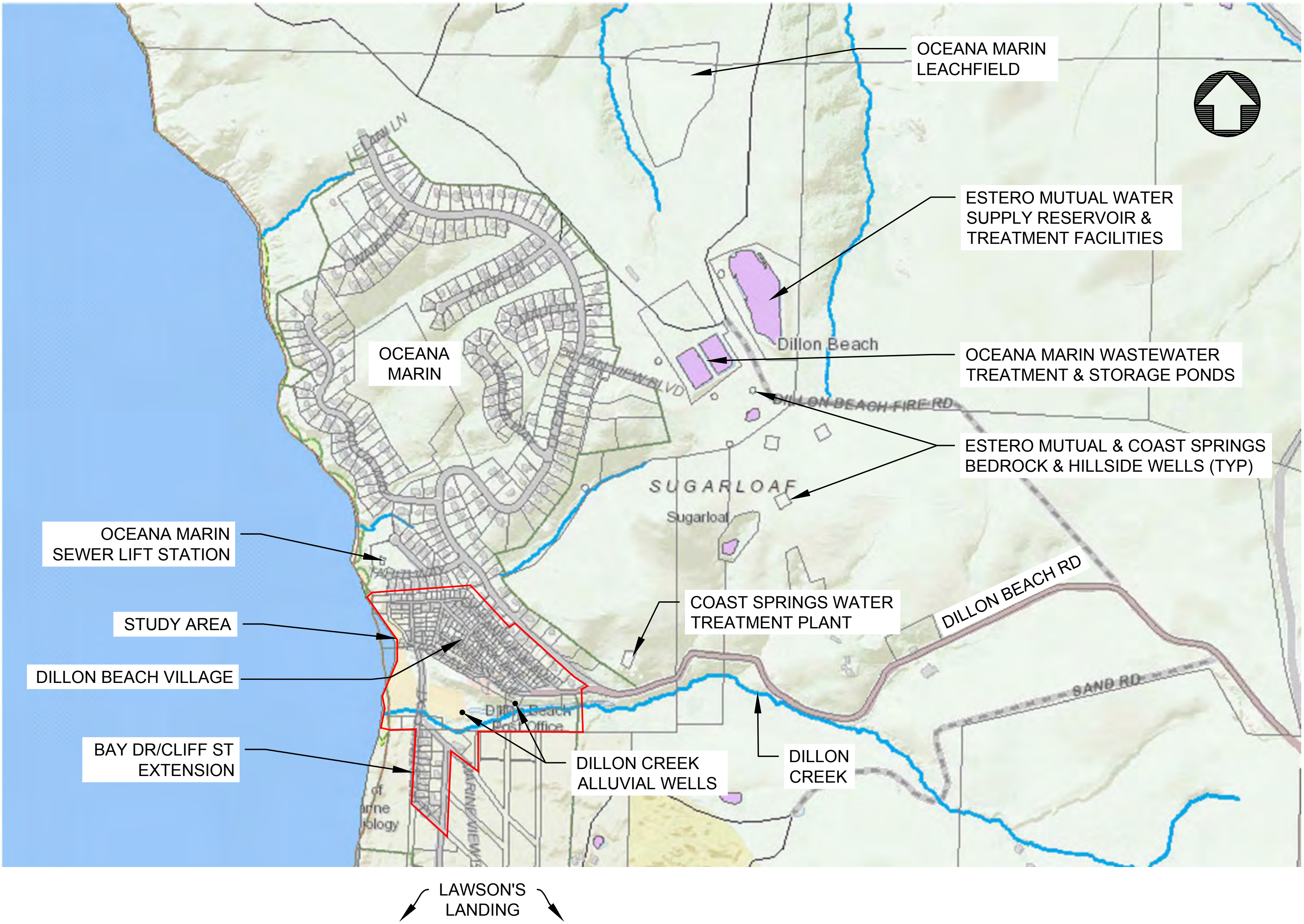
Bay Road-Cliff Street Extension. This includes a separate cluster of 16 houses located south of Dillon Creek, developed in the 1950s with lot sizes averaging about 6,300 ft^2.

Oceana Drive. This includes a group of six (6) larger lot, residential properties within Oceana Marin, bordering the Village and served by septic systems; lot sizes average about 8,200 ft^2.

Table 3-1 summarizes the residential characteristics of the three neighborhoods in the study area.

Table 3-1. Dillon Beach Village Study Area Residential Property Characteristics

Area	No. of Parcels		Average Lot Size (ft^2)	Average Living Area (ft^2)	Average No. of Bedrooms	Average Year Built
	Developed	Vacant				
Dillon Beach Village	127	16	2,400	1,050	2.1	1940
Bay Dr-Cliff St Extension	16	5	6,300	1,350	2.2	1964
Oceana Dr	6	1	8,200	2,700	2.3	1976



DIILON BEACH VILLAGE WASTEWATER STUDY
DILLON BEACH, 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

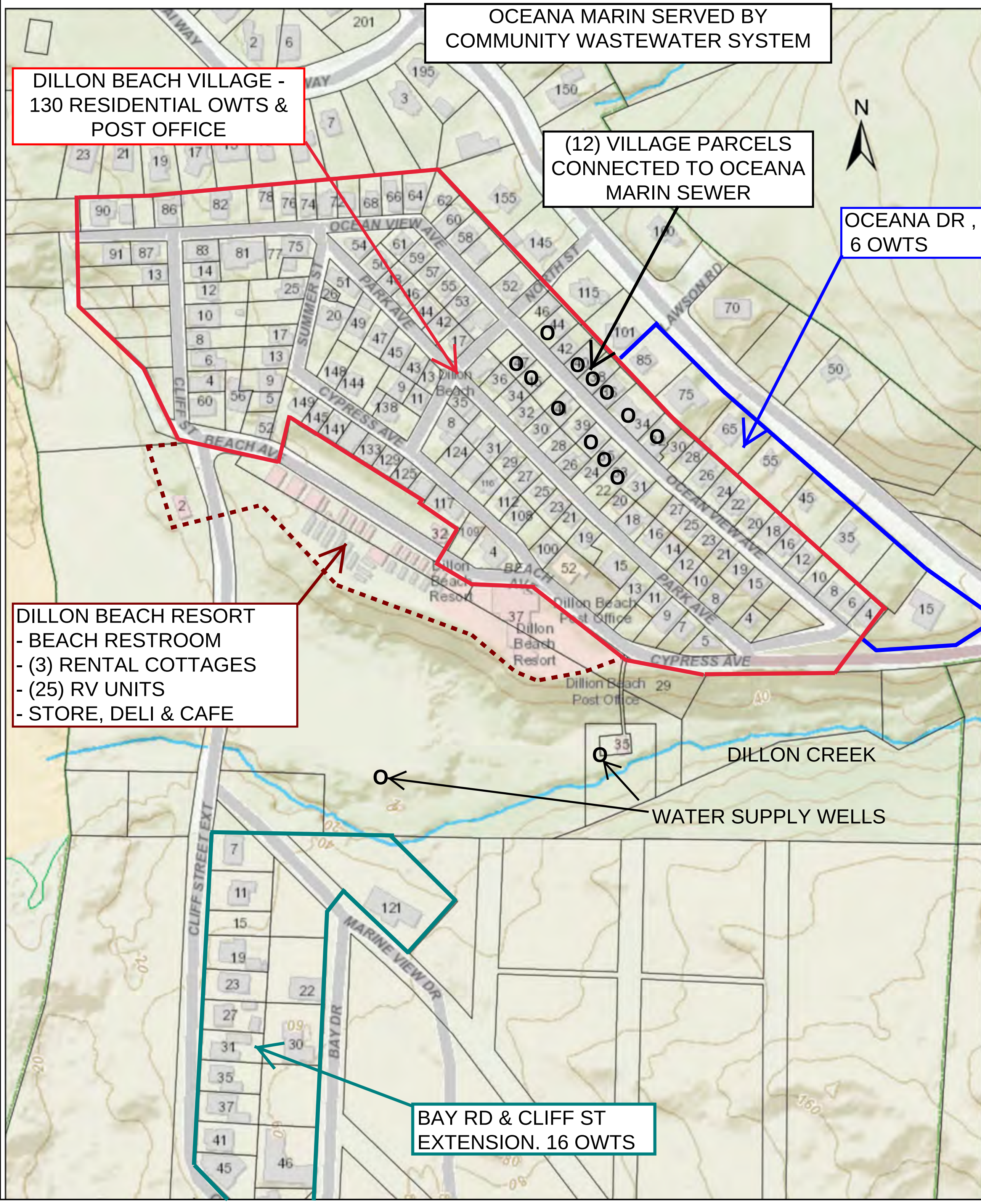
Design:	NH
Drawn:	PS
Checked:	NH
Appr'd:	NH

DILLON BEACH VICINITY MAP
DILLON BEACH, CA

FIGURE
3-1

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

P:\2020\2000170_DILLON_BEACH_VILLAGE_WASTEWATER\CAD\MODEL\2000170_PROJECT ALTERNATIVES.DWG LAST SAVED: 7/7/2022 PLOT DATE: 7/7/2022 PLOT STYLE: QUESTA-GRAYSCALE-255.CTB



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:	PS
Checked:	NH
Appr'd:	NH

ALTERNATIVES 2A &2B OWTS UPGRADES & MANAGEMENT

DILLON BEACH, CA

FIGURE 3-2

P:\2020\2000170_DILLON_BEACH_VILLAGE_WASTEWATER\CAD\MODEL\2000170_PROJECT ALTERNATIVES.DWG LAST SAVED: 7/7/2022 PLOT DATE: 7/7/2022 PAGE SETUP: ---- PLOT STYLE: ----

CLIMATE

Like most of the California coastal area, the climate is Mediterranean, with wet winters and dry summers. The annual average rainfall for the area is approximately 27 inches, with 85 percent of the annual total typically occurring during the months of November through April. **Table 3-1** presents average monthly rainfall amounts for the Dillon Beach area, based on the past 15 years of recorded data at the Marin County-maintained rain gage located at the Oceana Marin wastewater treatment plant, elevation 460 feet above mean sea level (amsl). Also listed in **Table 3-2** are reference evapotranspiration rates applicable to "Coastal Plains and Heavy Fog Belt" like Dillon Beach, as published by the California Department of Water Resources[1].

Table 3-2: Average Rainfall and Evapotranspiration for Dillon Beach, California

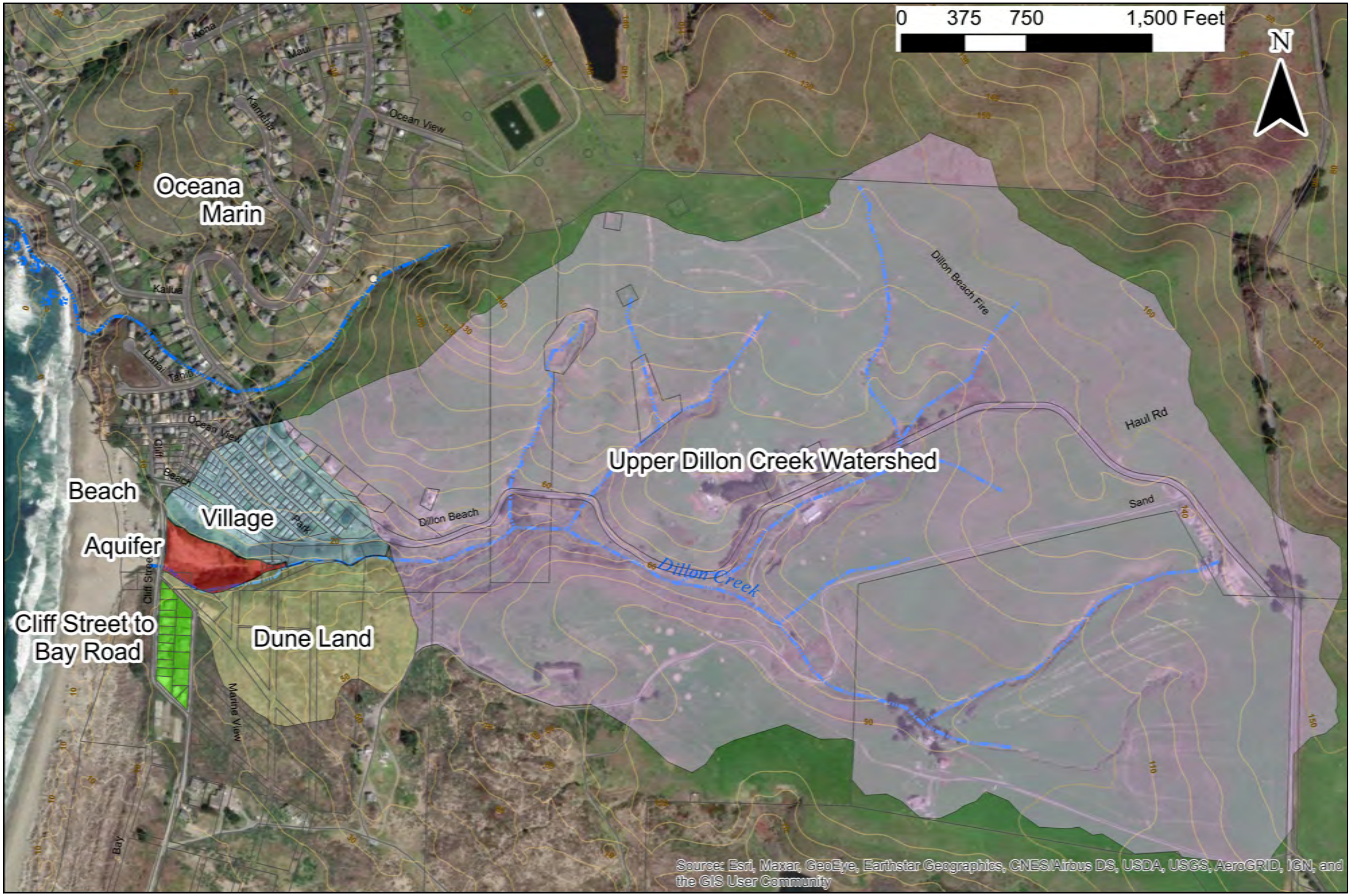
Month	Average Rainfall (inches)	Evapotranspiration, ETo (inches)
January	4.16	0.93
February	4.73	1.40
March	3.57	2.48
April	1.70	3.30
May	0.95	4.03
June	0.86	4.50
July	0.14	4.65
August	0.13	4.03
September	0.20	3.30
October	1.67	2.48
November	2.63	1.20
December	6.32	0.62
Annual Total	**27.06**	**32.92**

DILLON CREEK WATERSHED

Dillon Creek flows east to west, has a watershed of approximately 430 acres, and flows nearly year-round, depending on seasonal rainfall. The watershed includes: (a) grazing lands; (b) a portion of the developed village area of Dillon Beach on the north side of the creek; and, (c) a small area of undeveloped, well-vegetated sand dunes on the south side of the creek. See **Figure 3-3** for a map of the watershed.

The freshwater aquifer at the mouth of Dillon Creek is formed from an accumulation of beach sands and alluvial stream deposits, overlain and bounded by aeolian (dune) sands. Dillon Creek flows through the aquifer along the southern edge, crossing under Cliff Street in a concrete box culvert, with an invert elevation approximately 13 feet above sea level. Dillon Creek provides a primary source of recharge to the aquifer via percolation along the sand and mixed gravel creek bottom. The aquifer occupies a surface area of about 3.5 acres, has an average depth of 30 feet, and is estimated to have a maximum storage capacity of about 10 million gallons.

[1] https://cimis.water.ca.gov/App_Themes/images/etozonemap.jpg



DIILON BEACH VILLAGE WASTEWATER STUDY

DILLON BEACH, 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:	PS
Checked:	NH
Appr'd:	NH

DILLON CREEK WATERSHED MAP

DILLON BEACH, CA

FIGURE 3-3

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

P:\2020\2000170_DILLON_BEACH_VILLAGE_WASTEWATER\CAD\MODEL\2000170_PROJECT ALTERNATIVES.DWG LAST SAVED: 7/22/2022 PLOT DATE: 7/26/2022 PLOT STYLE: QUESTA-GRAYSCALE-255.CTB

WATER SUPPLY

The Dillon Creek watershed is the primary water source for the Coast Springs Water System, which is owned and operated by California Water Services Company (Cal Water). The Coast Springs system supplies water to the entire Village area plus about 100 additional homes in the Oceana Marin subdivision. The water sources for the Coast Springs system include a series of bedrock wells and springs located in the northeastern portion of the Dillon Creek watershed and a shallow well (Well No. 4") that draws from alluvial deposits adjacent to Dillon Creek. Well No. 4 has historically provided the majority of the water supply for the Coast Springs Water System. It is constructed of corrugated metal casing, 12 feet in diameter and 23 feet deep, extending a few feet below sea level. In 2009 Coast Springs began purchasing water from the owners of a second well located in the Dillon Creek aquifer (known as the "Cline" or "Dillon Beach" well), approximately 400 feet west of Well No. 4. This second well draws water from the sand and alluvial deposits which extend to a depth of 45 feet below ground surface at the well location. Cal Water treats raw water from these various sources at a water filtration treatment plant on the hill east of Oceana Dr. The water is treated in compliance with State standards for "groundwater under the direct influence of surface water".

A review of the past 20 years of water production records shows the Coast Springs Water System has overall annual average daily water demand of about 21,500 gpd, with seasonal averages ranging from 18,500 gallons per day (gpd) in the winter months up to about 23,500 gpd during the summer months. Water demand during peak months of July and August averages 27,500 gpd, with maximum use close to 36,000 gpd. These fluctuating water demands are indicative of the vacation character of Dillon Beach, where the average flow is typically about 60 percent of peak daily demand. **Table 3-3** summarizes monthly water production data from 2000 to 2020.

Table 3-3
Cal Water-Coast Springs Water System[1]
Monthly Water Production Summary - 2000-2020 (GPD)

Month	Average	Minimum	Maximum
January	18,085	12,137	24,563
February	18,863	12,369	40,419
March	18,281	12,451	28,038
April	21,463	15,334	33,461
May	21,473	15,708	26,470
June	23,960	15,982	29,995
July	28,310	22,754	35,711
August	26,725	18,242	32,526
September	21,989	17,054	29,546
October	20,779	14,670	30,282
November	19,897	13,065	25,507
December	17,876	11,920	25,456
Average	**21,475**	**15,140**	**30,164**

[1] Supply for 250 residential and commercial connections in Dillon Beach and portions of Oceana Marin.

A more focused review of metered water use for residential properties in the Dillon Beach Village area was made for the 5-year period of 2016-2020. The data indicate average year-round water usage rates of about 43 gpd per residential connection, based on data for 2-month billing cycles. During the peak summer-fall season water usage averages about 45 to 55 gpd per parcel, decreasing to 40 gpd or less per parcel during the winter season.

GEOLOGY, SOILS AND GROUNDWATER

Geology

Dillon Beach is located within the Coast Ranges Geomorphic Province of California. The regional bedrock geology consists of folded, faulted, and sheared sedimentary, igneous, and metamorphic rock of the Franciscan Complex. Regional geologic maps indicate the Dillon Beach Village area is underlain by Pleistocene-aged marine terrace deposits (dune sands) with sandstone of the Franciscan Complex mapped in the surrounding areas to the north and east, and beach sand and a large expanse of dune deposits to the west and south.

The site is located within the seismically active San Francisco Bay Region and subject to the effects of earthquakes. Such earthquakes could occur on any of several active faults within the region. The California Division of Mines and Geology (CDMG, 1998) has mapped various active and inactive faults in the region. The nearest known active fault is the San Andreas Fault, located about one mile to the west of Dillon Beach.

Soils

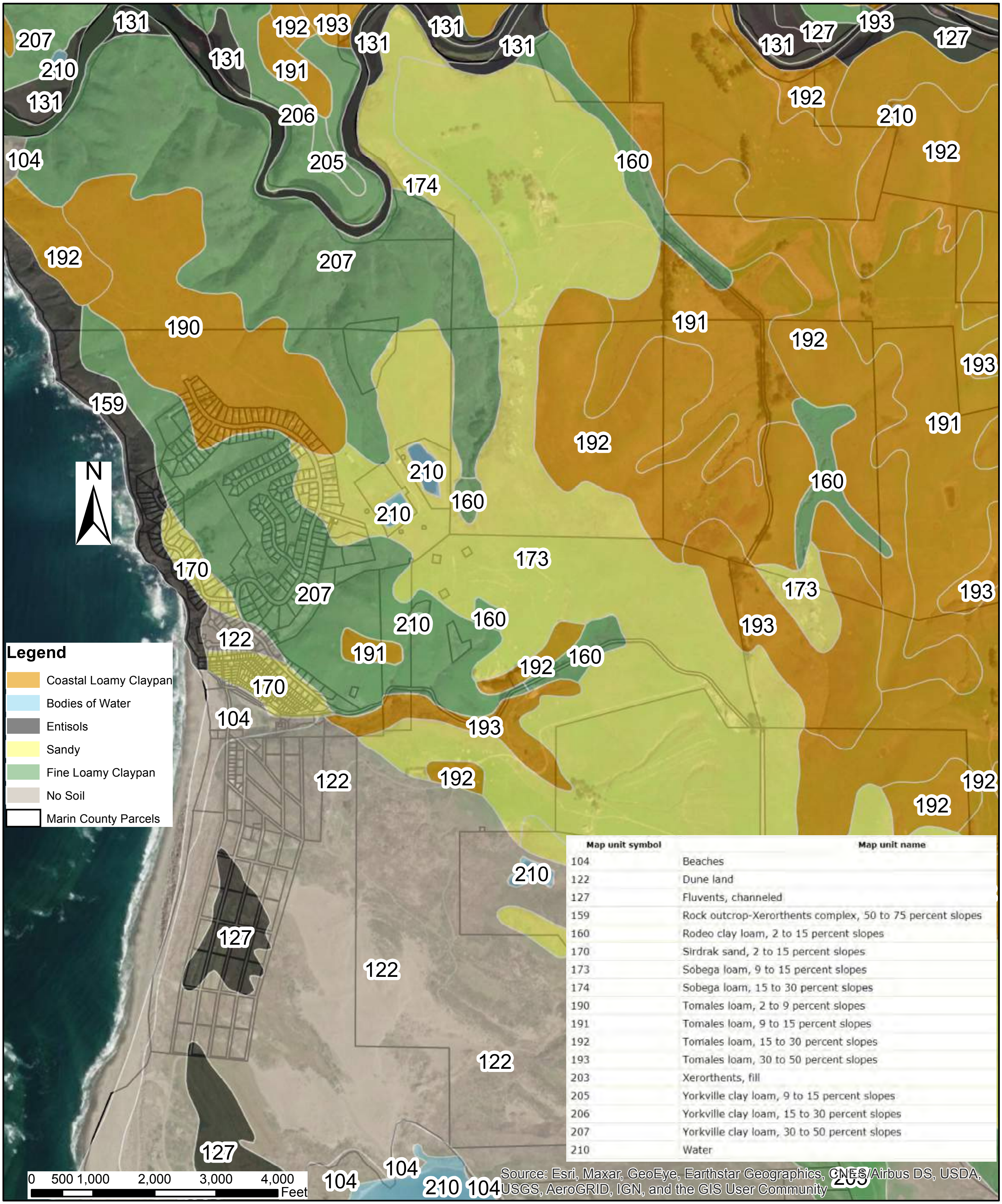
Soils in Dillon Beach Village area, including properties along Oceana Drive, are very deep, well-drained sands of the Sirdrak Series, as mapped in the Soil Survey of Marin County (**Figure 3-4**). They are described as sandy soils occurring in rolling dune-like areas, formed in windblown deposits from coastal beaches. Soil textures are typically sands and loamy sands in the upper 4 to 5 feet, and mainly sands below that depth. Permeability is rapid (6 to 20 inches per hour), with clay fraction less than 5%, and having very low water holding capacity (0.05 to 0.07).

The Bay Dr/Cliff Street Extension area is mapped as dune land, consisting of hummocks and mounds of loose windblown sands from the adjacent beaches. The sands have rapid permeability and exhibit no real soil profile development.

Beyond the general information contained in the Soil Survey, over the past 30 to 40+ years numerous exploratory soil borings (commonly by hand-auger) have been made throughout the Dillon Beach Village area in connection with the design and permitting of new, repair and replacement septic system projects. Nearly 40 exploratory soil logs are contained in EHS septic system permit files and were reviewed as part of the current study. The soil borings, extending typically 10 to 30 feet in depth, confirm the soil conditions in the Village area as consisting of a mix of very permeable, well drained sands and loamy sands, with groundwater normally encountered at the contact with underlying clays or weathered rock below. Additional information is presented in the following discussion of groundwater.

Groundwater

Groundwater in the Village area consists of percolating rainwater plus drainage from septic systems that collects on top of the clayey soils and weathered bedrock that underlie the deep sandy soils. The groundwater that forms at the contact then flows laterally along the bedrock



Design: NXH Drawn: NXH Approved: NNH Date: 7/8/22 Project Number: 2000170 Location: Dillon Beach, CA Source: USGS	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	DILLON BEACH SOILS MAP	FIGURE 3-4

FILENAME: 2000170 Soil Map Letter Size

surface, which slopes in some areas westerly toward the beach and ocean, and in other areas south and southwesterly toward Dillon Creek and the adjacent alluvial aquifer. The Dillon Creek alluvial aquifer does not extend under the Village area. However, groundwater that develops under portions of the Village (east side) is a source of lateral inflow/recharge to the aquifer.

The above is illustrated in: (a) **Figure 3-5,** which shows a map of estimated groundwater contours and flow directions; and (b) **Figure 3-6**, which shows a hydrogeologic cross-section through the center of the Village area (roughly along North Street).

- **Figure 3-5** shows the locations of 38 soil borings on file for different properties in the Village, along with the elevation (in feet, amsl) of the observed or estimated groundwater/bedrock at each location. The elevations were determined by subtracting the measured depth to groundwater/bedrock from the ground surface elevation at each boring location. The lines of equal groundwater/bedrock elevations were drawn by triangulation, the same way ground surface topography is mapped. Arrows representing groundwater flow direction are drawn at right angles to the contour lines. The blue shaded area in **Figure 3-5** was drawn to indicate the estimated extent of the Village area that drains (via percolation) as recharge to the Dillon Creek groundwater basin. The northern boundary is a conservative (safe) first approximation that can be refined with further subsurface investigation; for example, additional information may support a shift in the boundary closer to the position of cross-section line C-C[1]. The subsurface information used for **Figure 3-5** indicates deeper sands in the northwestern portion of the Village and groundwater flow direction toward the west and northwest.

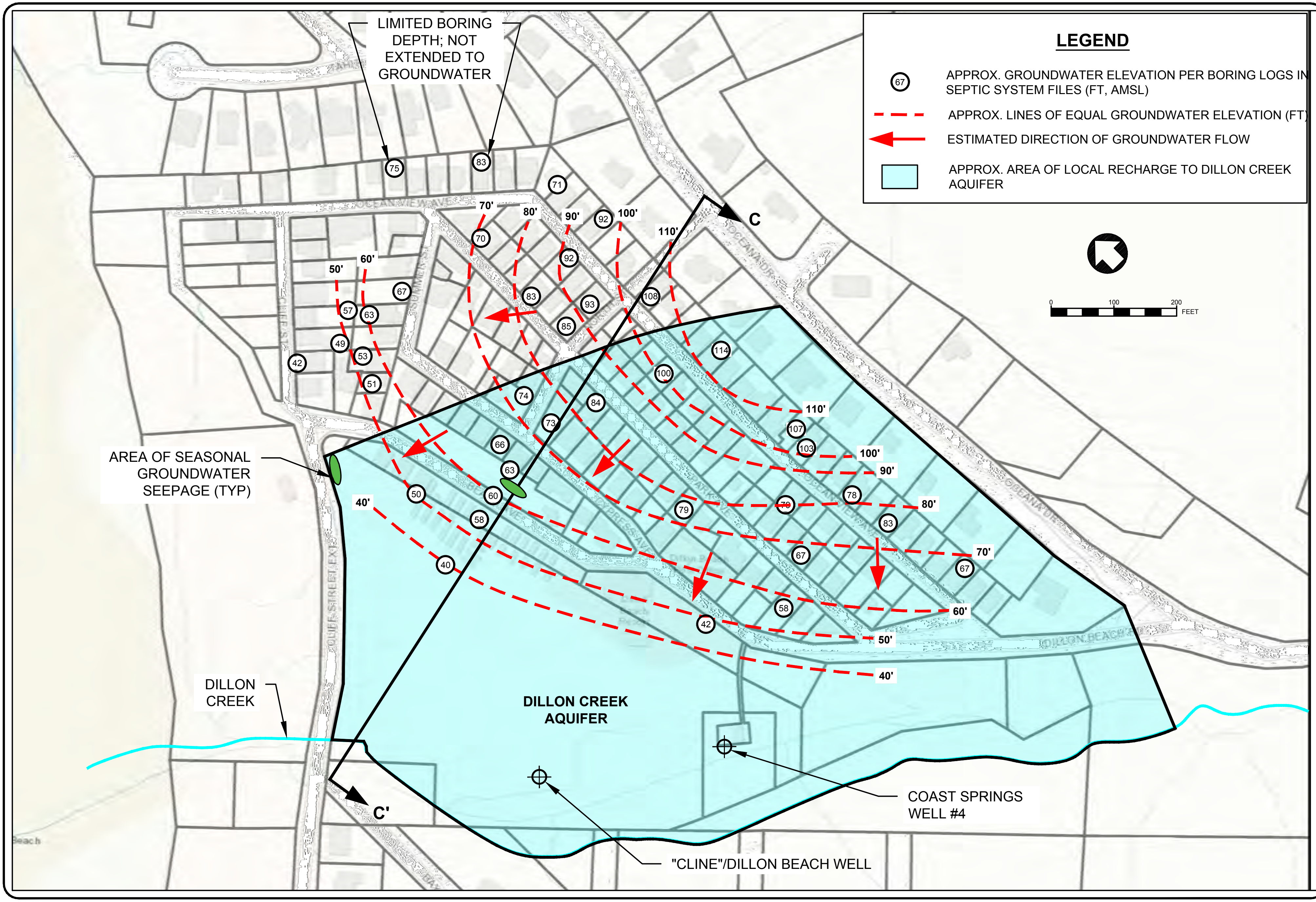
- **Figure 3-6** shows a cross-section (C-C[1]) roughly through the center of the Village, depicting the surface topography, approximate depths of sand and loamy sand deposits, slope of the underlying bedrock, and the connection to the Dillon Creek groundwater basin in the sand dune area southwest of Dillon Beach Resort RV Park.

Figure 3-5 also shows two locations where groundwater seepage to the surface is known to occur in the Village during the rainy season: (1) adjacent/upslope of the unpaved parking area on Beach Ave across from the RV park; and (2) downhill of the Dillon statue at the road cut made to form Cliff Street. March 2019 street-view photos of the seepage locations are shown in **Figure 3-7**. Both seepage locations are where historical grading of overlying sand deposits has brought the lateral subsurface water flow closer to the surface. This is illustrated in C-C[1] for the Beach Ave seepage location.

WATER QUALITY

Water quality issues of primary interest and concern in Dillon Beach are those affecting recreational activities, drinking water supplies and public health in general. This includes: (a) ocean water; (b) Dillon Creek; and (c) Dillon Creek groundwater basin.

Ocean Water Quality Monitoring. Marin County Environmental Health Services (EHS) collects ocean water samples at Dillon Beach weekly from April 1st through October 31st for bacteriological testing. This is part of a County-wide beach water quality monitoring program that has been in place since 2003, under the California Clean Beaches Program (known as AB411). Water samples are tested for levels of total coliform, fecal coliform and enterococcus to determine compliance with California water quality standards for recreational water contact. The results of testing are available on the EHS website, and an advisory notice is posted at the



DIILON BEACH VILLAGE WASTEWATER STUDY
DILLON BEACH, 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

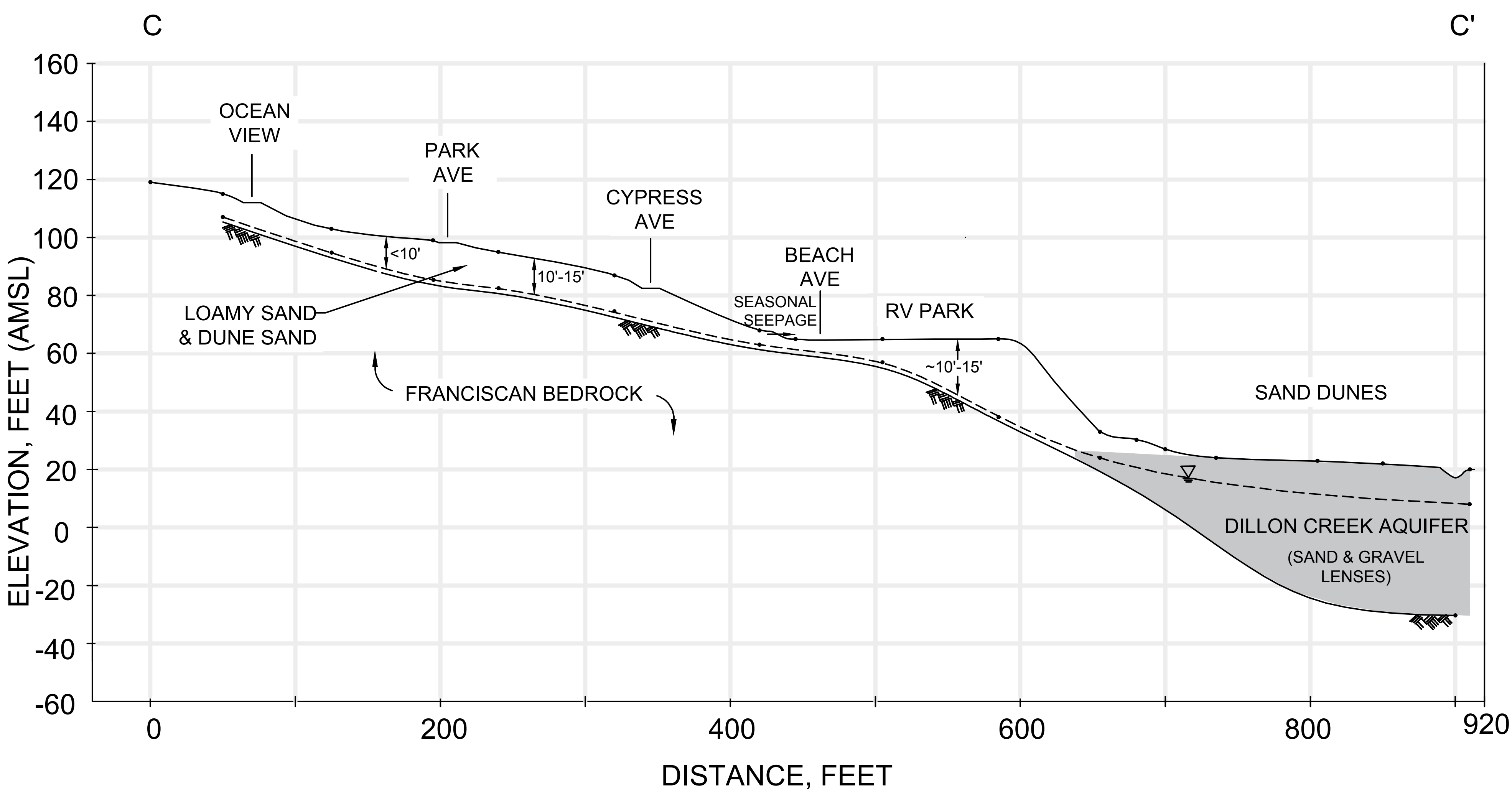
Design:	NH
Drawn:	PS
Checked:	NH
Appr'd:	NH

GROUNDWATER CONDITIONS
DILLON BEACH, CA

FIGURE **3-5**

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

P:\2020\2000170_DILLON_BEACH_VILLAGE_WASTEWATER\CAD\MODEL\2000170_PROJECT ALTERNATIVES.DWG LAST SAVED: 7/7/2022 PLOT DATE: 7/7/2022 PLOT STYLE: QUESTA-GRAYSCALE-255.CTB



SUBSURFACE DATA: SOIL PROFILE AND
GEOTECHNICAL BORING LOGS ON FILE
@ MARIN COUNTY MARIN CO.EHS

DIILON BEACH VILLAGE WASTEWATER STUDY
DILLON BEACH, 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

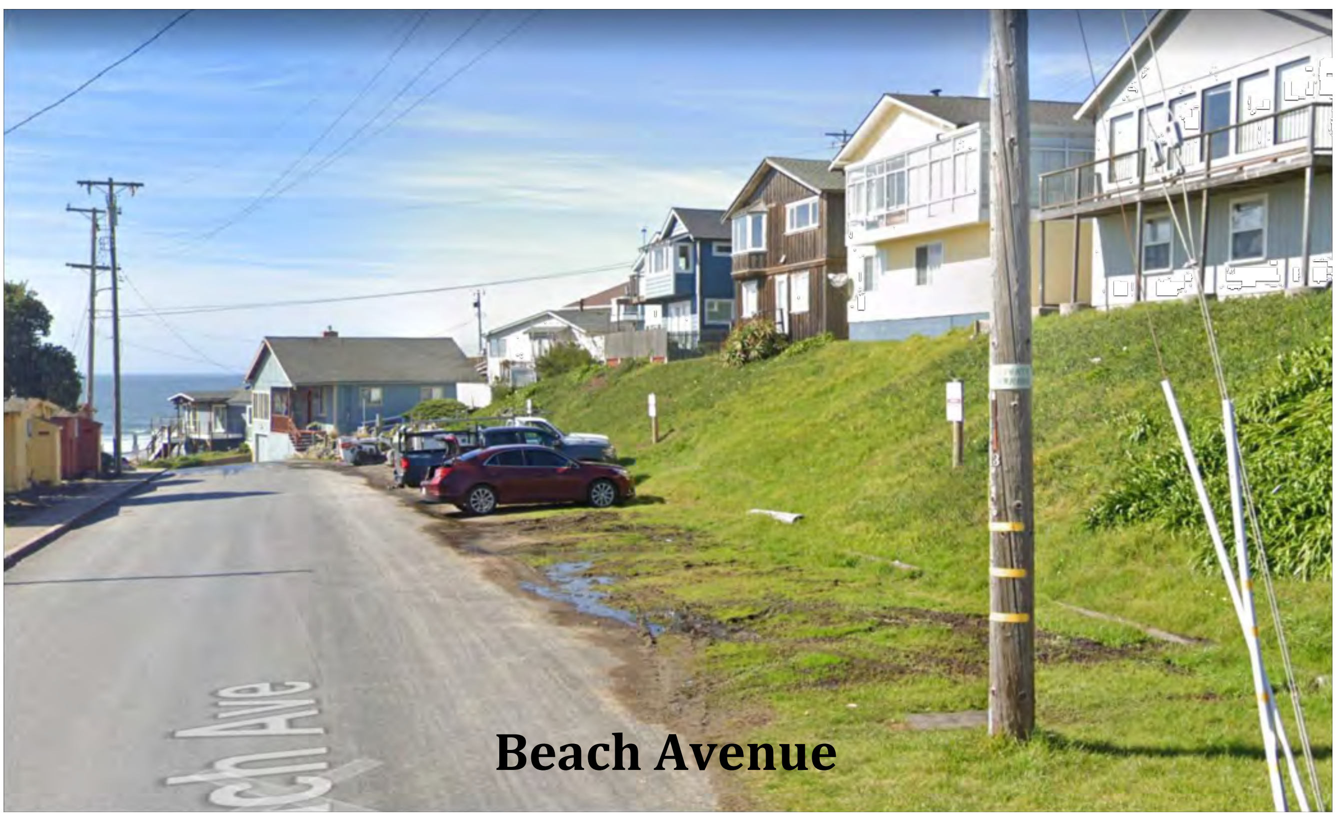
Design:	NH
Drawn:	PS
Checked:	NH
Appr'd:	NH

CENTER CROSS-SECTION, C-C'
DILLON BEACH, CA

FIGURE
3-6

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

PLOT STYLE: QUESTA-GRAYSCALE-255.CTB PLOT DATE: 7/7/2022 LAST SAVED: 7/7/2022
P:\2020\2000170_DILLON_BEACH_VILLAGE_WASTEWATER\CAD\MODEL\2000170_PROJECT ALTERNATIVES.DWG



LAST SAVED: 7/7/2022 PLOT DATE: 7/26/2022 PAGE SETUP: ---- PLOT STYLE: ----

P:\2020\200170_DILLON_BEACH_VILLAGE_WASTEWATER\CAD\MODEL\200170 REPORT FIGURES.DWG

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:	PS
Checked:	NH
Appr'd:	NH

AREA OF SEASONAL GROUNDWATER SEEPAGE (MARCH 2019)

DILLON BEACH, CA

FIGURE

3-7

beach whenever there is an exceedance of State standards. Bacteriological testing at Dillon Beach has a consistent record of compliance with State standards.

Dillon Creek. The outflow from Dillon Creek creates surface water flow across the beach during normal winter rainfall conditions. With declining outflow during spring and summer, the stream is reduced to a "pond" or pooling area just west of the box culvert on Cliff Street. By fall the ponding area is usually dry or buried-over by shifting sand. EHS has conducted limited (once or twice a year) spot sampling of the "pond" the past few years. The results have shown high bacteriological readings (total coliform and fecal indicator bacteria), in excess of water contact recreation standards. The cause of the high readings has not been determined. Animal activity in and around the "pond" is a likely contributor, as the semi-stagnant pool of water is an attractive play area for dogs. Surface flow in Dillon Creek is normally dry by early spring and not available for water quality testing concurrent with pond water sampling.

Groundwater Quality. Water quality is monitored regularly at Coast Springs Well No. 4 and occasionally at the Cline/Dillon Beach well. The data, which can be accessed at the State Water Board, Division of Drinking Water (DDW) website[2], indicate following regarding groundwater quality of the Dillon Creek aquifer:

- Conformance with primary drinking water standards, i.e., constituents that can have health effects;

- Conformance with secondary drinking water standards for all parameters except manganese, a naturally occurring mineral leached from geologic formations. The secondary limit for manganese is based on its tendency to cause discoloration of water and staining. Manganese is amenable to removal by the existing water treatment system.

- No indication of salt water influence as reflected in the total dissolved solids concentrations near 300 mg/L, and specific conductance values of in the range of 500 to 600 µmhos/cm.

The one principal groundwater quality constituent of concern is nitrate[3]. Monitoring data for Well No. 4 shows seasonal fluctuations in nitrate concentrations, commonly reaching elevated levels significantly above background during the dry season. This is indicative of influence from land use activities in the Dillon Creek watershed, the likely sources being septic systems[4] in the adjacent Village area and possibly animal grazing in the upper watershed area. Nitrate levels in the 4 to 6 mg-N/L range have been observed on a recurring basis. These levels are below the drinking water limit of 10 mg-N/L, but closely approaching 7 mg-N/L, which is a common action level triggering follow-up sampling and investigation. Coast Springs is currently required by the

---

2 https://sdwis.waterboards.ca.gov/PDWW/JSP/WaterSystemDetail.jsp?tinwsys_is_number=2729&tinwsys_st_code=CA&wsnumber=CA2110007

3 Nitrate in drinking water is regulated with a maximum contaminant level (MCL) of 10 mg-N/L because it can cause blue baby syndrome (infant methemoglobinemia); it is also being studied for possible links to thyroid diseases, certain types of cancer, and birth defects.

4 Effluent from residential septic tanks typically contains total nitrogen concentrations of 50 to 70 mg-N/L, which converts to nitrate and undergoes very little reduction during percolation and migration through the sandy soils and groundwater.

DDW to test the treated water for nitrate on a monthly basis, as well as raw water from Well No. 4, the main source of supply. Nitrate sampling results for 2015-2022 for all Coast Springs wells and treatment plant are provided in **Appendix A**. **Figure 3-8** is a side-by-side plot of nitrate sampling results for Well No. 4 and treated water for 2015-present, showing the fluctuations and close correspondence between raw and treated water levels. Nitrate is not removed by conventional water treatment filtration processes and, therefore, normally requires that it be addressed at the raw water source, i.e., through groundwater basin management and source control.

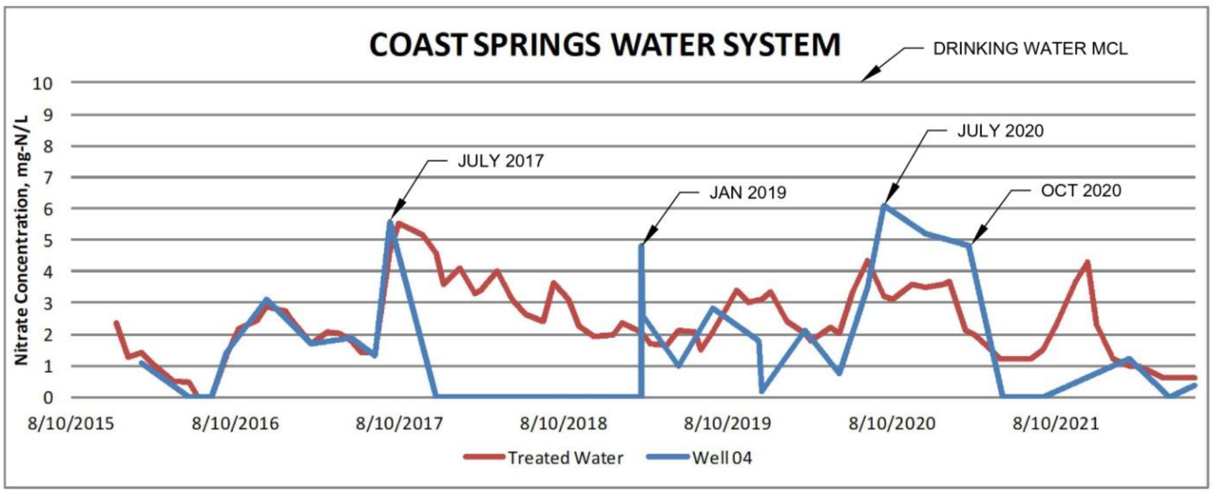


Figure 3-8. Comparison of Nitrate-N Concentrations for Coast Springs Treated Water and Well No. 4, 2015–2022.

SECTON 4: EXISTING WASTEWATER PRACTICES AND CONCERNS

OVERVIEW

Dillon Beach Village was developed in the early 1900s, long before there were any codes or regulations pertaining to onsite sewage disposal systems. Cesspools and seepage pits formed by redwood boxes were a common practice. Given the state of knowledge regarding sewage treatment and disposal at the time, the presence of deep well drained sandy soils, and the limited seasonal occupancy the homes, redwood cesspools and seepage boxes served their purpose adequately for many years. Since the 1950s, new construction, as well as replacement of many of the original cesspools and seepage boxes, has included more modern septic tanks and separate drainfields of some type. An unknown number of redwood cesspools are believed to still exist, as they are discovered from time-to-time in connection with septic system and building improvements documented in County files.

As part of the current wastewater feasibility study, Questa Engineering researched and reviewed septic system and related parcel information on file with Marin County EHS for properties in the Study Area. This included system permits, design drawings, soil borings/profiles, percolation test data, groundwater determinations, correspondence and other file information. Out of approximately 150 developed properties in the Study Area, files were located for 115 parcels, of which about 90 contained septic system permits, installation or design information. We also conducted a homeowner questionnaire survey (discussed later in this section) to supplement our file research. This information combined with review and evaluation of soils, geology and hydrology of the area was used for the summary provided below on existing wastewater practices and concerns.

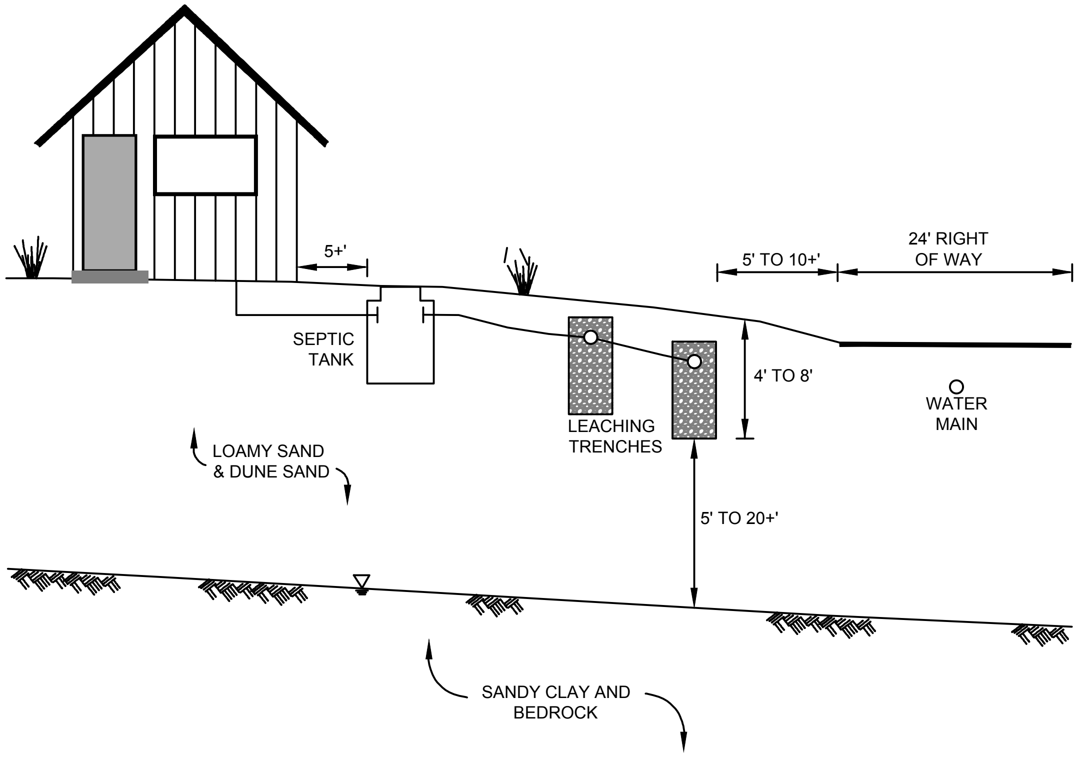
SUITABILITY AND SITING CONSTRAINTS

Soils and Groundwater. The findings from dozens of exploratory soil borings and augur test holes show deep well-drained sand and loamy sand soils over nearly the full extent of Dillon Beach Village. Percolation rates are fast, which is helpful for drainfield operation, but limiting from the standpoint of filtering and removing the contaminants contained in percolating septic tank effluent. This is mitigated to a large extent by the depth of sandy soils beneath the leaching systems, which ranges typically from about 5 to 20+ feet (below common 4-ft to 8-ft deep leaching trenchES) in different part of the Village. This is illustrated in **Figure 4-1**.

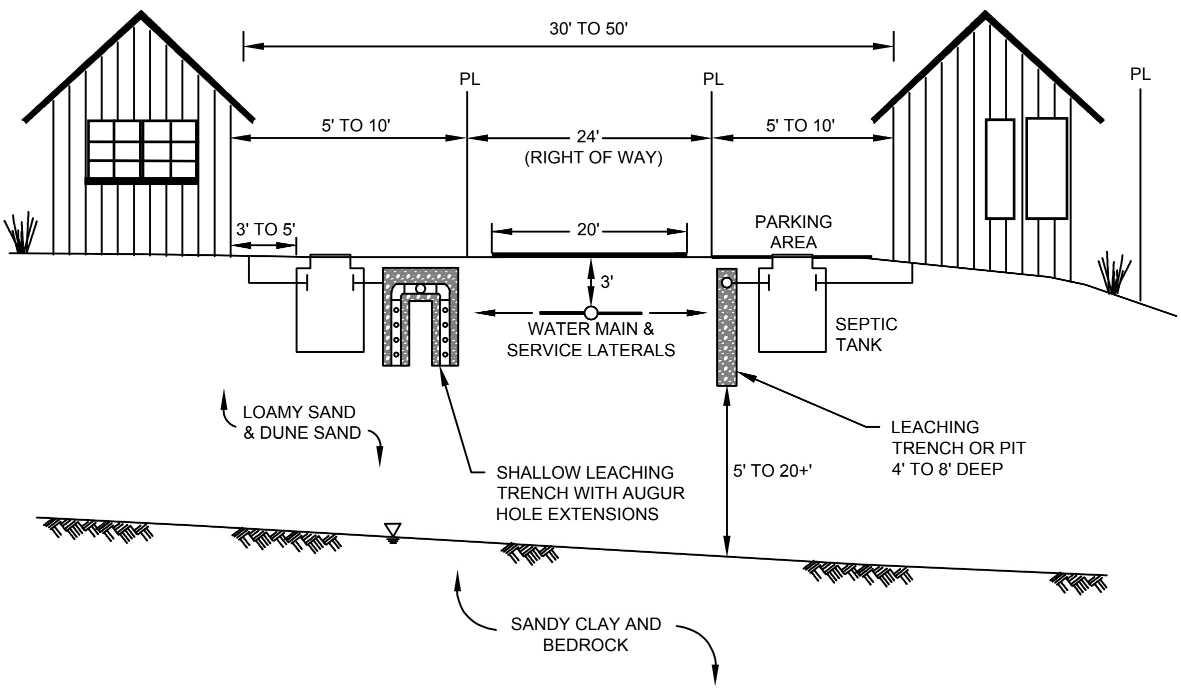
Proximity to Water Courses and Wells. There are no water courses within the Village. Lateral setbacks from Dillon Creek on the south side of the Village are well in excess of the minimum 100-ft required setback; and setbacks from the Coast Springs Well No. 4 are greater than the required 150 feet. However, there is a potential question as to whether or not a 400-foot setback may be required under the 2012 State Water Board OWTS Policy, which applies to water course setbacks in the vicinity of public water system intakes. This is relevant since Coast Springs Well No. 4, the primary water source for the community, is classified as “under the direct influence of surface water”, and regulated the same way as surface water supplies for public water systems.

Site Limitations and Setbacks. A major constraint for OWTS is the extremely limited space on individual parcels (averaging less than 2,500 ft^2) to accommodate code-compliant septic tanks and disposal fields. This results in encroachment within standard setback distances from

LESS CONSTRAINED SITES



HIGHLY CONSTRAINED SITES



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:	PS
Checked:	NH
Appr'd:	NH

TYPICAL SEPTIC SYSTEM PRACTICES

DILLON BEACH, CA

FIGURE

4-1

buildings, property lines, paved areas and utilities on nearly every site. The well drained sands allow smaller drainfield size; but there is little or no room as a failsafe or for incorporation of supplemental treatment systems where that may be needed. It is also common for tanks and leaching systems to be locate beneath paved or other impervious surfaces. The illustrations in **Figure 4-1** are examples of the best to worst case situations.

TYPICAL UPGRADE-REPLACEMENT DESIGNS AND OWTS STATUS

Our review of EHS files showed plans and permits for 60 to 70 septic system upgrades in the Dillon Beach Village that have occurred over the past 35 to 40 years. The great majority of these were for replacement of cesspools and other older, non-conforming installations. The replacement systems have consistently included new 1,200-gallon septic tanks, documentation of soils and groundwater depth, and leachfield design sizing based on current criteria (1.2 gpd/ft^2) for sandy soil conditions and house size (bedroom count). Standard gravity systems are most common, with limited use of pump systems or pressure distribution. Innovative use of trenches in combination with augur hole extensions to maximize leaching application area has been employed in a few cases due to extreme space limitations. We found no use of supplemental treatment except for the new system designed to serve the Dillon Beach Resort RV Park; this includes two recirculating sand filters, UV disinfection and a shallow pressure-dosed dispersal bed.

Nearly all of the 60 to 70 replacement OWTS reflected in County files would be categorized as Class II Repairs under the EHS “Residential Improvement Policy for Septic Systems”. The EHS policy defines the other OWTS classes as follows: Class I: code compliant under current regulations for new construction; Class III: permitted in the past under former regulations (e.g., prior to 1984); and Class IV: undocumented or including non-permitted features like cesspools.

Based on our review we developed the following estimates of the classification of OWTS in Dillon Beach Village:

- Class I and II: 45%
- Class III: 10%
- Class IV: 45%

Based on this assessment, there are likely many dozens of existing OWTS in Dillon Beach Village of older, non-conforming construction which probably includes a number of cesspools and redwood seepage boxes.

CUMULATIVE IMPACTS

Separate from the standard siting and design criteria (i.e., soils, percolation, setbacks, sizing, etc.), consideration also needs to be given to the cumulative effects on groundwater and the environment where there are large concentrations or large volume septic system discharges. As discussed in **Section 3** (under Groundwater Conditions), the east side of Dillon Beach Village lies over an area where the underlying groundwater drains as recharge water to the alluvial aquifer of Dillon Creek. Although the aquifer is recharged mainly from surface runoff and percolation of water from the 400-acre Dillon Creek watershed, percolating rainfall and septic effluent from the adjacent Village represents an additional year-round source that becomes more significant during the dry season when flow in Dillon Creek declines or ceases.

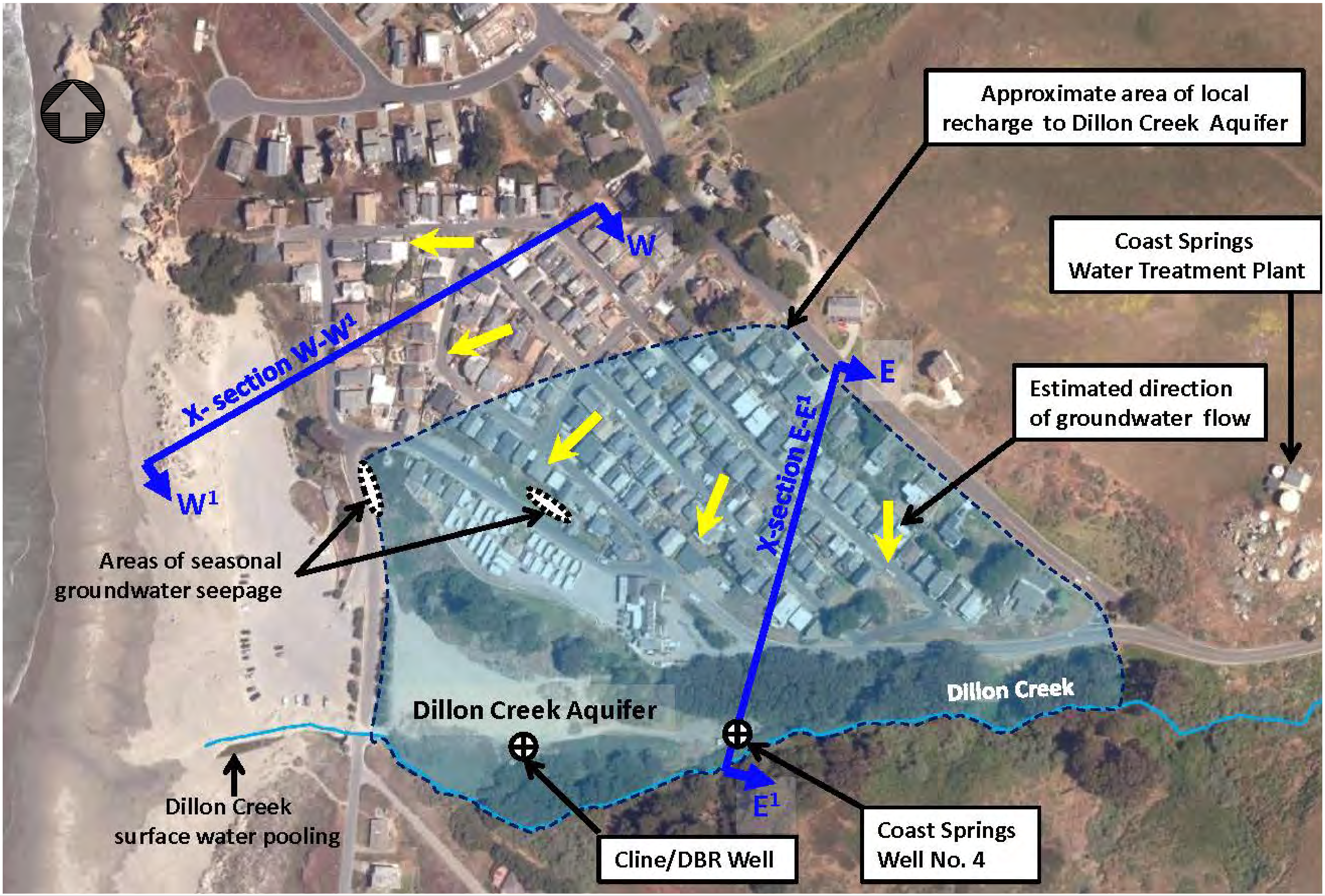
Figure 4-2 provides an overview of the Village and local water resources factors of note. **Figures 4-3** and **4-4** are hydrogeologic cross-sections depicting the conditions across the west side and east sides of the Village, respectively. **Figure 4-3** illustrates the very deep sands and westerly direction of groundwater flow toward Cliff St and the sand dunes below. **Figure 4-4** shows the subsurface conditions on the east side of the Village where drainage and groundwater flow is from the developed hillside toward Dillon Creek and Well No. 4.

Because of the close proximity, the high concentrations of nitrogen in domestic wastewater (50 to 70 mg-N/L, mainly associated with ammonia), and the high density of development, the combined discharges from OWTS located on the east side of the Village pose a risk of cumulative impact to the groundwater quality and drinking water supply. An analysis of the nitrate-nitrogen loading effects from the OWTS located on the east side of the Village is provided in **Appendix C**. The analysis accounts for the contributions from the residential and commercial properties in the Village area, plus the six (6) additional OWTS on Oceana Dr. The analysis, completed per guidelines in the County regulations, is used to estimate the combined nitrate concentration resulting from percolating rainfall plus septic system discharges.

The County guidelines establish a level of 7.5 mg-N/L as the maximum permissible concentration in areas used for domestic water supply; this is purposely set below the drinking water standard of 10 mg-N/L to provide a margin of safety. The analysis in **Appendix C** concludes that septic system discharges from the east side of the Village produce a resultant nitrate concentration in recharge water in the range of about 8 to 12 mg-N/L under current occupancy and water use/wastewater flows (50 gpd per household). The analysis further shows the resultant concentrations could increase to as much as 10 to 15 mg-N/L as a result of higher occupancy rates contributing to increased septic system discharges, e.g., on the order of 75 gpd/household. As indicated in the water quality discussion in **Section 3**, the main water supply well (No. 4) experiences fluctuating and frequently elevated nitrate concentrations, below the 10 mg-N/L level, but significantly above background levels.

STATE WATER BOARD POLICY

In 2012 the State Water Board adopted the “Water Quality Control Policy for Siting, Design, Operation, and Maintenance of Onsite Wastewater Treatment Systems”, also known as the OWTS Policy. The OWTS Policy provides a multi-tiered strategy for management of OWTS in California, under which local jurisdictions are authorized to regulate septic systems, provided they conform to certain requirements in the Policy. Marin County EHS is in the process of obtaining Water Board approval of the County’s program, referred to as the Local Agency Management Program, or LAMP. The OWTS Policy is relevant in the evaluation of Dillon Beach Village since: (a) the Policy presents a list of 12 key concerns and conditions that local agencies must consider in their LAMP; and (b) 8 of the 12 areas of concern are conditions that exist in Dillon Beach Village. **Table 4-1** lists the Policy language and its applicability to Dillon Beach Village. It provides a summary of the key OWTS concerns and issues to be considered in wastewater management decisions for Dillon Beach Village.



DIILON BEACH VILLAGE WASTEWATER STUDY
DILLON BEACH, 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

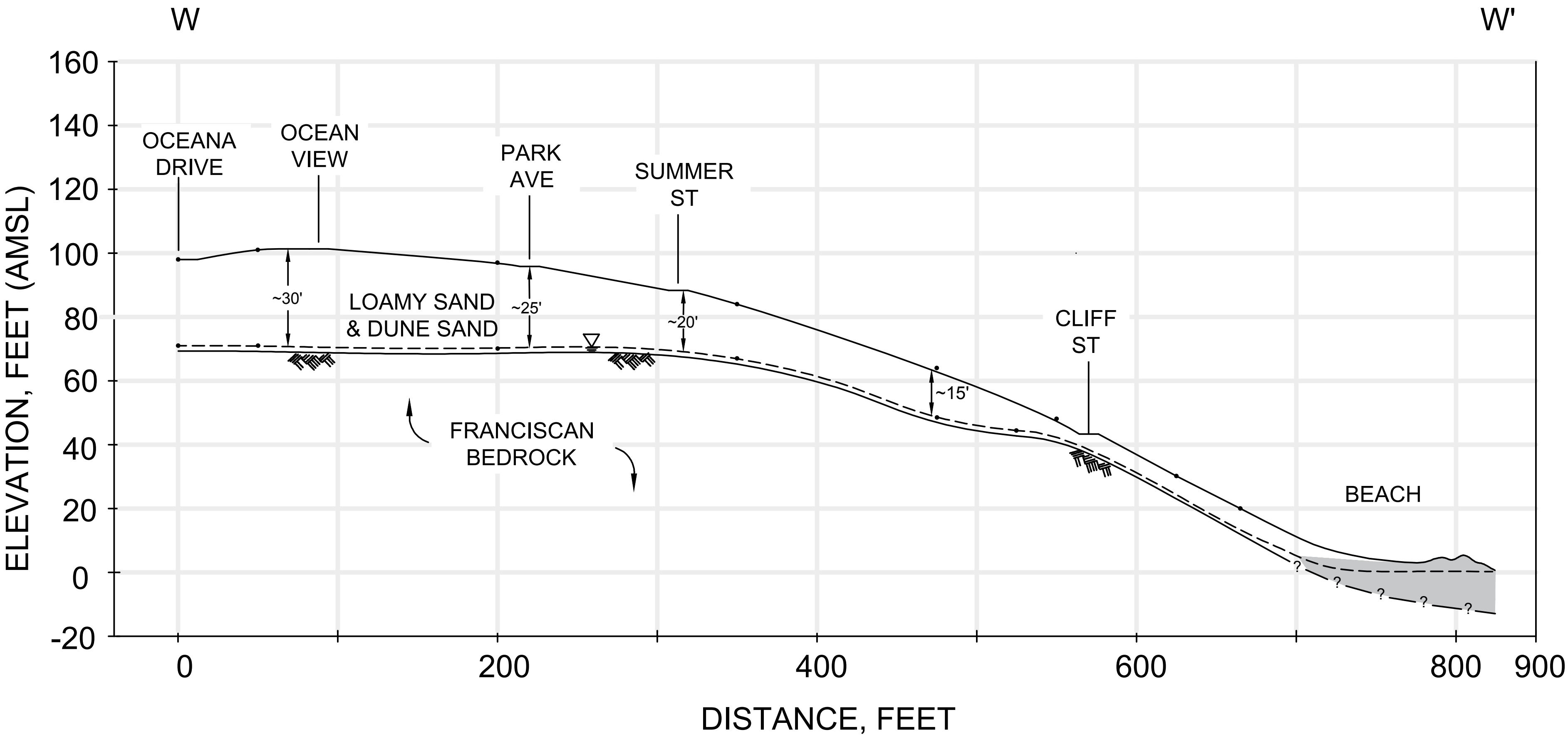
Design:	NH
Drawn:	PS
Checked:	NH
Appr'd:	NH

WATER RESOURCE ISSUES
DILLON BEACH, CA

FIGURE
4-2

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

PLOT STYLE: QUESTA-GRAYSCALE-255.CTB
PLOT DATE: 7/7/2022
LAST SAVED: 7/7/2022



SUBSURFACE DATA: SOIL PROFILE AND GEOTECHNICAL BORING LOGS ON FILE @ MARIN COUNTY MARIN CO.EHS

DIILON BEACH VILLAGE WASTEWATER STUDY
DILLON BEACH, CA

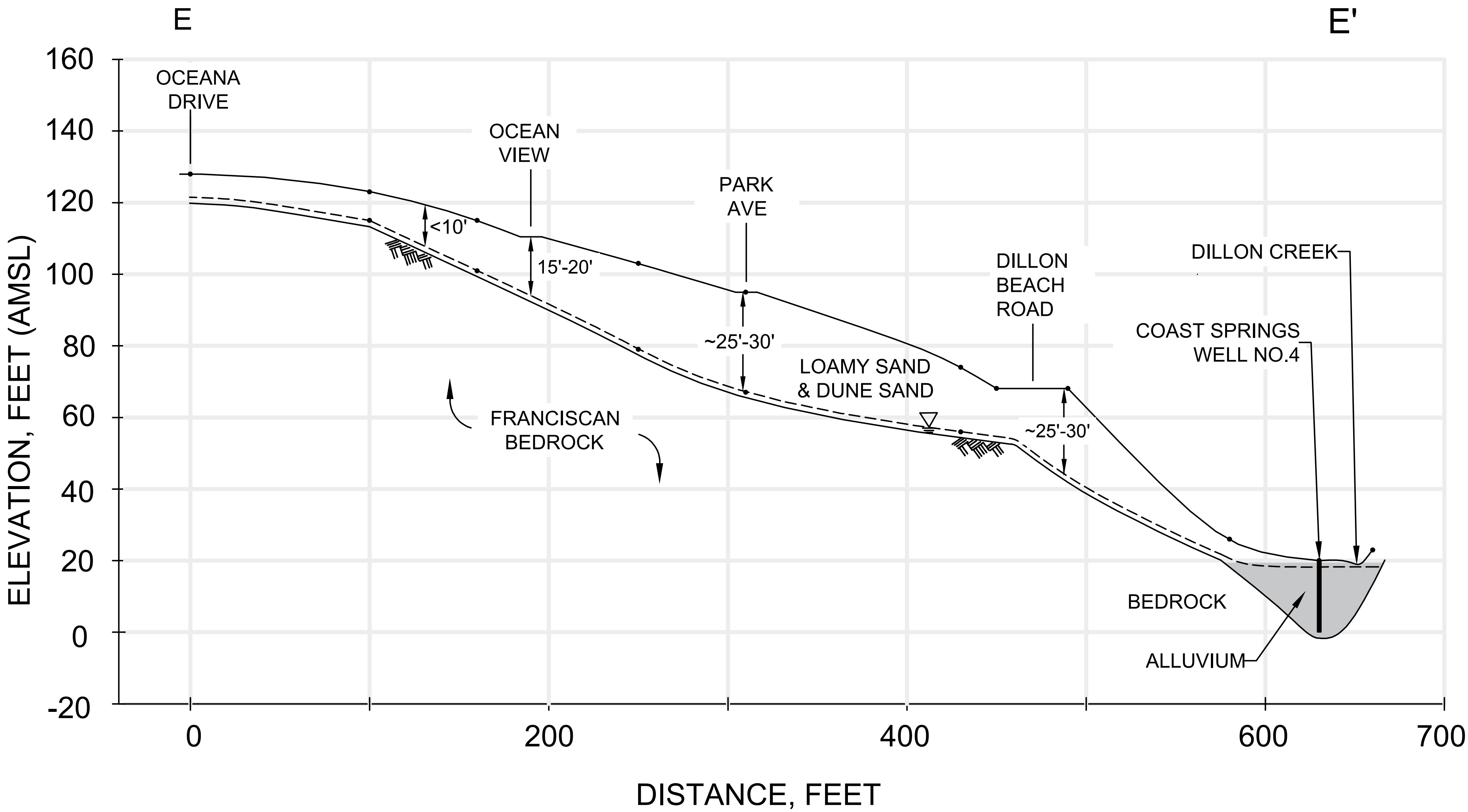
QUESTA ENGINEERING CORP.
Civil Environmental & Water Resources
(510) 236-6114
FAX (510) 236-2423
questa@questaec.com
P.O. Box 70356 1220 Brickyard Cove Road Point Richmond, CA 94807

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

WEST CROSS-SECTION, W-W'
DILLON BEACH, CA

FIGURE
4-3

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



SUBSURFACE DATA: SOIL PROFILE AND GEOTECHNICAL BORING LOGS ON FILE @ MARIN COUNTY MARIN CO.EHS

DIILON BEACH VILLAGE WASTEWATER STUDY
DILLON BEACH, 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:	PS
Checked:	NH
Appr'd:	NH

EAST CROSS-SECTION, E-E'
DILLON BEACH, CA

FIGURE
4-4

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

PLOT STYLE: QUESTA-GRAYSCALE-255.CTB
PLOT DATE: 7/7/2022
LAST SAVED: 7/7/2022
P:\2020\2000170_DILLON_BEACH_VILLAGE_WASTEWATER\CAD\MODEL\2000170_PROJECT ALTERNATIVES.DWG

Table 4-1. Excerpts from State Water Board OWTS Policy

Section No.	OWTS Issues of Concern	Applicability to Dillon Beach Village
9.1.1	Degree of vulnerability to pollution from OWTS due to hydrogeological conditions.	**YES.** Half of the OWTS drain to highly permeable sandy soils overlying a recharge area tributary to the community groundwater supply; most are within a few months travel time to the well(s).
9.1.2	High quality waters or other environmental conditions requiring enhanced protection from the effects of OWTS	**YES.** Half of the OWTS drain to the primary water supply aquifer, heavily relied on due to limited alternate water sources in the area.
9.1.3	Shallow soils requiring a dispersal system installation that is closer to the surface than is standard	**N/A**
9.1.4	OWTS is located in area with high domestic well usage	**YES.** Half of the OWTS are within 200 to 600 feet of the main community water supply well(s), which supply drinking water to 250 residences and businesses in Dillon Beach and Oceana Marin.
9.1.5	Dispersal system is located in an area of fractured rock.	**N/A**
9.1.6	Dispersal system is located in an area with poorly drained soils	**N/A**
9.1.7	Surface water is vulnerable to pollution from OWTS	**YES**. Many OWTS are located adjacent to and under paved areas that drain via streets, gutters and storm drain to Dillon Creek, with the outfall approx 200' upstream of main water supply well; OWTS surface failures can be carried rapidly with rainfall-runoff to the creek.
9.1.8	Surface water within the watershed is listed as impaired for nitrogen or pathogens	**N/A**
9.1.9	OWTS is located in an area of high OWTS density	**YES.** Very high density; 127 developed residences plus commercial on 8.7 acres; average parcel size less than 2,500 ft^2
9.1.10	A parcel's size and its susceptibility to hydraulic mounding, organic or nitrogen loading, and whether there is sufficient area for OWTS expansion in case of failure.	**YES.** High risk of nitrogen loading impacts on local groundwater supply due to combination of very small parcel sizes, high density of OWTS, rapidly draining sandy soils, and close proximity of wells.
9.1.11	Geographic areas that are known to have multiple, existing OWTS predating any adopted standards of design and construction including cesspools.	**YES.** Homes date back to the early 1900s, average 1940; cesspools (redwood boxes) are known to have been a common historical practice and many still exist.
9.1.12	Geographic areas that are known to have multiple, existing OWTS located within either the pertinent setbacks listed in Section 7.5 of this Policy, or a setback that the local agency finds is appropriate for that area.	**YES.** Small lot sizes makes it impossible for many OWTS to comply with multiple horizontal setback requirements, e.g., property lines, buildings, driveways, utilities; possibly "surface water intake" of public water system.

ONSITE WASTEWATER QUESTIONNAIRE SURVEY

In spring of 2022 an Onsite Wastewater Questionnaire Survey was developed and mailed to approximately 160 property owners in the Dillon Beach Village area. The mailing list for the survey was that used by Marin County for the Dillon Beach Village area. Purposes of the survey included:

a. To inform members of the community about the feasibility study being conducted;

b. To evaluate existing OWTS conditions and practices, wastewater treatment and disposal needs

c. To obtain community input that might assist in the review and evaluation of potential long-term wastewater management alternatives for Dillon Beach Village.

The survey was voluntary and responses did not require identification of property owner name or address. The completed surveys were identified and grouped only in relation to general locations within Dillon Beach Village.

The scope of the survey and individual questions were developed by Questa Engineering with review and input from Marin County EHS and the Technical Advisory Committee for the study. A reference map was also included with the questionnaire. The issues covered in the questionnaire survey related to:

- General location of the property in Dillon Beach Village
- Occupancy on the property
- Type of OWTS serving the property
- Septic tank location, age, construction and O&M issues
- Leach field location, age, design, construction and O&M issues
- How graywater is handled
- Concerns and interests about existing septic system
- Level of interest in the long-term Wastewater Management Approaches
- Suggestions and other comments

A copy of the questionnaire and the accompanying transmittal letter sent to property owners is included in **Appendix B**.

A total of 52 completed questionnaires were returned to Questa Engineering in April and May 2022. **Table 1** summarizes the key information from the survey forms, organized by general geographical sub-areas, west and east of North Street.

Table 4-2. Questionnaire Survey Results

Survey Item	Sub-Area Study Area		Total
	West of North St	East of North St	
Total Responses	20	32	52
Total # Bedrooms:			
1-2	11	25	36
3-4	7	4	11
Total # Bathrooms:			
1-2	15	26	41
2.5-3.5	1	2	3
# of Full-time Residents	3	4	7
Code-Compliant Septic Tank (size, material)	16	24	40
Age of Tank:			
<20 years	8	9	17
20-40 years	7	10	17
>40 years	3	5	8
Location/Access to Tank:			
Front yard	2	9	11
Side yard	9	2	11
Backyard	7	13	20
Septic Tank Pumping Frequency:			
Every 1 year	3	2	5
2.5 years	10	7	17
5-10 years	3	6	9
>10 years	-	6	6
Never	2	4	6
Disposal System Design			
Trench	11	14	25
Seepage Pit	3	1	4
Age of Disposal System:			
<20 years	8	8	16
20-40 years	5	11	16
>40 years	3	3	6
Leachfield:			
Single	4	6	10
Dual	6	8	14
Leachfield Location:			
Front yard	2	6	8
Side yard	6	4	10
Backyard	8	11	19
Clothes Washer Disposal:			
To Septic Tank	10	11	21
Directly to Leach field	-	1	1
To Landscaping	1	1	2
Household Graywater Disposal:			
To Septic Tank	11	23	40
To Leach field	-	1	1
To Landscape	1	-	1
Interest in Implementing Graywater System:			
For Washer	8	7	15
For Other Household Graywater	11	11	22

Key findings from the tabulation above and other comments contained in the completed questionnaire survey are summarized below.

- **Responses.** The 52 responses represent about 32% of the total surveys distributed in the defined Study Area. This is a good response rate as 30% to 50% response is common for these types of surveys. There was more responses to the survey were from the east side than the west side of Dillon Beach Village.

- **Septic Tanks**. The vast majority of the properties indicated their systems to be between 20-40 years, and about 20% being more than 40 years. Location of the septic tank is spread around the house, half of which is located in the backyard. 40% of the respondents indicated tank maintenance done every 2-5 years where as about 15% indicate never having pumped their tank.

- **Leachfield.** Almost all the properties have trenches of about the same age as the septic tank. Half of the survey takers have leach fields in the backyard and other half have it in front and side yards

- **Graywater Systems.** Majority of the responders reported that the household graywater and water from clothes washer are disposed to septic tanks. About 40% indicated an interest in implementing a graywater system.

- **Concerns & Interests about OWTS.** The vast majority of respondents indicated low level of concerns about condition, age, use and functioning of the systems. There were few concerned about public health & water quality impacts of septic systems and other watersheds. See **Table 4-3.**

- **Wastewater Management Approach. Table 4-4** summarizes the opinions and interest regarding a range of different wastewater management approaches. The indicated support was varied and similar across the alternatives listed.

- **Comments.** Other comments added at the end of the questionnaire included more specific information the OWTS components (e.g., tank/leach field size), emphasis on how well their system has operated for many years, caution against trying to fix what isn't broken, appreciation for the survey and overall effort to study OWTS issues.

Table 4-3. Issues and Levels of Concern

Issue	West of North St			East of North St		
	Low (%)	Medium (%)	High (%)	Low (%)	Medium (%)	High (%)
Condition, Functioning, Age of OWTS	85	5	10	86	10	4
Code Compliance	84	3	13	94	4	2
Impacts on Use of Property	87	5	8	94	3	3
Public health & water quality impacts of septic systems	58	20	22	53	25	22
Public health & water quality impacts of other watershed factors	52	18	30	56	23	21
General Concerns	50	20	30	32	26	42

Table 4-4. Wastewater Management Approaches – Level of Interest

	West of North St			East of North St		
	Low (%)	Medium (%)	High (%)	Low (%)	Medium (%)	High (%)
Status Quo	47	40	13	50	30	20
Management & financing for improvements of existing onsite septic systems	38	37	25	68	23	9
Community wide sewer system	35	30	35	44	26	30
Hybrid Mix of Above	13	34	53	44	12	44

SECTION 5: PROJECT ALTERNATIVES AND WASTEWATER FLOWS

FORMULATION OF ALTERNATIVES

Service Area

The Dillon Beach Village Study Area encompasses three distinct sub-areas currently served by onsite wastewater systems as follows:

- **Dillon Beach Village**. The Village comprises about 90 percent of the development and wastewater generation within the Study Area. It includes 127 residential properties on very small lots (2,000 to 3,000 ft^2) and several commercial properties utilizing onsite septic systems. The commercial properties in the Village which are each served by separate onsite septic systems include: U.S. Post Office, General Store & Deli, Coastal Kitchen (café), 25-unit RV Park, (3) Rental Cabins, and Beach Restroom.

- **Bay Road-Cliff Street Extension.** This includes a group of 16 residential properties built in the 1950s and 1960s located on the south side of Dillon Creek.

- **Oceana Drive.** This includes a group of six (6) residential properties bordering the east side of the Village, located within the Oceana Marin development and utilizing onsite septic systems built in the 1970s.

Project Alternatives

Wastewater management alternatives were formulated after extensive review of background information on existing and historical OWTS practices in Dillon Beach, the status and capacity of the Oceana Marin wastewater facilities, local site conditions including subsurface information within the Village and nearby areas, and issues of most concern from a water quality and public health perspective. Below is a brief description of the alternatives identified for analysis and comparative review. The alternatives were formulated to provide: (a) a range options that include no project, OWTS upgrades and management, and community sewerage to Oceana Marin; and (b) a mix of different options for the three distinct sub-areas, as summarized in **Table 5-1**.

Alternative 1 - No Project. The No Project alternative would maintain the status quo, where individual property owners would continue to be responsible for ongoing maintenance, repair, upgrade and replacement of existing OWTS in accordance with current practices and Marin County onsite sewage disposal regulations and policies. There would be no set schedule for upgrading any existing septic systems, and no mandatory inspection or maintenance work. OWTS improvements and correction of non-conforming or problematic septic systems would take place, one-by-one over an indefinite amount of time.

Alternative 2 – OWTS Upgrades and Management Program. This alternative would provide for systematic evaluation and as needed upgrade of onsite systems to be done in conjunction with the formation of an OWTS maintenance/management "zone" or district. Two options are identified under this alternative, which differ according to the target level of OWTS upgrade and treatment requirements to be achieved as follows:

- **Alternative 2a**: The objective of this alternative would be to evaluate and upgrade all OWTS to meet Marin County Class II septic system repair criteria in a manner generally consistent with the repair and replacement practices that have been followed over the past 25 to 30 years.

- **Alternative 2b:** This alternative would follow the same approach as **Alternative 2a**, but with the additional step of designating the east side of the Village as an advanced water quality protection management sub-area, due to its close proximity and recharge contribution to the Dillon Creek water supply aquifer. It would include requirements for supplemental treatment for nitrogen removal to be incorporated for existing and replacement OWTS in the designated management area.

Alternative 3 – Community Sewerage Connection to Oceana Marin. This alternative provides for the installation of sanitary sewers and connection to the neighboring Oceana Marin Wastewater System, which is operated by North Marin Water District (NMWD). Two variations of this alternative are presented:

- **Alternative 3a** would extend sewer service to all developed residential and commercial properties in the Study Area, including the Village, Bay Dr/Cliff St Extension, and properties using OWTS on Oceana Dr.

- **Alternative 3b** would extend sewer service to the Village area only, including all residential and commercial properties with the exception of the RV Park, which is in the process of implementing an advanced OWTS, recently approved by the State and County. Areas not included in the sewer service area would remain under status quo.

Both **Alternatives 3a** and **3b** would require expansion of the existing Oceana Marin leachfield system, which does not currently have capacity for the additional flows that would be added from Dillon Beach Village. The proposed expansion would occur within the overall footprint of the existing 11-acre Oceana Marin leachfield site. To accommodate additional flows from the Village, it is also assumed that other capital improvement upgrades to the existing wastewater system would be completed in accordance with recommendations in the 2015 "Master Plan Update for the Oceana Marin Wastewater System"[5], key projects being (a) reliability upgrades at the main lift station; (b) installation of a second, parallel force main from the main lift station to the treatment plant; and (c) wastewater pond repairs. Funding of improvements would be facilitated by the connections fees charge to properties within the Dillon Beach Village service area, which are accounted for in project cost estimates.

Alternative 4 – Hybrid - Village Sewerage and OWTS Upgrades/Management. This alternative consists of a combination of **Alternatives 1**, **2a** and **3b**. It would:

(a) prioritize the east side of the Village (plus the beach restroom) for community sewerage and connection to the Oceana Marin Wastewater System;

(b) establish an OWTS upgrade and management program for the west side of the Village; and

[5] Nute Engineering, January 2016.

(c) leave Bay Dr, Cliff St Extension, and Oceana Drive areas under the status quo – i.e., continued individual property owner responsibility for OWTS.

Alternative 4 would also include expansion of the existing Oceana Marin leachfield system and capital improvements to the existing Oceana Marin wastewater facilities per **Alternatives 3a/3b**.

Table 5-1. Summary of Project Alternatives

Alternative	Service Sub-Areas			
	Village		Bay Dr & Cliff St Ext.	Oceana Dr
	East	West		
Alternative 1: No Project	Status Quo	Status Quo	Status Quo	Status Quo
Alternative 2a: OWTS Mgt	OWTS Mgt	OWTS Mgt	OWTS Mgt	OWTS Mgt
Alternative 2b: OWTS Mgt w/N Mitigation	OWTS Mgt w/N Mitigation	OWTS Mgt	OWTS Mgt	OWTS Mgt w/N Mitigation
Alternative 3a Full Sewerage	Sewerage	Sewerage	Sewerage	Sewerage
Alternative 3b: Village Sewerage	Sewerage	Sewerage	Status Quo	Status Quo
Alternative 4: Hybrid: Village-East Sewerage Village-West OWTS Mgt	Sewerage	OWTS Mgt	Status Quo	Status Quo

ESTIMATED WASTEWATER FLOWS

Onsite Wastewater Treatment Systems

Design Flow – Maximum. Wastewater flows used to design onsite wastewater treatment systems is done in accordance with criteria contained in Marin County Onsite Sewage Disposal Regulations. Maximum expected flows are used to size leachfield systems, which for residences are based on bedroom count, at 105 gpd per bedroom. Wastewater flows for non-residential properties are based on the uses and wastewater generating activities, such as employees, meals served, guest lodging, etc. In repair situations, the standard sizing criteria are followed to the maximum extent practicable. In cases where the property does not have sufficient suitable area to accommodate the full design flow, all efforts are typically made to provide as much capacity as possible in the available area. In some cases, supplemental treatment may be considered to reduce the required amount of leachfield. However, historically in Dillon Beach Village, supplemental treatment systems to mitigate for small available leaching area have not been employed, as the treatment systems themselves would themselves end up occupying some of the valuable space otherwise used for leaching trenches.

Average Flow. Monitoring of hundreds of residential OWTS in Marin County (and elsewhere) over the past 15 to 20 years shows average wastewater flows to be well below standard OWTS design flow assumptions, commonly as little as one-third to one-half of the estimated maximum daily flow. Water use data for Dillon Beach Village area presented in Section 3 indicates average wastewater flow per residence during the peak summer period to be in the range of 45 to 55 gpd per residence, compared to a design flow of 210 gpd for the typical 2-bedroom houses in the Village. Average wastewater flows are relevant to the consideration of overall wastewater loading and cumulative effects of septic systems, as addressed in the analysis of nitrate loading (**Appendix C**).

Community Sewerage Alternatives

Estimated wastewater flows for the community sewerage alternatives are necessary for design and capacity evaluation of the Oceana Marin wastewater collection, transmission, treatment and disposal facilities. Factors considered in estimating flows for the Dillon Beach Village area included the following:

- **Existing Oceana Marin flows and projections**. The 2015 Master Plan Update report by Nute Engineering uses an estimated average dry weather daily flow per residence of 70 gpd for the Oceana Marin service area. We also obtained and reviewed the monthly wastewater flow records for the Oceana Marin system for 2021 calendar year from the monitoring reports submitted to the Regional Water Board. The data indicated a dry season (May-October) average flow of 74 gpd per connection, and 82 gpd per connection year-round average.

- **Infiltration and Inflow**. The Oceana Marin wastewater system experiences significant infiltration and inflow (I/I) in some sewer segments, especially in areas subject shallow groundwater and drainage issues. The I/I flow component is in addition to the average residential sewage flow cited above. In Dillon Beach Village, which is characterized by deep, well drained sands, sewer system I/I is expected to be small to insignificant. The only location in the Village potentially subject to I/I would be along Beach Avenue, where the underlying bedrock is within the trenching depth for gravity sewer lines and laterals. I/I can be minimized by selective placement of manholes, good construction practices, and careful inspection of sewer and manhole installations. With this approach the I/I component can be considered negligible for the Dillon Beach Village sewer alternatives.

- **Historical water use information for Dillon Beach Village residences**. Review of water use data for Dillon Beach Village residences, as presented in **Section 3**, indicates average residential water usage of less than 40 gpd during the winter season, increasing to 45 to 55 gpd/residence during the peak summer season. This is based on data from 2-month meter reading and billing cycles, and does not necessarily reflect peak weekly or daily water demand. Also, water use does not translate directly to sewage generation; actual sewage flows are commonly estimated at 75 to 90 percent of water use, where landscape irrigation is small or negligible.

- **Design flows and historical water use for commercial facilities.** We reviewed historical water use for the Dillon Beach Resort commercial facilities (store-deli-café, RV park, rental cabins and beach restroom) along with design (maximum) wastewater flows for existing and proposed new OWTS for these facilities.

- **Marshall Community Wastewater System.** Lastly, we compiled actual 2021 wastewater flow data for the Marshall Community Wastewater System which has some similarities to Dillon Beach Village, with a mix of occupied residences, rentals and part-time occupancies and a popular restaurant and deli-café. The Marshall system does not experience significant I/I. We found the unit wastewater flows for Marshall to be higher than Oceana Marin in 2021, averaging 93 gpd during the May-Oct dry season, and 87 gpd year-round. Comparative wastewater flow data for Oceana Marin and Marshall are listed in **Table 5-2** alongside 5-yr water use data for Dillon Beach.

Table 5-2. Reference Water and Wastewater Flow Data

Month	Oceana Marin Wastewater System (235 connections*)	Marshall Community Wastewater System (60 connections)	Dillon Beach Village Coast Springs Water System (150 connections**)
	2021 Ave Wastewater Flow per Connection (gpd)	2021 Ave Wastewater Flow per Connection (gpd)	2016-2020 5-yr Ave Water Use per Connection (gpd)
January	65	72	33
February	76	76	
March	137	83	36
April	66	92	
May	70	92	42
June	73	98	
July	84	81	57
August	79	100	
September	60	102	48
October	77	85	
November	79	80	40
December	116	87	
Annual Average	**82**	**87**	**43**
May – Oct Average	**74**	**93**	**49**

*Updated since 2015 Master Plan
** Does not include Oceana Marin properties served by Coast Springs

Unit Wastewater Flows

Based on the review of the above information we propose the following unit wastewater flows for estimation of wastewater flows Dillon Beach Village community sewerage alternatives:

- Residences: 75 gpd (per dwelling)
- Commercial
  - ✓ Rental cabins 50 gpd (per cabin)
  - ✓ RV units 50 gpd (per RV)
  - ✓ Store-deli-café (based on water use) 650 gpd (total uses)
  - ✓ Beach restroom (500 uses/day at 2 gal ea) 1,000 gpd (total uses)
- Post Office 25 gpd (total uses)

Total Projected Average Dry Weather Flows

The estimation of total wastewater flows were developed by applying the above unit wastewater flow assumptions for residential and small commercial properties, to the proposed number and make-up of connections for **Alternatives 3a**, **3b** and **4**. The resulting flow estimates are presented in **Table 5-3.**

Table 5-3. Wastewater Flow Estimates – Project Alternatives

Alternative 3a				
Sewer System for Entire Study Area				
	No. of Units	Unit Flow (gpd)	Total Flow to Sewer (gpd)	Total Flow to OWTS (gpd)
Dillon Beach Village Residential	127	75	9,525	0
Bay Rd-Cliff St Extension	16	75	1,200	0
Oceana Dr	6	75	450	0
Commercial				
Beach Restroom (per use)	500	2	1,000	0
Rental Cottages	3	50	150	0
RV Park	25	50	1,250	0
Store-Deli-Café	1	650	650	0
Post Office	1	25	25	0
		Total	**14,250**	0

Alternative 3b				
Village Area Sewer (excluding RV Park)				
	No. of Units	Unit Flow (gpd)	Total Flow to Sewer (gpd)	Total Flow to OWTS (gpd)
Dillon Beach Village Residential	127	75	9,525	0
Bay Rd-Cliff St Extension	16	75	0	1,200
Oceana Dr	6	75	0	450
Commercial				
Beach Restroom (per use)	500	2	1,000	0
Rental Cottages	3	50	150	0
RV Park	25	50	0	1,250
Store-Deli-Café	1	650	650	0
Post Office	1	25	25	0
		Total	**11,350**	**2,900**

Alternative 4				
Priority Village Sewer – East Side Only				
	No. of Units	Unit Flow (gpd)	Total Flow to Sewer (gpd)	Total Flow to OWTS (gpd)
Dillon Beach Village - East	71	75	5,326	0
Dillon Beach Village - West	56	75	0	4,200
Bay Rd-Cliff St Extension	16	75	0	1,200
Oceana Dr	6	75	0	450
Commercial				
Beach Restroom (per use)	500	2	1,000	0
Rental Cottages	3	50	150	0
RV Park	25	50	0	1,250
Store-Deli-Café	1	650	650	0
Post Office	1	25	25	0
		Total	**7,150**	**7,100**

Per the 2015 Master Plan Update, the projected average daily wastewater flow for the Oceana Marin Wastewater System at build-out of an estimated 300 connections is approximately 21,000 gpd. The total combined wastewater flows for the Oceana Marin Wastewater System plus Dillon Beach Village at build-out under **Alternatives 3a**, **3b** and **4** would be:

- **Alternative 3a**: Oceana Marin at 21,000 gpd + 14,250 gpd = 35,250 gpd
- **Alternative 3b**: Oceana Marin at 21,000 gpd + 11,350 gpd = 32,350 gpd
- **Alternative 4**: Oceana Marin at 21,000 gpd + 7,150 gpd = 28,150 gpd

SECTION 6: ALTERNATIVES ANALYSIS

INTRODUCTION

This section presents an analysis of each of the identified alternatives for the Dillon Beach Village Study Area. The analysis included the completion of file reviews, field reconnaissance investigations and engineering studies, which were used to determine the facility requirements, engineering feasibility, operation and maintenance needs and estimated costs for the various alternatives.

For each alternative, maps and other reference materials are provided, along with a description of the key facilities, a review of regulatory issues, 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 7** presents a comparative review of the treatment and disposal alternatives and identifies the “apparent best alternative(s)”.

The alternatives have been developed to a <u>planning level</u> of detail rather than a <u>design level</u>, appropriate for comparison of the alternatives and for use by the community in determining the preferred course of action and next steps.

ALTERNATIVE 1 – NO PROJECT

Description

The No Project alternative would maintain the status quo, where individual property owners would continue to be responsible for ongoing maintenance, repair, upgrade and replacement of existing OWTS in accordance with current practices and Marin County onsite sewage disposal regulations and policies. There would be no set schedule for upgrading any existing septic systems, and no mandatory inspection or maintenance work. OWTS improvements and correction of non-conforming or problematic septic systems would take place, one-by-one over an indefinite amount of time (likely many years or decades), generally under the following circumstances:

- As a direct result of abatement required by Marin County EHS for individual properties in response to complaints or observed system failures;
- In connection with referrals from Marin County Planning and Building Departments regarding permits for site development, conditional use permits and new construction or building modifications;
- At the time of property transfers for refinancing (note: this is not a County requirement, but commonly arises as a condition of sale between buyer and seller); or
- By individual property owners on their own initiative, as needed.

Marin County Class II Repair Standards. OWTS repairs and upgrades would generally be made per EHS requirements for Class II systems, as outlined in the Marin County EHS

"Residential Improvement Policy for Septic Systems"[6]. This policy sets forth minimum criteria for repairs, which include reductions in some of the setback distances and relaxation of other requirements that apply to Class I OWTS installations for new construction and house expansion (i.e., bedroom additions). At a minimum, cesspools (where found to be in use) and sub-standard septic tanks would be brought up to a modern standard, including a 1,200-gallon septic tank and gravity (or pump-up) leachfield.

Waivers and Variances. Because of the very small lot sizes and limited area for septic systems, repair/replacement systems in Dillon Beach Village are not always able to meet even the minimum Class II setback standards, e.g., from buildings, property lines, utilities and other site development and landscape features. Historically, EHS has issued setback waivers administratively, and has generally not required repair systems to include supplemental treatment as mitigation for any waivers/variances.

Possible Changes per State OWTS Policy. The County's current/historical approach to OWTS repairs and replacement systems could change in the near future as a result of provisions in the State Water Board's 2012 OWTS Policy[7], under which the County may be obligated to impose an accelerated schedule or additional requirements for individual OWTS repairs and replacement systems in all or in portions of the Dillon Beach Village area. This could be required due to the age, non-conformity (cesspools), and high density of OWTS, along with their proximity to the local drinking water source (Dillon Creek aquifer). This could include future requirements for use of alternative OWTS, such as advanced ("supplemental") treatment units and pressure distribution or drip dispersal for effluent disposal, which have been employed sparingly or not at all in the past.

Other Measures. Retrofitting houses with ultra-low flush toilets and other water conserving plumbing devices may also be a necessity for many houses to reduce the volume of wastewater. In some cases graywater reuse/disposal systems for laundry, shower/baths and hand sinks may be feasible and could potentially be credited as part of the OWTS capacity, in accordance with provisions of the Chapter 15 to the California Plumbing Code ("Graywater Code").

Estimated Costs

It is not possible to provide a total cost for the No Project alternative. Costs will be borne individually by each property owner according to their own particular circumstances, including such things as the status of their existing septic system, property conditions, use/occupancy of their property, and any potential building plans they may have. Review of County septic system permit files for Dillon Beach indicates about 55% of the properties in the study area have either undocumented septic systems (no records) or other indications of a septic system (categorized as Class III and IV) that is noncompliant with current practices and minimum repair standards. These are the properties likely facing the most significant costs for septic system upgrade (at some point in time) under the No Project alternative. Based on cost estimates developed and presented under **Alternative 2** (OWTS Upgrade & Management Program), **Table 6-1** summarizes the range of costs for individual property owners that should be anticipated under

[6] https://www.marincounty.org/-/media/files/departments/cd/ehs/septic/septicsystemresidentialimprovementpolicy.pdf?la=en

[7] https://www.waterboards.ca.gov/water_issues/programs/owts/docs/owts_policy.pdf

the No Project Alternative. Cost estimates were developed for each category and reviewed with a local contractor experienced with all types of OWTS repair and replacement systems throughout Dillon Beach Village. The indicated costs include engineering, permitting and construction. There would also be the normal on-going costs incurred for septic tank maintenance pumping for all properties with OWTS.

Table 6-1. Estimated Range of OWTS Upgrade-Replacement Costs – No Project Alternative

Existing OWTS Status		Approximate % of Properties	Estimated Cost for Class II Upgrade or Replacement		Added Cost for Supplemental Treatment*
			Low	High	
Class I & II	New or repair permit since 1984	45%	0	$15,000	$22,000
Class III	Permitted prior to 1984	10%	$23,000	$36,000	$22,000
Class IV	Undocumented; no permit records.	45%	$45,000	$90,000	$22,000

*Additional cost if supplemental treatment becomes a future requirement for certain locations or situations within Dillon Beach Village for compliance with provisions of the State Water Board 2012 OWTS Policy.

Summary

Under the No Project Alternative, over some period of time there would be gradual improvements made to OWTS in Dillon Beach Village. This would occur: (a) where older systems are no longer able to function adequately; (b) from increasing levels of occupancy putting added stress on existing systems; (c) as a requirement in connection with house remodeling and other building projects; (d) as a condition of refinancing or property transfer; or (e) voluntarily by property owners.

The improvements would elevate each OWTS to a Class II repair standard, which would allow a modest level of building improvements. New residential construction, major building additions and second units would generally not be permissible except for a limited number of properties having sufficient area and site conditions to support the installation of an OWTS that conforms to current (Class I) code requirements.

Achieving compliance with Class II repair standards would address overt septic system failures that result from inadequate leaching/drainage capacity, sewage back-ups, seepage flow between properties or to surface breakout points, and safety concerns related to tank or leachfield construction. However, meeting Class II repair standards would not address the cumulative nitrate loading impact on local groundwater resources from the high density and overall volume of septic system discharges in the Dillon Beach area. This is an existing condition that is likely to worsen with higher levels of occupancy and septic system discharges, coupled with increasing demand on limited available water supplies. At some point the County may be obligated under provisions of the State Water Board's 2012 OWTS Policy to recognize the Dillon Creek groundwater basin as an advanced protection management area, which could include new requirements for supplemental OWTS treatment in certain parts of the Village.

ALTERNATIVE 2 – OWTS UPGRADE AND MANAGEMENT PROGRAM

Description

This alternative would provide for systematic evaluation and as needed upgrade of onsite systems to be done in conjunction with the formation of an OWTS maintenance/management "zone" or district. The legal basis and procedures for this are contained in the California Health and Safety Code under Division 6, Part 2, Chapter 3 - On-site Wastewater Disposal Zones. Although not the only approach, it is anticipated that the Marin County Board of Supervisors would serve as the governing board and the program would be administered through EHS or an equivalent arrangement. This is the organizational approach adopted by the County for the construction, oversight and management of the Marshall Community Wastewater System.

Establishing an OWTS Zone would allow more flexibility and options for OWTS improvements through adoption of customized local standards and waivers for OWTS siting and design requirements (as applicable), streamlined permitting process, and access to loans and grants for system improvements. Other key elements of an onsite wastewater management program would be: (a) provisions (such as operating permits) to ensure routine inspection and maintenance of all OWTS; and (b) ongoing monitoring of groundwater and surface water quality to assess local OWTS impacts and guide future improvements.

Two options are identified under this alternative, which differ according to the target level of OWTS upgrade and treatment requirements to be achieved as follows:

Alternative 2a: The objective of this alternative would be to evaluate and upgrade all OWTS to meet Marin County Class II septic system repair criteria in a manner generally consistent with the repair and replacement practices that have been followed over the past 25 to 30 years. This would include a code-compliant 1,200-gallon septic tank with gravity or pump-up leachfield, designed for 100% capacity and in accordance with current regulations to the maximum extent practicable. In some cases, due to extremely limited space, it may be appropriate and necessary to require the use of alternative treatment and dispersal methods, rather than conventional septic tank and leachfield approach.

Alternative 2b: This alternative would follow the same approach as **Alternative 2a**, but with the additional step of designating the east side of the Village as an advanced water quality protection management sub-area, due to its close proximity and recharge contribution to the Dillon Creek water supply aquifer. Consistent with State OWTS Policy for advanced protection management areas, at a minimum it is anticipated that this would require OWTS in the designated sub-area to include supplemental treatment for nitrogen removal. The objective under **Alternative 2b** would be to reduce the cumulative nitrate loading impacts on the local groundwater to an acceptable level through the application of advanced OWTS technologies, which would be done in connection with system replacements and retrofits of existing Class II OWTS to the extent practicable.

OWTS Upgrade-Replacement Criteria. Under both **Alternatives 2a** and **2b**, a minimum set of standards would be established particular to the Dillon Beach service area, and all existing septic systems would be reviewed and evaluated for compliance. From this information, the level of upgrade and replacement would be determined and plans developed to implement the identified improvements. Grants and loans would be pursued to aid in financing the individual OWTS improvements. **Table 6-2** presents a preliminary outline of recommended OWTS

Table 6-2: Preliminary Upgrade-Replacement Criteria- OWTS 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 and per minimum Class II repair standards.
Supplemental Treatment Units (if/where required)	▪ NSF Certification or equivalent technology verification required. ▪ Performance standard: (a) per State OWTS Policy for nitrogen removal and pathogen reduction, where applicable; or (b) substitute EHS protocol and criteria contained in Marin County OWTS Local Agency Management Program for advanced management protection areas or Dillon Beach-specific (approval pending).
Dispersal System	▪ All reasonable dispersal technologies may be considered, including trenches, beds, seepage pits, local augur-hole variations, pressure distribution and drip dispersal; ▪ Design capacity – 100% of daily sewage; provide reserve area as feasible; ▪ Design loading rate: 1.2 gpd/ft^2, for loamy sand and dune sand; treatment credit for supplemental treatment OK per established sand filter design criteria; ▪ Sizing: sizing based on combination of sidewall and bottom infiltration area, with specified limitations; ▪ Setbacks to water and landscape features to be maintained as close as possible to code requirements and per minimum Class II repair standards.
Other Options	▪ Holding tanks: may be necessary and approved case-by-case to overcome extreme site limitations; ▪ Graywater systems: case-by-case evaluation and approval/credit for year-round irrigation or disposal based on State Graywater Code.
Performance Monitoring	▪ Wastewater flow: (a) annual water use records for gravity systems; (b) pump operating data for pump systems. ▪ Monitoring: as applicable for nitrogen and/or fecal coliform, where supplemental treatment is required to meet water quality criteria; not required where enhanced treatment used for reduction in dispersal; monitoring frequency to be determined. ▪ Visual inspection, effluent filter cleaning and as needed maintenance once per year minimum; ▪ Remote alarm monitoring for identified high risk systems, e.g., large flow-commercial systems; location.

upgrade-replacement criteria. In general, all applicable siting criteria (i.e., soil depth, percolation, groundwater, slope requirements, etc.) would be considered in evaluating and designing septic system upgrades. The tentative criteria in **Table 6-2** would be refined and formally adopted as an initial task of the OWTS management program.

Generally, on-lot septic system improvements under **Alternative 2a** would be similar to those for the No Project alternative; i.e., replacement of substandard systems with new septic tanks and leachfields, using supplemental treatment units and alternative dispersal methods selectively, as appropriate or necessary. Retrofitting houses with ultra-low flush toilets and other water conserving plumbing devices would be included to reduce water use and wastewater flows. In some cases graywater reuse/disposal systems for laundry, shower/baths and hand sinks may be feasible and could be considered and credited as part of the OWTS capacity, in accordance with provisions of the Chapter 15 of the California Plumbing Code ("Graywater Code").

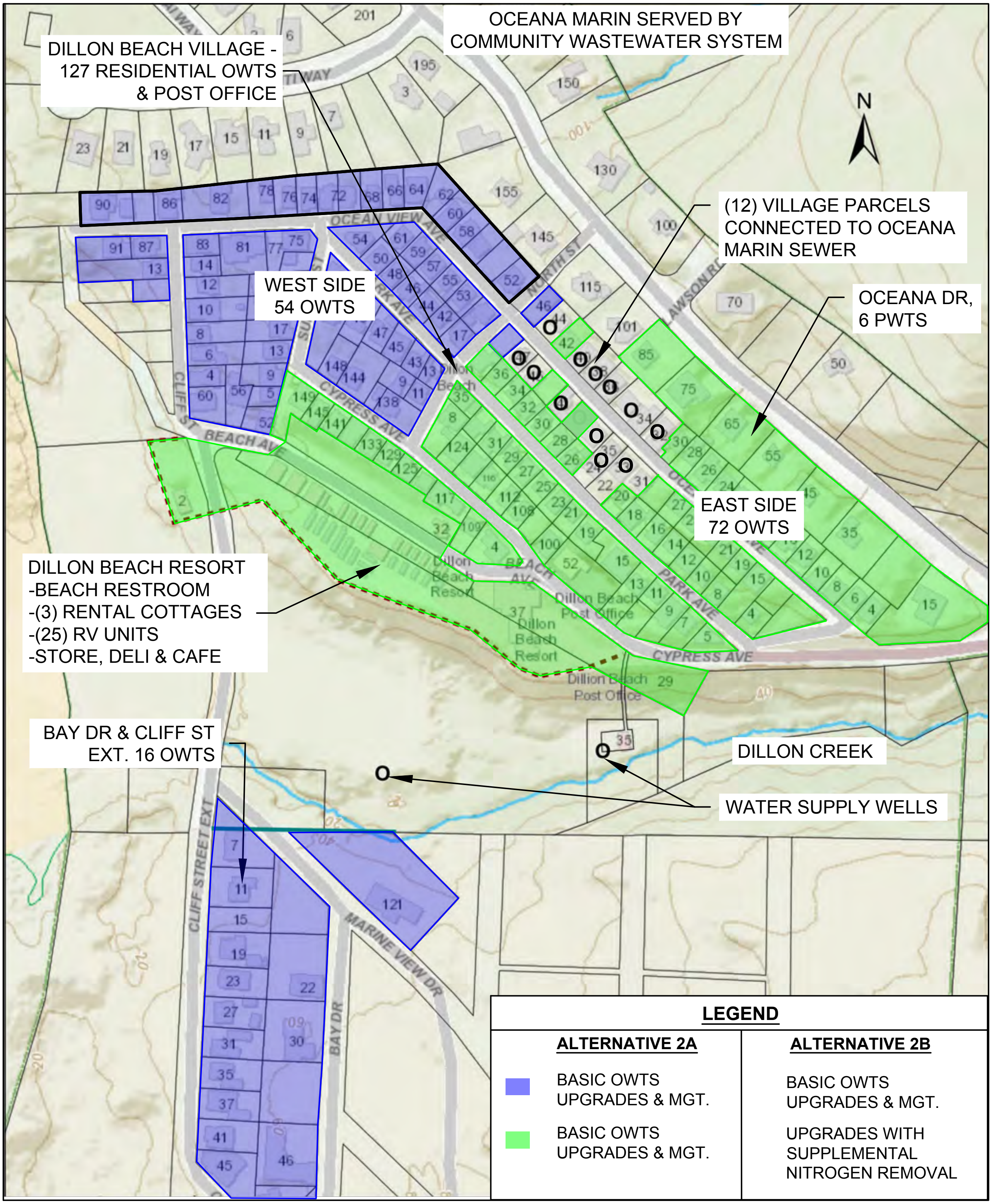
Supplemental Treatment for Nitrogen Reduction. Alternative 2b would be structured the same as **Alternative 2a**, but with the additional aim of addressing the cumulative nitrate loading impact from Village septic systems that discharge within the recharge area of the Dillon Creek aquifer. This encompasses approximately 80 individual residential OWTS on the east side of the Village, plus commercial properties of the Dillon Beach Resort, except for the beach restroom which drains westerly to the ocean (see **Figure 6-1**).

As previously discussed in **Section 3**, the existing domestic water supply wells that draw from the local aquifer (Coast Springs Well No. 4 and DBR/"Cline" well) both exhibit large fluctuations in nitrate levels, commonly reaching elevated concentrations significantly above background levels during the dry season. This coincides with the time of year when the subsurface drainage from the Village area makes up a significant portion of the inflow/recharge to the aquifer. Nitrate levels in the 4 to 6 mg-N/L range have been observed on a recurring basis. These levels are below the drinking water limit of 10 mg-N/L; however, higher levels can be expected with increased occupancy and wastewater discharges in Dillon Beach. The Dillon Creek aquifer is the principal source of water for the Coast Springs water system; and nitrate is not removed appreciably by conventional water filtration processes.

Nitrate loading analysis and calculations provided in **Appendix C** indicate the nitrogen associated with septic system discharges located on the east side of the Village currently result in recharge water (combined rainfall and septic effluent percolation) at or above the drinking water standard of 10 mg-N/L. These levels are projected to increase even higher in response to increases in occupancy and accompanying wastewater discharges in Dillon Beach. The nitrate analysis also shows that the concentrations can be reduced to safe levels (well below 10 mg-N/L) if the septic systems on the east side of the Village are upgraded with the installation of supplemental treatment units having 50% or more nitrogen removal capability. There are several commercial and non-proprietary nitrogen-removal treatment units developed for onsite wastewater systems that can be employed to meet this design objective. Two examples appropriate for Dillon Beach Village are:

- **RetroFast 0.375**. This is a small aerobic treatment unit, with NSF Standard 245[8] certification at 53% nitrogen removal, which is designed to be installed in the second

[8] NSF stands for National Sanitation Foundation. NSF Standard 245 refers to domestic nitrogen-removing aerobic treatment units certified as providing at least 50% nitrogen removal. A current listing of certified treatment units can be found at https://info.nsf.org/Certified/Wastewater/Listings.asp?TradeName=&Standard=245



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: PS
Checked: NH
Appr'd: NH

ALTERNATIVES 2A & 2B
OWTS UPGRADES & MANAGEMENT
DILLON BEACH, CA

FIGURE
6-1

P:\2020\2000170_DILLON_BEACH_VILLAGE_WASTEWATER\CAD\MODEL\2000170 REPORT FIGURES.DWG LAST SAVED: 9/6/2022 PLOT DATE: 9/6/2022 PAGE SETUP: ---- PLOT STYLE: ----

chamber of a standard (e.g., 1,200-gallon) septic tank. It requires a continuously operating air blower located external to the septic tank and a venting system. Otherwise there are no required changes to the septic system. There are currently several RetroFast units installed at residences in Marin County. See **Appendix D** for technical literature.

- **Recirculating Sand Filter (RSF)**. This is a non-proprietary treatment system in wide usage and included in Marin County regulations as an approved alternative (supplemental) treatment unit. It requires a pump and medium-coarse sand filter bed, which occupies an area of about 40 to 50 square feet for a typical 2-bedroom capacity system. See **Appendix D** for technical literature. An RSF has been approved by EHS, Regional Water Board and Coastal Commission to serve the Dillon Beach Resort RV Park, and is scheduled for installation in the fall of 2022. Other RSF examples in Marin County are at Due West Tavern in Olema and at French Ranch development and Lagunitas School in San Geronimo. The French Ranch system currently achieves nitrogen removal rates greater than 60 percent.

Under **Alternative 2b**, incorporation of supplemental nitrogen-removal treatment units (NSF Standard 245 or equal) would be required for all OWTS located within the defined Dillon Creek aquifer recharge area. This would include retrofit-upgrades for existing Class I and Class II systems and incorporation of nitrogen-removal units as required design element for upgrade-replacement of existing Class III and Class IV systems. Grant funds and loan funds would be pursued to assist in the financing of supplemental treatment units.

Estimated Capital Costs

Estimated costs were developed for **Alternatives 2a** and **2b** based on an assessment of the status of existing OWTS, the desired level of upgrade and improvements, and estimated costs for different types/levels of upgrade. Review of nearly 100 County septic system permit files for Dillon Beach along with information from the Homeowner Questionnaire Survey indicates the following approximate break down in the status of existing OWTS:

- 45% - Class I and Class II: New or repair OWTS permitted since 1984
- 10% - Class III: Record of OWTS having been permitted prior to 1984
- 45% - Class IV: Undocumented; no OWTS permit records on file

Using this approximate distribution we estimated the number of properties (OWTS) in each category and developed estimates of the expected level of OWTS upgrade work and associated costs for each classification, including:

(a) system inspection, evaluation and minor repair work for Class I and II;
(b) septic tank <u>or</u> leachfield replacement for Class III; and
(c) full system replacement for Class IV.

We further segregated Class IV into sub-categories related to the challenges for design and installation of replacement systems based on construction access and availability of space to accommodate new septic tank and leachfield installations on typical Dillon Beach Village lots. Sub-categories were: good access; difficult access; and highly constrained. Approximate numbers in each sub-category were based on the types and level of design and construction challenges we found in our review of many dozens of Class II repair systems documented in County permit files. Cost estimates were developed for each category and sub-category and then reviewed with a local contractor experienced with all types of OWTS repair and replacement systems throughout Dillon Beach Village. We also developed and included preliminary cost estimates for upgrades to the OWTS serving the commercial properties in Dillon Beach (store-deli-café, RV Park, rental cabins, and beach restroom) and included those costs in the overall estimates for each alternative.

Using the estimated number of OWTS in each category and corresponding cost estimate for each upgrade work category, overall cost estimates were developed for **Alternatives 2a** and **2b** as shown, respectively, in **Tables 6-3** and **6-4**. In addition to the actual construction costs, the overall cost estimates include a 15% contingency allowance, and a 30% allowance for planning, engineering, permitting and project administration. The average cost per residential parcel or "ESD" (which stands for "equivalent single-family dwelling") is calculated and shown at the bottom. For preliminary analysis, the commercial properties are estimated as equivalent to approximately 24 ESDs. This does not include the RV Park, to be served by a State- and County-approved advanced OWTS, currently under construction. As indicated, the estimated total capital costs are:

- **Alternative 2a** - approximately $5.89 million, with an average cost of about $33,600 per parcel/ESD; and

- **Alternative 2b** – approximately $7.74 million with an average cost of about $44,200 per parcel/ESD.

Table 6-3: Estimated Costs for Alternative 2a – OWTS Upgrades and Management (154 parcels; 175 ESDs)

Existing OWTS Status	Required Work	Percent of Total OWTS (residential)	Number of Systems	Average Cost per System	Total Estimated Cost ($)
A. Class I and II	inspect & upgrade	45%	69	$ 11,000	$ 759,000
B. Class III – tank issue	replace tank	5%	8	$ 16,000	$ 128,000
C. Class III – disposal issue	replace leachfield	5%	8	$ 25,000	$ 200,000
D. Class IV – good access	replace system	20%	30	$ 31,000	$ 930,000
E. Class IV – difficult access	replace system	15%	22	$ 38,000	$ 836,000
F. Class IV – highly constrained	replace system	10%	14	$ 61,000	$ 854,000
G. Commercial - Class II & III[1]	upgrades & replacement	-	3	-	$ 350,000
				Subtotal	**$ 4,057,000**
				Contingency @ 15%	$ 608,550
				Engineering, Environmental, Permitting and Administration @ 30%	$ 1,217,100
				TOTAL ESTIMATED COST	**$ 5,882,650**
				Estimated Average Cost Per ESD (175 ESDs)	**$ 33,615**

[1] Includes store-deli-café, rental cabins and beach restroom, estimated 24 ESDs; RV Park assumed to be accommodated by advanced Class II system (including N removal), permitted and under construction.

Table 6-4: Estimated Costs for Alternative 2b – OWTS Upgrades with Nitrogen Removal (154 parcels; 175 ESDs)

Existing OWTS Status	Required Work	Percent of Total OWTS (residential)	Number of Systems	Average Cost per System[1]	Total Estimated Cost ($)[1]
A. Class I and II	inspect & upgrade	45%	69	$ 18,500	$ 1,276,500
B. Class III – tank issue	replace tank	5%	8	$ 23,500	$ 188,000
C. Class III – disposal issue	replace leachfield	5%	8	$ 32,500	$ 260,000
D. Class IV – good access	replace system	20%	30	$ 38,500	$ 1,155,000
E. Class IV – difficult access	replace system	15%	22	$ 45,500	$ 1,001,000
F. Class IV – highly constrained	replace system	10%	14	$ 68,500	959,000
G. Commercial - Class II & III	upgrades & replacement	-	3	-	$ 500,000
				Subtotal	**$ 5,339,500**
				Contingency @ 15%	$ 800,925
				Engineering, Environmental, Permitting and Administration @ 30%	$ 1,601,850
				TOTAL ESTIMATED COST	**$ 7,742,275**
				Estimated Average Cost Per ESD (175 ESDs)	**$ 44,241**

1 Average unit cost assuming 50% of properties with supplemental treatment, 50% without.

2 Includes store-deli-café, rental cabins and beach restroom, estimated 24 ESDs; RV Park assumed to be accommodated by advanced Class II system (including N removal), permitted and under construction.

Operation, Maintenance and Monitoring (OM&M)

In conjunction with septic system upgrading, an ongoing inspection and monitoring program would be established and implemented under both **Alternatives 2a** and **2b.** This is envisioned to include collection of water use/wastewater flow information and regular inspection of each septic system, at frequencies matched to the operating complexity of the each type of system. For example, conventional gravity systems could be scheduled for basic annual inspection including cleaning of the effluent filter, measurement of sludge and scum accumulation, and check of leachfield drainage status. More complex systems, e.g., those with supplemental nitrogen-removal units (**Alternative 2b**), would require more frequent inspections and some level of water quality testing to track and confirm the proper operation, maintenance and performance of treatment units. A program for water quality sampling of groundwater and surface water locations in the areas potentially impacted by septic system discharges would also be conducted by as part of the oversight program under both **Alternatives 2a** and **2b**. An efficient way of carrying out the necessary OM&M could be through a single maintenance contractor or contractors retained by the County/EHS. This is the approach used by the County/EHS for OM&M at the Marshall Community Wastewater System.

Under **Alternative 2b** there would be electrical costs associated with the operation of supplemental treatment systems as well as pump systems used for any pump-up or pressure-dosed disposal systems. Each property owner would be responsible for providing and maintaining electrical service for this equipment. From time-to-time various system components (such as valves, pumps and float controls) would require repair or replacement. The need for this work would be determined through maintenance inspections. Depending on the complexity, the actual repair/replacement work could be done by the maintenance inspector, a separate contractor or, possibly, the property owner.

Estimated costs for ongoing OM&M would include fees to cover maintenance inspections, routine servicing, water quality sampling activities, and overall administration of the program by the County/EHS (or other entity that may be established). Using the County's current OWTS operating permit program for alternative OWTS as an example, it is estimated that baseline costs would be on the order of about $900 per year, including: (a) $500 for administrative oversight and water quality sampling program; (b) $200 for annual inspection and maintenance; and (c) $200 per year toward septic tank pump-out costs that occur every 3 to 5 years. Additional costs would likely be incurred for equipment replacement/repair for those OWTS that include supplemental treatment and/or pump systems.

Summary

Septic system upgrades and replacement, along with establishment of an onsite management program, would address water quality concerns and hazards posed by aging, nonconforming septic systems and ensure adequate capacity for the increasing occupancy levels that appear to be trending in Dillon Beach. Requirements for supplemental treatment under **Alternative 2b** would specifically aim to address the cumulative nitrate loading impacts on local groundwater resources used for domestic water supply; it would recognize the east side of the Village as an advanced protection management area. The institution of an onsite wastewater management program would provide the means for monitoring the performance of all upgraded systems, as well as the local environment, to mitigate wastewater-water quality impacts.

Potential negative aspects of this approach would be the land disturbance and conflicts with other existing or potential uses of the limited yard areas to accommodate basic OWTS upgrades and, in some cases (**Alternative 2b**), the installation of equipment/structures for supplemental treatment units.

Alternatives 2a and **2b** would not bring about any significant land use/development changes in Dillon Beach Village. The OWTS upgrades and management program would allow house remodeling and modest expansion to existing structures consistent with the EHS Septic System Residential Improvement Policy. There would be no assurance that undeveloped properties could be developed, or that house additions/remodeling could be undertaken beyond the provisions of existing EHS policies.

ALTERNATIVE 3 – COMMUNITY SEWERAGE TO OCEANA MARIN

Description

This alternative provides for the installation of sanitary sewers and connection to the neighboring Oceana Marin Wastewater System, which is operated by North Marin Water District (NMWD). Existing septic systems would be abandoned, and annexation to NMWD would be required. Two variations of this alternative are presented:

(a) **Alternative 3a** would extend sewer service to all developed residential and commercial properties in the study area, including the Village, Bay Dr/Cliff St Extension, and properties on Oceana Dr. Estimated wastewater flow (average dry weather) for this alternative is 14,275 gpd. This would increased the projected total wastewater flows at the Oceana Marin Wastewater System from 21,000 gpd to 35,275 gpd at build-out.

(b) **Alternative 3b** would extend sewer service to the Village area only, including all residential and commercial properties with the exception of the RV Park (assumed to be served by County and State-approved advanced, Class II OWTS). Estimated wastewater flow (average dry weather) for this alternative is 11,375 gpd. This would increased the projected total wastewater flows at the Oceana Marin Wastewater System from 21,000 gpd to 32,375 gpd at build-out.

A smaller sewerage alternative serving only the east side of the Village is addressed under **Alternative 4**.

In **Alternatives 3a** and **3b**, the collection system would consist of conventional gravity sewers leading to a central sanitary lift station, tentatively proposed to be located adjacent to the beach restroom at the foot of Beach Avenue. A sewer force main would convey the sewage back uphill through the Village for connection to the existing Oceana Marin sewer system at the manhole located near the intersection of Oceana Dr and North Street. From there, the sewage would flow by gravity via existing sewers to the Oceana Marin main lift station at the end of Tahiti Way. It would combine at that point with all other sewage flows in the Oceana Marin system, to be pumped uphill to the wastewater treatment ponds on the hilltop area above the Oceana Marin development. Final disposal of secondary treated water would be to the existing Oceana Marin leachfield located on the hillside north of the ponds. Expansion of leaching trench capacity, within the existing leachfield parcel, would be required as part of **Alternatives 3a** and **3b** in order to accommodate the increased wastewater flows from Dillon Beach Village service area. It is also assumed that other capital improvement upgrades to the existing wastewater system would be completed in accordance with recommendations in the 2015 "Master Plan Update for the Oceana Marin Wastewater System", a key project being the installation of a second, parallel force main from the main lift station to the treatment plant.

Wastewater Collection System

Several possible wastewater collection system options were evaluated, including conventional gravity sewers, pressure sewers, and effluent sewers, in which septic tanks are retained on individual properties for solids collection. Description, pros and cons, and cost estimates for the various collection system options are provided in **Appendix E**. Our analysis indicates gravity sewers to be the most suitable and cost effective approach, which is attributable to the favorable terrain, soil conditions, and existing high development density in the Village area, along with the availability of a suitable location for a central lift station.

The tentative sewer layout for **Alternative 3a** is provided in **Figures 6-2** (Village area) and **Figure 6-3 (**Bay Dr/Cliff St Ext). **Figure 6-4** shows the sewer layout for **Alternative 3b**, providing sewer service to the Village area only. The following describes the required facilities.

Septic Tank Abandonment. Properties connecting to the sewer would be responsible for abandoning their septic tank (and pump basin, if any). This is done under County permit and typically involves pumping out the tank of all sewage, punching drainage holes in the tank, and backfilling with sand or other granular soil. For existing redwood tanks and cesspools, all material would be excavated and hauled for disposal at an approved landfill. The leachfield system would be disconnected and left as is. It is not standard practice to dig-up leaching trenches when they are decommissioned, unless they happen to interfere with other building activities.

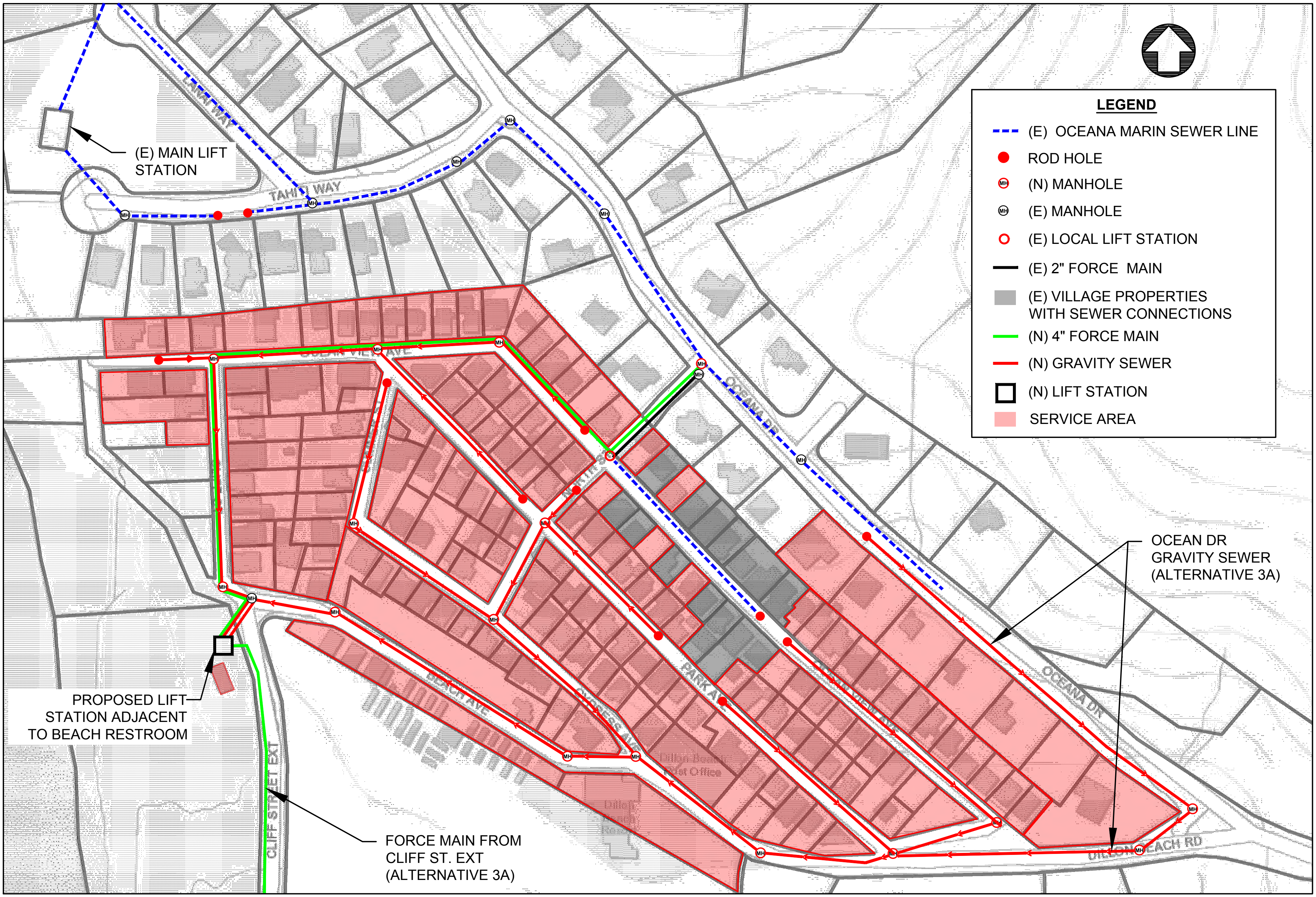
Lateral Sewer Connections. Lateral connections from the house to the sewer would be 4-inch gravity lines wherever feasible. It is estimated that about 75% of the properties in the Village area would be able to connect to the street sewers by gravity. The property owner would be responsible for re-routing house plumbing and installing the sewer lateral at the appropriate grade. For efficiency and cost savings, this is commonly work the general sewer contractor can complete for homeowners during a sewer installation project. For houses situated at elevations below the street sewer, an ejector pump or grinder pump may be required to pump up to the gravity line. The installation and ongoing maintenance of these individual pump units would be the responsibility of the homeowner.

Gravity Sewers and Manholes. For Dillon Beach Village, 6-inch diameter gravity sewers are proposed. The sewers would be placed in streets and installed at minimum grades to maintain gravity flow, following the preliminary alignments shown in **Figures 6-2**, **6-3** and **6-4**. Sewers would be installed by open cut trenching, generally about 4- to 5-feet deep in order to maintain at least 12-inch vertical separation (below) any crossing or parallel water lines or other buried utilities. A 10-foot lateral separation from water mains is standard, but can be reduced to a minimum of 4 feet where 10-foot separation is infeasible. Gravity sewer pipe and fittings would be either PVC or high density polyethylene (HDPE). Native soils would be suitable for pipe bedding and backfill, greatly reducing the sewer installation costs.

Sewer manholes would be installed: (a) at all intersections of sewer lines; (b) at vertical or horizontal angle points; and (c) at intervals not greater than about 400 feet. Manholes provide access for maintenance and cleaning. Rodholes (i.e., mainline cleanouts) would be placed at the terminal end of each run of sewer main, serving as an entry point for sewer cleaning and inspection equipment.

Bay Dr/Cliff St Ext. - Local Lift Station and Force Main. Under **Alternative 3a**, a local lift station and force main would be required to convey sewage flows from the Bay Dr/Cliff St Ext. service area to the central lift station (discussed below). The tentative location identified for the local lift station is at the small vacant corner parcel (or adjacent public right of way) at the intersection of Cliff Street Ext. and Marine View Dr. As indicated in **Figure 6-3,** gravity sewers installed on Marine View Dr., Bay Dr. and Cliff Street Ext. would drain by gravity to this collection point. Sewage would then be pumped to the central lift station by way of 4-inch diameter force main running north on Cliff Street, a distance of approximately 600 feet. The local lift station would consist of (a) a concrete pump vault (“wet well”) with duplex submersible pumps; (b) emergency reserve capacity within the pump vault; (c) control panel with local and remote telemetry alarm and monitoring capabilities; (d) standby generator power, or capability for operation with portable equipment; (e) passive venting with odor control; and (e) fencing or other means to ensure security of the equipment and controls.

Central Lift Station. The gravity sewer lines would drain to a central lift station, proposed (tentatively) to be located adjacent to the beach restroom on property owned by the Dillon Beach Resort. The owners are aware of and preliminarily receptive to considering this proposal. The lift station would be located on the north side of the restroom, situated at an approximate elevation of 25 feet above sea level. It would consist of: (a) buried concrete vaults containing duplex submersible sewage pumps; (b) emergency reserve capacity and flow equalization; (c) small building enclosure for electrical/control equipment, with local and remote telemetry alarm and monitoring capabilities; (d) standby generator power; (e) passive venting with odor control (e.g., charcoal or biofilter); and (f) security fencing and screening as needed. The sewage discharge rate from the lift station would be on the order of about 30 to 40 gallons



DIILON BEACH VILLAGE WASTEWATER STUDY
DILLON BEACH, 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

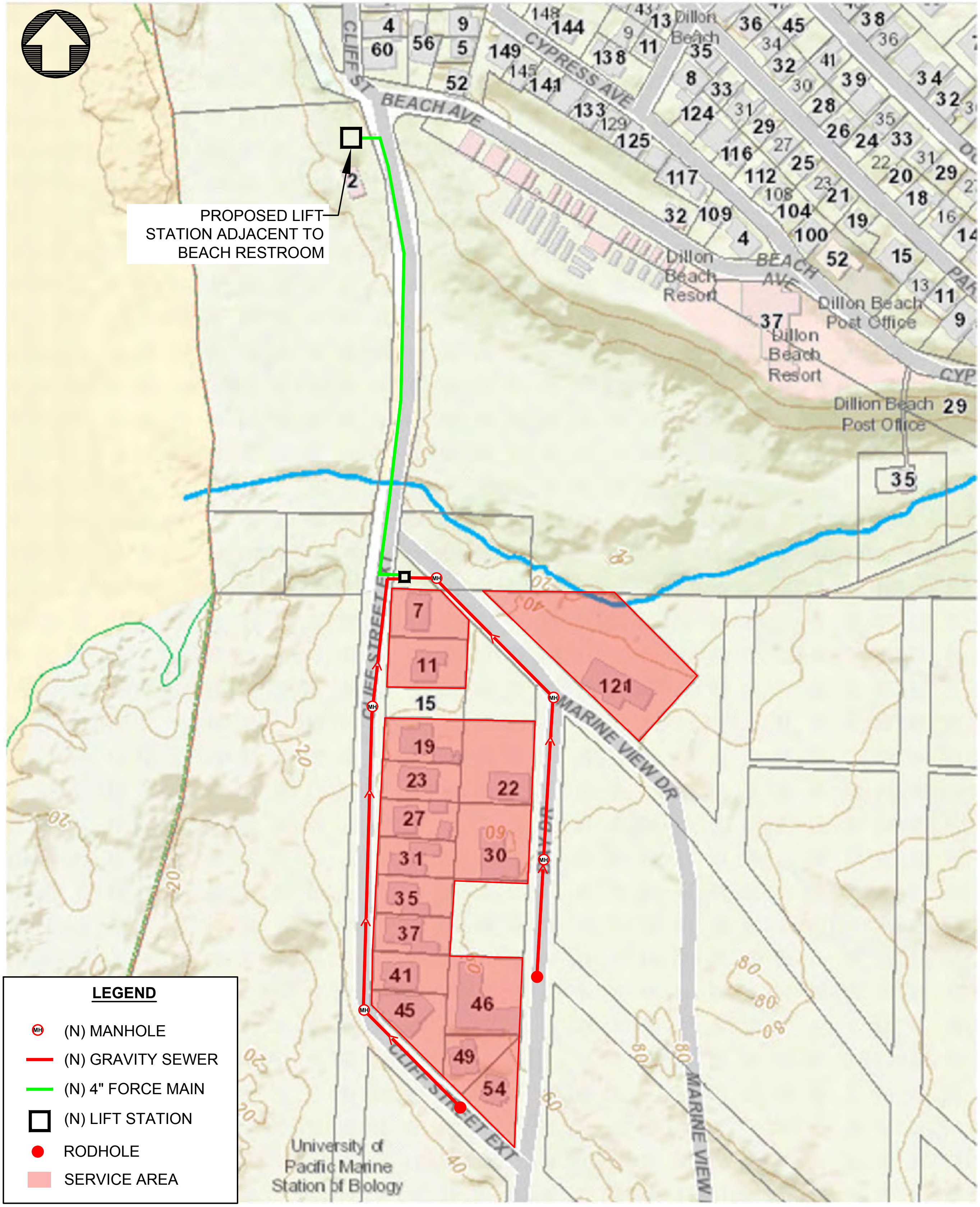
Design:	NH
Drawn:	PS
Checked:	NH
Appr'd:	NH

ENTIRE STUDY AREA
GRAVITY SEWER - ALTERNATIVE 3A
DILLON BEACH, CA

FIGURE 6-2

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

P:\2020\2000170_DILLON_BEACH_VILLAGE_WASTEWATER\CAD\MODEL\2000170_PROJECT ALTERNATIVES.DWG LAST SAVED: 10/19/2022 PLOT DATE: 10/19/2022 PLOT STYLE: QUESTA-GRAYSCALE-255.CTB



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

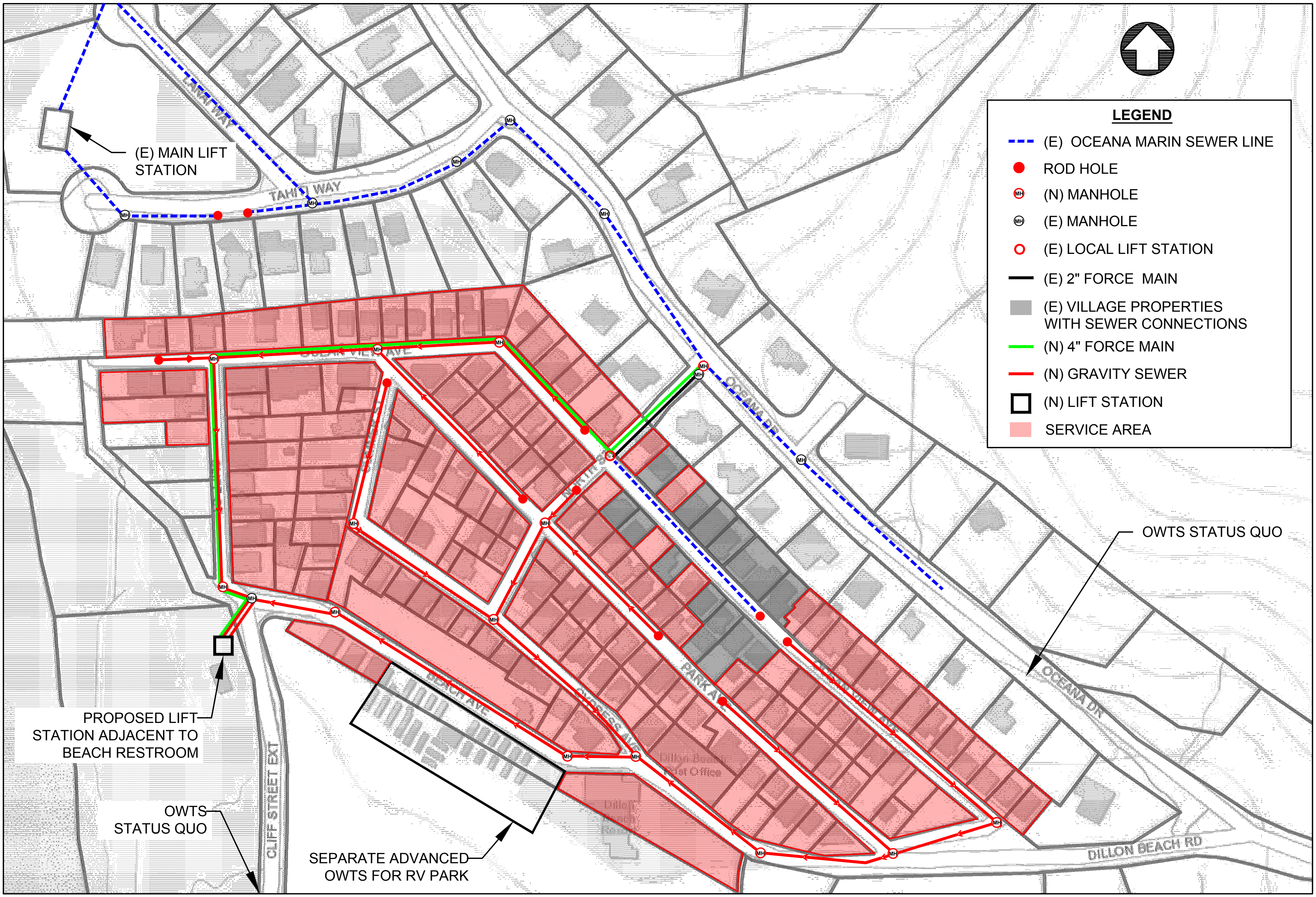
Design:	NH
Drawn:	PS
Checked:	NH
Appr'd:	NH

SEWER LAYOUT FOR BAY DR/ CLIFF ST EXT (ALTERNATIVE 3A)

DILLON BEACH, CA

FIGURE 6-3

P:\2020\2000170_DILLON_BEACH_VILLAGE_WASTEWATER\CAD\MODEL\2000170_PROJECT ALTERNATIVES.DWG LAST SAVED: 7/27/2022 PLOT DATE: 7/27/2022 PAGE SETUP: ---- PLOT STYLE: ----



DIILON BEACH VILLAGE WASTEWATER STUDY

DILLON BEACH, 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:	PS
Checked:	NH
Appr'd:	NH

VILLAGE ONLY - GRAVITY SEWER ALTERNATIVES - 3B

DILLON BEACH, CA

FIGURE 6-4

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

P:\2020\2000170_DILLON_BEACH_VILLAGE_WASTEWATER\CAD\MODEL\2000170_PROJECT ALTERNATIVES.DWG LAST SAVED: 10/19/2022 PLOT DATE: 10/19/2022 PLOT STYLE: QUESTA-GRAYSCALE-255.CTB

per minute (gpm), pumping against a total dynamic head of about 110 to 120 feet (45 to 50 psi). Emergency storage capacity would be a critical component of this lift station for several purposes, including: (1) reserve capacity for pump station failure/outage; (2) containment of sewage overflow from break or damage to the force main; (3) curtailing discharge to the Oceana Marin sewer system in the event of outage or other emergency affecting the Oceana Marin main lift station or force main.

Sewage Force Main. A 4-inch diameter (HDPE pipe) sewage force main would be installed from the lift station to the point of connection to the Oceana Marin sewer system at the intersection of Oceana Dr and North Street. The tentative alignment of the force main would be along Cliff Street, Ocean View Ave, and North Street, a total distance of about 1,300 feet. An alternate (slightly longer) route would be via Beach Ave, Cypress Ave and North Street. The last 200 feet on North Street would run parallel to the existing 2-inch pressure sewer line serving the existing twelve (12) houses on Ocean View Ave; this line could be connected to the new 4-inch force main, or left as is. The 4-inch force main would most probably be installed in the same/shared open cut trenching for the gravity sewer lines. At the connection point on Oceana Dr, a new receiving manhole would be installed for transitioning the sewage flow from the pressure main to the existing 6-inch gravity sewer line on Oceana Dr. From this point on, the sewage flow would be accommodated within the capacity of the existing Oceana Marin sewer system.

Table 6-5 summarizes the wastewater collection facilities for **Alternatives 3a** and **3b**.

Table 6-5. Wastewater Collection Facilities Summary - Alternatives 3a and 3b

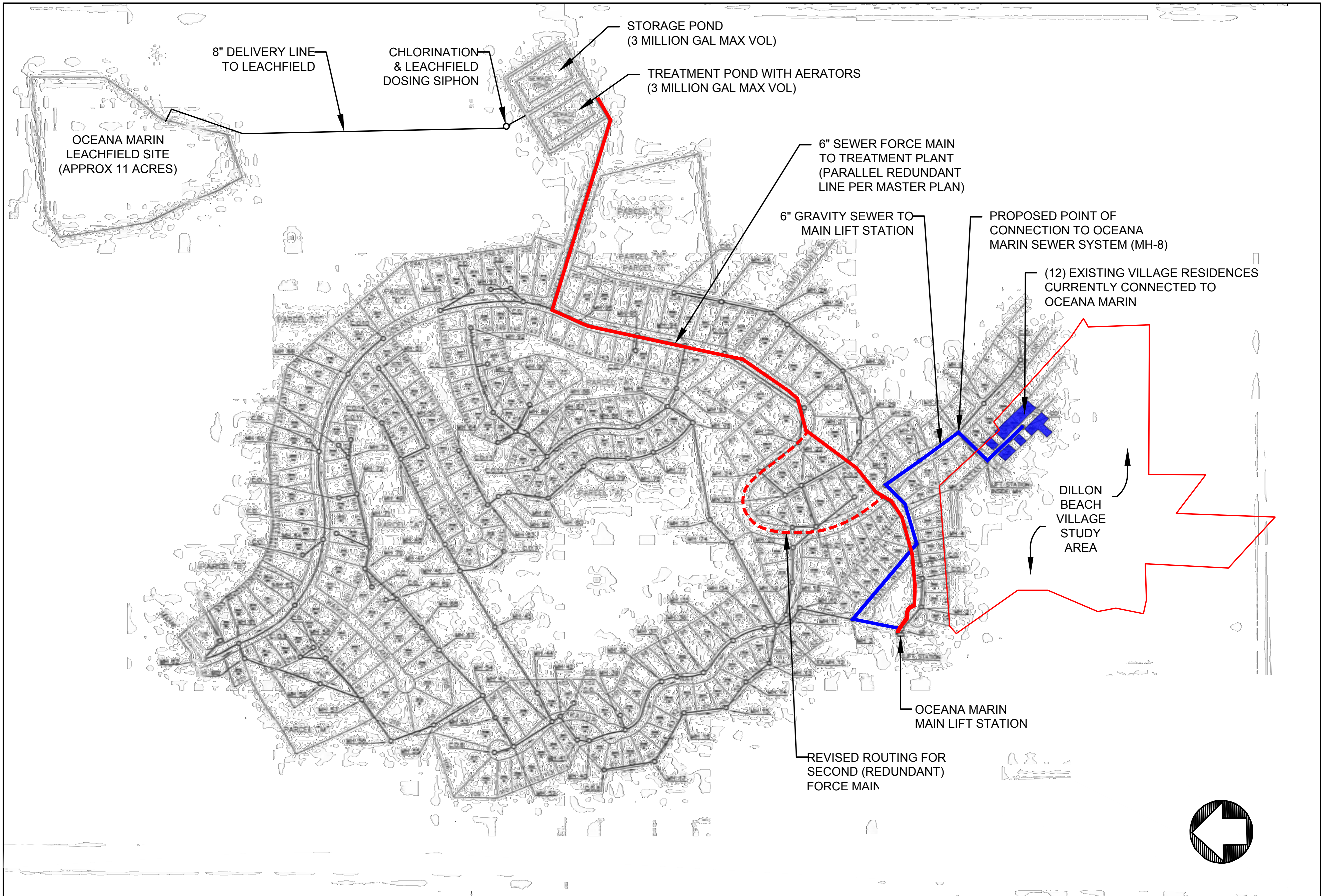
Alternative	Service Area	Wastewater Flow (gpd)	Length of Gravity Sewer (feet)	No. of Manholes	Force Main Length (feet)	Local Lift Station	Central Lift Station
3a Entire Study Area	150 residences 190 ESDs	14,250	7,220	22	1,900	1	1
3b Village Area Only	128 residences 152 ESDs	11,350	4,760	15	1,300	0	1

*ESD stands for equivalent single-family dwelling

Oceana Marin Wastewater System

Overview. The Oceana Marin wastewater system currently serves 235 residential connections, with an estimated 300 connections at build-out of the existing service area. Twelve (12) of the existing connections are residential properties located on Ocean View Ave in Dillon Beach Village; all others are developed properties in the Oceana Marin development. **Figure 6-5** provides a map of the Oceana Marin wastewater system, which is described below.

The wastewater system consists of approximately 5 miles of mainly 6-inch gravity sewers which bring all raw sewage flows to a main lift station located at the west end of Tahiti Way. From there, sewage is pump via a 6-inch diameter, 0.7-mile long force main uphill (380-ft elevation lift) to wastewater treatment ponds located at the end of Ocean View Blvd. The two wastewater



DIILON BEACH VILLAGE WASTEWATER STUDY

DILLON BEACH, 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:	PS
Checked:	NH
Appr'd:	NH

OCEANA MARIN WASTEWATER FACILITIES

DILLON BEACH, CA

FIGURE 6-5

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

PLOT STYLE: QUESTA-GRAYSCALE-255.CTB PLOT DATE: 9/6/2022 LAST SAVED: 9/6/2022 P:\2020\2000170_DILLON_BEACH_VILLAGE_WASTEWATER\CAD\MODEL\2000170_PROJECT ALTERNATIVES.DWG

ponds are identically sized, each with a surface area of about 1.25 acres, 10-ft maximum depth, and 3.0 million gallons storage volume (at capacity). One pond, with mechanical aerators, is used for treatment (oxidation) and the other for storage, evaporation and regulation of outflow to the disposal system. The disposal system consists of a pressure-dosed leachfield located within an approximately 11-acre fenced grassland area on the hillside north of the treatment ponds. The leachfield is comprised of approximately 3,700 lineal feet of shallow (3-ft deep) leaching trenches, divided into seven (7) separate lines. Treated wastewater (following chlorination) is delivered to the leachfield from a large capacity dosing siphon, at a rate of about 25 gpm, approximately 2,200 gallons per dosing cycle. Wastewater discharge is automatically switched each day among the seven leaching trenches. The fenced leachfield area is bordered by grazing lands, and is periodically opened to allow cattle grazing.

Wastewater flows in the Oceana Marin system vary seasonally and from year to year due the seasonal occupancy and the effect of inflow and infiltration into the sewer system during wet weather periods. **Table 6-6** provides a summary of wastewater flows and effluent quality as indicated in monitoring reports to the Regional Water Board for the period of January 2021 through April 2022. Excess influent wastewater not discharged to leachfield is accounted for by net evaporation from pond surface and potentially some seepage losses.

Table 6-6. Oceana Marin Wastewater Monitoring Results[1]
January 2021 – April 2022

Month	Wastewater Flows		Effluent Quality	
	Total Influent To Ponds (gpd)	Discharge to Leachfield (gpd)	BOD (mg/L)	NFR (mg/L)
Jan 2021	15,448	0	NS	NS
Feb	17,821	33,536	42	51.4
Mar	32,387	28,032	24	66.4
Apr	15,667	0	NS	NS
May	16,548	0	NS	NS
Jun	17,233	10,300	7	10.75
Jul	19,710	9,806	30	37
Aug	18,452	20,677	22	16.4
Sep	14,267	30,600	15	27.15
Oct	18,065*	0	NS	NS
Nov	18,467*	24,467	42	78.45
Dec	27,161*	0	NS	NS
Jan 2022	19,677*	21,484	21	39
Feb	16,429*	28,000	40	52.7
Mar	13,419*	24,581	67.6	89.8
Apr	15,933*	13,567	45.5	56.7
Average	**18,074***	**16,680**	**33**	**48**

[1] From monitoring reports on file with North Coast Regional Water Board
[2] BOD: biochemical oxygen demand
[3] NFR: nonfilterable residue
*Note: Per NMWD staff, the indicated flows for Oct 2021-Apr 2022 represent minimum flows.

Wastewater Discharge Permit. The Oceana Marin wastewater system is currently regulated by the North Coast Regional Water Quality Control Board (Regional Water Board) under Waste Discharge Requirements (WDR) issued in 1992 (Order No. 92-57). The WDR includes various prohibitions, discharge specifications and provisions for the operation, maintenance and monitoring of the wastewater facilities. The WDR specifies a maximum daily discharge to the leachfield of 53,000 gpd, with effluent water quality limits for biochemical oxygen demand (BOD) and nonfilterable residue (suspended solids) of 50 mg/L mean and 80 mg/L maximum; the maximum effluent limit for total coliform is 230 MPN/100 ml. The WDR requires that the Regional Water Board be notified when the wastewater facilities are projected to reach capacity with four years, along with a technical report demonstrating the measures to be taken to accommodate the flows and/or expand the capacity. The WDR also requires the preparation of a long-term wastewater facilities master plan, which was originally prepared for the Oceana Marin system in 1995, and subsequently updated in 2005 and 2015 (see discussion below).

Regional Water Board staff have indicated the existing permit is slated to be updated in the near future, with the intent of bringing the Oceana Marin wastewater system under the State Water Board General Order for Small Domestic Wastewater Treatment Systems (Order WQ 2014-0153-DWQ)[9]. The General Order is applicable to domestic wastewater systems with flows up to 100,000 gpd. The Marshall Community Wastewater System and Lawson's Landing are two nearby facilities currently regulated under the General Order. Updating the WDR for Oceana Marin will be triggered by expansion of the service area to include additional connections from Dillon Beach Village per **Alternatives 3a/3b** and **4** in this study; but it will also occur in the near future even if no there is no expansion in the service area.

Transitioning from Order No. 92-57 to coverage under the General Order is expected to involve the submittal of a technical report ("Report of Waste Discharge"), including information such as: (a) description, maps/drawings, and design of the current wastewater collection, treatment and disposal facilities; (b) wastewater source characterization; (c) wastewater flows and performance data; and (d) facilities operation and maintenance. The technical report would be expected to document compliance with requirements in the General Order applicable to the particular type of wastewater treatment system (e.g., ponds) and disposal facilities (leachfield), including assurance of adequate capacity for current and projected wastewater flows. Our preliminary review indicates the existing wastewater facilities are generally consistent with requirements in the General Order; however, additional study/documentation of leachfield capacity is likely to be required due to past information (see Master Plan Update below) indicating the existing 53,000 gpd flow capacity limit in the WDR likely overstates the system capacity. Also, under the General Order, facilities with wastewater flows of 20,000 gpd or more require an evaluation and potentially adoption of performance standards to address nitrogen loading impacts on surface water and groundwater resources.

2015 Master Plan Update. In 2015 Nute Engineering completed a Master Plan Update for the Oceana Marin Wastewater System, containing an evaluation of existing facilities, future capacity needs and recommendations for capital improvements. The study addressed the potential future build-out of vacant properties within Oceana Marin (approximately 75 residences), but did not include any assessment of the possible future connection of the Dillon Beach Village area to the Oceana Marin wastewater system. Long range capital improvement needs recommended in the Master Plan update included the following:

---

[9] Personal communication, Rachel Prat, Environmental Specialist, North Coast Regional Water Quality Control Board, June 14, 2022.

- Sewer collection system improvements primarily to reduce I/I
- Improvements to the main Oceana Marin pump station to improve reliability and redundancy
- Force main improvements consisting of a second force main to provide redundancy
- Dredging and possibly lining of the treatment and storage ponds to eliminate berm erosion
- Electrical power system arc flash hazard study
- Study of the effluent disposal system to assess its ability to dispose of the treated effluent
- Site reconnaissance of geologic hazard of ocean bluff and slide below disposal field
- Additional studies of different aspects of the wastewater system

High, medium and low priorities were assigned to the various improvement projects according to their importance for: (a) improving unit process functioning; (b) improving critical reliability and redundancy; and (c) reducing sewer system I/I. Estimated costs are detailed in the Master Plan Update for all recommended improvements. Listed below is a summary of the estimated 2015 costs for the identified improvements, along with corresponding costs adjusted to reflect 2022 costs, based on an increase in the construction cost index of 1.43 from end of 2015 to the present[10].

	2015 Costs	2022 Costs
• High Priority Projects	$1,448,300	$2,128,270
• Medium Priority Projects	$1,230,300	$1,759,330
• Low Priority Projects	$ 442,000	$ 632,060
Total	$3,120,600	$4,519,660

It is assumed that expansion of the Oceana Marin system to serve Dillon Beach Village would necessitate completion of capital improvement projects related to the reliability and redundancy of the main lift station, force main, wastewater ponds and effluent disposal system. These fall mainly in the high and medium priority categories above, indicating the potential need for approximately $4 million of facility upgrades at the Oceana Marin wastewater system in conjunction with the expanded service to Dillon Beach Village. As indicated in the discussion of cost estimates later in this section, **Alternatives 3a** and **3b** include total estimated connection fees (per existing NMWD fee ordinance) of $5.7 million and $4.5 million, respectively. These fees, which essentially represent a "buy-in" cost for connection to and use of the existing Oceana Marin facilities, would provide a significant source of funding to undertake the critical high and medium priority facility improvements above.

Feasibility/Capacity for Dillon Beach Village Expansion. Following is a review of key components of the Oceana Marin wastewater facilities with findings and recommendations from the Nute Engineering study and extended assessment of the feasibility and capacity for extending sewer service to Dillon Beach Village.

- **Wastewater Flows.** Wastewater unit flows in Oceana Marin were estimated at approximately 70 gpd per residence, based on a per capita flow estimate of 51 gpd and average occupancy of 1.35 persons per dwelling. This gives an average system flow of about 16,000 gpd for the 229 connections, and a projected flow of 21,000 gpd for the

[10] California construction cost index December 2015 - 6108; October 2022 – 8712; increase: 8712/6108 = 1.43

projected build-out to 300 connections. This does not include the infiltration and inflow (I/I) contribution.

Assessment: The unit flow of 75 gpd per residence proposed for Dillon Beach Village is in line with the Oceana Marin Master Plan Update.

- **Collection System**. The study identified the need and priorities for sewer rehabilitation measures to correct and control I/I in various parts of the Oceana Marin collection system.

  Assessment: The sections of existing sewer that would be used for conveyance of sewage flows from Dillon Beach Village (i.e., Oceana Dr, Tahiti Way, and Lanai Way) were not identified as having any I/I problems of note. This is likely attributable to the well drained dune sands that occur in the southerly extent of Ocean Marin, which are a continuation of soil and geologic conditions in Dillon Beach Village. Additionally, we made a check of the sewer grades for these sections of sewer of sewer, which indicates more than sufficient grade and capacity to accept additional sewage flows from Dillon Beach Village.

- **Main Lift Station**. The Oceana Marin main lift station is equipped with two sets of (2) high head pumps (4 pumps total), each pump having a rated capacity of 100 gpm at a discharge pressure of 180 psi. The two pumps in each set are connected in series and operate together to overcome the high pumping head. The two sets of pumps operate alternately, in lead-lag mode. The 2015 assessment found the pumps to be well maintained and in good mechanical/working condition. At 100 gpm the pumps are more than sufficient for the current and projected future flows in the system (100 gpm equates, theoretically to a discharge of 144,000 gpd). The Nute study identified several items to upgrade the reliability of the lift station, which include the following: (a) redundant sump pump to protect the below ground electrical equipment against flooding from local drainage and rainfall; (b) PG&E meter replacement; and (c) relocation of electrical equipment to an aboveground block building.

  Assessment: The added wastewater flow from Dillon Beach Village under the various alternatives in the current study would add flows of approximately 7,000 to 14,000 gpd (depending on the alternative) during peak summer use periods, with smaller flows during the winter. This would be well within the capacity of the existing Oceana Marin main lift station. Also the additional flows and would be at their lowest during the winter when the lift station is normally under greatest stress due to sewer system I/I from certain parts of Oceana Marin. Additionally, since the recommended plan for sewerage from Dillon Beach includes a central lift station with flow equalization, inflows to the Oceana Marin system can potentially be regulated to spread the wastewater flows evenly over the course of the day and overnight hours to minimize impacts during peak times of the day; flows can also be suspended temporarily, if needed as an added contingency measure for emergency situations.

- **Force Main**. The Nute study recommended that a second parallel/redundant force main be installed due to the age and potential weaknesses of the existing force main. It is a critical element in the Oceana Marin wastewater system and is considered a high priority improvement project.

Assessment: It is assumed that connection of Dillon Beach Village to the Ocean Marin wastewater system would require the completion of the high priority sections of the redundant force main project, and would include payment of connections fees to facilitate the funding of the work.

- **Wastewater Treatment Ponds**. Nute Engineering found the wastewater treatment capacity to be well within typical design criteria for existing and projected future flows, based on consideration of hydraulic retention time (30 days minimum) and organic loading rates (35 to 50 lbs BOD5/acre/day). The analysis was conservative and did not consider the additional oxidation capacity provided by the aeration units.

Assessment: Table 6-7 below is an extended version of Table 8 in the Nute Engineering report, showing the projected treatment pond detention times for wastewater flows for existing 229 Oceana Marin homes, 300 homes at Build-out, and additional projected flows from Dillon Beach under **Alternatives 3a** and **3b**. As indicated, in all scenarios the addition of wastewater flows from Dillon Beach Village will result in detention times of more than 30 days in the wastewater treatment pond, i.e., within the general design guideline for domestic wastewater treatment ponds.

Table 6-7. Treatment Pond Detention Time for Projected Wastewater Flows (days)

	Oceana Marin		**With Addition of Dillon Beach Village**	
	Existing (2015) 229 Homes	Build-out 300 Homes	Alternative 3a 14,250 gpd 5,201,250 gal/yr	Alternative 3b 11,350 gpd 4,142,750 gal/yr
Dry Year Flow, gallons/yr	6,475,000	8,074,000	13,275,250	12,216,750
HRT, Full Pond (3,052,000 gal)	172	138	84	92
HRT, Half-Full Pond	86	69	42	46
Wet Year Flow, gallons/yr	7,475,000	9,074,000	14,275,250	13,216,750
HRT, Full Pond (3,052,000 gal)	149	123	78	84
HRT, Half-Full Pond	75	62	39	42

HRT stands for hydraulic retention time in days (i.e., detention time)

An additional method of assessing the wastewater pond treatment capacity is provided by Bracewell Engineering in prior Long-Range Master Plans for the Oceana Marin Wastewater System (1995 and 2005). The analysis accounts for natural aeration based on pond surface area plus mechanical aeration in the treatment pond provided by two 3-horsepower (hp) aerators. The storage pond provides additional natural surface aeration.

<u>Aeration Capacity</u>:

- ✓ Natural surface aeration, at 35 to 50 lbs BOD5 per acre/day for 1.25 acre treatment pond:
  - 1.25*35 = 42 lbs/day, to
  - 1.25*50 = 62 lbs/day
- ✓ Mechanical aerators: (2) aerators at 3-hp each = 288 lbs/day
- ✓ Total aeration capacity:
  - 42 + 288 = 330 lbs/day, to
  - 62 + 288 = 350 lbs/day

The projected total BOD loading (in lbs per day) to the wastewater ponds at build-out can be estimated based on average dry weather flow and an assumed BOD concentration representative of residential wastewater strength. Using a conservatively high value of in the range of 250 to 300 mg/L BOD, the projected BOD loading for the Dillon Beach Village sewerage alternatives would be as follows:

$$\text{Calculation: BOD (lbs/day)} = \frac{(8.34)*(\text{mg/L})*(\text{gpd})}{(1.0\ \text{MGD})}$$

<u>Alternative 3a</u>:

$$@\ 250\ \text{mg/L BOD} = \frac{(8.34)*(250\ \text{mg/L})*(35{,}250\ \text{gpd})}{(1.0\ \text{MGD})} = 73\ \text{lb/day}$$

$$@\ 300\ \text{mg/L BOD} = \frac{(8.34)*(300\ \text{mg/L})*(35{,}250\ \text{gpd})}{(1.0\ \text{MGD})} = 88\ \text{lb/day}$$

<u>Alternative 3b</u>:

$$@\ 250\ \text{mg/L BOD} = \frac{(8.34)*(250\ \text{mg/L})*(32{,}350\ \text{gpd})}{(1.0\ \text{MGD})} = 67\ \text{lb/day}$$

$$@\ 300\ \text{mg/L BOD} = \frac{(8.34)*(300\ \text{mg/L})*(32{,}350\ \text{gpd})}{(1.0\ \text{MGD})} = 81\ \text{lb/day}$$

<u>Alternative 4</u>:

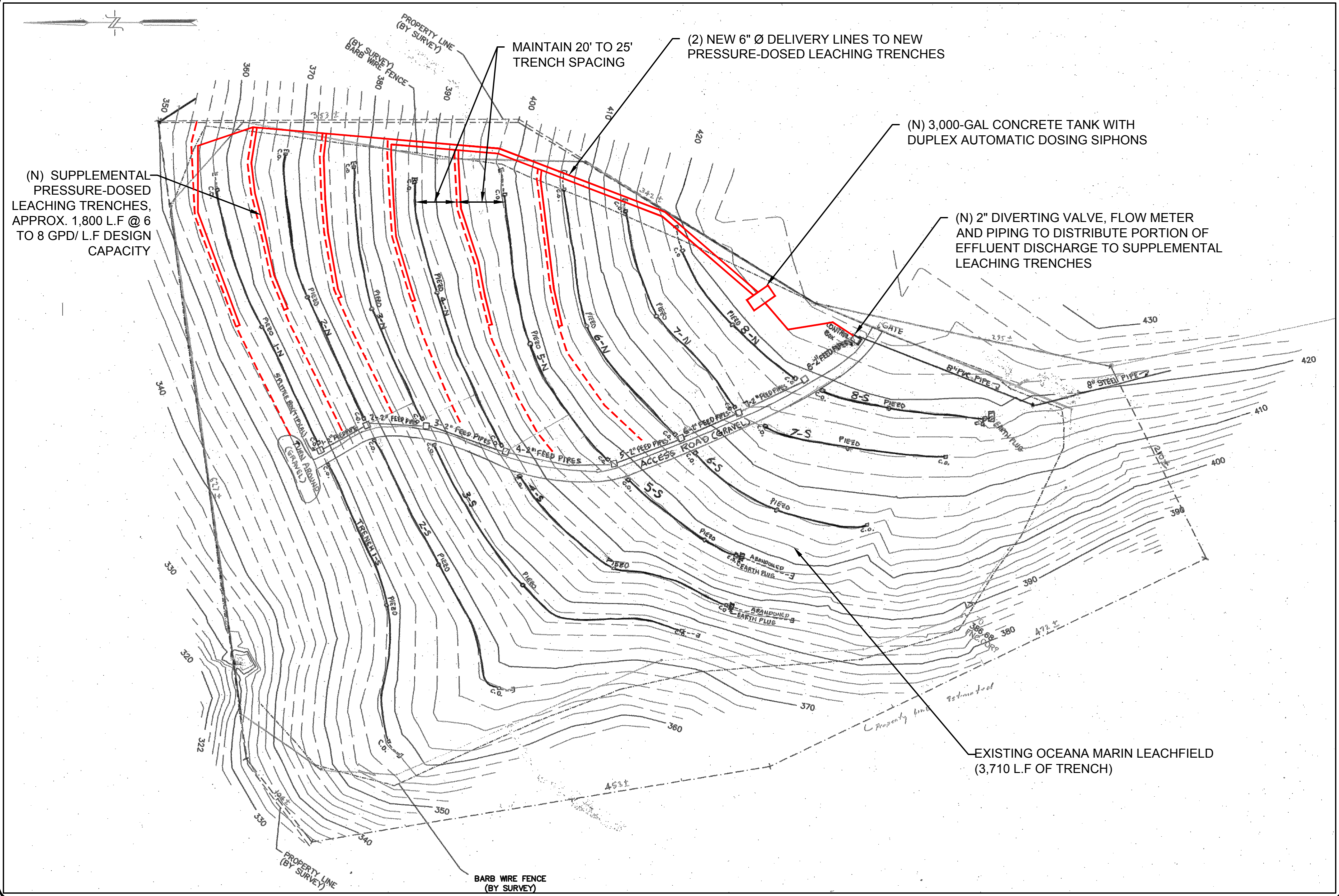
$$@\ 250\ \text{mg/L BOD} = \frac{(8.34)*(250\ \text{mg/L})*(28{,}150\ \text{gpd})}{(1.0\ \text{MGD})} = 59\ \text{lb/day}$$

$$@\ 300\ \text{mg/L BOD} = \frac{(8.34)*(300\ \text{mg/L})*(28{,}150\ \text{gpd})}{(1.0\ \text{MGD})} = 70\ \text{lb/day}$$

The calculations show in all cases the organic (BOD) loading to the treatment pond would be well within the available aeration capacity provided by the combination of natural surface aeration and mechanical aeration, estimated at 330 to 350 lbs BOD per day. Also, these organic loading calculations do not account for additional oxidation provided by the natural surface aeration provided in the second (storage) pond.

- **Leachfield**. The Nute study concluded that the leachfield is the limiting factor in the overall capacity of the Oceana Marin wastewater system. The study cited an earlier assessment by Bracewell Engineering (original leachfield designer) in 2005, which indicated a maximum capacity of 29,600 gpd based on actual system operation. The Nute study did not confirm Bracewell's assessment; they found no current operational issues with the leachfield, but identified the need for additional study to better assess capacity. They also questioned the rationale for the existing requirement for chlorination prior to subsurface dispersal.

  Assessment: Questa conducted a field inspection including hand-augur soil borings in the leachfield area along with review of soils work reported in the Nute study. We concluded that expansion of the leachfield should be included if sewers are extended to serve portions or all of Dillon Beach Village. Based on the favorable soil conditions on the northeastern half of the leachfield, along with large lateral spacing between existing leaching trenches (up to 50 feet on centers), **Figure 6-6** provides a preliminary plan for adding up to 1,800 lineal feet of additional leaching trench within the leachfield area. This would expand the existing capacity by approximately 50%. The proposed leaching trenches would be pressure-dosed using a separate, newly



DIILON BEACH VILLAGE WASTEWATER STUDY

DILLON BEACH, 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:	PS
Checked:	NH
Appr'd:	NH

POTENTIAL EXPANSION OF OCEANA MARIN LEACHFIELD

DILLON BEACH, CA

FIGURE 6-6

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

installed tank (e.g., 3,000 gal capacity) with dual dosing siphons, installed just east of the existing distribution manifold. The main effluent line to the leachfield would be plumbed to allow a controlled portion of the flow to be directed to the supplemental dosing tank and leachfield. It would have no effect on the existing leachfield and dosing system, other than to reduce the amount of effluent directed to the existing trenches on each dosing cycle.

The leaching trenches would be of a similar design as the existing trenches, with an estimated dispersal capacity of 8 gpd per lineal foot (gpd/lf), based on 6 square feet of infiltration area and a wastewater application rate of 1.33 gpd/ft^2. The proposed dosing siphon and distribution plan is very similar to the system installed and operating since 2008 at the Marshall Community Wastewater System (design flow 15,000 gpd). The proposed additional leaching trench length and capacity would be:

- **Alternative 3a:** 1,800 lineal feet @ 8 gpd/lf = 14,400 gpd
- **Alternative 3b:** 1,500 lineal feet @ 8 gpd/lf = 12,000 gpd

Estimated Capital Costs

The estimated capital costs for **Alternatives 3a** and **3b** are summarized in **Tables 6-8** and **6-9.** There are two main cost categories: (1) sewer collection costs; and (2) fees and costs for connection to the Oceana Marin Wastewater System.

- **Sewer collection costs**. The sewer collection cost estimates were developed from the preliminary layout of sewer lines, lift stations, and appurtenances along with unit cost assumptions applicable to the type of work and local conditions. The unit cost assumptions were developed based on experience with other comparable work in Marin County and the North Bay Area and through discussions with manufacturers, equipment suppliers, and local contractors. The totals reflect costs for construction plus a 15% contingency and 30% allowance for engineering, permitting, and project administration.

- **Oceana Marin connection fees and costs.** Costs for connection to the Oceana Marin Wastewater System will include:

  (a) connection fees of $30,000 per residential connection (per ordinance);

  (b) connection fees for commercial properties to be determined based on wastewater equivalency to that from a single-family dwelling (ESD); preliminary estimates indicate approximately 40 ESDs for all commercial flows from the Dillon Beach Resort, and 24 ESDs if the RV Park is excluded;

  (c) estimated costs for wastewater facilities expansion specifically required to accommodate the added wastewater flows from Dillon Beach; this would pertain to engineering, permitting and construction of the recommended leachfield expansion identified as part of **Alternatives 3a** and **3b**; and

  (d) fees and costs for annexation into the NMWD-Oceana Marin wastewater improvement district, estimated at an approximate cost of $5,000 per acre to cover engineering, mapping, legal and administrative fees.

In addition to the project costs presented in **Tables 6-8** and **6-9**, homeowners would be individually responsible for the costs associated with: (a) abandonment of existing septic tanks; (b) on-lot re-plumbing of house drains and lateral connections to the sewer; and (c) installation of ejector pump and associated electrical work, where needed. Each of these items would require County permitting. In the Marshall Community wastewater project, EHS organized a streamlined permitting process with reduced permit fee for properties connecting to the community system. Costs for these items, including permit fees, will vary from property to property, typically in the range of about $5,000 to $10,000.

Table 6-8. Estimated Capital Costs - Alternative 3a
Entire Dillon Beach Village Study Area

Service Area: 150 SFR Parcels + All Commercial; 190 ESDs				**ADWF: 14,250 gpd**
Sewer Collection System Costs – Dillon Beach Study Area				
Description	**Units**	**Estimated Quantity**	**Unit Cost ($)**	**Total Cost ($)**
6-inch gravity sewer	LF	7,220	$ 200	$ 1,444,000
Manholes	EA	22	$ 10,000	$ 220,000
Rodholes	EA	11	$ 1,500	$ 16,500
4-inch Force Main	LF	1,900	$ 140	$ 266,000
Local Lift Station (Cliff St)	LS	1	$ 150,000	$ 150,000
Lift Station (including easement)	LS	1	$ 750,000	$ 750,000
Collection Subtotal				$ 2,846,500
Miscellaneous & Contingency @ 15%				$ 426,975
Engineering, Permitting & Administration @ 30%				$ 853,950
Collection System Total				**$ 4,127,425**
Connection Fee & Costs – Oceana Marin Wastewater System				
Sewer Connection Fee – Residential	EA	150	$ 30,000	$ 4,500,000
Sewer Connection Fee - Commercial*	EA	40	$ 30,000	$ 1,200,000
Leachfield Expansion	LS	1	$ 420,000	$ 420,000
Annexation	AC	18	$ 90,000	$ 90,000
Estimated Oceana Marin Sewer Connection Costs				**$ 6,210,000**
Estimated Total Project Cost				**$ 10,337,425**
Estimated Cost per Parcel (ESD)				**$ 54,407**

* Connection fee for commercial properties not currently established by NMWD; to be determined based on wastewater loading equivalency; preliminary assumption of 40 ESDs for Beach Restroom, Rental Cabins, Store, Deli & Café and RV Park

Table 6-9. Estimated Capital Costs - Alternative 3b
Dillon Beach Village Only

Service Area: 128 SFR parcels + Commercial (excluding RV Park)			ADWF: 11,350 gpd	
Sewer Collection System Costs – Dillon Beach Village				
Description	**Units**	**Estimated Quantity**	**Unit Cost ($)**	**Total Cost ($)**
6-inch gravity sewer	LF	4,760	$ 200	$ 952,000
Manholes	EA	15	$ 10,000	$ 150,000
Rodholes	EA	8	$ 1,500	$ 12,000
4" Force Main	LF	1,300	$ 140	$ 182,000
Lift Station	LS	1	$ 500,000	$ 650,000
			Collection Subtotal	$ 1,946,000
			Miscellaneous & Contingency @ 15%	$ 291,000
			Engineering, Permitting & Administration @ 30%	$ 582,000
			Collection System Total	**$ 2,819,000**
Connection Fees & Costs – Oceana Marin Wastewater System				
Sewer Connection Fee – Residential	EA	128	$ 30,000	$ 3,840,000
Sewer Connection Fee - Commercial*	EA	24	$ 30,000	$ 720,000
Leachfield Expansion	LS	1	$ 364,000	$ 364,000
Annexation	AC	14	$ 70,000	$ 70,000
			Total Oceana Marin Sewer Connection Costs	$ 4,994,000
			Estimated Total Project Cost	**$ 7,813,000**
			Estimated Cost per Parcel (ESD)	**$ 51,401**

* Connection fee for commercial properties not currently established by NMWD; to be determined based on wastewater loading equivalency; preliminary assumption of 24 ESDs for Beach Restroom, Rental Cabins, Store, Deli & Café

Operation and Maintenance

Wastewater Collection System. Operation and maintenance activities for the gravity sewer system in Dillon Beach would consist of cleaning the sewers, monitoring sewers for illegal inflow connections, and pump station operation and maintenance. Access for cleaning is provided by manholes and rodholes at the upstream terminal ends on each sewer run. Cleaning of gravity sewers may require removal of obstructions from time-to-time, as well as flushing. Video inspection of sewer lines would typically be performed as a preventative measure and/or to investigate specific sections of sewer lines.

Central pump station O&M would involve routine onsite inspections (e.g., weekly) to observe pump station operations and conditions, as well as on-going monitoring of operations remotely via telemetry. Major inspections and servicing would be conducted quarterly or as needed, including evaluation and servicing of all major pumping components, valves, piping, controls, alarms, structural elements and other mechanical/electrical equipment. The standby emergency generator would be tested and operated on a monthly basis. Repair and/or replacement of equipment components would be performed, as needed. Operator(s) would be tasked with the responsibility to respond to alarms or other emergency conditions.

Oceana Marin Wastewater System. The Oceana Marin Wastewater facilities are operated and maintained by NMWD personnel, including certified treatment plant operators of the appropriate grade (Class II), as required by State regulations. System maintenance includes regular inspection of all equipment and processes. A telemetry system facilitates remote, continuous monitoring of the critical elements of the system.

Monitoring of the wastewater system is conducted in accordance with requirements contained in "Monitoring and Reporting Program No. 92-57", issued for the facility by the North Coast Regional Water Board, and summarized in **Table 6-10** below.

Table 6-10. Existing Monitoring Requirements - Oceana Marin Wastewater System

Item	Constituent	Frequency
Influent	Average Daily Flow	Continuously
Effluent	Average Daily Flow	Continuously
	BOD	Monthly
	Nonfilterable Residue	Monthly
	Coliform	Monthly
	Chlorine Residual	Weekly
Disposal Field	Trench Water Level Measurements	Weekly
Reporting	-	Monthly

The existing Waste Discharge Requirements (WDRs) and monitoring program were issued in 1992 and are slated for updating by the Regional Water Board. Updating will most likely bring the Oceana Marin wastewater system under the State Water Board General Order for Small Domestic Wastewater Treatment Systems (Order WQ 2014-0153-DWQ)[11]. The General Order includes a "Model Monitoring and Reporting Program" with requirements that match very closely with the existing monitoring requirements for the Oceana Marin Wastewater System. Regional Water Boards generally follow the "Model" program, but they have the authority to modify and adapt the requirements to address site specific conditions or facilities. (Note: Updating of the WDRs is scheduled to occur regardless of whether or not the Oceana Marin system is expanded to include service to Dillon Beach Village.)

According to the State Water Board Wastewater Treatment Classification criteria, the Oceana Marin plant falls under the category of "Modified Treatment Pond", which qualifies as a Class II treatment plant, regardless of plant size/wastewater flow. Therefore, the treatment plant classification would not change based on any expansion to accommodate flows from Dillon Beach Village. A Class II wastewater facility requires a Class II operator, which is the current staffing provided by NMWD. With expansion of the service area, greater operator time would be required for operation and maintenance of sewers, lift stations, treatment and disposal facilities; but the required treatment plant personnel level would not change.

Annual Operation and Maintenance Cost. The existing annual sewer fee for the Oceana Marin wastewater system is $1,296 per residential connection, which is set by NMWD and adjusted from year-to-year, as necessary. Service area expansion to include Dillon Beach Village would require increased labor and expenses to operate and maintain the additional facilities and process higher wastewater volumes. At the same time, the larger service area would increase the number of properties over which the total costs would be spread. The existing fee can be taken as an approximation of the probable annual cost for community

[11] Personal communication, Rachel Prat, Environmental Specialist, North Coast Regional Water Quality Control Board, June 14, 2022.

sewerage options. However, in conjunction with any expansion to serve Dillon Beach Village, a detailed fee study would be conducted to determine the appropriate annual O&M fees.

ALTERNATIVE 4 – HYBRID - VILLAGE SEWERAGE AND OWTS UPGRADES

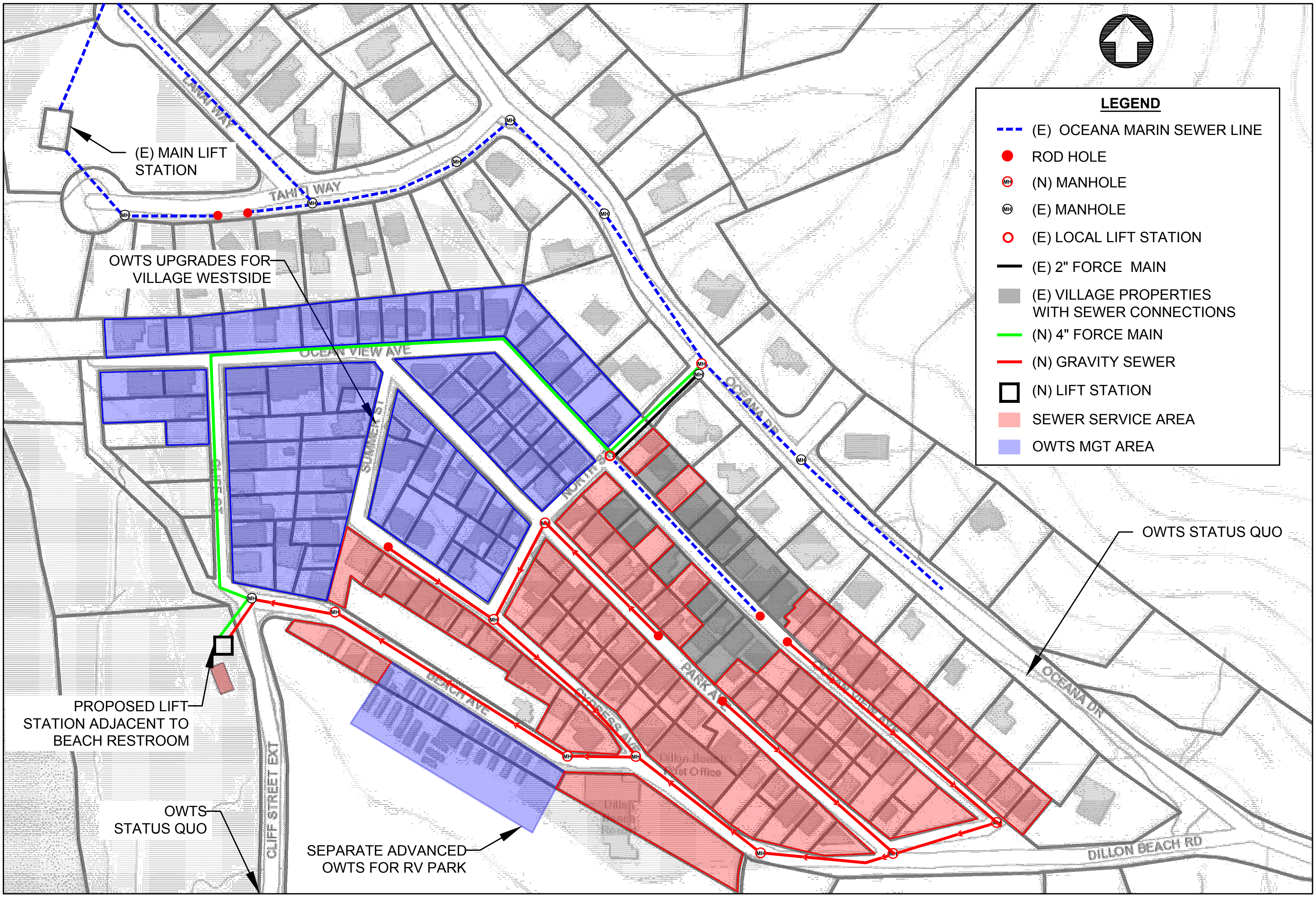
Description

Alternative 4 consists of a combination of **Alternatives 1**, **2a** and **3b**. It would: (a) prioritize the east side of the Village (plus the beach restroom) for community sewerage and connection to the Oceana Marin Wastewater System; (b) establish an OWTS upgrade and management program for the west side of the Village; and (c) leave the Bay Dr, Cliff St Ext. and Oceana Drive areas in the status quo – i.e., continued individual property owner responsibility for OWTS.

Village-Eastside. This alternative would extend sewer service to all properties in the east side of the Village, prioritizing the area overlying the groundwater recharge zone that drains to the Dillon Creek water supply aquifer. This would include approximately 75 developed residential properties along with the Dillon Beach Resort store-deli-café, rental cottages and beach restroom. It would not include the RV Park, which will be served by an advanced Class II wastewater system (with nitrogen removal and disinfection) approved by the County and State agencies, and monitored under a County-issued operating permit. A preliminary layout of the wastewater collection system is shown in **Figure 6-7**, which includes gravity sewers leading to a central lift station adjacent to the beach restroom, and sewage force main back uphill through the Village connecting to the Oceana Marin sewer system at the intersection of Oceana Dr and North Street. The estimated wastewater flow (average dry weather) for the sewer service area under this alternative is 7,800 gpd. The sewer service area would be annexed to the NMWD – Oceana Marin wastewater district.

Village-Westside. OWTS in west side of the Village would be addressed through the establishment of a program to systematically upgrade and provide ongoing management oversight of OWTS. The objective would be to evaluate and upgrade all OWTS to meet Marin County Class II septic system repair criteria in a manner generally consistent with the repair and replacement practices that have been followed over the past 25 to 30 years. This would include a code-compliant 1,200-gallon septic tank with gravity or pump-up leachfield, designed for 100% capacity and in accordance with current regulations to the maximum extent practicable. In some cases, due to extremely limited space, it may be appropriate and necessary to require the use of alternative treatment and dispersal methods, rather than conventional septic tank and leachfield approach. There is also the possibility that, in extremely difficult circumstances, individual properties in the west side area could connect directly to the sewer force main serving the eastside properties using an individual on-lot grinder pump, matched to the hydraulic requirements of the force main. Establishment of an OWTS management "zone", e.g., governed by the County or another public entity, would provide the opportunity for obtaining grants and loan assistance for OWTS improvements.

Bay Dr, Cliff St Ext. and Oceana Dr. Properties located on Bay Dr, Cliff St Ext. and Oceana Dr served by OWTS would be not be included in either the proposed Village sewer service area or OWTS management zone. Due to larger lot sizes, greater distance from Dillon Creek aquifer, and generally higher percentage of modern septic systems, these properties would remain under the status quo – i.e., continued individual property owner responsibility for OWTS.



DIILON BEACH VILLAGE WASTEWATER STUDY

DILLON BEACH, 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:	PS
Checked:	NH
Appr'd:	NH

GRAVITY SEWER ALTERNATIVE - 4

DILLON BEACH, CA

FIGURE

6-7

Any necessary upgrades, repair, replacement of OWTS would be on an as needed basis and in accordance with existing EHS policy and procedures.

Estimated Capital Costs

Estimated costs were developed for **Alternative 4** based on information presented previously for **Alternatives 1**, **2a** and **3b**. Estimates are summarized below and detailed in **Table 6-11.**

Sewerage–Village (Eastside). Estimated costs for providing sewerage for east side of the Village include costs for (a) the wastewater collection system and (b) connection to the Oceana Marin wastewater system. The same cost factors presented for **Alternatives 3a** and **3b** were used, adjusted to reflect the smaller service area and reductions in sewer lengths and other facilities. Under **Alternative 4**, leachfield addition to the Oceana Marin system would include about 1,000 feet of leaching trench. As indicated in **Table 6-11**, the total estimated cost for the sewerage portion of **Alternative 4** is $5.2 million, which equates to an average cost (per parcel/ESD) of $54,012 for properties in the sewer service area. Properties connecting to the sewer would also have costs for abandonment of their existing septic tank, re-plumbing and installation of lateral connection to the street sewer, typically in the range of $5,000 to $10,000.

OWTS Upgrades and Management-Village (Westside). OWTS upgrade costs for properties in the west side of the Village are estimated per the analysis for **Alternative 2a** to be approximately $35,600 per parcel. This amounts to a total of about $2.0 million for the OWTS management portion of the project.

Alternative 4 - Total. The estimated combined cost for the sewerage and OWTS upgrade portions of the project total about $7.2 million, with an overall average of $46,315 per parcel (ESD). This does not include the individual costs for other properties not included in the service area addressed by **Alternative 4**, (i.e., Bay Dr, Cliff St Ext, Oceana Dr and the Dillon Beach Resort RV Park), that would handle their OWTS costs and management individually.

Operation, Maintenance and Monitoring

Operation, maintenance and monitoring (OM&M) requirements for **Alternative 4** would include a combination of measures described under: (a) **Alternative 3b** for the proposed east side sewered area; and (b) **Alternative 2a**, for the west side OWTS upgrade-management area. The annual OM&M costs are estimated as follows:

- **Village-Eastside Sewer Service Area:** $1,296 per year, according to the existing annual NMWD sewer charge for properties in the Oceana Marin wastewater service area (subject to adjustment based on detailed fee study as noted previously).

- **Village-Westside OWTS Management Zone**: $900 per year, based on: (a) $500 for administrative oversight and water quality sampling program (i.e., equivalent of an operating permit fee); (b) $200 for annual inspection and maintenance; and (c) $200 per year toward septic tank pump-out costs that occur every 3 to 5 years. These cost estimates assume there would be a dedicated contract service provider(s) to conduct the routine field checks and maintenance work for efficiency.

Table 6-11. Estimated Capital Costs - Alternative 4
Village Sewerage (Eastside) and OWTS Upgrades (Westside)

Village Eastside - Sewerage Costs				
Service Area: 75 Residential + Commercial (Total 99 ESDs)				**ADWF: 7,150 gpd**
Wastewater Collection System				
Description	**Units**	**Estimated Quantity**	**Unit Cost ($)**	**Total Cost ($)**
6-inch gravity sewer	LF	3,110	$ 200	$ 622,000
Manholes	EA	9	$ 10,000	$ 90,000
Lampholes	EA	5	$ 1,500	$ 7,500
4" Force Main	LF	1,300	$ 140	$ 182,000
Lift Station (including easement)	LS	1	$ 500,000	$ 500,000
			Collection Subtotal	$ 1,401,500
			Contingency @ 15%	$ 210,225
			Engineering, Permitting & Administration @ 30%	$ 420,450
			Wastewater Collection System Total	$ 2,032,175
Connection Fees & Costs – Oceana Marin Wastewater System				
Sewer Connection Fee – Residential	EA	72	$ 30,000	$ 2,160,000
Sewer Connection Fee – Commercial*	EA	24	$ 30,000	$ 720,000
Leachfield Expansion	LS	1	$ 252,000	$ 238,000
Annexation	AC	7	$ 5,000	$ 35,000
			Oceana Marin Connection Costs	$ 3,153,000
			Estimated Total Eastside Village Sewerage Cost	**$ 5,185,175**
			Estimated Cost per Parcel (ESD)	**$ 54,012**

* Connection fee for commercial properties not currently established by NMWD; to be determined based on wastewater loading equivalency; preliminary assumption of 24 ESDs for Beach Restroom, Rental Cabins, Store, Deli & Café

Village Westside - OWTS Upgrade & Management Program (56 ESDs)			
OWTS Parcels	# of Parcels	Estimated Average Upgrade Cost ($)	Total Cost ($)
Residential – Village Westside	56	$ 35,600	$ 1,993,600
		Total Estimated Onsite Upgrade Cost	**$ 1,993,600**

Total Estimated Cost – Alternative 4	
Total Estimated Combined Cost – Sewerage plus OWTS Upgrades	**$ 7,178,775**
Estimated Average Cost per Parcel (ESD)	**$ 46,315**

SECTION 7: 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, energy demands, 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 community wastewater improvement project in Dillon Beach Village would be to provide reliable sanitary wastewater facilities for all properties in the community, suited to the local site conditions, protective of the environment and having sufficient capacity for the increasing number of people visiting and residing in the Village. This is to ensure protection of water quality, public health and nuisance problems, and bring wastewater treatment and disposal into compliance with accepted sanitary practices and environmental quality standards. For onsite systems, this means bringing all systems up to Class II status or better, compliant with current Marin County onsite wastewater treatment standards to the maximum extent practicable. For community sewerage, compliance would be in accordance with regulatory standards set by the Regional Water Quality Control Board.

Alternative 1 (No Project-Status Quo) would leave a large number of properties out of compliance with State and County regulatory requirements for onsite wastewater disposal, specifically those properties still reliant on cesspools, known to have been a common historical practice in Dillon Beach Village. Cesspools are prohibited under the 2012 State Water Board Policy for OWTS, and Marin County is obligated to pursue their abandonment and replacement where they are discovered or known to exist. Over an unknown period of time (probably decades) non-compliant and faulty septic systems and cesspools would gradually be replaced and upgraded under the status quo; however, this would likely not be considered responsive to or compliant with State Policy. This alternative would also not provide a means of addressing the existing and potentially increasing threat of nitrate impacts on the local groundwater, which may come under additional regulatory oversight as an area requiring advanced management protection under the State OWTS Policy and the County's Local Agency Management Program (LAMP).

Alternative 2a would address non-compliant septic systems under a systematic upgrade and replacement program. The septic system upgrades would be intended to achieve compliance with the Marin County EHS requirements for Class II systems. Due to the space limitations, upgrades would likely be similar to the approaches that have been followed in the recent past, including new tanks, small leachfields (gravity where possible), and waiver of standard setbacks to property lines, structures and the like. Very few systems would likely be able to be upgraded to meet full, Class I standards, which includes dual dispersal capacity and compliance with all horizontal setback requirements. This alternative is also not designed to specifically address the nitrate loading impact on groundwater, which may become a requirement under the County's LAMP if identified for advanced management protection.

Alternative 2b would be similar to **Alternative 2a** in bringing all septic systems up to a Class II repair/replacement level. Additionally, it would include the requirement for supplemental treatment in selective portions of the Village to address groundwater nitrate impacts. As such it would provide a higher level of OWTS regulatory compliance than **Alternative 2**.

Alternatives 3a and **3b** would decommission existing non-conforming septic systems and provide connections to the Oceana Marin sewer system, which operates under regulatory requirements established by the North Coast Regional Water Quality Control Board. **Alternative 3a** would serve all properties in the study area and **Alternative 3b** would serve the Village area, focusing on the highest concentration and greatest number of septic systems. **Alternative 3a** would bring the area into full compliance with wastewater treatment and disposal standards. Under **Alternative 3b:** (1) about 80 percent of the wastewater flow would go to the public sewer system; (2) RV Park wastewater would be treated in an advanced onsite system under Marin County EHS operating permit with State approval; and (3) the Bay Dr, Cliff St and Oceana Dr areas would continue to operate using existing and upgraded Class II OWTS (per status quo).

Alternative 4 would provide public sewers to about half of the study area - the east side of the Village where the threat to groundwater quality (nitrate contamination) from existing septic systems is the greatest. The west side of the Village would be addressed through a managed septic system upgrade per **Alternative 2a**. The level of regulatory compliance would fall between **Alternatives 3b** and **2a**.

ENVIRONMENTAL IMPACTS

A complete environmental impact report would be prepared separately as part of the overall facilities planning work if a project moves forward for Dillon Beach Village. Presented here is a brief overview of the environmental issues posed by the different alternatives. It 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 an unknown number of repair and replacement OWTS occurring over an unspecified time frame, likely 20 to 30 years or more. It is anticipated that the septic system improvements will occur as a result of individual system failures and in connection with building improvements and at time of property transfer or refinancing. The types of septic systems will likely be similar to the practices followed over the past 20 to 30 years, including new septic tanks, and small, limited-capacity leachfields, augmented with vertical (augur) drains in some cases. Installations will be underneath paved areas and closer to buildings, utilities and property lines than allowed under standard code requirements, i.e., requiring variances and waivers. There will be increased use of pump systems and probably an increasing amount of sewage hauling in response to the current trend toward higher occupancy rates in the community. A large number of existing cesspools and redwood seepage boxes will eventually be decommissioned, reducing the health and safety hazards posed by this antiquated practice. A major negative impact of the No Project alternative would be the lack of any comprehensive plan or schedule to bring about the upgrading of onsite systems, in particular to address the cumulative nitrate loading effects on the local groundwater and community water supply, which are likely to intensify with higher occupancy rates.

Through a managed program for system upgrading and replacement per the County's Class II repair criteria, **Alternative 2a** will largely protect against the public health hazards and nuisance conditions that can result from failing, poorly functioning and antiquated septic systems. 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.

However, following the Class II standards will not address cumulative nitrate loading effects on the local groundwater and water supply uses, which are evident from the Coast Springs water quality monitoring data and the nitrate loading analysis conducted as part of this study. Groundwater nitrate concentrations during the dry season are likely to increase over present levels if trends toward higher occupancy rates continue.

Alternative 2b will have similar positive environmental impacts as described for **Alternative 2a**, except that it will also include measures (supplemental onsite treatment units) to mitigate the nitrate loading effects on the local groundwater and drinking water supply. Once implemented throughout the eastern side of Village (as proposed), this will provide substantial water quality improvement over existing conditions; this will become a more significant issue as occupancy (and sewage generation) in the community increases. In addition to nitrogen reduction, incorporation of supplemental treatment units will also protect and extend the life of the leachfield-disposal systems and provide some pathogen removal benefits. The identified examples of treatment units for nitrogen removal are small and can be incorporated either; (a) as an insert into a standard 1,200-gallon septic tank (RetroFast unit), or (b) in a relatively small landscaped area (recirculating gravel filter). However, retrofitting existing septic systems will be difficult to accomplish on many properties without significant impacts to the conditions and use of the individual properties. Supplemental treatment units would require electrical-mechanical equipment in the form of a blower or submersible pump, which will increase home electrical use and maintenance requirements. The sound generated by small submersible pumps is imperceptible. Blower units run constantly and produce a humming noise measured at about 60 decibels, which is noticeable and typically mitigated with sound-proofing enclosures.

Alternatives 3a and **3b** will provide septic to sewer conversion for all or most all of the study area, which will eliminate substantially all impacts from existing septic system discharges. Both alternatives include the use of conventional sewers, eliminating the need for septic tanks, leachfields and management of sewage on individual properties. Some properties will require ejector pump units, where the house is on the downhill side of the street sewer. Also, in **Alternative 3a**, the identified sewer plan includes the use of pressure sewers for Bay Rd/Cliff Street Extension and for Oceana Dr as the most cost effective approach for these two sub-areas. This would require individual grinder pump units at each property, with associated electrical requirements and additional maintenance attention. The collection system will generate short-term impacts throughout the service area during the construction phase.

The most significant new structure in these sewerage alternatives would be a central/main sanitary lift station proposed to be located adjacent to the beach restroom. The lift station would consist of below ground or low-profile tanks and standard submersible sewage pumps, plus a small control building. It would be fenced and could be screened with vegetation to mitigate visual impacts. Noise levels would be low, but there would be regular activity at the site and routine maintenance operation of a standby generator. Sewage odors would be generated, but can be mitigated with appropriate odor control facilities. Pump failures and/or pipeline leaks or breaks would pose the potential for discharge of raw sewage to the environment. Mitigation would be through the design of surplus emergency storage capacity to control and contain sewage overflows, redundant pumps and other critical equipment, local and remote alarm systems, standby generator, and frequent site inspection and maintenance.

Sewer connection to the Oceana Marin wastewater system would make use of existing facilities for wastewater transmission, treatment and disposal. Recommended upgrades to the Oceana Marin wastewater system have been identified and outlined in the 2015 Master Plan Update report by Nute Engineering, for the main lift station, force main, wastewater ponds and leachfield. The recommendations were made taking into account future growth within Oceana Marin, but did not consider future service area extension to include Dillon Beach Village. The need to implement most of the identified upgrades would become even more critical with the addition of the Dillon Beach Village due the increase in sewage flows. Consequently, **Alternatives 3a** and **3b** assume that the recommended upgrades would be implemented as a condition of extending sewer service to Dillon Beach Village, and that a substantial portion of the funding would come from the connection fees (i.e., “buy-in” cost), estimated to be in the range of $5.7 to $4.5 million, respectively, for **Alternatives 3a** and **3b**, and a smaller amount ($2.9 million) for **Alternative 4**. Most all of the facilities upgrade work would occur at or adjacent to the site of existing facilities and pose no obvious environmental obstacles. However, environmental review would likely be triggered for most of the work, due to land disturbance and construction work required. The proposed additions to the Oceana Marin leachfield identified under **Alternatives 3a, 3b** and **4** to increase the capacity, reliability and overall performance of the leachfield, would all take place within the existing, fenced leachfield area, approved and dedicated for wastewater disposal. The potential impacts of additional leaching trench can be judged by the 30+ years of historical use of the existing disposal system.

Alternative 4 amounts to a combination of Alternatives **2a** and **3b**, and would have the types of environmental impacts described for each of those two alternatives.

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 rates poorly in terms of reliability. Options to correct existing septic system problems will be limited and costly. While the underlying sandy soils are forgiving, some property owners will have extreme difficulty finding solutions that can assure long-term performance reliability because of building obstructions, utility conflicts and space limitations. Without a concerted effort to systematically assess and upgrade existing systems, many systems will remain as is, and will be a source of continuing public health and water quality concerns, with limited ability to deal with emergencies and surges in usage and wastewater flows.

Alternative 2a represents a substantial improvement in reliability through the proposed implementation of an onsite inspection and maintenance program. Upgraded septic tanks with gravity leachfields sized and designed for each site can provide good reliability, especially for the low amount of use they have historically received. The inspection and monitoring program would also be important as a check on possible impacts from the increasing levels of occupancy that are starting to be seen in Dillon Beach. Monitoring of groundwater would be helpful in tracking long-term effects from septic system discharges, and could provide additional impetus and support for future measure to address the cumulative nitrate loading or other effects on groundwater quality and the local drinking water supply.

Alternative 2b offers a significantly higher degree of reliability over present sewage disposal practices, and also an improvement over **Alternative 2a**, through the required use of supplemental nitrogen treatment to address the cumulative wastewater loading impacts on groundwater. This alternative will not completely eliminate the nitrate impacts on the local groundwater, but it will significantly reduce the loading and reverse the current trend toward increasing impacts. To achieve this, **Alternative 2b** will rely on proper operation and maintenance of many individual treatment units in the area of concern (a little over half of the properties in the Village). This is a potential vulnerability that will require diligent oversight to ensure reliable treatment and compliance with water quality objectives.

Alternatives 3a/3b would provide the highest level of reliability as these sewerage options would consolidate the transmission, treatment and disposal of wastewater into a managed system, with professional 24-hr operation and oversight. The groundwater nitrate impacts posed by existing septic systems would be mitigated (eliminated) by conversion to sewerage. These alternatives will increase the volume of wastewater collected, treated and disposed of by the Oceana Marin wastewater system, putting greater reliance on system operations. The 2015 Master Plan Update for Oceana Marin identified and recommended a number of high and medium priority projects to improve the functioning, reliability and redundancy of the wastewater facilities; however, estimated costs for the capital improvements are unaffordable for the current service area. **Alternatives 3a/3b** will include substantial connection fees as the cost of “buy-in” to the existing Oceana Marin facility. These fees would provide sufficient funding to allow implementation of the identified high and medium priority projects, resulting in an overall improvement in system reliability over current conditions. These alternatives will also expand the existing leachfield system to accommodate the added flows from Dillon Beach Village, including an improved effluent dosing system and leachfield design, adding flexibility and reliability to the existing leachfield constructed in the early 1990s.

Alternative 4 would provide the type and level of reliability (and vulnerability) as described above for **Alternatives 2a** and **3b**.

ENERGY REQUIREMENTS

Alternative 1 would create new energy requirements and resource demands: (a) to the extent that individual actions are taken to upgrade existing septic systems with more modern treatment devices: and (b) for increasing needs for pumping and hauling of sewage to sustain poorly functioning systems.

Alternative 2a would increase energy requirements in comparison with the No Project Alternative, since it would accelerate the process of upgrading older non-compliant systems to meet current repair-replacement standards. Because of site and building constraints, it is likely that a number of pump systems would be required. There would also be increased usage of fossil fuels as a result of the construction work for onsite system improvements and regular inspection and monitoring activities. A somewhat higher rate of routine septic tank pump-outs might occur as a result of regular inspection work; but it is also likely that system improvements will reduce the need for frequent pump-outs of older marginally operating systems.

Alternative 2b would have increased energy requirements in comparison with **Alternatives 1** and **2a**, because of the need to include electrical-mechanical devices (e.g., pumps, blowers) which are used in supplemental nitrogen-removal treatment units. This would affect a little over half the properties in the Village lying within the east side area identified as a recommended nitrogen management area.

Alternative 3a/3b would have the greatest energy requirements among the various alternatives for: (a) the pumping required to convey the raw sewage from the proposed lift station (at the Beach Restroom area) to the sewer connection on Oceana Dr (100-ft lift), and then from the

Oceana Marin main lift station at Tahiti Way to the hilltop treatment ponds (380-ft lift); and (b) operation of wastewater pond aerators. There would also be increased usage of fossil fuels for the **Alternative 3a/3b** sewerage project as a result of more extensive construction work for pipeline, lift station, and leachfield installation.

Energy requirements for **Alternative 4** would fall between **Alternatives 2a** and **3b**, as a hybrid of these other two alternatives. Energy use for sewage transmission and treatment would be about half of that for **Alternative 3a**; and remaining OWTS upgrades would make use of gravity systems wherever feasible.

LAND USE

This factor considers the impact of wastewater facilities on land use activities for individual properties, public areas and other lands**.**

Alternative 2b would pose the biggest impact on individual properties in the service area through the need to modify and upgrade onsite wastewater systems on each property, including the addition of supplemental treatment for about half of the properties. This would affect existing landscaping and other property improvements and activities. **Alternatives 1, 2a** and **4** would have a similar effect, but not to the same degree, since: (a) **Alternatives 1** and **2a** do not include requirements for supplemental treatment units; and (b) **Alternative 4** does not affect as many individual properties served by onsite systems. **Alternatives 3a/3b** and **4** would involve the installation of sanitary sewers in the local streets, plus one major lift station in the community. However, under the recommended use of gravity sewers, they would eliminate the need for onsite septic tanks and disposal fields on individual properties, **Alternative 3a/3b** to the greatest degree. From a property-owner perspective, "freeing-up" space on the very small lots for other uses would be viewed as a positive impact, potentially allowing other uses and enjoyment without the restrictions posed by on-lot septic tanks and leachfields. For those properties where ejector pumps or grinder pumps are required (to pump up to the street sewer), this would be a new, negative impact as there are currently very few pump systems in use within the Village.

Off-site land use impacts are only a consideration for **Alternatives 3a/3b** and **4**, which include sewerage and connection to the Oceana Marin wastewater system. The most significant impact would be associated with the location(s) selected for the placement of a central lift station within the Village. The proposed location tentatively identified for a central lift station is adjacent to the public restroom at the beach, on property owned by the Dillon Beach Resort. The owners are aware of and preliminarily receptive to consideration of the restroom site as a potential location for a community sewer lift station. It makes sense from an engineering and utility standpoint, and would be located adjacent to the single largest source of sewage flow in the Village during peak periods (i.e., beach restroom).

Once the collected sewage from the Village is pumped uphill and enters the Oceana Marin sewer system on Oceana Drive, it becomes part of fully-built facilities already used and dedicated for wastewater management. There are no envisioned land use impacts within Oceana Marin from the extension of sewer service to Dillon Beach Village, since no enlargement of existing sewers, lift station, force main or ponds would be required specifically to accommodated the flows from the Village. It is assumed that sewer improvements such as the main lift station upgrades, pond repair, and installation of a second, redundant force main would be implemented as a condition of expanded service to Dillon Beach Village. However, these are all recommended capital improvement projects for the existing Oceana Marin system, identified for eventual implementation, regardless of service area expansion to Dillon Beach Village. The only identified expansion work for each of the sewerage alternatives would be installation of additional leaching trenches. The leaching trenches are proposed to be within the existing 11-acre Oceana Marin leachfield area, which is dedicated and has been used historically for wastewater disposal. As such, the leachfield excavation and construction would occur in areas already set aside for this purpose and therefore not be considered a change in land use activities under this evaluation criterion.

COSTS

The estimated capital cost and operation and maintenance (O&M) cost for the various wastewater project alternatives are summarized in **Table 7-1.** Supporting cost information is itemized for each alternative in preceding individual sections and in the appendices. No overall cost estimate is given for the No Project Alternative, as the costs will be highly variable from one property to the next, and will occur over an undetermined time frame. There is also uncertainty about potential future regulatory requirements, e.g., related to protection of the Dillon Creek water supply aquifer, that could be instituted under the No Project approach that could ultimately impact costs significantly.

The cost comparison shows **Alternative 2a (**OWTS upgrade/management**)** to have the lowest projected costs, with an estimated average capital cost of $33,615 and annual O&M costs of about $900 per parcel. This is followed by **Alternative 2b** and **4**, with estimated capital costs averaging $44,241 and $46,315 per parcel, respectively. Annual O&M for these alternatives include estimated costs of $900 to $1,200 for standard and advanced OWTS, and $1,296 for those served by community sewage (Oceana Marin sewer fee). The highest projected costs are for **Alternatives 3a** (complete sewerage), and **Alternative 3b** (Village area sewerage), with estimated capital costs per connection of about $54,400 and $51,400, respectively.

Table 7-1:
Cost Comparison of Alternatives

Cost Factor	Alternative 1 No Project Status Quo	Alternative 2 OWTS Upgrade and Management Program 2a Basic Class II Repairs	2b w/ Partial Nitrogen Removal Systems	Alternative 3 Community Sewerage to Oceana Marin 3A Entire Study Area	3B Village Only	Alternative 4 -- Hybrid -- East Village Sewer West Village OWTS
Capital Costs						
Estimated Capital Cost	-	$5,582,650	$7,742,275	$10,337,425	$ 7,813,000	$7,178,775
Average Cost per ESD*	**$0 - $60,000+**	**$33,615**	**$44,241**	**$54,407**	**$ 51,401**	**$46,315**
Annual O&M Costs (per ESD)						
Oceana Marin Sewer Fee	-	-	-	$1,296 (193 ESDs)	$1,296 (155 ESDs)	$1,296 (99 ESDs)
OWTS Fees**	-	$700	$700-$900	-	-	$700 (56 ESDs)
OWTS Additional Owner Cost***	$0 - $1,000+	$200	$200-$300	-	-	$200 (56 ESDs)
Average Cost per ESD	**$0 - $1,000+**	**$900**	**$900 - $1,200**	**$1,296**	**$1,296**	**$900 - $1,296**

***** ESD = equivalent single family dwelling
**Per EHS annual operating permit fee (~$500) plus $200-$400 annual inspection/maintenance allowance
***Allowance for septic tank pump-outs, pump equipment service/replacement

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 7-2**. 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.

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 6 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 2a, 2b, 4, 3b** and **3a,** 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.

Reliability

Projects were subjectively ranked in order of increasing reliability and assigned points according to rank. The most reliable alternatives (**3a** and **3b**) were assigned the highest score (6).

Energy Demand

Project alternatives were ranked in order of decreasing energy requirements, and assigned points according to rank. Higher points correspond to projects with lower net energy 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, or conversely removed from that use.

Costs

Project alternatives were ranked by estimated capital costs and annual O&M costs. **Alternative 2a** (OWTS upgrade/management) was ranked highest per cost estimates presented in **Table 7-1**; the second highest total was assigned to the **Alternative 1** (No Project) as somewhat similar to **2a** on average, but with greater uncertainty. Costs to an individual property could be significantly higher than other community-based options depending on their particular situation.

Apparent Best Alternative

This comparative analysis shows **Alternative 3b** to have the highest ranking, with **Alternative 3a** the next highest; these would be considered the "apparent best" alternatives for the Dillon Beach Village study area. Both of these alternatives are based on community sewerage and connection to the Oceana Marin wastewater system. **Alternative 3b** would provide community sewerage to the entire Village area, leaving the larger properties in the Bay Rd/Cliff St Extension and Oceana Drive areas to remain as is (status quo). **Alternative 3a** would provide sewerage to all properties.

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, or add other factors, which could alter the outcome. Also, the availability of funding may be different among alternatives, which could in turn affect the actual cost to property owners and the cost comparison between alternatives. For example, the level of grant funding available for community facilities compared with onsite improvements could affect the cost rankings. Also, the results of formal environmental studies could provide additional information affecting the comparative ranking among the alternatives.

Table 7-2: Numerical Ranking of Alternatives*

Comparison Factor	Alternative 1	Alternative 2 OWTS Upgrade and Management Program		Alternative 3 Community Sewerage to Oceana Marin		Alternative 4
		2a	2b	3a	3b	
	No Project Status Quo	Class II Repairs	w/ Nitrogen Removal Systems	Entire Study Area	Village Area Only	-- Hybrid-- East Village Sewer; Remainder OWTS
Regulatory Compliance	1	2	3	6	5	4
Environmental Impacts	1	2	3	5	6	4
Reliability	1	2	3	6	6	4
Energy Demand	6	5	4	1	2	3
Land Use	3	2	1	6	5	4
Capital Cost	5*	6	4	1	2	3
O&M Costs	5*	6	4	1	2	3
TOTAL	**22**	**25**	**22**	**26**	**28**	**25**
RANKING	**5**	**4**	**6**	**2**	**1**	**2**

*Costs for Alternative 1 are not known, but are estimated to be generally similar to Alternative 2 on average, but with larger uncertainty; costs for individual property owners would vary widely depending on individual circumstances.

SECTION 8: MANAGEMENT REQUIREMENTS AND ALTERNATIVES

This section addresses management issues. Specifically, it provides background information regarding management requirements and alternatives for a community wastewater system as well as for an onsite wastewater management approach for the Dillon Beach Village study area

COMMUNITY WASTEWATER FACILITIES MANAGEMENT REQUIREMENTS

As described in the preceding sections of this report, a community wastewater project in Dillon Beach Village would involve construction of physical wastewater facility improvements for up to 160 existing homes and businesses located in the Study Area. If the community decides to move forward with that approach, project selection would be made upon completion of an environmental impact report and in connection with acquisition of necessary governmental and local sources of funding to finance the project. Management requirements for implementation and ongoing operation of a community wastewater facilities project include the following:

- **Public Entity for Facility Ownership and Operation**. A public entity will be required to assume responsibility for ownership and ongoing operation of any community facilities that are constructed. A public entity is 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 responsible for system ownership and ongoing operation must be in place prior to initiation of project construction.

- **Assessment District for Construction Financing.** Grant funds from State, Federal or other sources may available for the implementation of a community wastewater project for Dillon Beach Village. Such funds could be used to pay for administration, planning and design-related services, as well as 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; the remaining costs ("local share") were financed through the formation of a local assessment district. This is one of the most common methods used to finance sewer systems and other public works projects. The assessments, secured against the properties in the project service area, are 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.

- **Fees for Operation, Maintenance, and Capital Improvements.** Once constructed, the project facilities will entail ongoing costs for operation, maintenance and capital improvement projects (CIP), which will 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 tax bill; however, they may be collected through direct billing, which is more cumbersome and not as common. The annual operation, maintenance and CIP costs will vary depending on the specific facilities included in the selected project as well as the number of service connections. A review of anticipated operation and maintenance requirements and approximate costs for the various project alternatives is covered in **Section 6**. A detailed fee study would be required to more accurately determine the annual fees for expanded service to Dillon Beach Village once a final decision is made on the service area boundaries and specific facilities to be constructed.

DILLON BEACH VILLAGE ONSITE WASTEWATER MANAGEMENT PROGRAM

Some of the alternatives considered for Dillon Beach Village include the option of upgrading individual onsite septic systems along with ongoing management and oversight. Implementation under this approach would require the establishment of an onsite wastewater management program (also “management district” or “management zone”) that covers all developed properties within the defined service area. The aim would be to develop and implement a local program to help finance and oversee the implementation of onsite wastewater system improvements and provide for ongoing oversight of all systems in the service area.

The functions of an onsite wastewater management district can range widely, depending on the goals, the facilities to be maintained, local resources and capacity to undertake management and maintenance responsibilities. Some of the key functions of a management program for Dillon Beach Village would likely include the some or all of the following:

- Develop locally appropriate standards and practices to help streamline the design, approval and construction process for upgrade of OWTS;
- Inspect and monitor individual onsite system upgrades and new installations;
- Conduct ongoing water quality monitoring of groundwater and surface waters in selected areas of concern;
- Seek grant funds or other financing for other phases of improvements, and for direct assistance to homeowners;
- Provide reports to the County, Regional Water Board and others on the functioning status of OWTS and wastewater-water quality conditions in the Dillon Beach Village area; and
- Represent the Dillon Beach property owners in regulatory matters concerning wastewater system requirements for the area.

The institutional and financial requirements for implementing an onsite wastewater management program would include the same basic items previously described for a community wastewater facility project, with some variation as described below.

- **Public Entity.** Formation of a public entity (i.e., management district) would be required to obtain and utilize public grants or loan assistance for implementing onsite wastewater improvements and to carry out the ongoing septic system oversight and management functions.

- **Assessment District and Loans.** An assessment district could potentially be formed to help finance the onsite wastewater improvements. However, since assessment districts are normally used for financing facilities that serve the common good, rather than individual property improvements, there is little experience in this area and finding suitable lending sources may be difficult. Alternatively, a loan program could potentially be set up by the public management district to make low-interest State funds available to private property owners to help finance individual onsite improvements.

- **Ongoing Operation and Maintenance/Management Fees.** Costs to maintain and oversee the onsite wastewater improvements would be paid for by user fees from the homeowners in the Dillon Beach Village service area. Similar to the requirements for a community wastewater facilities project, such fees would go toward the payment of district administration and overhead costs, technical services/equipment for inspections, monitoring of individual systems, water quality sampling costs, and reporting. The fees could be included on tax bills or collected through direct billings. The fee structure could be customized to reflect different levels of management oversight. For example, a fee structure could be established to charge a uniform base rate to all properties, with additional fees assigned according to the type of technology (standard or advanced system), monitoring frequency, etc.

INSTITUTIONAL ALTERNATIVES

Introduction

The implementation of a community wastewater project in Dillon Beach will require the formation of or annexation to a public district that has suitable powers and authority for operation and management of public sewers. This is required as a matter of public policy and also to enable the community to obtain and utilize various forms of public financial assistance available from the State and Federal government.

Provided here is a brief 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. In general, all options presented here are technically viable; the ultimate decision by the community will likely focus on issues of local autonomy, economics and possibly political or personal preferences.

Existing Institutions

The present wastewater feasibility study is 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. This is the approach that was followed for the Marshall Phase Community Wastewater System. However, ultimately a district will be needed for the operation and maintenance of the facilities that are constructed or for the governance of an onsite wastewater management program, if that option is selected.

Presently, the one local district with sewerage powers is North Marin Water District, which currently provides wastewater service to about 225 homes in Oceana Marin plus twelve (12) residences in the Dillon Beach Village area that have been annexed to the district in the past 10 to 15 years. **Figure 8-1** shows the NMWD boundaries and annexations. The remainder of the Dillon Beach Village is not currently within the adopted sphere of influence of NMWD; but it was identified by LAFCO in 2017[12] as a priority area to be evaluated for inclusion at the next 5-year sphere of influence update.

[12] LAFCO. Final Report - Sphere Update Report, North Marin Water District. October 2017.

TABLE

Annex No	Imp. District No	Year Annexed	Parcel No.
	OM-1	1969	OM units 3&4
	OM-2	1970	OM unit 1
	OM-3	1973	OM units 1&5
1	OM-3	1977	100-153-02
2	OM-3	1990	100-153-01
2	OM-3	1990	100-153-03
2	OM-3	1990	100-153-04
2	OM-3	1990	100-153-13
3	OM-3	1991	100-133-11
3	OM-3	1991	100-152-02
4	OM-3	1993	100-152-03
5	OM-3	1993	100-331-19
6	0M-3	1994	100-251-06
7	OM-3	1995	100-152-05
8	OM-3	1995	100-311-27
9	OM-3	2006	100-300-03

LEGEND

- TERRITORIAL BOUNDARY
- ID OM–1
- ID OM–2
- ID OM–3
- ANNEXATION 1 TO OM–3
- ANNEXATION 2 TO OM–3
- ANNEXATION 3 TO OM–3
- ANNEXATION 4 TO OM–3
- ANNEXATION 5 TO OM–3
- ANNEXATION 6 TO OM–3
- ANNEXATION 7 TO OM–3
- ANNEXATION 8 TO OM–3
- ANNEXATION 9 TO OM–3
- EXCEPTION TO OM–1 BOUNDARY
- 490 STREET ADDRESS–NO SERVICE
- 315 STREET ADDRESS
- 10026115 ASSESSORS PARCEL NO.

NO.	DATE	REVISION	BY	APP.
1	11/01/04	FIRST CAD FILE EDITION		

NORTH MARIN WATER DISTRICT
NOVATO, CALIFORNIA

NORTH MARIN WATER DISTRICT
IMPROVEMENT DISTRICTS
OCEANA MARIN AND DILLON BEACH

DES | DR: XX | CH | SCALE: 1"=200' | DATE: 11/01/04
APPROVED: CHIEF ENGINEER | SHEET NO.: 1 OF 1 SHEETS
R.E. C40936 | SERVICE AREA | JOB NO. | NO. 001

PLOT STYLE: QUESTA–GRAYSCALE–255.CTB PLOT DATE: 9/6/2022 LAST SAVED: 9/6/2022
P:\2020\2000170_DILLON_BEACH_VILLAGE_WASTEWATER\CAD\MODEL\2000170_PROJECT ALTERNATIVES.DWG

DIILON BEACH VILLAGE WASTEWATER STUDY

DILLON BEACH, 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: PS
Checked: NH
Appr'd: NH

EXISTING NMWD-OCEANA MARIN WASTEWATER SERVICE AREA

DILLON BEACH, CA

FIGURE 8-1

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

In 2000 NMWD adopted Resolution 00-20 to clarify the District's policy regarding sewer annexations in West Marin, a copy of which is included in **Appendix F**. The policy includes six (6) key provisions, briefly summarized as follows:

1. The proposed service area expansion must be consistent with the Marin County Plan and specific community plans.

2. Engineering feasibility and adequate wastewater capacity shall be determined by NMWD, land use consistency established, and environmental review completed.

3. Request for annexation must be supported by a clear and substantial majority (75%) of the property owners in the affected area, and financial arrangements made for the benefiting property owners to pay for the required engineering and economic feasibility studies.

4. The following conditions must be met:
    a. No adequate alternative community system is available;
    b. Compliance with requirements of appropriate permitting agencies;
    c. Annexation per LAFCO policies and procedures;
    d. Compliance with applicable District regulations;
    e. Satisfactory arrangements established for payment of all pertinent costs by the area to be served.

5. Any proposed new development area shall be geographically adjacent to or within the existing community service area.

6. Service to new customers shall not adversely affect existing customers, and no service will be extended for exclusive benefit of a single development or developer.

Independent Local Districts

Independent local districts are those formed to carry out a specific local public function, where the administration and decision-making is entrusted to a locally elected Board of Directors. This board assumes the responsibility for all policy, staffing and fiscal matters for the properties within the district. The boundaries of the district are established to encompass the areas benefiting from the district facilities or activities. Common types of independent local districts pertinent to the provision of sewerage services include:

- **Community Services District (CSD)**. These districts have the authority to provide a broad range of public services, including police and fire protection, recreation and lighting, as well as water and sewer service. The formation of a CSD is initiated by local initiative; i.e., petition to the Board of Supervisors. An election is required for district formation and for election of the Board of Directors. The election can be waived if the petition includes at least 80 percent of the registered voters in the proposed district. The nearest existing CSD in the Dillon Beach area is the Tomales Village CSD, which operates the community's wastewater collection, treatment and disposal facilities. Connection to the Tomales CSD was initially considered as a possible wastewater management alternative for Dillon Beach, but was excluded from the detailed review in this study based on the prohibitive cost ($4 to $5 million) of a 3-mile long wastewater transmission line that would be required.

- **County Water Districts**. These local districts, authorized under the California Water Code, are formed in a similar manner to CSDs. But their powers are limited to provision of water and sewer service within their boundaries. Stinson Beach County Water District (SBCWD) is an example of this type of district. The SBCWD, with a locally elected board of directors, provides water service and also manages the onsite wastewater management program for the entire Stinson Beach community. North Marin Water District and Marin Municipal Water District are municipal water districts with similar structure and powers as County Water Districts. These districts supply water to large portions of the population in Marin County, including incorporated and unincorporated areas.
- **Sanitary Districts**. These districts are authorized under the Health and Safety Code specifically for the provision of sewage collection, treatment and disposal services. They can also provide water service. They are formed in a manner similar to CSDs and County Water Districts. The governing board of a Sanitary District is locally elected. Presently, there are no Sanitary Districts or County Sanitation Districts in West Marin. However, there are several sanitary districts throughout other parts of the County, such as the Ross Valley Sanitary District, Novato Sanitary District, and Las Gallinas Valley Sanitary District.
- **Public Utility Districts.** These districts are authorized under the State Public Utilities Code and can provide a wide range of utility services, including sewer and water service. Public Utility Districts (PUD) can only be formed in unincorporated areas. They are governed by a locally elected board consisting of either three or five members. Inverness PUD and Bolinas Community PUD are local examples of PUDs in Marin County. Both of these districts provide water service within their districts; Bolinas Community PUD also owns and operates community sewerage facilities serving the downtown area of Bolinas.

Some of the common advantages of independent local districts include: (1) local autonomy in the decision-making process; and (2) local accountability and control over costs. The disadvantages of independent local districts may include: (1) limited financial resources and leverage; (2) limited economies of scale; and (3) limited resources and ability to meet public service demands.

County-Dependent Districts

This category encompasses those districts formed and administered as sub-sets of County government. The County Board of Supervisors serves as the governing body or decision-maker for these districts. The Board of Supervisors acts as the Board of Directors for various dependent districts. As such, they assume responsibility for all policy, staffing, debt and rate structures within the boundaries of the district.

Marin County utilizes dependent districts to provide such things as sewer maintenance, landscape maintenance, lighting, recreation, fire protection, drainage and paramedic services. Marin County Counsel provides legal service. The Board of Supervisors typically works with a Citizen’s Advisory Committee within each of the dependent districts to provide an opportunity for local input to the decision-making process.

Examples of County-dependent districts in Marin County include the following:

- **County Service Areas (CSA)**. County service areas are much the same as CSDs in their range of authority. The key distinction is the governing body, which is the Board of Supervisors for all CSAs. They can be formed by either local petition or by a resolution of the Board of Supervisors. Presently, there are 16 CSAs in Marin County providing a variety of public services, ranging from park and open space management to drainage maintenance. There are currently no existing CSAs in Marin County that provide sewer services. However, in neighboring Sonoma County, a county-wide CSA, with multiple zones of benefit, is used to provide wastewater treatment and disposal services for several unincorporated communities.

- **County Sanitation Districts and Sewer Maintenance Districts**. These districts are authorized under the Health and Safety Code specifically for the provision of sewage collection, treatment and disposal services. They can include unincorporated and incorporated areas; the governing board is comprised of County Board of Supervisors and/or City Council members, depending upon the makeup of the district. A district may be formed upon local petition and Board/Council approval. San Quentin Village Sewer Maintenance District is currently the only district of this type in Marin County. It was formed to manage the sewer collection system for the San Quentin Village area; collected sewage is treated at the Central Marin Sanitation Agency Wastewater Treatment Plant.

- **Onsite Wastewater Management Districts.** The concept of public management of onsite wastewater disposal was developed in California in the mid-1970s to expand wastewater options in rural and suburban communities, specifically by providing a means for more effective planning, operation and maintenance of onsite systems. The enabling legislation, Senate Bill 430, became law in January 1978 and was added to the California Health and Safety Code, commencing with Section 6950. This legislation enables public agencies that have powers to manage sewerage systems to form, under certain specified conditions, Onsite Wastewater Disposal Zones (OWTS Zones) in order to provide for the collection, treatment, reclamation or disposal of wastewater without the use of community-wide sanitary sewers or sewage systems. Such Zones may also manage community leachfield systems. Public agencies empowered to form such Zones include qualified special districts such as county service areas, community services districts, utility districts, sanitation districts, water districts, etc., as well as cities. The Zone formed under the Health and Safety Code is the area defined for operation and maintenance of onsite wastewater systems by the public agency. In 2007 the County of Marin formed the Marshall Onsite Wastewater Disposal Zone to serve as the governing entity for the Marshall Phase Community Wastewater System. This continues to operate as the only Onsite Wastewater Disposal Zone in the County. The Zone formation process can be initiated by petition from the community or by resolution of the Board of Supervisors. The Zone can be formed with or without a vote, depending on the number of protests.

The main advantages of County-dependent districts include: (1) availability of County resources and associated economies of scale; (2) financial strength and leverage for bonding and contracting. Disadvantages of County-administered districts may include: (1) reduced local control of the decision-making process (although this is not always the case); and (2) reduced ability to influence fiscal matters, e.g., through voluntary/community service or other cost reduction measures (e.g., County overhead, travel time and costs).

LAFCO

The Local Agency Formation Commission (LAFCO) was created by the Legislature in 1963 to discourage urban sprawl and encourage the orderly formation and development of local government agencies. There is a LAFCO in each county in California, except the City and County of San Francisco. LAFCO is a seven-member Commission comprised of two city council members (chosen by the Council of Mayors), two county supervisor members (chosen by the Board of Supervisors), two special district members (chosen by Independent Special District election), and one public member (chosen by the members of the Commission).
LAFCO has four major functions under State law:

1) To review and approve or disapprove proposals for changes in the boundaries or organization of cities and special districts in the county (including annexations to or detachments from cities and districts, incorporations of cities, formations of districts, and the dissolution, consolidation or merger of special districts), applications for activation of special district latent powers, and applications to provide service outside of a city or district boundary;
2) To establish and periodically update the sphere of influence or planned service area boundary for each city and special district;
3) To initiate and assist in studies of existing local government agencies with the goal of improving the efficiency and reducing the costs of providing urban services; and
4) To provide assistance to other governmental agencies and the public concerning changes in local government organization and boundaries.

NMWD has indicated that they see the potential project as an opportunity to revise its role in providing sewer services to a remote portion of the County in light of its primary mission to provide water. NMWD is open to discussions with the County, other established Sewer Agencies, and/or LAFCO to review alternative governance for his area and perhaps beyond (e.g., Tomales and Marshall, etc.).

With regard to the formation of County Service Areas, the Marin LAFCO implements the following policy:

> *"County Service Area (CSA) Policy*
>
> *A County Service Area may be formed when unincorporated areas that are located outside municipal sphere-of-influence boundaries desire extended urban-type services including police and fire protection from the County of Marin.*
>
> *Unincorporated lands located within a municipal sphere-of-influence boundary should not be eligible to receive extended urban-type services from the county in the form of a County Service Area except when (a) evaluation on a case-by-case basis justifies creation and (b) the affected city, by letter, expresses approval of such action. (Originally Adopted: July 13, 1977; Revised: January 13, 1983)"*

Dillon Beach Village does not fall within the sphere-of-influence boundary of any municipality. LAFCO policy concerning the formation of County Service Areas would appear to permit the establishment of a CSA for the provision of wastewater collection and treatment services for the Village if that were to be proposed.

SUMMARY

Based on the above information, the following briefly summarizes the apparent best or logical management/organizational options for each alternative.

Alternative 1 - Status Quo. No change or action required. Onsite wastewater treatment systems continue to be managed individually and regulated by Marin County Environmental Health Services.

Alternative 2a – OWTS Upgrades and Management Program. Formation of an OWTS Zone under the governance of the Marin County Board of Supervisors, administered through Environmental Health Services.

Alternative 2b – OWTS Upgrade Program with Supplemental Nitrogen Removal Systems. Formation of an OWTS Zone under the governance of the Marin County Board of Supervisors, administered through Environmental Health Services.

Alternative 3a – Community Sewerage and Connection to Oceana Marin Wastewater System. Annexation of the entire Study Area to NMWD for design, construction and management of sewer collection, treatment and disposal.

Alternative 3b – Community Sewerage and Connection to Oceana Marin Wastewater System. Annexation of the entire Village area to NMWD for design, construction and management of sewer collection, treatment and disposal.

Alternative 4 – Hybrid: Village Eastside Sewerage, Village Westside OWTS Upgrade Program
Two options:

a. Annexation of the Village east side for sewerage by NMWD, and formation of a County-governed OWTS Zone for the remaining portion (per Alternative 2a).
   or
b. Formation of an OWTS Zone under the governance of the Marin County Board of Supervisors for the entire Village, with management authority over both sewer collection and onsite systems. Outside service agreement with NMWD for wastewater conveyance, treatment and disposal for the east side (sewered) portion of the Village.

SECTION 9: REFERENCES

Bracewell Engineering, Inc., "Long-Range Master Plan for Oceana Marin Wastewater System", Prepared for North Marin Water District, March 1996.

Bracewell Engineering, Inc., "Long-Range Master Plan for Oceana Marin Wastewater System", Prepared for North Marin Water District, December 2005.

California State Water Resources Control Board, "Water Quality Control Policy for Siting, Design, Operation, and Maintenance of Onsite Wastewater Treatment Systems", June 19, 2012.

California State Water Resources Control Board, "Drinking Water Watch", online Public Water Systems Search version 22.06, https://sdwis.waterboards.ca.gov/PDWW/

Clark, Joseph C. and Brabb, Earl E. "Geology of the Point Reyes National Seashore and Vicinity, A Digital Database". U.S. Department of the Interior, United States Geological Survey. Derive from Open File Report 97-456.

County of Marin, MarinMap Map Viewer https://www.marinmap.org/Html5Viewer/Index.html?viewer=smmdataviewer

Crites, Ron and Tchobanoglous, George, Small and Decentralized Wastewater Management Systems, McGraw-Hill, 1998.

Marin County Environmental Health Services, file review of available septic system permit information for Dillon Beach.

Marin County Flood Control and Water Conservation District Real-Time Rainfall, Creek Stage, and Weather Data, https://marin.onerain.com/

Marin County Planning Department and Wallace Roberts & Todd, "Dillon Beach Community Plan", August 1989.

Marin County Regulations for Design, Construction and Repair of Individual Sewage Disposal Systems, Adopted May 6, 2008.

Miller-Pacific Engineering Group, "Geotechnical Feasibility Report – Dillon Beach Master Plan, Dillon Beach, California", January 23, 1996.

North Marin Water District, various maps, reports, monitoring data, and other documents related to the Oceana Marin Wastewater System.

Nute Engineering, "2015 Master Plan Update – Final Report for the Oceana Marin Wastewater System", Prepared for North Marin Water District, January 13, 2016.

Questa Engineering Corporation, "Water Supply Report for Dillon Beach Resort Master Plan, Dillon Beach, California", July 29, 1996.

Questa Engineering Corporation, “Dillon Beach Well Evaluation Report”, Prepared for Cal Water Services Company, April 30, 2021.

USDA – Soil Conservation Service, Soil Survey of Marin County California, 1985.

US EPA, “Onsite Wastewater Treatment Systems Manual” EPA/625/R-00/008, February 2002.

Appendix A

Well and Drinking Water Quality Data

Coast Springs Water System

Source Water and Treated Water Nitrate Concentrations, mg-N/L

Sampling Date	Upland/Hillside Wells							Alluvial Wells		Treatment Plant	
	Well 01	Well 02	Well 03	Well OM05	Well OM09	Well OM10	Side Hill Well	Well 04	Cline Well	Raw Water	Treated Water
6/14/2022	<0.23			<0.23				0.4			
6/13/2022											0.6
5/2/2022											0.6
4/18/2022							2.8	<0.4			
4/5/2022											0.6
3/8/2022											0.8
2/9/2022											1.0
1/18/2022							0.9	1.2			1.0
12/14/2021											1.2
11/8/2021											2.3
10/19/2021							<.23				4.3
9/20/2021											3.7
8/10/2021											2.3
7/12/2021								<0.4			1.5
7/6/2021		<0.4					<0.4				
7/1/2021				<0.4							
6/22/2021						<0.4		<0.4	2.0		
6/14/2021	<0.4		<0.4		<0.4						1.2
5/18/2021											1.2
4/12/2021							<0.4	<0.4			
4/7/2021											1.2
3/9/2021											1.6
2/10/2021											2.0
1/27/2021							0.6	4.8			
1/20/2021											2.1
12/15/2020											3.7
11/30/2020											3.6
11/17/2020										3.4	
10/21/2020							<0.4	5.2			3.5
10/5/2020					<0.4						
9/23/2020											3.6
8/11/2020											3.1
7/21/2020								6.1			3.2
7/14/2020							<0.4				
6/24/2020	<0.4	0.5	<0.4								
6/18/2020									4.1		
6/15/2020				<0.4		<0.4		3.5			4.4
5/13/2020											3.4
4/14/2020							<0.4	0.8			2.0
3/24/2020											2.2
2/10/2020											1.8
1/29/2020								2.1			2.0
12/19/2019											2.4
11/13/2019											3.4
10/23/2019							0.8	0.2			3.1
10/19/2019								1.8			
10/7/2019			<0.4	<0.4	0.7	<0.4					
9/23/2019											3.0
8/28/2019											3.4
8/12/2019									0.8		
8/1/2019							<0.4				
7/8/2019								2.8			2.1
6/17/2019	0.5	<0.4									
6/12/2019											1.5
5/29/2019											2.1
4/22/2019											
4/22/2019							1.9	1.0			2.1
3/25/2019											1.6
2/19/2019											1.7
1/31/2019								2.6			
1/30/2019								4.8			
1/29/2019								2.4			

1/28/2019							<0.4	<0.4			2.1
12/17/2018											2.4
11/26/2018											2.0
10/15/2018							<0.4				1.9
9/12/2018											2.3
8/20/2018											3.1
8/6/2018	<0.4						<0.4				
7/26/2018									<0.4		
7/23/2018		<0.4	<0.4								
7/17/2018											3.6
7/16/2018				<0.4	<0.4	<0.4					
6/26/2018											2.4
5/16/2018											2.6
4/17/2018							3.2	<0.4			3.1
3/14/2018											4.0
2/6/2018											3.4
1/24/2018							4.3	<0.4			3.3
12/20/2017											4.1
11/14/2017											3.6
10/30/2017							1.9	<0.4			4.6
9/28/2017											5.1
9/26/2017	<0.4			<0.4	<0.4						
9/12/2017			<0.4			<0.4	1.9				
9/11/2017		<0.4									
9/5/2017									<0.4		
8/8/2017											5.5
7/18/2017								5.6			4.7
6/15/2017								1.3			1.4
5/16/2017											1.4
4/25/2017								1.9			1.8
3/28/2017											2.0
2/28/2017											2.1
1/24/2017								1.7			1.7
12/13/2016											2.5
11/28/2016											2.7
10/18/2016							2.5	3.1			2.9
9/27/2016											2.4
8/16/2016											2.2
8/10/2016									<4.0		
7/19/2016								1.4			1.3
7/18/2016	<0.4	<0.4	<0.4	<0.4	0.8	<0.4	1.6				
6/16/2016								<0.4			<0.4
5/17/2016											<0.4
4/26/2016								<0.4			0.5
3/22/2016											0.5
2/9/2016											1.0
1/12/2016								1.1			1.4
12/15/2015											1.3
11/17/2015											2.4
8/10/2015									<0.4		

Data source: Drinking Water Watch California
https://sdwis.waterboards.ca.gov/PDWW/

Appendix B

Homeowner Questionnaire Survey

DILLON BEACH VILLAGE WASTEWATER FEASIBILITY STUDY
Homeowner Wastewater Questionnaire
April 2022

GENERAL

1. Circle you property location per map: **1 2 3 4 5**

2. Occupancy (check as applicable)
   - Personal use: ____; full-time ___ or part-time ___
   - Rental: _____
   - Both: _____

3. Size of home:
   # of bedrooms: _____
   # of bathrooms: _____

SEPTIC TANK

4. Septic Tank construction and age (to the best of your knowledge):
   - Material: concrete _____; fiberglass/plastic ______; redwood _____ ; unsure _____
   - Approx age of tank: <20 yrs _____; 20-40 yrs______; >40 yrs______; unsure _____
   - Size/capacity of tank: ________ gallons; unsure _______
   - Does the tank have access risers at/near grade? yes _____ ; no_______; unsure ______
   - Are there County permit records available? yes _____; no______; unsure_______

5. Septic tank location (check all that apply):
   - Front of house _____; side yard _____; back of house _______; unsure _______
   - Open yard/landscape area _______
   - Under deck or other structure _______
   - Under driveway/parking/paved area _______
   - Any special circumstances/notes: ____

6. Maintenance and Operational Issues (to the best of your knowledge):
   - Approx pump-out frequency: every 1 yr ___; 2-5 yrs___; 5-10 yrs___; >10 yrs___; never ____
   - Any recurring incidents of (check all that apply):
     - Backups or sewage surfacing at tank _________
     - root intrusion, pipe blockage________
     - structural damage/decay_________
     - nuisance odors _________
     - other: ____

LEACHFIELD

7. Leachfield design/construction and age (to the best of your knowledge):
   - Type of system: trench ____; seepage pit_____; other_____________; unsure_____
   - Inspection pipes in leachfield to check trench water levels? yes ____; no ____; unsure _____
   - Approx age of leachfield: <20 yrs ____; 20-40 yrs_____; >40 yrs ____; unsure _____
   - Single Leachfield ______ or Dual Leachfield ________ ; unsure ________
   - Is there a designated reserve leachfield area: yes ____ ; no ____; unsure _______

8. Leachfield location (check all that apply):
   - Front of house ____; side yard _____; back of house ____; off-site easement ______; unsure _____
   - Open yard/landscape area: _________
   - Under deck or other structure: _______
   - Under driveway/parking/paved area: _______

9. Leachfield Maintenance and Operational Issues:
   - Any recurring incidents of (check all that apply):
     - Sewage surfacing, down-slope hillside seepage _________
     - root intrusion, pipe blockage______
     - settlement, erosion ______
     - nuisance odors ______
     - Other ____
   - Any special circumstances/notes: ____
     ____

GRAYWATER

10. How is your clothes washer graywater disposed of?
    - Into septic tank ____
    - Directly to leachfield ____
    - Separate laundry to landscape ____
    - Onto ground surface ____
    - Other (describe): ____

11. How is other household graywater (bath, shower, hand sinks) disposed of?
    - Into septic tank ____
    - Directly to leachfield ____
    - Separate to landscape ____
    - Onto ground surface ____
    - Other (describe): ____

12. Have you considered or would you have interest in implementing a graywater system?
    - For clothes washer: yes _____ no _____
    - For other household graywater: yes _____ no _____

CONCERNS AND INTERESTS

Indicate your level of concern about the following:

Issue	Level of Concern Low	 2	 Medium	 4	 High
	1	2	3	4	5
1. Condition, age, functioning of your existing septic system					
Under current normal usage					
Under current peak usage					
Under future higher occupancy, rental etc					
For selling or refinancing					
For house or property improvements you are or may be considering					
Other? ____________________________					
2. Code compliance, non-conforming, unpermitted status of your existing septic system					
For selling or refinancing					
For house or property improvements you are or may be considering					
Other? ____________________________					
3. Interference of your existing septic system with use and enjoyment of your property					
For owner uses of the property					
For rental uses of the property					
For house or property improvements you are or may be considering					
4. Potential public health and water quality impacts of septic systems in Village area					
Local hillside seepage and runoff in roadside ditches					
Runoff and seepage reaching Dillon Creek and beach recreation areas					
Groundwater affecting Coast Springs water supply wells in Dillon Creek aquifer					
5. Potential public health and water quality impacts from other watershed activities					
Agricultural runoff (livestock, soil erosion)					
Street runoff (vehicles, trash, etc)					
Other ______________________________					
6. General concerns about other septic systems in the Village, not necessarily your own					

Indicate your level of interest in the long-term **Wastewater Management Approaches** for the Dillon Beach Village area listed in the table below.

Note on Costs and Financing. Cost estimates have not yet been developed for specific project Alternatives; however, the following can be assumed about how capital costs would be financed for the different **Approaches**:

1. **Status Quo** – cost of improvements would be private property owner responsibility.
2. **Onsite Management/Upgrade Program** – low interest loans would be available to individuals for onsite system upgrades.
3. **Community Sewerage** – community sewerage facilities would be financed with some level of grant assistance and loans/bonds that would spread costs over a 20 to 30-year payback period (similar to the community wastewater project in Marshall).
4. **Hybrid Approach** – combination of #1, #2 and #3 above.

Wastewater Management Approach	**Level of Interest** **Low**		**Medium**		**High**
	1	2	3	4	5
1. Status Quo					
2. Management and financing program for improvements to existing onsite septic systems					
3. Community-wide sewer system, such as connection to Oceana Marin					
4. Hybrid, mix of: (a) status quo for some; (b) financing of onsite upgrades for some; (c) sewer connections for properties with greatest need.					
5. Other _________________________ _______________________________					

List any suggestions on septic system improvements, alternatives, practices or variances not currently allowed by the County that you would like to see considered for Dillon Beach Village:_____________
____
____
____

Other Comments:____
____
____

Appendix C
Nitrate Loading Analysis

DILLON BEACH VILLAGE
NITRATE LOADING ANALYSIS

OVERVIEW

The following presents an analysis of the estimated nitrate loading effects on local groundwater associated with the existing septic systems located in the Dillon Beach Village. The east side of the Village drains mostly via deep sand deposits into Dillon Creek and the underlying alluvial aquifer, which is a principal source of drinking water for the community (Coast Springs Water System). Historical monitoring of the Coast Springs Well No. 4, particularly during the past 5 to 10 years, has shown evidence of elevated nitrate concentrations, notably higher during the dry season. There has been no reported exceedance of the drinking water standard of 10 mg-N/L. However, readings in the 4 to 6 mg-N/L range have become more common during the summer and fall, requiring closer oversight and routine nitrate sampling and analysis of the water supply for nitrate. While possibly not the only source, it appears likely that septic system discharges are a key contributor, and that increasing occupancy and wastewater flows in the Village could put the drinking water supply at further risk of nitrate contamination. The purpose of the nitrate loading analysis presented here is to evaluate: (a) the contribution from the existing septic system discharges within the Village; (b) changes that could occur from increased occupancy and wastewater flows in the Village; and (c) measures that could be used to mitigate the nitrate loading effects.

METHODOLOGY

The nitrate loading analysis was completed using an annual chemical-water balance analysis in accordance with criteria and guidelines contained in Marin County Sewage Disposal Regulations, Section 807.E.2. The methodology followed is described in the document entitled "Assessment of Cumulative Impacts of Individual Waste Treatment and Disposal Systems" (RAMLIT, 1982), and also in the publication "Predicting Groundwater Nitrate-Nitrogen Impacts" (Hantzsche and Finnemore, *Groundwater*, Vol. 30, No. 4, July-August 1992). According to this methodology, the long-term concentration of nitrate as nitrogen (NO_3-N or nitrate-nitrogen) in the upper saturated groundwater zone can be closely approximated by the quality of percolating recharge water. The average concentration of nitrate-nitrogen in recharge water, n_r, is estimated using the following equation:

$$n_r = \frac{Wn_w(1-d)+Rn_b}{(W+R)}$$

where: n_r = resultant average concentration of NO_3-N in recharge water, mg-N/L

W = average annual volume rate of wastewater entering the soil, acre-ft/yr (AFY)

n_w = total nitrogen concentration of wastewater, mg-N/L

n_b = background NO_3-N concentration of rainfall recharge normally percolating through the soil, mg-N/L

d = fraction of NO_3-N loss due to denitrification in the soil

R = average annual volume of rainfall recharge in sub-basin area, AFY

DATA AND ASSUMPTIONS

Per the equation presented above, the resultant nitrate concentration in the groundwater flow from the Village is estimated to be the weighted average or combined concentration due to wastewater loading and deep percolation of rainfall. In this case the local recharge area of concern encompasses the portion of the Village area that drains toward Dillon Creek, plus the sand dunes and riparian area between the edge of the developed area and Dillon Creek, as shown in **Figure C-1**. This includes the discharges from 77 individual septic systems plus the commercial septic systems for the Dillon Beach Resort deli and café, RV Park and rental cabins. On an annual basis, this makes up only a small portion of the total volume of water that recharges Dillon Creek; the vast majority of inflow to the aquifer occurs during the rainy season via stream flow percolation through the creek channel from the approximately 400-acre Dillon Creek watershed. However, during the summer and fall when Dillon Creek goes dry, the lateral inflow of groundwater from the Village area on the north and dune land on the south side of Dillon Creek become the predominant sources of recharge. This analysis focuses on the north side groundwater inflow where the existing water supply wells are located.

- **Recharge Area.** The recharge area for the analysis encompasses approximately 16.4 acres, which includes 10.1 acres of developed area and 6.3 acres of dune and riparian area.

- **Wastewater Flows.** The nitrate loading analysis completed for existing conditions used average annual wastewater flow assumptions as follows: (a) 77 residential septic systems at 50 gpd each (3,850 gpd); and (b) commercial area septic system discharges from the deli-café, RV Park and rental cabins at 1,850 gpd. This equates to a total combined average daily flow of 5,700 gpd, or 4.79 ac-ft/yr. For the analysis of potentially higher future occupancy rates, the unit flow assumption for residential septic systems was increased to 75 gpd each.

- **Wastewater Nitrogen Concentrations.** For the analysis of existing conditions, total nitrogen concentration in wastewater effluent was assumed to be in the range

Figure C-1. Groundwater Nitrate Recharge Area

of 50 to 70 mg/L, which is typical for domestic wastewater following primary (septic tank) treatment; calculations were made for both values. For the analysis of nitrogen removal technologies as a potential mitigation strategy, the wastewater nitrogen concentration was reduced by 50% to 25 and 35 mg-N/L, respectively.

- **Background Nitrogen Concentration.** A background nitrate concentration of 0.5 mg-N/L was used as a baseline value for percolating rainfall, which is attributable to the natural leaching of small amounts of nitrogen from vegetation, landscaped areas and animals.

- **Soil Denitrification.** Total nitrogen removal in the upper soil zones via denitrification was estimated to be in the range of 10 to 15 percent of the total nitrogen in the effluent. This is at the lower end of the normal range (10% to 25%) commonly cited, based on the very sandy, well-drained soil conditions which are not conducive to high levels of denitrification.

- **Deep Percolation of Rainfall (Recharge).** Deep percolation of rainfall was estimated through completion of a month-by-month water balance analysis, which took into account rainfall, runoff, evapotranspiration, landscape conditions, impervious areas and drainage patterns as follows:

  - ✓ The analysis considered and evaluated four sources of rainfall recharge: (1) direct rainfall percolation into vegetated-pervious yard areas within the 10.1-acre developed area; (2) direct rainfall percolation into the 6.3-acre dune-riparian area adjacent to Dillon Creek; (3) percolation of runoff from impervious areas into adjacent pervious areas in the developed area and dune-riparian area (as applicable); and (4) estimated percolation of outflow from the major storm drains from the Village that discharge to Dillon Creek upstream of Well No. 4.

  - ✓ Detailed, lot-by-lot analysis was made using street view and distance tools on Google maps to estimate the percentages and total amount of pervious and impervious areas in the developed areas; estimates were also made of the percentage of imperious area draining to streets vs drainage to adjacent pervious areas. This analysis showed the following breakdown: 52% impervious; 48% pervious; and 29% of impervious areas draining to adjacent pervious areas. For the dune-riparian area, all rainfall was considered to be available for either percolation or uptake by native vegetation (i.e., no runoff).

  - ✓ Using monthly time steps, water balance calculations (worksheets attached) were completed to determine the net amount of rainfall contributing to groundwater recharge as the difference between the available rainfall minus the evapotranspiration (ET). ET was determined from the California DWR published ETo Zone Map, for Zone 1 (Coastal Plains Heavy Fog

Belt), adjusted for the estimated plant factor (0.5 for dune-riparian; 0.6 for common landscape vegetation).

- ✓ Recharge of stormwater runoff via Dillon Creek channel percolation was estimated as: (a) 100% of runoff during the dry season (May-Oct); (b) 50% during November and April; and (c) 10% during December-March, when the creek is normally flowing, recharge is at capacity and local runoff bypasses to the beach and ocean.

- ✓ The resulting rainfall-recharge amount used for nitrogen loading calculations was 21.57 ac-ft/yr, broken down as follows: (a) 7.51 ac-ft/yr for developed area; (b) 11.36 ac-ft/yr for the dune-riparian area (direct rainfall plus overland flow); and (c) 2.70 ac-ft/yr for stormwater percolation via Dillon Creek.

RESULTS AND DISCUSSION

Using the above assumptions and rainfall-recharge amounts from the water balance and analysis, the results of the nitrate loading analysis are provided in attached spreadsheet calculations and summarized in the tables below.

- **Table C-1 - Septic Tank Treatment.** Table C-1 presents results for existing conditions and future, potentially higher occupancy conditions under the assumption of continued use of conventional septic tanks for treatment. The results indicate the level of nitrate in recharge waters contributed from septic systems in the east side of the Village is significant - at or above the drinking water standard of 10 mg-N/L – and that it can be expected to increase even more with higher occupancy. The analysis shows that maintenance of groundwater-nitrate concentrations within drinking water standards in the water supply is and will continue to be highly dependent from year-to-year on dilution provided by aquifer replenishment from the larger Dillon Creek watershed.

- **Table C-2 – Supplemental Treatment for Nitrogen.** Table C-2 presents results for the assumption of modifying all existing and future repair and replacement systems with supplemental treatment units providing 50% removal of nitrogen. This level of nitrogen removal can be achieved through commercially available treatment devices, come of which can be retrofitted to existing septic tanks. The results indicate that supplemental treatment would be effective in dropping the nitrate concentration in the east side Village recharge waters to acceptable levels, below the maximum drinking water standard. This would be effective for both existing and potentially higher levels of occupancy and wastewater flows. Marin County has adopted a criterion of 7.5 mg-N/L as a target guideline limit for groundwater nitrate impacts in areas of domestic water supply. Our analysis indicates that modifying septic systems to include 50% nitrogen removal would achieve this objective.

Table C-1
Nitrate Loading Analysis Results
Existing Conditions and Potential Higher Occupancy
Conventional Septic Tank Treatment

Wastewater Flow		*Effluent NO_3-N*	*Denit.*	*Backgrnd NO_3-N*	*Annual Rainfall Recharge*			*Resultant NO_3-N*
gpd	ac-ft/yr	mg-N/L	fraction	mg-N/L	Developed Area ac-ft/yr	Dune-Riparian ac-ft/yr	Storm Drainage ac-ft/yr	(mg-N/L)
Existing Conditions								
5,700	4.79	50	0.15	0.5	7.51	11.36	2.70	8.13
5,700	4.79	50	0.10	0.5	7.51	11.36	2.70	8.58
5,700	4.79	70	0.15	0.5	7.51	11.36	2.70	11.22
5,700	4.79	70	0.10	0.5	7.51	11.36	2.70	11.85
Potential Future, Higher Occupancy								
7,625	6.41	50	0.15	0.5	7.51	11.36	2.70	10.12
7,625	6.41	50	0.10	0.5	7.51	11.36	2.70	10.69
7,625	6.41	70	0.15	0.5	7.51	11.36	2.70	14.01
7,625	6.41	70	0.10	0.5	7.51	11.36	2.70	14.81

Table C-2
Nitrate Loading Analysis Results
Existing Conditions and Potential Higher Occupancy
Supplemental Treatment – 50% Nitrogen Removal

Wastewater Flow		*Effluent NO_3-N*	*Denit.*	*Backgrnd NO_3-N*	*Annual Rainfall Recharge*			*Resultant NO_3-N*
gpd	ac-ft/yr	mg-N/L	fraction	mg-N/L	Developed Area ac-ft/yr	Dune-Riparian ac-ft/yr	Storm Drainage ac-ft/yr	(mg-N/L)
Existing Conditions								
5,700	4.79	25	0.15	0.5	7.51	11.36	2.70	4.27
5,700	4.79	25	0.10	0.5	7.51	11.36	2.70	4.50
5,700	4.79	35	0.15	0.5	7.51	11.36	2.70	5.81
5,700	4.79	35	0.10	0.5	7.51	11.36	2.70	6.13
Potential Future, Higher Occupancy								
7,625	6.41	25	0.15	0.5	7.51	11.36	2.70	5.25
7,625	6.41	25	0.10	0.5	7.51	11.36	2.70	5.54
7,625	6.41	35	0.15	0.5	7.51	11.36	2.70	7.20
7,625	6.41	35	0.10	0.5	7.51	11.36	2.70	7.60

Wastewater Nitrogen Loading Analysis - Dillon Beach Village
Existing Conditions and Higher Occupancy - Septic Tank Treatment

Wastwater Flow & Nitrogen Mass Loading

Existing - Average wastewater flow from OWTS in recharge area; 50 gpd per residence, for 77 lots: **3,850 gpd + Commercial at 1,850 gpd = 5,700 gpd**

Potentially Higher Occupancy: 75 gpd per residence, for 77 lots: 5,775 gpd + DBR commercial at 1,850 gpd = 7,625 **gpd**

Total effluent nitrogen concentration: Calculate for **50 and 70 mg-N/L,**

Assumed nitrogen assimilation by adsorption and denitrifiation: **15%, 10%**

Site Characteristics & Assumptions

Rainfall-Recharge Area: Total Site**: 16.4 acres**

Average Annual Rainfall: 27 **inches**

Pervious open space & landscaping: **3.72 acres Village; 6.3 acres Dune and riparian; impervious area: 6.38 acres**

Impervious runoff captured for infiltration: 28% increase, per map & photo inspection/analysis

Annual rainfall recharge, open space & lanscape areas: per water balance calculations

Water Quality Criteria/Limits

Groundwater nitrate-N drinking water standard: 10 mg-N/L; objective for recharge waters: 7.5 mg-N/L domestic water supply areas

Nitrate-N Loading Calculations - mg-N/L Existing Conditions, Septic Tank Treatment

Wastewater					Housing Area Recharge			Dune and Riparian Recharge (6.30 ac)			Total Rainfall Recharge	Background Nitrogen, N_B	Resultant Groundwater-N Concentration	
Flow		Effluent Total N_w		Denit.	Recharge Area	Annual Average Recharge		Direct Rainfall	DBR Commercial	Street RO Infiltration			(a) 50 mg/L	(b) 70 mg/L
gpd	ac-ft/yr	(a) mg-N/L	(b) mg-N/L	(fraction)	Acres	feet	ac-ft	ac-ft	ac-ft	ac-ft	ac-ft	mg-N/L	mg-N/L	mg-N/L
5,700	4.79	50	70	0.15	3.72	2.02	7.51	9.75	1.61	2.70	21.57	0.5	8.13	11.22
5,700	4.79	50	70	0.10	3.72	2.02	7.51	9.75	1.61	2.70	21.57	0.5	8.58	11.85

Nitrate-N Loading Calculations - Potentially Higher Occupancy, Septic Tank Treatment

Wastewater					Housing Area Recharge			Dune and Riparian Recharge (6.30 ac)			Total Rainfall Recharge	Background Nitrogen, N_B	Resultant Groundwater-N Concentration	
Flow		Effluent Total N_w		Denit.	Recharge Area	Annual Average Recharge		Direct Rainfall	DBR Commercial	Street RO Infiltration			(a) 50 mg/L	(b) 70 mg/L
gpd	ac-ft/yr	(a) mg-N/L	(b) mg-N/L	(fraction)	Acres	feet	ac-ft	ac-ft	ac-ft	ac-ft	ac-ft	mg-N/L	mg-N/L	mg-N/L
7,625	6.41	50	70	0.15	3.72	2.02	7.51	9.75	1.61	2.70	21.57	0.5	10.12	14.01
7,625	6.41	50	70	0.10	3.72	2.02	7.51	9.75	1.61	2.70	21.57	0.5	10.69	14.81

Wastewater Nitrogen Loading Analysis - Dillon Beach Village
Mitigated Existing & Higher Occupancy - Supplmental Nitrogen Removal

Wastwater Flow & Nitrogen Mass Loading

Existing - Average wastewater flow from OWTS in recharge area; 50 gpd per residence, for 77 lots: **3,850 gpd + Commercial at 1,850 gpd = 5,700 gpd**

Potentially Higher Occupancy: 75 gpd per residence, for 77 lots: 5,775 gpd + DBR commercial at 1,850 gpd = 7,625 **gpd**

Total effluent nitrogen concentration: Calculate for **25 and 35 mg-N/L, assume 50% N removal**

Assumed nitrogen assimilation by adsorption and denitrifiation: 15**%, 10%**

Site Characteristics & Assumptions

Rainfall-Recharge Area: Total Site**: 16.4 acres**

Average Annual Rainfall: 27 **inches**

Pervious open space & landscaping: **3.72 acres Village; 6.3 acres Dune and riparian; impervious area: 6.38 acres**

Impervious runoff captured for infiltration: 28% increase, per map & photo inspection/analysis

Annual rainfall recharge, open space & lanscape areas: per water balance calculations

Water Quality Criteria/Limits

Groundwater nitrate-N drinking water standard: 10 mg-N/L; objective for recharge waters: 7.5 mg-N/L domestic water supply areas

Nitrate-N Loading Calculations - mg-N/L Existing Conditions, Supplemental Nitrogen Treatment														
Wastewater					Housing Area Recharge			Dune and Riparian Recharge (6.30 ac)			Total Rainfall Recharge	Background Nitrogen, N_B	Resultant Groundwater-N Concentration	
Flow		Effluent Total N_w		Denit.	Recharge Area	Annual Average Recharge		Direct Rainfall	DBR Commercial	Street RO Infiltration			(a) 25 mg/L	(b) 35 mg/L
gpd	ac-ft/yr	(a) mg-N/L	(b) mg-N/L	(fraction)	Acres	feet	ac-ft	ac-ft	ac-ft	ac-ft	ac-ft	mg-N/L	mg-N/L	mg-N/L
5,700	4.79	25	35	0.15	3.72	2.02	7.51	9.75	1.61	2.70	21.57	0.5	4.27	5.81
5,700	4.79	25	35	0.10	3.72	2.02	7.51	9.75	1.61	2.70	21.57	0.5	4.50	6.13

Nitrate-N Loading Calculations - Potentially Higher Occupancy,Supplemental Nitrogen Treatment														
Wastewater					Housing Area Recharge			Dune and Riparian Recharge (6.30 ac)			Total Rainfall Recharge	Background Nitrogen, N_B	Resultant Groundwater-N Concentration	
Flow		Effluent Total N_w		Denit.	Recharge Area	Annual Average Recharge		Direct Rainfall	DBR Commercial	Street RO Infiltration			(a) 25 mg/L	(b) 35 mg/L
gpd	ac-ft/yr	(a) mg-N/L	(b) mg-N/L	(fraction)	Acres	feet	ac-ft	ac-ft	ac-ft	ac-ft	ac-ft	mg-N/L	mg-N/L	mg-N/L
7,625	6.41	25	35	0.15	3.72	2.02	7.51	9.75	1.61	2.70	21.57	0.5	5.25	7.20
7,625	6.41	25	35	0.10	3.72	2.02	7.51	9.75	1.61	2.70	21.57	0.5	5.54	7.60

Appendix D

Supplemental OWTS Treatment Literature

REVIEW OF TECHNOLOGIES FOR THE ONSITE TREATMENT OF WASTEWATER IN CALIFORNIA

Prepared for the California State Water Resources Control Board

Center for Environmental and Water Resources Engineering
Department of Civil and Environmental Engineering
University of California, Davis
Davis, California
Report No. 02-2

Prepared by
Harold Leverenz
George Tchobanoglous
Jeannie L. Darby
August, 2002

8-1.6 FAST wastewater treatment systems

Category	Primary and secondary treatment
Technology	Continuous flow, aerated suspended/attached growth
Input	Untreated wastewater
Function	Oxidation, nutrient transformation/removal, and pathogen reduction
Applications	Recommended for individual, small community, and commercial systems. Offer alternate systems for advanced nitrogen and phosphorus removal, lagoons, and retrofits to existing systems.

Background
Bio-Microbics Inc. offers wastewater treatment systems for single family residences. The units are composed of a septic tank, fixed film media, and an air supply. Bio-Microbics also provides systems for applications such as lagoon treatment (LagoonFAST), retrofitting existing septic systems (RetroFAST), enhanced nitrification (NitriFAST), enhanced clarification (ABC-C), advanced nitrogen removal (ABC-N), and advanced phosphorus removal (ABC-P). Smith & Loveless custom design systems using the FAST technology for larger applications.

Description of process
The basic residential FAST system consists of a fixed-film media which is submerged in the second compartment of a modified, two-compartment septic tank. Air is supplied to the fixed-film process by a remote blower. Alternate modes of operation include recirculation of nitrified wastewater to the primary settling chamber for denitrification and intermittent operation of the blower to reduce electricity usage and increase denitrification.

System footprint
The system is integrated into a standard septic tank and therefore does not require additional space. The blower is generally located above grade in an area that will not be flooded or below grade in a vault (2 ft x 2 ft x 2 ft). The effluent meets secondary quality requirements and can be distributed to soil treatment system or disinfected for surface irrigation.

Performance
The Bio-Microbics FAST system has been evaluated in numerous research studies, as reported in Table 8-4. Depending on the treatment objectives, various systems are available for advanced nitrogen and phosphorus removal using chemical addition.

Advantages
The treatment unit can be installed in a standard septic tank. The space requirements are not greater than a standard septic tank. Performance data for the FAST system is available from multiple studies.

Disadvantages
Requires the use of a blower to supply air to the treatment process.

Operation and maintenance
The FAST systems incorporate a blower that will need periodic monitoring. The air intake filter for the blower will need to be cleaned. The blower is equipped with an alarm to signal in the event that the blower malfunctions. Sludge removal will also be needed on a periodic basis, approximately every one to three years.

Power and control
Annual electrical needs expected to be 2,000 to 3,000 kWh.

Cost

Basic system (MicroFAST 0.5) costs $3,000, and includes the capital cost for the FAST system, blower, blower housing, and control panel.

Table 8-4

Selected representative studies of Bio-Microbics FAST system performance

Parameter	Unit	Location of study			
		Ventura CA[a]	Mass[b]	Florida[c]	Rhode Island[d]
Description of system		Demonstration	Demonstration	Test facility	Home system
HLR	gal/d	365	330	307	214
System performance[e]					
BOD_5	mg/L	13 (93%)	18 (90%)	3.7 (97%)	15
TSS	mg/L	5.9 (97%)	12 (92%)	3.9 (96%)	9
TN	mg/L	20.4 (34%)	15.5 (55%)	11.5 (76%)	20
NO_3-N	mg/L	15		10.34	
NH_3-N	mg/L	1.2			
P	mg/L	2.7 (16%)		6.62 (24%)	
Fecal coliform	MPN/100 mL	>1600	5E4 (1.6)		2E4

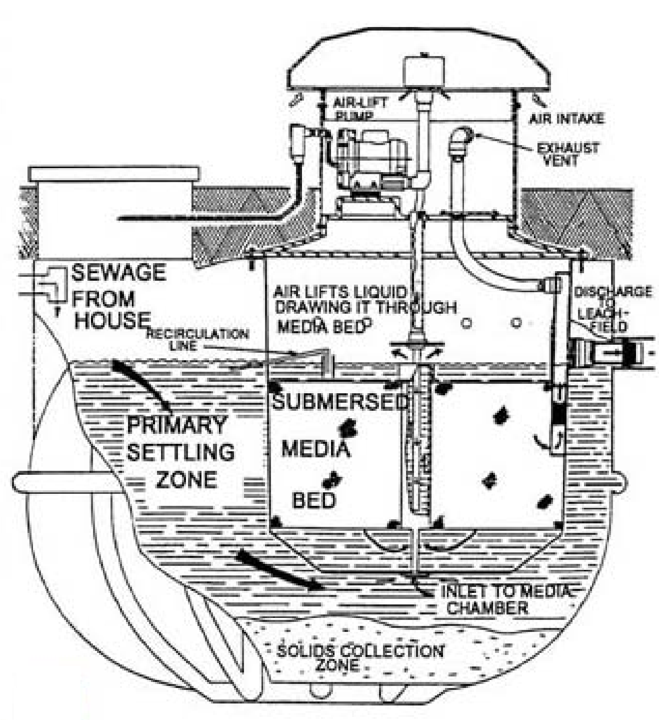
[a] Loomis *et al*. (2001); note operation was modified to evaluate reduced blower operation, resulting in higher effluent concentrations than under normal operating conditions.

[b] Ventura County Sanitation District (2001)

[c] Massachusetts Alternative Septic System Test Center (2001)

[d] Florida Department of Health (2000)

e Performance reported as average effluent concentration with average removal in parentheses, except microorganism removal, which has logs of removal reported in parentheses.



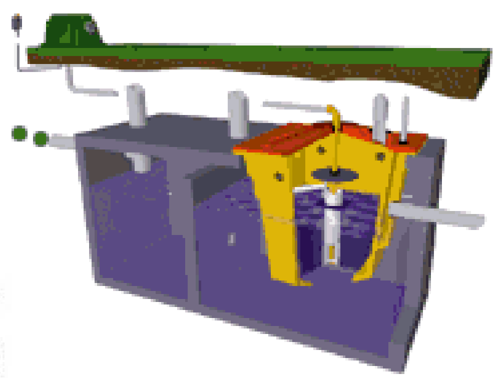


Figure 8-5

Cut-away illustration (left) and diagram (right) of the BioMicrobics MicroFAST 0.5. (Adapted from BioMicrobics, Inc.)

Contact
Bio-Microbics, Inc.
8450 Cole Parkway
Shawnee, KS 66227
Phone (913) 422-0707; (800) 753-FAST
Fax (913) 422-0808
E onsite@biomicrobics.com
Web www.biomicrobics.com

Model description
- MicroFAST 0.5, 0.9, 1.5, 3.0, 4.5, 9.0 (for domestic wastewater flows from 500 to 9000 gal/d)
- HighStregnthFAST 1.0, 1.5, 3.0, 4.5, 9.0 (for commercial wastewater flows from 1000 to 9000 gal/d)
- RetroFast 0.25, 0.375 (for existing standard septic systems with wastewater flows from 250 to 375 gal/d)
- LagoonFast 1.5, 3.0, 4.5, 9.0 (for lagoon treatment systems with flows from 1500 to 9000 gal/d)
- NitriFAST 0.5, 1.0, 1.5, 3.0, 4.5, 9.0 (for nitrification of high nitrogen wastewater with flows from 500 to 9000 gal/d)
- ABC-C 0.5, 1.0, 1.5, 3.0, 4.5, 9.0 (for clarification of wastewater with flows from 500 to 9000 gal/d)
- ABC-N 0.5, 1.0, 1.5, 3.0, 4.5, 9.0 (chemical addition for advanced removal of nitrogen from wastewater with flows from 500 to 9000 gal/d)
- ABC-P 0.5, 1.0, 1.5, 3.0, 4.5, 9.0 (chemical addition for advanced precipitation of phosphorus from wastewater with flows from 500 to 9000 gal/d)

Manufacturer support

Bio-Microbics manufactures an assortment of systems that are based on a patented process for wastewater treatment. The systems are distributed and installed by approved organizations. Bio-Microbics provides equipment and controls for the gravity based systems, additional pumps and components for other configurations obtained locally. Company covers materials and workmanship for two years from date of installation or three years from date of shipment.

Smith & Loveless, Inc.
14040 Santa Fe Trail Drive
Lenexa, KS 66215-1284
Phone 913-888-5201
Fax 913-888-2173
E answers@smithandloveless.com
Web www.smithandloveless.com
Model description

Smith & Loveless offer the Modular FAST system for larger flows (>10,000 gal/d), serving domestic, commercial, and industrial needs.

References and other resources

Anderson, D.L., M.B. Tyl, R.J. Otis, T.G. Mayer, and K.M. Sherman (1998) Onsite Wastewater Nutrient Reduction Systems (OWNRS) for Nutrient Sensitive Environments, *Proceedings of the Eight National Symposium on Individual and Small Community Sewage Systems*, Orlando, FL.

Bio-Microbics (2001) Manufacturer information.

Loomis, G.W., D.B. Dow, M.H. Stolt, L.T. Green, and A.J. Gold (2001) Evaluation of Innovative Onsite Wastewater Treatment Systems in the Green Hill Pond Watershed, Rhode Island – A

NODP II Project Update, *Proceedings of the Ninth National Symposium on Individual and Small Community Sewage Systems*, Fort Worth TX.

Massachusettes Alternative Septic System Test Center (2001) Technology Fact Sheet Interim Findings, MicroFAST Model 0.5.

Florida Department of Health (2000) *Florida Keys Onsite Wastewater Nutrient Reduction Systems Demonstration Project – Phase II Addendum*, Florida Department of Health.

NSF International (1997) Report on Evaluation of Scienco/FAST Model 23-001-750, NSF International, Ann Arbor, MI.

Ventura Regional Sanitation District (2001) Septic Tank Nutrient Removal Project, Advanced Onsite Sewage Disposal System Demonstration.

U.S. EPA (2001) *CEIT Virtual Trade Show: Fast Wastewater Treatment Systems (available at www.epa.gov/region1/steward/ceitts/wastewater/techs/fast.html).*

8-1.7 JET BAT™

Category	Primary and secondary treatment
Technology	Continuous flow, aerated suspended growth
Input	Untreated wastewater
Function	Oxidation, nutrient transformation/removal, and pathogen reduction
Applications	Individual, community, and larger systems

Background
The JET 1500 Series treatment system is available in 5 models (500, 750, 1000, 1250, and 1500) serving flow rates from 500 to 1,500 gal/d. The J-500 and J-750 systems are single reactors divided into three sections. The J-1000, J-1250, and J-1500 models are composed or two separate tanks, a pretreatment tank (divided into two sections) and a treatment unit (divided into three sections. The J-500 model is described below.

Description of process
Household wastewater flows into the primary treatment section. As new water enters the system, an equal amount of water is displaced through the system. After sedimentation the liquid is aerated and exposed to the fixed packing and associated microbial community. The water is then settled in the clarification chamber and a fixed surface baffle keeps surface particles from flowing out in the effluent.

System footprint
The unit has a length of 10 ft, width of 5 ft, and depth of 5.75 ft. A standard soil treatment system is used for subsequent effluent management.

Advantages
All treatment occurs in single tank (for models J-500 and J-750). The fixed film media prevents washout of bacterial culture. There is only one mechanical component (aeration device).

Disadvantages
Limited performance data is available. Backup of wastewater into the unit (due to soil clogging or high water event) may damage the aeration device.

Performance
The Jet treatments systems J-500 through J-1500 have been certified under the NSF program. Additional performance data are provided in Table 8-5.

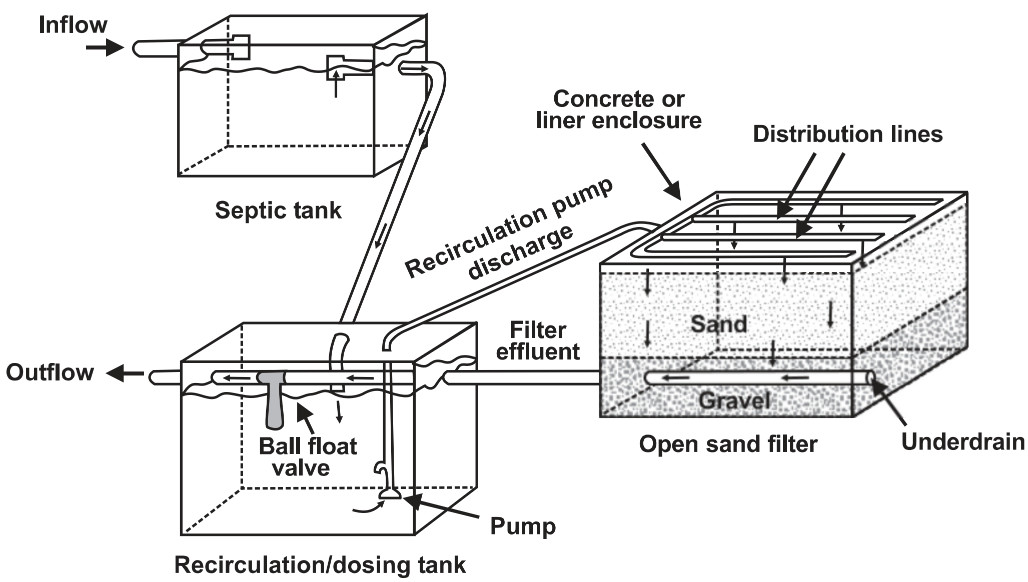
Onsite Wastewater Treatment Systems Technology Fact Sheet 11

Recirculating Sand/Media Filters

Description

Recirculating filters using sand, gravel, or other media provide advanced secondary treatment of settled wastewater or septic tank effluent. They consist of a lined (e.g., impervious PVC liner on sand bedding) excavation or structure filled with uniform washed sand that is placed over an underdrain system (see figure 1). The wastewater is dosed onto the surface of the sand through a distribution network and allowed to percolate through the sand to the underdrain system. The underdrain system collects and recycles the filter effluent to the recirculation tank for further processing or discharge.

Figure 1. Typical recirculating sand filter system



Recirculating sand filters (RSFs) are aerobic, fixed-film bioreactors. Other treatment mechanisms that occur in sand filters include physical processes, such as straining and sedimentation, that remove suspended solids within the pores of the media. Also, chemical sorption of pollutants onto media surfaces plays a finite role in the removal of some chemical (e.g., phosphorus) constituents. Bioslimes from the growth of microorganisms develop as films on the sand particle surfaces. The microorganisms in the slimes absorb soluble and colloidal waste materials in the wastewater as it percolates over the sand surfaces. The absorbed materials are incorporated into a new cell mass or degraded under aerobic conditions to carbon dioxide and water.

Most biochemical treatment occurs within approximately 6 inches of the filter surface. As the wastewater percolates through this layer, suspended solids and carbonaceous biochemical oxygen demand (BOD) are removed. Most suspended solids are strained out at the filter surface. The BOD is nearly completely removed if the wastewater retention time in the sand media is sufficiently long for the microorganisms to absorb waste constituents. With depleting carbonaceous BOD in the percolating wastewater, nitrifying microorganisms are able to thrive deeper in the surface layer, where nitrification will readily occur.

Chemical adsorption can occur throughout the media bed. Adsorption sites in the media are usually limited, however. The capacity of the media to retain ions depends on the target constituent, the pH, and the mineralogy of the media. Phosphorus is one element of concern that can be removed from wastewater in this manner, but the number of available adsorption sites is limited by the characteristics of the media.

The basic components of recirculating filters include a recirculation/dosing tank, pump and controls, distribution network, filter bed with an underdrain system, and a return line. The return line or the underdrain must split the flow to recycle a portion of the filtrate to the recirculation/dosing tank. A small volume of wastewater and filtrate is dosed to the filter surface on a timed cycle 1 to 3 times per hour. Recirculation ratios are typically between 3:1 and 5:1. In the recirculation tank, the returned aerobic filtrate mixes with the anaerobic septic tank effluent before being reapplied to the filter.

Recirculating filters must use a coarser media than single-pass filters because recirculation requires higher hydraulic loadings. Both coarse sand and fine gravel are used as filter media. Because of the high hydraulic conductivities of the coarse media, filtrate recirculation is used to provide the wastewater residence times in the media necessary to meet the treatment requirements. Based on forward flow, daily hydraulic loadings are typically about 3 gpd/ft^2 (2 to 5 gpd/ft^2) when the filter media is coarse sand. Therefore, the corresponding combined daily filter hydraulic loading, including the recirculated flow, may be 6 to 25 gpd/ft^2. Where gravel is used as the media, the daily hydraulic loadings are increased to as much as 10 to 15 gpd/ft^2 with a combined daily loading of 30 to 75 gpd/ft^2. BOD and TSS removals are generally the same as those achieved by single-pass filters. Nearly complete ammonia removal by nitrification is also achieved. In addition, the mixing of the return filtrate anaerobic septic tank effluent removes approximately 50 percent of the total nitrogen. However, because of the greater hydraulic loadings and coarser media, fecal coliform removal is somewhat less than in single-pass filters.

Recirculating filters offer advantages over single-pass filters. Greater control of performance is possible because recirculation ratios can be changed to optimize treatment. The filter can be smaller because of the higher hydraulic loading. Recirculation also reduces odors because the influent wastewater (septic tank effluent) is diluted with return filtrate that is low in BOD and high in dissolved oxygen.

Many types of media are used in packed-bed filters. Washed, graded sand was the most common, but pea gravel has generally replaced it in recent times. Other granular media used include crushed glass, garnet, anthracite, plastic, expanded clay, expanded shale, open-cell foam, extruded polystyrene, and bottom ash from coal-fired power plants. Coarse-fiber synthetic textile materials are also used. These materials are generally restricted to proprietary units. Contact the system manufacturers for application and design using these materials.

Other modifications to the basic RSF design include the type of distribution system, the location and design of the recirculation tank, the means of flow splitting the filtrate between discharge and return flows, and enhancements to improve nitrogen removal. The last is addressed in Technology Fact Sheet 9 on nitrogen removal.

Applications

Recirculating sand filters can be used for a broad range of applications, including single-family residences, large commercial establishments, and small communities. They are frequently used to pretreat wastewater prior to subsurface infiltration on sites where soil has insufficient unsaturated depth above ground water or bedrock to achieve adequate treatment. They are also used to meet water quality requirements before direct discharge to a surface water. RSFs are primarily used to treat domestic wastewater, but they have also been used successfully in treatment trains to treat wastewaters high in organic materials such as those from restaurants and supermarkets. Single-pass filters are most frequently used for smaller applications and at sites where nitrogen removal is not required. Recirculating filters are used for both large and small flows and are frequently used where nitrogen removal is necessary. RSFs frequently replace aerobic package plants in many parts of the country because of their high reliability and lower O/M requirements.

Design

Packed-bed filter design starts with the selected media. The media characteristics determine the necessary filter area, dose volumes, and dosing frequency. Availability of media for a specific application should be determined before completing the detailed design. Typical specifications, mass loadings, and depths for sand and gravel media are presented in chapter 4. The sand or gravel selected should be durable with rounded grains. Only washed material should be used. Fine particles passing the U.S. No. 200 sieve (<0.074 mm) should be limited to less than 3 percent by weight. Other granular media are bottom ash, expanded clay, expanded shale, and crushed glass. These media should perform similarly to sand and gravel for similar effective sizes, uniformity, and grain shape. Newer commercial media such as textile materials have had limited testing, but should be expected to perform as well as the above types.

Traditionally, media filters have been designed based on hydraulic loadings. However, since they are primarily aerobic biological treatment units, it is more appropriate that they be designed based on organic loadings. Unfortunately, insufficient data exist to establish well-defined organic loading rates. Experience suggests that BOD_5 loadings on sand media should not exceed about 5 lb/1000 ft^2 per day (0.024 kg/m^2 per day) where the effective size is approximately 1.0 mm and the dosing rate is at least 12 times per day. Higher loadings have been measured in short-term studies, but designers are cautioned about exceeding this loading rate until quality-assured data confirm these higher levels. The BOD_5 loading should decrease with decreasing effective size of the sand. Because of the larger pore size and greater permeability, gravel filters can be loaded more heavily. BOD_5 loadings of 20 lb/1000 ft^2 per day (0.10 kg/m^2 per day) have been consistently successful, but again higher loadings have been measured. Some often-quoted design specifications for RSFs are given in table 1.

Table 1. Typical design specifications for individual home recirculating sand filters

Design parameter	Typical design value
Median	Durable, washed sand/gravel with rounded grains
Specifications	
Effective size	
Sand	1.0 – 5.0 mm
Gravel	3.0 – 20.0 mm
Uniformity coefficient	< 2.5
Percent fines (passing 200 sieve or < 0.074 mm)	≤ 3
Depth	24 in. (18 to 36 in.)
Mass loadings	
Hydraulic loading [1]	
Sand	3 -5 gpd/ft^2
Gravel	10 –15 gpd/ft^2
Organic loading [2]	
Sand	≤ 5 lb BOD_5/1000ft^2-d
Gravel	≤ 15 lb BOD_5/1000ft^2-d
Underdrains	
Type	Slotted or perforated pipe
Slope	0 – 0.1%
Transition bedding	0.6 – 1.0 cm washed pea gravel
Size	0.6 – 4.0 cm washed gravel or crushed stone
Dosing	
Frequency	48 times/day (every 30 min.) or more
Per Dose	1 to 2 gal./orifice
Recirculation tank	
Volume	1.5 times design daily flow
Recirculation rate	3 to 5 times daily flow

[a] 1 gpd/ft^2 = 4 cm/day = 0.04 m^3 / m^2 per day (forward flow only).
[b] 1 lb BOD/1,000 ft^2 per day = 0.00455 kg/m^2 per day.

The RSF dose volume depends on the recirculation ratio, dosing frequency, and distribution network:

Dose Volume = Design Flow (gpd) x (Recirculation Ratio + 1) ÷ Number of Doses/Day

Small dose volumes are preferred because the flow through the porous media will occur under unsaturated conditions with higher moisture tensions. Better wastewater media contact and longer residence times occur under these conditions. Smaller dose volumes are achieved by increasing the number of doses per day.

The recirculation ratio increases the hydraulic loading without increasing the organic loading. For example, a 4:1 recirculation ratio results in a hydraulic loading of five times the design flow (1 part forward flow to 4 parts recycled flow). The increased hydraulic loading reduces the residence time in the filter so that recirculation is necessary to achieve the desired treatment. Typical recirculation ratios range from 3:1 to 5:1. As the permeability of the media increases, the recirculation ratio may need to increase to achieve the same level of treatment.

Media characteristics can limit the number of doses possible. Media reaeration must occur between doses. As the effective size of the media decreases, the time for drainage and reaeration of the media increases. For single pass filters, typical dosing frequencies are once per hour (24 times/day) or less. Recirculating sand filters dose 2 to 3 times per hour (48 to 72 times/day).

Distribution network requirements will also limit the number of doses possible. To achieve uniform distribution over the filter surface, minimum dose volumes are necessary and can vary with the distribution method selected. Therefore, if the dose volume dictated by the distribution network design is too high, the network should be redesigned. Since the dose volume is a critical operating parameter, the method of distribution and the distribution system design should be considered carefully.

Distribution methods used include rigid pipe pressure networks with orifices or spray nozzles, and drip emitters. Rigid pipe pressure networks are the most commonly used method. Orifices with orifice shields, facing upward, minimize hole blockage by stones. Since the minimum dose volume required to achieve uniform distribution is five times the pipe volume, large multihome filters are usually divided into multiple cells. Drip emitter distribution is being used increasingly because the minimum dose volumes are much less than the rigid pipe network volumes.

Recirculation tanks are a component of most recirculation filter systems. These tanks consist of a tank, recirculation pump and controls, and a return filter water flow splitting device. The flow splitting device may or may not be an integral part of the recirculation tank. Recirculation tanks store return filtrate, mix the filtrate with the septic tank effluent, and store peak influent flows. The tanks are designed to either remain full or be pumped down during periods of low wastewater flows. Since doses to the recirculating filter are of a constant volume and occur at timed intervals, the water level in the tank will rise and fall in response to septic tank effluent flow, return filtrate flow, and filter dosing.

In tanks designed to remain full, all filtrate is returned to the recirculation tank to refill the tank after each dosing event. When the tank reaches its normal full level, the remaining return filtrate is discharged out of the system as effluent. This design is best suited where treatment performance must be maintained continuously. For single-family home systems, the recirculation tank is typically sized to be equal to 1.5 times the design peak daily flow.

When the filtrate flow is continuously split between the return (to the recirculation tank) and the discharge, the liquid volume in the recirculation tank will vary depending on wastewater flows. During low flow periods the tank can be pumped down to the point that the low-water pump off switch is activated. This method leaves less return filtrate available to mix with the influent flow. While simple, this method of flow splitting can impair treatment performance because minimum recirculation ratios cannot be maintained. This is less of a disadvantage, however, for large, more continuous flows typical in small communities or large cluster systems.

The recirculation pump and controls are designed to dose a constant volume of mixed filtrate and septic tank effluent flow onto the filter on a timed cycle. The pump must be sized to provide the necessary dosing rate at the operating discharge head required by the distribution system. Pump operation is controlled by timers that can be set for pump time on and pump time off. A redundant pump-off float switch is installed in the recirculation tank below the minimum dose volume level. A high water alarm is also installed to provide notice of high water caused by pump failure, loss of pump calibration, or excessive influent flows.

Recirculation tank sizing

In many types of commercial systems, daily flow variations can be extreme. In such systems, the recycle ratios necessary to achieve the desired treatment may not be maintained unless the recirculation tank is sized properly. During prolonged periods of high influent flows, the recirculation ratio can be reduced to the point that treatment performance is not maintained unless the recirculation tank is sized to provide a sufficient reservoir of recycled filtrate to mix with the influent during the high-flow periods.

To size the tank appropriately for the application, assess the water balance for the recirculation tank using the following procedure:

1. Select the dosing frequency based on the wastewater strength and selected media characteristics.

2. Calculate the dose volume based on the average daily flow:

   $$V_{dose} = [(\text{recycle ratio} + 1) \times Q_{ave.\ daily}] \div (\text{doses/day})$$

   $$Q_{dose} = V_{dose} \div (\text{dose period})$$

   Where V and Q are the flow volume and flow rate, respectively.

3. Adjust the dose volume if the calculated volume is less than the required minimum dose volume for the distribution network.

4. Estimate the volumes and duration of influent peak flows that are expected to occur from the establishment.

5. Calculate the necessary recirculation tank "working" volume by performing a water balance around the recirculation tank for the peak flow period with the greatest average flow rate during that peak period.

   $$\text{Inputs} = Q_{inf.} \times T + Q_{recycle} \times T = Q_{inf.} \times T + (Q_{dose} - Q_{eff}) \times T = V_{inf.} + V_{recycle}$$

   $$\text{Outputs} = V_{dose} \times (T \div \text{dose cycle time})$$

   Where T is the peak flow period duration.

   If the inputs are greater than the outputs, then $Q_{eff} = Q_{dose}$ and the peaks are stored in the available freeboard space of the recirculation tank. If the inputs are less than the outputs, then $Q_{eff.} = Q_{inf.}$

   To provide the necessary recycle ratio, sufficient filtrate must be available to mix with the influent septic tank effluent. The filtrate is provided by the return filtrate flow and the filtrate already in the recirculation tank.

   $$\text{Recycle ratio} \times Q_{inf.} \times T \leq Q_{recycle} \times T + \text{minimum tank working volume}$$

   $$\text{Where minimum tank working volume} = \text{Recycle ratio} \times (Q_{inf.} - Q_{recycle}) \times T$$

6. Calculate the necessary freeboard volume for storage of peak flows when the influent volume is greater than the dosing volume during the peak flow period.

   $$\text{Freeboard volume} = Q_{inf.} \times T + Q_{recycle} \times T - Q_{dose} \times T$$

   $$= Q_{inf.} \times T(Q_{dose} - Q_{eff.}) - Q_{dose} \times T$$

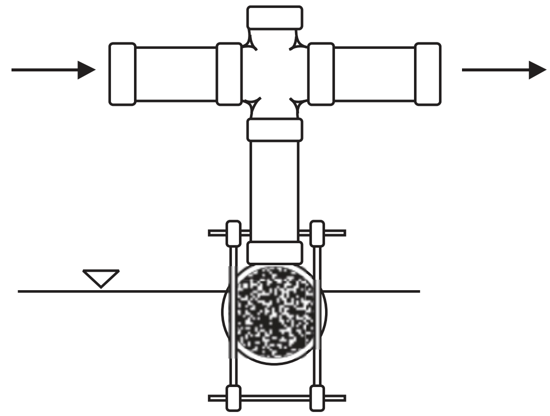
7. Calculate the minimum total recirculation volume.

   $$\text{Total tank volume} = \text{minimum tank working volume} + \text{freeboard volume}$$

(Adapted from Ayres Associates, 1998.)

Several flow splitting devices may be used. The most common are ball float valves and proportional splitters. The ball float valve is used where the recirculation tank is designed to remain full. The valve is connected to the return filtrate line inside the recirculation tank (see figure 2). The return line runs through the tank. The ball float valve is open when the water level is below the normally full level. When the tank fills from either the return filtrate or the influent flow, the ball float rises to close the valve, and the remaining filtrate is discharged from the system. The proportional splitters continuously divide the flow between return filtrate and the filtrate effluent (see figure 3). Another type of splitter consists of a sump in which two pipes are stubbed into the bottom with their ends capped. In the crowns of each capped line, a series of equal-sized, pluggable holes are drilled. The return filtrate floods the sump, and the flow is split in proportion to the relative number of holes left open in each perforated capped pipe.

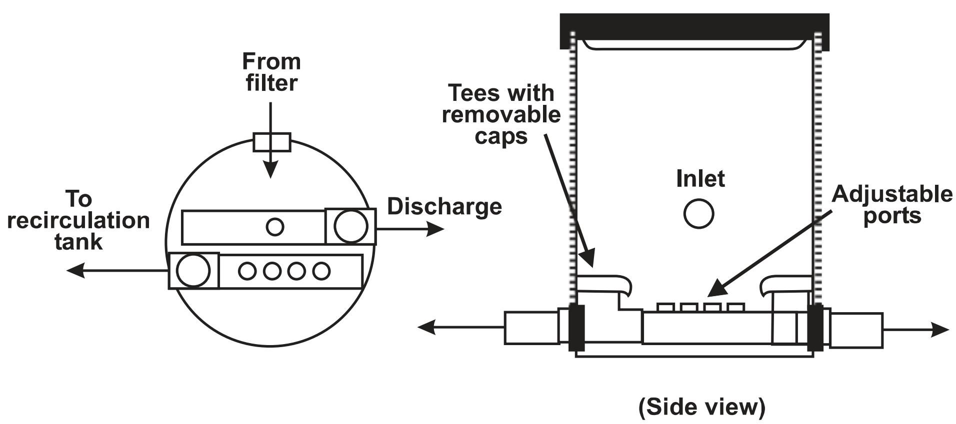
Figure 2. Flow splitter operated by a float ball valve



Another type of splitter divides flow inside the filter. The filter floor is raised so that it slopes in opposite directions. The raised point is located so that the ratio of the floor areas on either side is in proportion to the desired recirculation ratio. Each side has its own underdrain. One side drains back to the recirculation tank, the other side drains to discharge. This method has the disadvantage that adjustments to the recirculation ratio cannot easily be made.

Most RSFs are constructed aboveground and with an open filter surface; however, in cold climates, they can be placed in the ground to prevent freezing. Placing a cover over an RSF is recommended to reduce odors and to provide insulation in cold climates, although no freezing was observed in an open RSF in Canada using coarse gravel media. Covers must provide ample fresh air venting, because reaeration of the filter media occurs primarily from the filter surface.

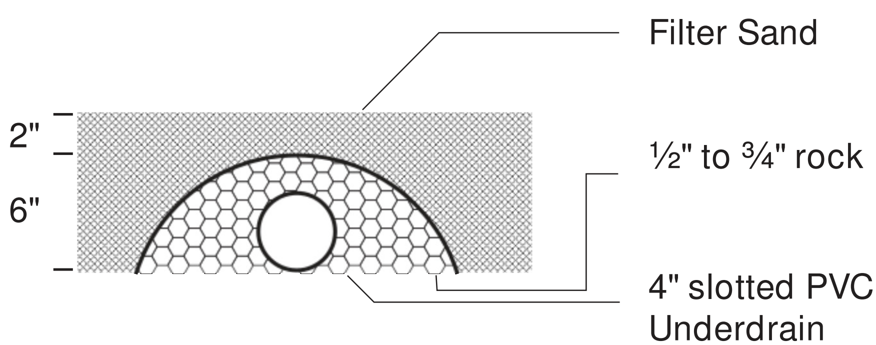
Figure 3. Splitter basin



The filter basin can be a lined excavation or fabricated tank. For single-home systems, prefabricated concrete tanks are commonly used. Many single-home filters and most large filters are constructed within lined excavations. Typical liner materials are polyvinyl chloride and polypropylene. A liner thickness of 30 mil can withstand reasonable construction activities yet be relatively easy to work with. A sand layer should be placed below the liner to protect it from puncturing if the floor and walls of the excavation are stony. The excavation walls should be brought above the final grade to prevent entry of surface water. It is often necessary to cover the filter surface to reduce the effects of algae fouling, odors, cold weather impacts, precipitation, and snow melt. The cover must provide ample fresh air venting, however. Reaeration of the filter media primarily occurs from the filter surface.

The underdrain system is placed on the floor of the tank or lined excavation (figure 4). Ends of the underdrains should be brought to the surface of the filter and fitted with cleanouts that can be used to clean the underdrains of biofilms if necessary. The underdrain outlet is cut in the basin wall such that the drain invert is at the floor elevation and the filter can be completely drained. The underdrain outlet invert elevation must be sufficiently above the recirculation tank inlet to accommodate a minimum of 0.1 percent slope on the return line and any elevation losses through the flow splitting device. The underdrain is covered with washed, durable gravel to provide a porous medium through which the filtrate can flow to the underdrain system. The gravel should be sized to prevent the filter media from mixing into the gravel, or a layer of 1/4- to 3/8-inch-diameter gravel should be placed over the underdrain gravel before the filter media is added.

Figure 4. Typical underdrain detail.



Performance

RSF systems are extremely effective and reliable in removing BOD, TSS, and contaminants that associate with the particulate fraction of the incoming septic tank effluent. Some typical performance data are provided in table 2.

Normally, BOD and TSS effluent concentrations are less than 10 mg/L when RSF systems are treating residential wastewater. Nitrification tends to be complete, except in severely cold conditions. Natural denitrification in the recirculating tank results in 40 to 60 percent removal of total nitrogen (TN). Fecal coliform removal is normally 2 to 3 logs (99 to 99.9 percent). Phosphorus removal drops off from high percentages to about 20 to 30 percent after the exchange capacity of the media becomes exhausted. Some media and media mixes have very high iron and/or aluminum content that extends the initial period of high phosphorus removal. (See Enhanced Nutrient Removal—Phosphorus, Technology Fact Sheet 8.)

Table 2. Recirculating filter performance

Reference	**BOD** (mg/L) Influ. Efflu. *(% Removal)*	**TSS** (mg/L) Influ. Efflu. *(% Removal)*	**TKN** (mg-N/L) Influ. Efflu. *(% Removal)*	**TN** (mg-N/L) Influ. Efflu. *(% Removal)*	**Fecal Coliform** (#/100mL) Influ. Efflu. *(% Removal)*
Louden et al., 1985 [a] (Michigan)	150 6 *(96.00%)*	42 6 *(85.71%)*	55 2.3 *(95.82%)*	55 26 *(52.73%)*	3.40E+03 1.40E+01 *(99.59%)*
Piluk and Peters, 1994 [b] (Maryland)	235 5 *(97.87%)*	75 8 *(89.33%)*	Not reported	57 20 *(64.91%)*	1.80E+06 9.20E+03 *(99.49%)*
Ronayne, et al., 1982 [c] (Oregon)	217 3 *(98.62%)*	146 4 *(97.26%)*	57.1 1.1 *(98.07%)*	57.5 31.5 *(45.22%)*	2.60E+05 8.50E+03 *(96.73%)*
Roy and Dube, 1994 [d] (Quebec)	101 6 *(94.06%)*	77 3 *(96.10%)*	37.7 7.9 *(79.05%)*	37.7 20.1 *(46.68%)*	4.80E+05 1.30E+04 *(97.29%)*
Ayres Assoc., 1998 [e] (Wisconsin)	601 10 *(98.34%)*	46 9 *(98.35%)*	65.9 3 *(95.45%)*	65.9 16 *(75.72%)*	> 2500 6.20E+01 *(> 98%)*
Owen and Bobb, 1994 [f] (Wisconsin)	80 8 *(90.00%)*	36 6 *(83.33%)*	- - *(> 95%)*	Not reported	Not reported

[a]Single-family home filters. Sand media: es = 0.3 mm; uc = 4.0. Average loadings = 0.9 gpd/ft^2 (forward flow) / 1.13 lb BOD/1,000 ft^2 –day. Recirculation ratio = 3:1. Dosed 4-6 times per hour. Open surface.

[b]Single-family home filters. Sand media: es = 1 mm; uc = <2.5. Design hydraulic loadings = 3.54 gpd//ft^2 (forward flow). Actual flow not measured. Recirculation ratio = 3:1. Doses per day = 24.

[c]Single-family home filters. Sand media: es = 1.2 mm; uc = 2.0. Maximum hydraulic loading (forward flow)= 3.1 gpd/ft^2. Recirculation ratio = 3:1-4:1. Doses per day = 48.

[d]Single-family home filters. Gravel media: es = 4.0 mm; uc = <2/5. Design hydraulic loading (forward flow)= 23.4 gpd/ft^2. Recirculation ratio = 5:1. Doses per day = 48. Open surface, winter operation.

[e]Restaurant (grease and oil inf./eff. = 119/<1 mg/L, respectively). Gravel media: pea gravel (3/8 in. dia.) Design hydraulic loading (forward flow) = 15 gpd/ft^2. Recirculation ratio = 3:1- 5:1. Doses per day = 72. Open surface, seasonal operation.

[f]Small community treating average 15,000 gpd of septic tank effluent. Sand media: es = 1.5 mm; uc = 4.5. Design hydraulic loading (forward flow) = 2.74 gpd/ft^2. Recirculation ratio = 1:1-4:1. Open surface, winter operation.

Management needs

As with all treatment systems, the RSF should be constructed carefully according to design specifications using corrosion-resistant materials. Every truckload of media delivered to the site should be tested for compliance with the specifications. All tanks and lined basins, including the entry and exit plumbing locations, must be watertight.

Inspection and operation/maintenance (O/M) needs are primarily related to inspection and calibration of the recirculation pump and controls. For sand media units, frequent removal of vegetation and scraping of the surface are required. Regular maintenance tasks include periodic checks on the pressure head at the end of the distribution system, draining of the accumulated solids from lines, and occasional brushing of the lines (at least once per year), with bottle brushes attached to a plumber's snake.

The recirculation tank should be checked for sludge accumulation on each visit and pumped as necessary (usually one to three times per year).

Risk management issues

RSFs are extremely reliable treatment devices and are quite resistant to flow variations. Toxic shocks are detrimental to RSF treatment performance because of the resistance of biofilms to upset and the extended period of contact between biofilms and wastewater.

Gravel RSFs (or RGFs) are likely viable throughout the United States when proper precautions (e.g., covering, insulation) are taken. These systems perform best in warmer climates, but they increase opportunities for odor problems. In general, gravel RSF systems are far less prone to odor production than ISFs. Increased recycle ratios should help minimize such problems. However, power outages will stop the process from treating the wastewater, and prolonged outages would be likely to generate some odors.

Costs

Construction costs for recirculating sand filters are driven by treatment media costs, the recirculating tank and pump/control system costs, and containment costs. Total costs are therefore site specific, but tend to vary from $8,000 to $11,000. Low-cost alternative media can reduce this figure significantly.

Power costs for pumping at 3 to 4 kWh/day are in the range of $90 to $120 per year, and management costs for monthly visits/inspections by semiskilled personnel typically cost $150 to $200 annually.

References

Anderson, D.L., R.L. Siegrist, and R.J. Otis. 1985. Technology Assessment of Intermittent Sand Filters. U.S. Environmental Protection Agency, Office of Research and Development, and Office of Water, Publication, Washington, DC.

Ayres Associates. 1997. Florida Keys Wastewater Nutrient Reduction Systems Demo Project: Second Quarter Report. Florida Department of Health, Tallahassee, FL.

Ayres Associates. 1998. Unpublished data from Wisconsin.

Bruen, M.G., and R.J. Piluk. 1994. Performance and Costs of Onsite Recirculating Sand Filters. In Proceedings of the Seventh On-site Wastewater Treatment Symposium. American Society of Agricultural Engineers, St. Joseph, MI.

Kerri, K.D., and J. Brady. 1997. Small Wastewater System Operation and Maintenance: Vol. 1. California State University, Sacramento, CA.

Louden, T.L., D.B. Thompson, L. Fay, and L.E. Reese. 1985. Cold-Climate Performance of Recirculating Sand Filters. In Proceedings of the Fourth On-site Wastewater Treatment Symposium. American Society of Agricultural Engineers, St. Joseph, MI.

National Small Flows Clearinghouse. 1998. Recirculating Sand Filters. U.S. Environmental Protection Agency, Office of Water, Washington, DC.

Orenco Systems, Inc. 1993. Cost Estimating for STEP Systems and Sand Filters. Orenco Systems, Inc., Roseburg, OR.

Owen, J.E., and K.L. Bobb. 1994. Winter Operation and Performance of a Recirculating Sand Filter. In Proceedings of the WEFTEC 67th Annual Conference. Water Environment Federation, Alexandria, VA.

Piluk, R.J., and E.C. Peters. 1994. Small Recirculating Sand Filters for Individuals Homes. In Proceedings of the Seventh On-site Wastewater Treatment Symposium. American Society of Agricultural Engineers, Joseph, MI.

Rhode Island Department of Environmental Management. 2000. Sand Filter Guidance Document. Rhode Island Department of Environmental Management, Providence, RI.

Roy, C., and J.P. Dube. 1994. A Recirculating Gravel Filter for Cold Climates. In Proceedings of the Seventh On-site Wastewater Systems Symposium. American Society of Agricultural Engineers, St. Joseph, MI.

Appendix E

Wastewater Collection System Alternatives

APPENDIX E
COLLECTION SYSTEMS ANALYSIS
DILLON BEACH VILLAGE WASTEWATER FEASIBILITY STUDY

1.0 INTRODUCTION

Provided here is a review and comparative analysis of sewage collection system alternatives for use in connection with a community wastewater system for the Dillon Beach Village service area. The basic types of sewage collection methods reviewed include:

- Conventional Gravity Sewers
- Pressure Sewers, with individual grinder pumps
- Small Diameter Effluent Sewers, including Septic Tank Effluent Pump (STEP) and Gravity (STEG).

The analysis begins with a general overview of each sewage collection method, along with a review of the typical advantages and disadvantages of each method. This is followed by a description, preliminary layout, cost comparison and review of various collection system options for connection to the Oceana Marin sewer system. The results of this analysis provide information on collection facilities requirements and costs for use in the overall project alternatives analysis (Section 6).

The layout of collection system options was done based on review of topographic mapping of the Village area, supplemented with field reconnaissance inspections. These represent our best professional judgment of the range of options for sewage collection suitable for this level of feasibility analysis. However, further study (e.g., during design) could reveal slightly different alignments or other refinements that may result in improvements or cost savings. The collection system layouts provide the information needed to define the expected routing of sewer lines, estimation of the need for individual pump systems, and the probable locations of sanitary lift stations, as applicable. It also provides basic data for preliminary hydraulic analysis of pumping requirements and an estimation of pipe sizes and corresponding costs.

The cost assumptions were developed through discussions with local contractors and suppliers, and review of construction costs for other similar work in Marin and the North Bay Area, including the wastewater facilities for nearby Lawson's Landing, which is currently under construction. The costs are planning-level estimates. The estimates do not include allowances for engineering, environmental and administrative costs, which are accounted for in the overall project cost estimates in Section 6 of the report.

2.0 SEWER COLLECTION METHODS

2.1 Conventional Gravity Sewers

General Description

In a conventional gravity sewer, untreated wastewater travels through a system of sewer pipes installed at a minimum grade to maintain gravity flow. Sewer pipes are usually six or eight-inch minimum diameter, with four-inch diameter lateral connections from buildings, and typically require a minimum of 4.5 feet of backfill cover to avoid conflicts with water mains, service laterals and other underground utility lines. Pipe and fitting material can be PVC, ABS, high density polyethylene (HDPE) or ductile iron. Conventional gravity sewers require manholes generally: (a) at all intersections of sewer lines other than side sewer connections less than six inches in diameter; (b) at all vertical or horizontal angle points; and (c) at intervals not greater than 400 feet. Manholes provide access for maintenance and cleaning. Since conventional gravity sewers require a constant downhill grade, gravity sewer mains may need to be installed at considerable depths where the terrain is flat or undulating.

Advantages and Disadvantages

Advantages. Conventional sewers are normally cost effective and appropriate in densely developed areas. The primary advantage of conventional sewers is the proven long-term reliability, long service life, and relatively low operation and maintenance (O&M) costs. Maintenance requirements for gravity sewers consist of routine cleaning of the sewer pipes and maintenance of lift stations. Another advantage is that construction techniques for conventional gravity sewers are familiar to most construction contractors and maintenance personnel.

Disadvantages. The typical disadvantages of conventional gravity sewers include cost and infeasible construction due to sparse population, flat terrain, high groundwater, shallow bedrock, or unstable soils. Infiltration from groundwater leaking into the sewers and inflow from direct storm water runoff into the sewers are an almost unavoidable component of conventional gravity sewers. Infiltration and inflow (I/I) may burden the treatment facility with sewage flows beyond capacity during wet weather. However, I/I can be mitigated by using high-quality pipe materials and construction and an ongoing preventative maintenance program.

Operation and Maintenance

Operation and maintenance activities for a conventional gravity sewer system consist of cleaning the sewers, monitoring sewers for illegal inflow connections, and pump station operation and maintenance. Pump station O&M involves repair and maintenance of mechanical, electrical and structural equipment. Access for cleaning is provided by manholes for 6-inch and 8-inch gravity sewers, and by clean-outs for 4-inch laterals. Cleaning of gravity sewers may require removal of obstructions from time-to-time, as well as flushing. Video inspection of sewer lines is also typically performed periodically as a preventative measure and/or to investigate specific sections of sewer lines.

2.2 Pressure Sewers

General Description

Pressure sewers are one of the most popular and successful alternatives to conventional gravity sewers. A pressure sewer is a small diameter pipeline, which is installed following the profile of the ground. Typical main diameters are 2 to 6 inches, and PVC and HDPE are the usual piping material. Burial depths usually have a 30-inch minimum cover, increasing where necessary to cross under water lines and other utilities. In residential areas served by a pressure sewer, each home uses a small grinder pump to discharge to the main line. A typical grinder pump and connection detail is provided in **Figure E-1**. The pump grinds the solids in the wastewater into slurry in the manner of a kitchen sink garbage grinder. Grinder pumps to serve individual homes usually range from one to two-horsepower in size. Installations using larger capacity pumps can be used to serve several homes with one pumping unit. Multifamily and commercial properties may make use of duplex pump stations designed for larger flows. The service line leading from the pumping unit to the main is usually 1.25-inch diameter PVC or HDPE. A check valve on the service line prevents backflow, which is insured with a redundant check valve at the pumping unit. If a malfunction occurs, a high liquid level alarm is activated. This alarm may be a light mounted on the outside wall of the home, or it may be an audible alarm that can be silenced by the resident. In the instance of an activated alarm, the resident would notify the sewer service district or a private sewer maintenance service, who would respond to make the necessary repair.

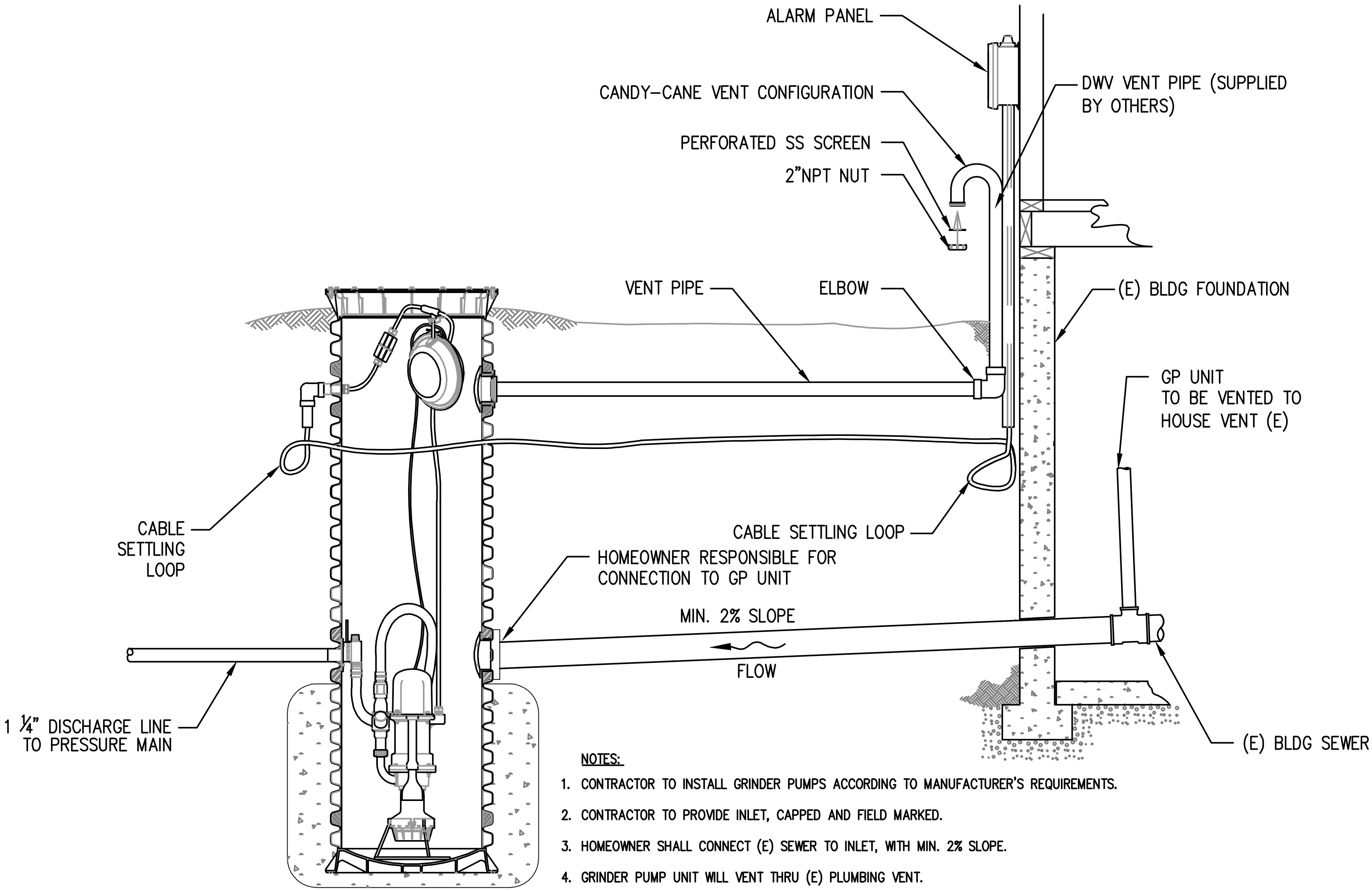
Advantages and Disadvantages

Advantages. With a typical pipe depth of about 36 inches, pressure sewers eliminate the need for the deep excavation, multiple lift stations, and groundwater dewatering and shoring involved in the installation of conventional gravity sewers. The shallow depth, positive pressure, and tight-glued PVC joints or fused HDPE joints also prevent groundwater infiltration and exfiltration, and substantially reduce the potential for storm water inflow. In many instances, small diameter HDPE pipe can be installed using Horizontal Directional Drilling (HDD) methods, which is typically much less expensive than open-cut trench installation, and greatly reduces the impacts to road pavement, traffic interruption, and hauling requirements for trench bedding material and excavated soils.

Disadvantages. The main disadvantage of pressure sewers is the added complexity of the large number of pumps and controls that would have to be installed and maintained at the individual residences. Most modern grinder pump units are very reliable, have a relatively long service life, and include built-in alarms to alert the homeowner in the event of a pump failure. Nevertheless, the impact during extended power outages is much greater with pressure sewers due to limited reserve storage at individual pump units and lack of readily available back-up power. Grinder pump units normally provide emergency storage capacity of about 50 to 100 gallons, unless an additional storage tank is added. Some sanitary districts require grinder pumps to be installed with a transfer switch to allow pump operation using a portable generator. Larger commercial or multifamily complexes can be equipped with an automatic backup generator. Another disadvantage of pressure sewers is the greater reliance upon on-lot facilities. The facilities located on private property normally require access easements or agreements for system maintenance or repair, and much more ongoing interaction with property owners and attention to public relations by the sewer district personnel.

Operation and Maintenance

On-lot grinder pumps require periodic maintenance and cleaning, which are normally handled by the sewer district or a private maintenance service; the associated electrical energy costs are absorbed directly by the property owner. Additionally, high-pressure flushing of the pressure sewer lines may be required occasionally to scour slime and solids buildup. However,



NOTES:

1. CONTRACTOR TO INSTALL GRINDER PUMPS ACCORDING TO MANUFACTURER'S REQUIREMENTS.
2. CONTRACTOR TO PROVIDE INLET, CAPPED AND FIELD MARKED.
3. HOMEOWNER SHALL CONNECT (E) SEWER TO INLET, WITH MIN. 2% SLOPE.
4. GRINDER PUMP UNIT WILL VENT THRU (E) PLUMBING VENT.
5. IF (E) PLUMBING VENTILATION IS NOT PER 1997 UPC, CONTRACTOR SHALL CONNECT OPTIONAL 2" VENT PIPE TO EXTERIOR OF BUILDING.

DILLON BEACH VILLAGE WASTEWATER STUDY
DILLON BEACH, 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:	PS
Checked:	NH
Appr'd:	NH

TYPICAL GRINDER PUMP UNIT
DILLON BEACH VILLAGE WASTEWATER FEASIBILITY STUDY

FIGURE E-1

experience with pressure sewer systems indicates this is fairly rare where the system has been designed to achieve minimum scouring velocities.

2.3 Small Diameter Effluent Sewers – Pump (STEP) and Gravity (STEG)

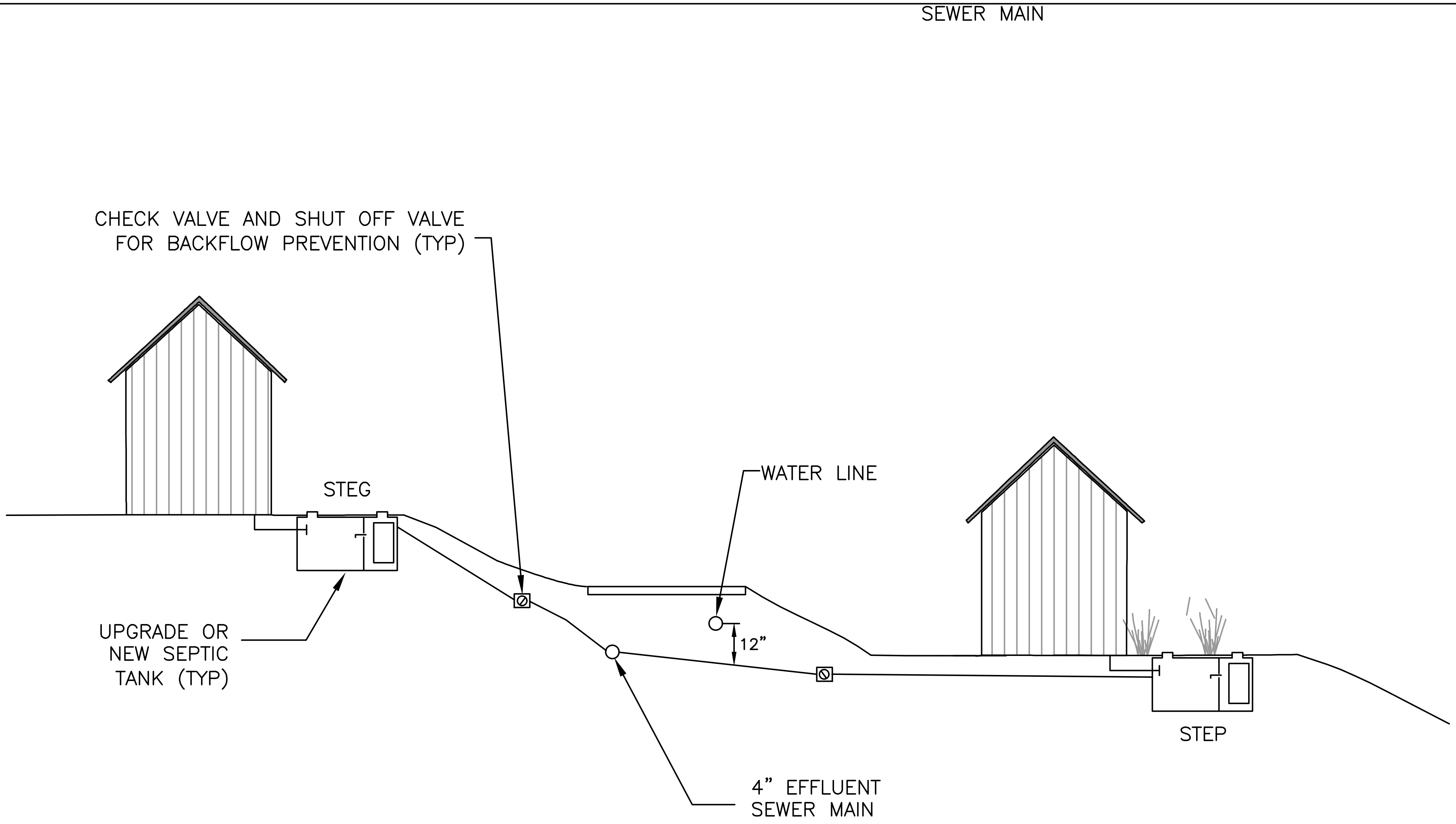
General Description

Small diameter, septic tank effluent pump (STEP) and gravity (STEG) sewers are gaining popularity in unsewered areas, especially for low density areas and to minimize sewer pipe sizes and deep trench construction. Unlike conventional sewers, primary treatment is provided at each connection by a septic tank, and only the settled wastewater is collected. Where the terrain is appropriate, the septic tank effluent can be collected by gravity flow (STEG system) in a common small diameter collection main. Where the terrain is flat or undulating individual pumping units (STEP) can be used. In these cases, each connection includes one or more effluent pumps located either in the septic tank or in a separate pump chamber. The septic tank effluent is then pumped into a small diameter force main (2 to 4-inch PVC or HDPE). Grit, grease, and other troublesome solids which might cause obstructions in the pumps or collector mains are separated from the waste flow and retained in septic tanks installed upstream of each connection. With the solids removed, the collector main need not be designed to carry solids, unlike conventional sewers. **Figure E-2** illustrates typical STEP/STEG sewer layout; **Figure E-3** provides details of a typical STEP unit. The Marshall Community Wastewater System is a local example of a STEP system, where the homes along the Tomales Bay shoreline each have an on-lot septic tank and pump unit that all pump into a common 3-inch diameter pressure line installed along the edge of Highway 1.

Advantages and Disadvantages

Advantages. Effluent STEP/STEG sewers have many of the same advantages cited for pressure sewers. An added advantage is the absence of solids in the sewer lines, since the solids are retained in septic tanks. This reduces the stress on pumping facilities and eases the passage of wastewater through the system. The removal of solids from the waste flow also significantly reduces the load on the treatment plant. Because of their smaller size, reduced gradients and lack of manholes, STEP/STEG systems can also have a distinct cost advantage over conventional gravity sewers where adverse conditions create excavation problems or where roadway restoration costs in developed areas can be significant.

Disadvantages. STEP/STEG sewers are generally not well suited in high-density developments because of the cost of installing and maintaining the septic tanks. Since sewage is maintained in an anaerobic or "septic" state in STEP/STEG systems, nuisance gases are produced that may cause odor problems at individual connections. However, the venting of odors is no different from the conditions with individual septic systems; odors are vented through the house plumbing stacks. Another disadvantage of STEP/STEG sewers is the reliance upon septic tank pump-outs and disposal of septage. Accumulated digested sludge and scum must be removed from the septic tank and disposed of on a periodic basis (every three to five years, on average), which is no different from an ordinary septic system (i.e., existing conditions). The main disadvantage of STEP sewers is the added complexity of the large number of pumps and controls that would have to be installed and maintained at the individual residences. Most modern STEP units are very reliable, have a relatively long service life, and include built-in alarms to alert the homeowner in



DILLON BEACH VILLAGE WASTEWATER STUDY

DILLON BEACH, 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:	PS
Checked:	NH
Appr'd:	NH

TYPICAL STEP/STEG EFFLUENT SEWER SYSTEM

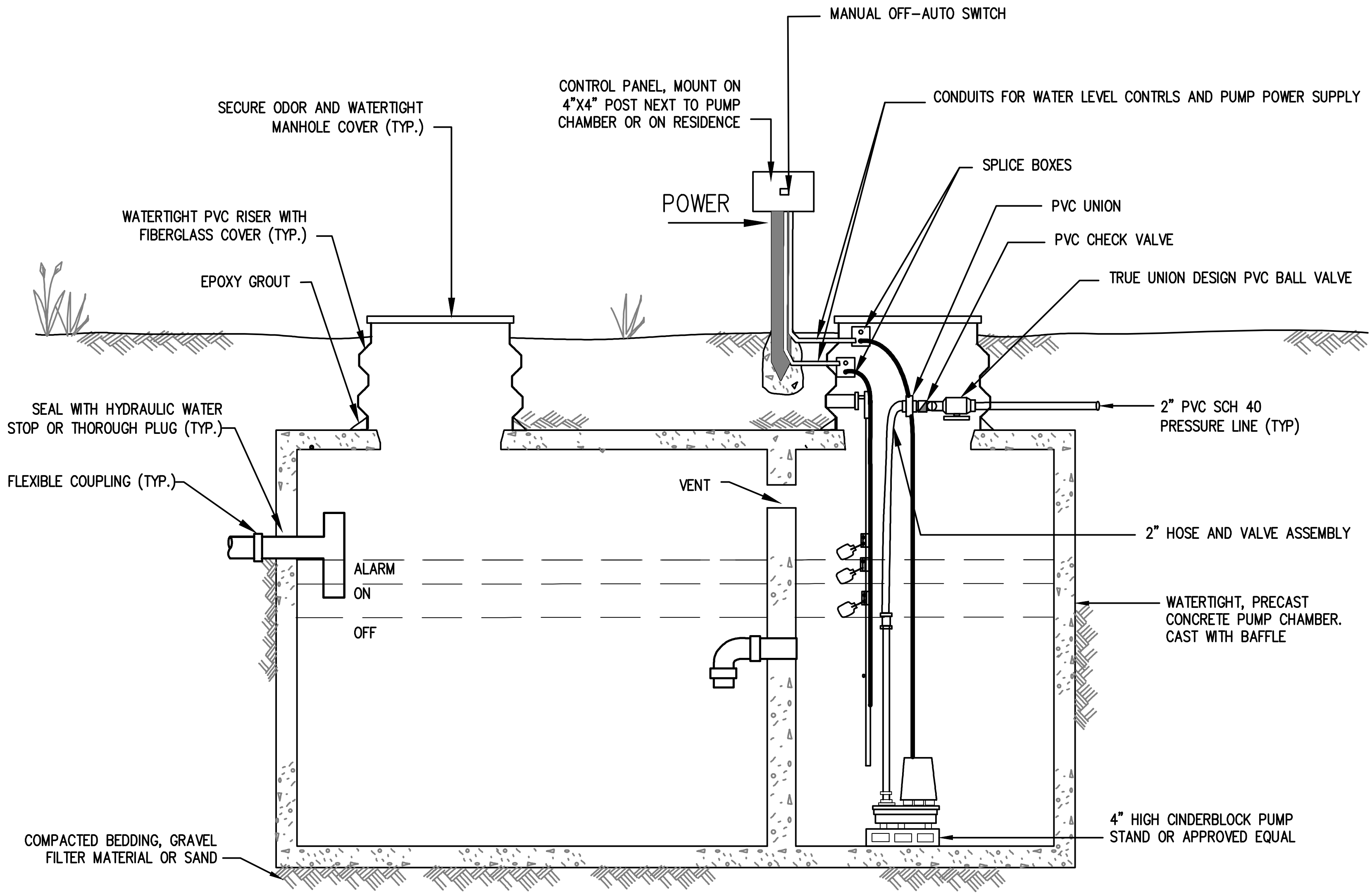
DILLON BEACH, CA

FIGURE

E-2

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

PLOT STYLE: QUESTA–GRAYSCALE–255.CTB
LAST SAVED: 7/28/2022 PLOT DATE: 7/28/2022
P:\2020\2000170_DILLON_BEACH_VILLAGE_WASTEWATER\CAD\MODEL\2000170 REPORT FIGURES.DWG



DILLON BEACH VILLAGE WASTEWATER STUDY
DILLON BEACH, 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:	PS
Checked:	NH
Appr'd:	NH

TYPICAL SEPTIC TANK WITH EFFLUENT PUMP (STEP)
WASTEWATER FEASIBILITY STUDY

FIGURE
E-3

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

the event of a pump failure. Nevertheless, the impact during extended power outages can be a concern with STEP sewers depending on the amount of reserve storage capacity provided at the STEP unit and available of back-up power. STEP units are normally configured to provide emergency storage capacity of about 100 to 200 gallons in the septic tank or a separate pump basin, which should normally be sufficient for a one to two-day power outage. Some sanitary districts require STEP units to be installed with a transfer switch to allow pump operation using a portable generator. Larger commercial or multi-family complexes can be equipped with an automatic backup generator. Finally, as noted previously under the discussion of pressure sewers, STEP/STEG sewers require easements for maintenance and repair of on-lot facilities along with greater attention to public relations and considerable interaction between the district personnel and property owners.

Operation and Maintenance

Operation and maintenance activities for a STEP/STEG sewer system consist mainly of septic tank pump-outs and maintenance, annual inspection and repair, and cleaning out of individual on-lot pump facilities, as needed. Because STEP collection lines are pressurized and do not transport any solids, solids accumulation and associated cleaning of the sewer lines are not normally required to the same degree as for conventional sewers. High-pressure flushing of the main collection lines may be required occasionally to scour slime buildup. However, in practice this is rarely found to be necessary.

3.0 COLLECTION ANALYSIS

Community sewerage Alternatives 3a, 3b & 4 for Dillon Beach Village would require collection and transmission of sewage to the intersection of North Street and Oceana Dr, where connection would be to the Oceana Marin sewer system. Conventional gravity sewers, pressure sewers or effluent (STEP/STEG) sewers could all potentially be used for local sewage collection, and in all cases would require pumping to the point of Oceana Marin sewer connection. Sewage collection options using each of these methods were formulated to determine and compare the facility requirements and costs of different methods, and to identify the apparent best option for Dillon Beach Village.

3.1 Option 1 – Conventional Gravity Sewer

Description. The sloping terrain in Dillon Beach Village is generally well-suited for conventional gravity sewers. Under this option gravity sewer lines would be installed on Ocean View Ave, Park Ave, Cypress Ave and connecting streets, leading downhill to Beach Ave on the east side and Cliff St on the west side, eventually terminating at a central lift station tentatively proposed to be located adjacent to the beach restroom (below Cliff St.) From this lift station, the sewage would be pumped via a sewer force main (pressure line) back uphill to the Oceana Dr sewer, by way of Cliff St, Ocean View Ave and North St. Most properties in the Village would be able to be served with a direct gravity sewer lateral connection from the house plumbing to the street sewer, with an estimated 25% requiring individual pump units to pump into the street sewer. Gravity sewers to serve the properties on Bay Dr/Cliff St Ext would require a local lift station near the intersection of Cliff St Ext. and Marine View Dr, with a force main from there to the proposed central lift station at the beach restroom. **Figure E-4** shows the layout of this sewage collection option for the Village area.

Facility Requirements. Per the preliminary layout the facility requirements of this gravity sewer collection option, if extended serve the entire Study Area, include the following:

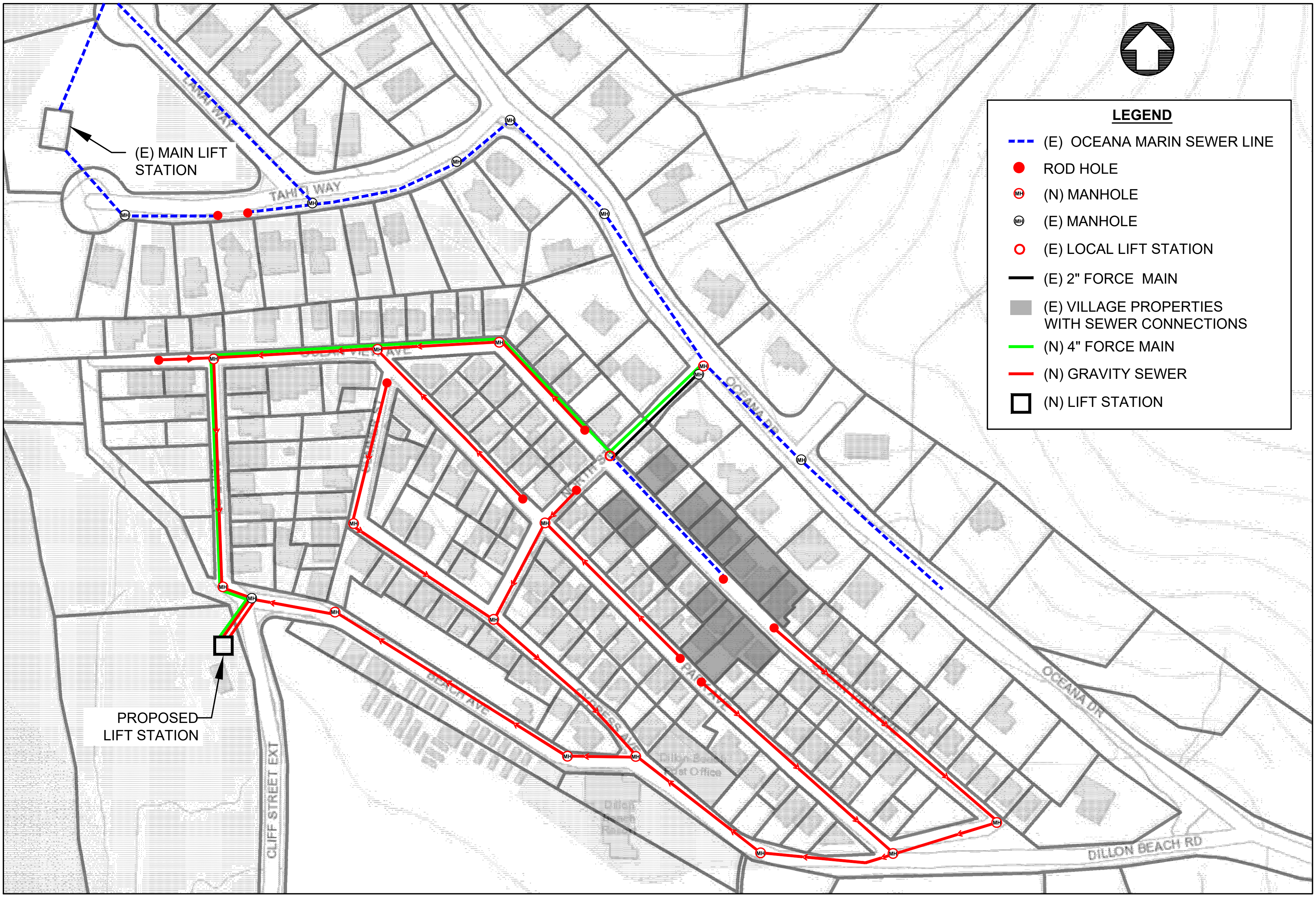
- **Standard Sewers**. Approximately 7,220 lineal feet of conventional 6-inch diameter gravity sewers, installed at a standard depth of approximately 4.5 to 5 feet deep.
- **Manholes and Rodholes**. Approximately 22 manholes and 11 rodholes would be required in the collection system.
- **Lift Stations:** An intermediate neighborhood lift station at Cliff St Ext and a central lift station near the beach restroom would be required.
- **Sewage Force Main**. A 4-inch force main would extend from Cliff St Ext to the central lift station, a distance of about 600 feet; the force main from the central lift station to the Oceana Marin connection would be about 1,300 feet long.

Estimated Costs. Estimated construction costs for the conventional gravity sewer alternative are presented in **Table E-1,** including quantities and unit cost assumptions, based on service to all 150 existing residences plus commercial parcels in the Dillon Beach Village study area. **Table E-2** shows the adjusted costs for service to only the Village area (127 residences plus commercial parcels). The quantities for gravity sewers and force main were taken directly from the preliminary sewer plan layout. Unit costs for on-lot facilities include abandoning existing septic tanks, excavation and installation of building sewers to the property line, materials, installation of grinder pumps where necessary, and required permitting. Unit costs for gravity sewer collection mains, service laterals and force mains include costs for trench excavation, pipeline installation, backfilling, pavement repair and clean-up. Preliminary lump-sum estimates are included for the local neighborhood lift station serving Bay Dr/Cliff St Ext and the central lift station at the beach restroom.

3.2 Option 2 – Pressure Sewer

Description. A pressure sewer collection system for the Dillon Beach Village service area would be suitable for conveying sewage flows directly to the Oceana Dr treatment/main lift station site without the need for any intermediate neighborhood lift stations. The pressure sewer lines, ranging from 2 to 4 inches in diameter, would be installed along most all streets in the service area, typically at a minimum depth of 3 to 4 feet or as needed to provide at least one foot clearance below existing water mains and service laterals. **Figure E-5** shows the preliminary layout of this sewage collection option for the Village area.

Facility Requirements. Per the preliminary layout, the facility requirements for this pressure sewer option include the following:



DIILON BEACH VILLAGE WASTEWATER STUDY

DILLON BEACH, 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:	PS
Checked:	NH
Appr'd:	NH

GRAVITY SEWER ALTERNATIVES (VILLAGE ONLY)

DILLON BEACH, CA

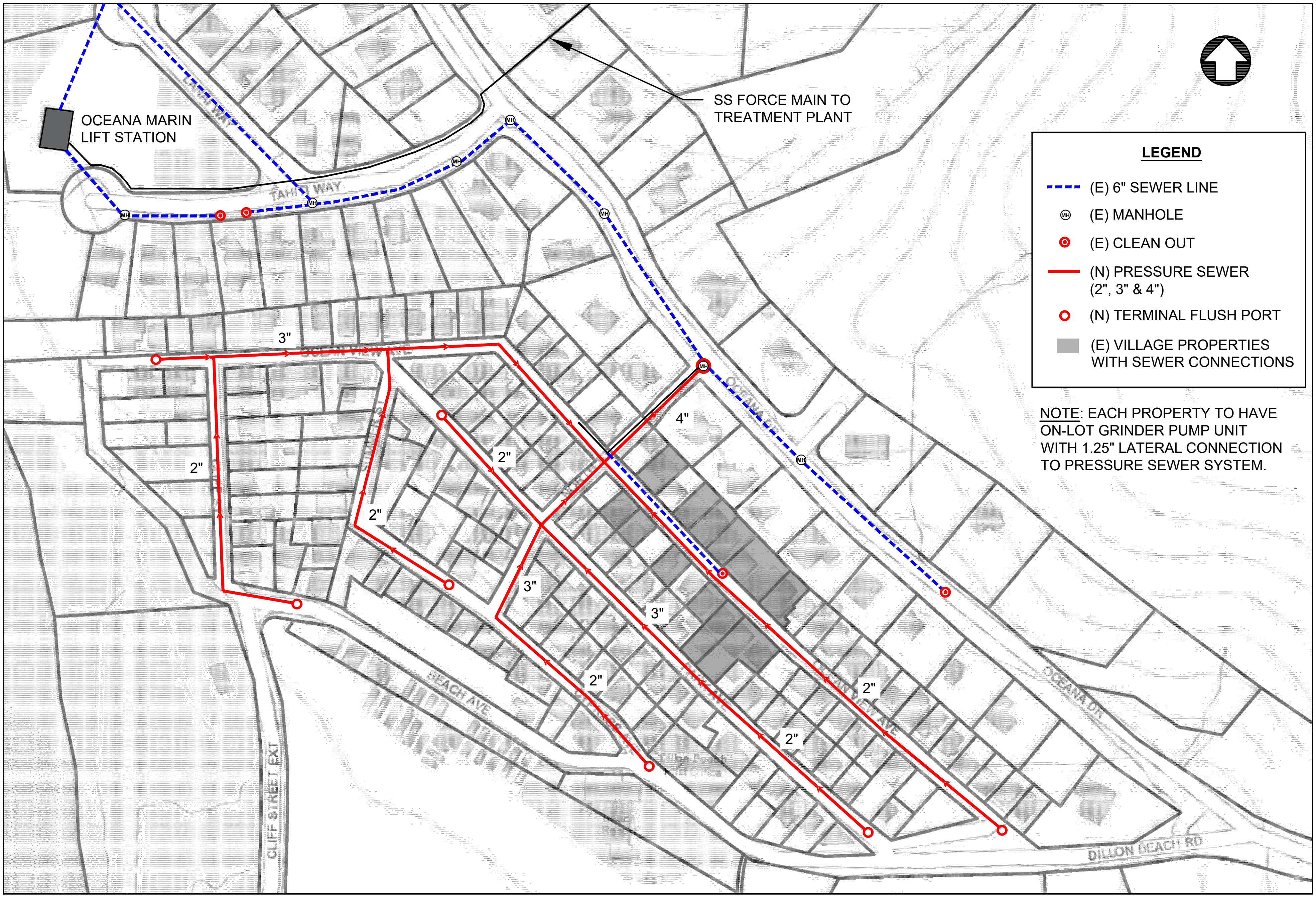
FIGURE

E-4

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

PLOT STYLE: QUESTA–GRAYSCALE–255.CTB PLOT DATE: 10/19/2022 LAST SAVED: 10/19/2022

P:\2020\2000170_DILLON_BEACH_VILLAGE_WASTEWATER\CAD\MODEL\2000170_PROJECT ALTERNATIVES.DWG



DIILON BEACH VILLAGE WASTEWATER STUDY

DILLON BEACH, 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: PS
Checked: NH
Appr'd: NH

PRESSURE SEWER ALTERNATIVE (VILLAGE ONLY)

DILLON BEACH, CA

FIGURE E-5

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

P:\2020\2000170_DILLON_BEACH_VILLAGE_WASTEWATER\CAD\MODEL\2000170_PROJECT ALTERNATIVES.DWG LAST SAVED: 10/19/2022 PLOT DATE: 10/19/2022 PLOT STYLE: QUESTA-GRAYSCALE-255.CTB

- **Grinder Pump Units.** An individual grinder pump would be installed at each service connection. Almost every residence would have its own standard simplex grinder pump; for commercial properties duplex units (2 pumps for redundancy) would be installed. Grinder pumps could be provided with a remote monitoring unit, with access via modem connection and programming for automatic shut-off for emergency conditions.

- **Pressure Sewers.** Pressure sewers, ranging in size from 2 to 4 inches diameter, would be installed in a continuous collection network, leading to the final section of 4-inch main line on North St which would connect to existing sewer on Oceana Dr. The complete system would require approximately 6,470 feet of pressure sewers.

- **Terminal Flush Ports.** Cleanouts would be placed at the beginning of pressure sewer branches and at intersections.

- **Air Release Valves.** The preliminary pressure sewer layout indicates no need for air release valves, which are installed at the high points in a sewer force main in undulating topography.

Estimated Costs. Estimated construction costs for the pressure sewer option are presented in **Table E-3,** including quantities and unit cost assumptions, based on service to all 150 residences plus commercial parcels in the Dillon Beach Village study area. **Table E-4** shows the adjusted costs for service to only the Village area (127 residences plus commercial parcels). The quantities were taken directly from the preliminary sewer plan layout. Unit costs for on-lot facilities include abandoning existing septic tanks, excavation and installation of building sewers to the grinder pump unit, installation of grinder pumps, and required permitting. Unit costs for pressure sewer collection mains, service laterals and force mains include costs for trench excavation, pipeline installation, backfilling, pavement repair and clean-up. The soil conditions and terrain in some parts of the Dillon Beach Village service area may be suitable for HDD installation methods; however open cut trenching in the sandy soils is likely to be the preferred method.

3.3 Option 3 –Effluent STEG/STEP Sewer

Description. Under this collection alternative, each property would retain an on-lot septic tank for primary treatment, and the clarified effluent would be conveyed from the tank to a network of small diameter effluent collection lines extending throughout the service area. The connection to the effluent sewer system would be either by gravity (STEG) or with a pump unit (STEP) located in the second compartment of the septic tank or an adjacent pump basin. Based on the sloping terrain of the Dillon Beach Village service area, most of the properties could be served by STEG connections. Gravity effluent sewer lines would be installed on Ocean View, Park, Cypress Avenues and connecting streets, following the same basic alignment as the conventional sewer layout. The effluent lines would terminate at a central effluent lift station tentatively proposed to be located adjacent to the beach restroom (below Cliff St.) From this lift station, the effluent would be pumped via a force main (pressure line) back uphill to the connection at Oceana Dr, by way of Cliff St, Ocean View Ave and North St. Most properties in the Village would be able to be served with a direct gravity sewer lateral connection from the existing septic tank to the effluent sewer in the street, with an estimated 25% requiring individual pump units installed in the second chamber of the septic tank to pump effluent into the street sewer. Gravity effluent sewers to serve the properties on Bay Dr/Cliff St Ext would require a local effluent lift station near the intersection of Cliff St Ext. and Marine View Dr, with a force main from there to the proposed central lift station at the beach restroom. **Figure E-6** shows the layout of this sewage collection option for the Village area. STEP and gravity effluent lines would be installed typically at a minimum depth of 3 to 4 feet or as needed to provide at least one foot clearance below existing water mains and service laterals.

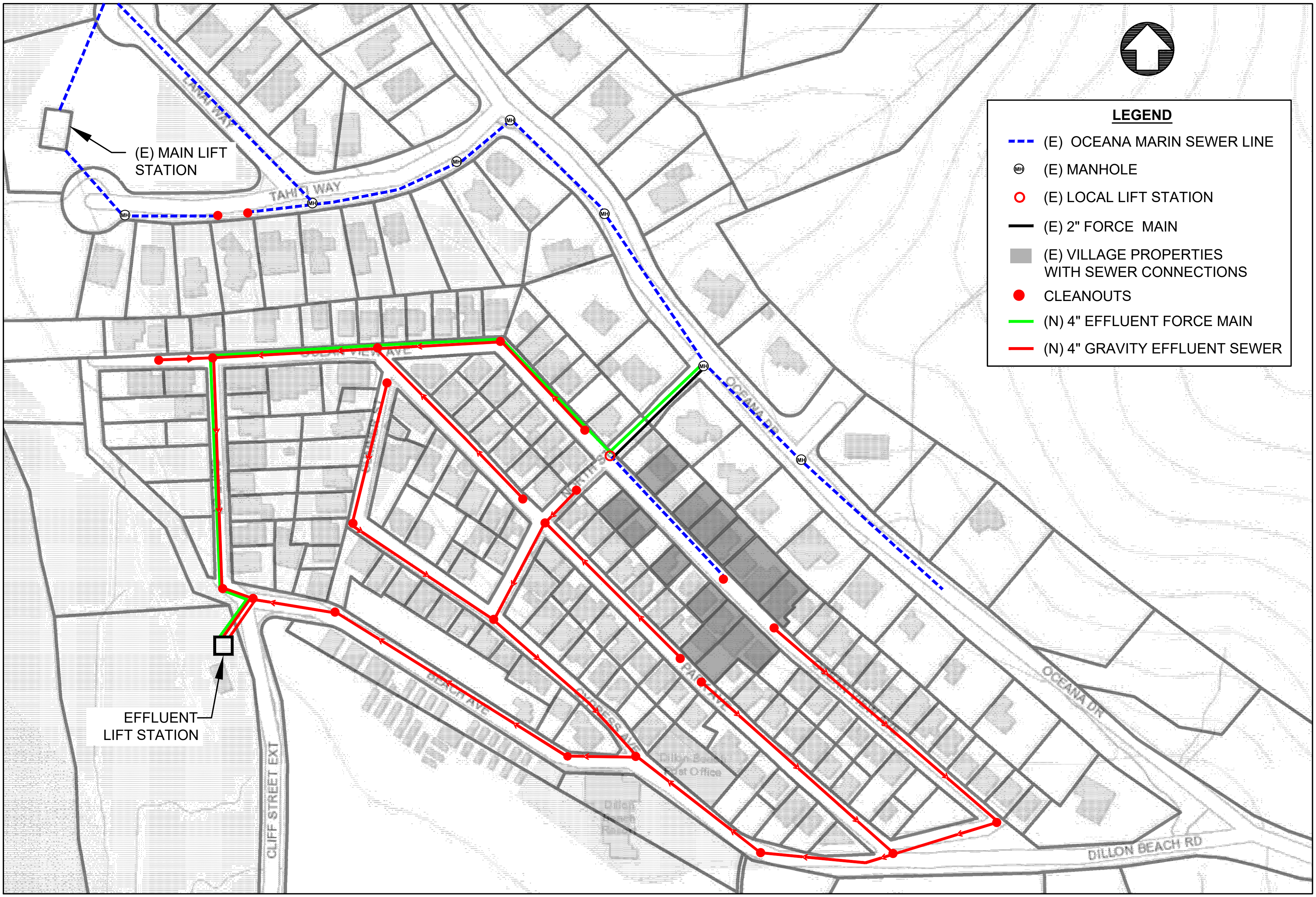
Facility Requirements. Per the preliminary layout, the facility requirements of this STEP/STEG effluent sewer option include the following:

- **Septic Tanks.** Watertight septic tanks would be required for each property (some commercial or multi-residential properties might have more than one tank). Based on review of EHS permit files, we estimate that close to half of the existing septic tanks could be salvaged and continue to be utilized; due to their age, size and condition the other half would have to be replaced with new tanks. All tanks would require watertight access risers. Any existing tanks that remain in service would be subject to inspection and testing to verify their conformance with minimum standards for continued use.

- **STEP and STEG Units.** We estimate that approximately 25% of the properties in the service area would require pumping (STEP) units. All others would accommodate gravity connections and be classified as STEG units. The STEP unit includes a submersible effluent pump installed in a separate tank following the septic or in the second compartment of the septic tank, along with associated electrical control and float-activated switches programmed to operate on demand (i.e., in response to flow from the property). Power is supplied from the house or commercial building, where an audio and visual alarm is located. Emergency/reserve storage capacity of 150 to 200 gallons is normally provided in the septic tank for pump malfunction or power outages. STEG units would have no additional equipment requirements other than a standard septic tank with access risers and effluent filter.

- **Service Laterals.** Every property will have a service lateral connection to the effluent sewer line in the street. Service laterals connecting the STEP unit to the collection main are usually 1.25-inch for pressure lines for residences and 2-inch diameter for commercial and multi-family connections. Service laterals for STEG units would be 3-inch diameter lines. All piping and valves are Schedule 40 PVC or HDPE. A check valve and shutoff valve would be installed on each service lateral at the property line to prevent backflow of effluent from the public sewer into the on-lot facilities.

- **Gravity Effluent Sewers.** Approximately 7,200 lineal feet of 4-inch diameter gravity effluent sewers would be required. Effluent sewers would be either PVC or HDPE pipe.



DIILON BEACH VILLAGE WASTEWATER STUDY
DILLON BEACH, 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:	PS
Checked:	NH
Appr'd:	NH

STEP/STEG EFFLUENT SEWER ALTERNATIVE (VILLAGE ONLY)
DILLON BEACH, CA

FIGURE
E-6

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

PLOT STYLE: QUESTA-GRAYSCALE-255.CTB PLOT DATE: 10/19/2022 LAST SAVED: 10/19/2022
P:\2020\2000170_DILLON_BEACH_VILLAGE_WASTEWATER\CAD\MODEL\2000170_PROJECT ALTERNATIVES.DWG

- **Clean-Outs.** Manholes are not required in STEP sewers; clean-outs and isolation valves are included for maintenance purposes.

- **Effluent Lift Stations.** The effluent lift stations (at Cliff St Ext. and the beach restroom) would consist of a large concrete vault with duplex submersible effluent pumps, emergency storage capacity within the main tank or a separate tank. They would be similar to raw sewage lift stations, except that the smaller capacity pumps can be used, since they are not required to pump sewage solids.

- **Effluent Force Main.** Approximately 1,900 lineal feet of 4-inch effluent force main would be required, for the line from Bay Rd/Cliff St Ext to the central effluent lift station, and from the lift station to the Oceana Marin sewer connection on Oceana Dr.

Estimated Costs. Estimated construction costs for the STEP/STEG effluent sewer system option are presented in **Table E-5,** including quantities and unit cost assumptions, based on service to all 150 existing residences plus commercial properties in the Dillon Beach Village study area. **Table E-6** shows the adjusted costs for service to only the Village area (127 residences plus commercial parcels). The quantities were taken directly from the preliminary sewer plan layout. Unit costs for on-lot facilities include the cost of abandoning existing septic tanks (where necessary), plus the costs of materials and installation of STEP/STEG units, new septic tanks or upgrade of existing tanks, and the excavation and installation of building sewers and service laterals. Unit costs for the collection system include material costs for sewer pipes and valves, trench excavation, pipeline installation, backfilling, pavement repair, and clean-up. The soil conditions and terrain in some parts of the Dillon Beach Village service area may be suitable for HDD installation methods; however open cut trenching in the sandy soils is likely to be the preferred method.

3.4 – Cost Comparison

Table E-7 below provides a comparative summary of the estimated cost for each sewer system alternative. Based on these estimates, gravity sewers would be the least cost and preferred option for Dillon Beach Village.

Sewer Alternative	Service: Entire Study Area		Service: Village Area Only	
	Total Cost	Cost per ESD	Total Cost	Cost per ESD
Gravity Sewers	$ 3,273,475	$ 17,229	$ 2,237,900	$ 14,723
Pressure Sewers	$ 3,345,695	$ 17,609	$ 2,645,230	$ 17,403
STEP/STEG Effluent Sewers	$ 3,709,325	$ 19,523	$ 2,811,750	$ 18,498

Table E-1. Gravity Sewer Collection Alternative 3A
Entire Study Area

Parcels: 150 + commercial (40 ESDs) **Design Flow: 14,250 gpd**

Public Sewer Facilities				
Description	**Units**	**Est Qty**	**Unit Cost ($)**	**Total Cost ($)**
6-inch gravity sewer	LF	7,220	$ 200	$ 1,444,000
Manholes	EA	22	$ 10,000	$ 220,000
Rodholes	EA	11	$ 1,500	$ 16,500
4" Force Main	LF	1,900	$ 140	$ 266,000
Local Lift Station (Cliff St)	LS	1	$ 150,000	$ 150,000
Lift Station (incl easement)	LS	1	$ 750,000	$ 750,000
			Public Collection Subtotal	$ 2,846,500
			Miscellaneous & Contingency @ 15%	$ 426,975
			Collection System Total	**$ 3,273,475**
			Cost per ESD	**$ 17,229**

Table E-2. Gravity Sewer Collection Alternative 3B
Dillon Beach Village Only

Parcels: 128 + Commercial (24 ESDs) **Design Flow: 11,350 gpd**

Public Sewer Facilities				
Description	**Units**	**Est Qty**	**Unit Cost ($)**	**Total Cost ($)**
6-inch gravity sewer	LF	4,760	$ 200	$ 952,000
Manholes	EA	15	$ 10,000	$ 150,000
Rodholes	EA	8	$ 1,500	$ 12,000
4" Force Main	LF	1,300	$ 140	$ 182,000
Lift Station (incl easement)	LS	1	$ 650,000	$ 650,000
			Public Collection Subtotal	$ 1,946,000
			Miscellaneous & Contingency @ 15%	$ 291,900
			Collection System Total	**$ 2,237,900**
			Cost per Parcel	**$ 14,723**

Table E-3. Pressure Sewer Collection Alternative 3A
Entire Study Area

Parcels: 150 + commercial (40 ESDs) **Design Flow: 14,250 gpd**

Public Sewer Facilities				
Description	**Units**	**Est Qty**	**Unit Cost ($)**	**Total Cost ($)**
2-inch Pressure Sewer	LF	3,160	$100	$ 316,000
3-inch Pressure Sewer	LF	3,130	$120	$ 375,600
4-inch Pressure Sewer	LF	180	$140	$ 25,200
Connecting Manhole	EA	2	$10,000	$ 20,000
2.0" Terminal Flush Port	EA	9	$ 2,500	$ 22,500
Air Release Valve, Isolation valves, appurte	EA	10	$ 2,500	$ 25,000
			Public Collection Subtotal	$ 784,300
			Miscellaneous & Contingency @15%	$ 117,645
			Collection System Total	**$ 901,945**
			Cost per Parcel	**$ 4,747**

Individual On-lot Facilites (assumed eligble for funding)				
Description	**Unit**	**Est Qty**	**Unit Cost ($)**	**Total Cost ($)**
Grinder Pump Unit-Residential	EA	150	$13,500	$ 2,025,000
Grinder Pump Unit-Commercial	EA	4	$25,000	$ 100,000
			On-lot Collection Sub-total	$ 2,125,000
			Contingency @ 15%	$ 318,750
			On-Lot Facilities Total	**$ 2,443,750**
			Cost per Parcel	**$ 12,862**

Estimated Total Pressure Sewer Cost	**$ 3,345,695**
Estimated Cost per Parcel (ESD)	**$ 17,609**

Table E-4. Pressure Sewer Collection Alternative 3B
Dillon Beach Village Only

Parcels: 128 + Commercial (24 ESDs) **Design Flow: 11,350 gpd**

Public Sewer Facilities				
Description	**Units**	**Est Qty**	**Unit Cost ($)**	**Total Cost ($)**
2-inch Pressure Sewer	LF	1,210	$100	$ 121,000
3-inch Pressure Sewer	LF	2,550	$120	$ 306,000
4-inch Pressure Sewer	LF	180	$140	$ 25,200
Connecting Manhole	EA	1	$10,000	$ 10,000
2.0" Terminal Flush Port	EA	6	$ 2,500	$ 15,000
Air Release Valve, Isolation valves, appurte	EA	8	$ 2,500	$ 20,000
			Public Collection Subtotal	$ 497,200
			Miscellaneous & Contingency @15%	$ 74,580
			Collection System Total	**$ 571,780**
			Cost per Parcel	**$ 3,762**

Individual On-lot Facilites (assumed eligble for funding)				
Description	**Unit**	**Est Qty**	**Unit Cost ($)**	**Total Cost ($)**
Grinder Pump Unit-Residential	EA	128	$13,500	$ 1,728,000
Grinder Pump Unit-Commercial	EA	3	$25,000	$ 75,000
			On-lot Collection Sub-total	$ 1,803,000
			Contingency @ 15%	$ 270,450
			On-Lot Facilities Total	**$ 2,073,450**
			Cost per Parcel	**$ 13,641**

Estimated Total Pressure Sewer Cost	**$ 2,645,230**
Estimated Cost per Parcel (ESD)	**$ 17,403**

Table E-5. STEP/STEG Effluent Sewer Collection Alternative
Entire Study Area

Parcels: 150 + Commercial (40 ESDs) **Design Flow: 14,250 gpd**

Public Sewer Facilities				
Description	**Units**	**Est Qty**	**Unit Cost ($)**	**Total Cost ($)**
4-inch Effluent Sewer	LF	7,210	$ 150	$ 1,081,500
Cleanouts	EA	22	$ 1,500	$ 33,000
4-inch Force Main	LF	1,900	$ 150	$ 285,000
4.0" Terminal Flush Port	EA	11	$ 2,500	$ 27,500
Local Lift Station	LS	1	$ 75,000	$ 75,000
Central Lift Station	LS	1	$ 400,000	$ 400,000
			Public Collection Subtotal	$ 1,902,000
			Miscellaneous & Contingency @ 15%	$ 285,300
			Collection System Total	**$ 2,187,300**
			Cost per Parcel	**$ 11,512**

Individual On-lot Facilites (assumed eligble for funding)				
Description	**Unit**	**Est Qty**	**Unit Cost ($)**	**Total Cost ($)**
New STEG Unit-Residential	EA	54	$8,000	$ 432,000
Upgrade Existing Tank to STEG Unit - Residential	EA	57	$5,000	$ 285,000
New or Upgraged STEP Unit - Residential	EA	39	$13,500	$ 526,500
Commercial STEG/STEG Units	LS	1	$80,000	$ 80,000
			On-lot Collection Sub-total	$ 1,323,500
			Contingency @ 15%	$ 198,525
			On-Lot Facilities Total	**$ 1,522,025**
			Cost per Parcel	**$ 8,011**

Estimated Total Effluent Sewer Cost	**$ 3,709,325**
Estimated Cost per Parcel (ESD)	**$ 19,523**

Table E-6. STEP/STEG Effluent Sewer Collection Alternative
Dillon Beach Village Area

Parcels: 128 + Commercial (24 ESDs) **Design Flow: 11,350 gpd**

Public Sewer Facilities				
Description	**Units**	**Est Qty**	**Unit Cost ($)**	**Total Cost ($)**
4-inch Effluent Sewer	LF	4,760	$ 150	$ 714,000
Cleanouts	EA	15	$ 1,500	$ 22,500
4-inch Force Main	LF	1,300	$ 150	$ 195,000
4.0" Terminal Flush Port	EA	8	$ 2,500	$ 20,000
Central Lift Station	LS	1	$ 400,000	$ 400,000
			Public Collection Subtotal	$ 1,351,500
			Miscellaneous & Contingency @ 15%	$ 202,725
			Collection System Total	**$ 1,554,225**
			Cost per Parcel	**$ 10,225**

Individual On-lot Facilites (assumed eligble for funding)				
Description	**Unit**	**Est Qty**	**Unit Cost ($)**	**Total Cost ($)**
New STEG Unit-Residential	EA	49	$8,000	$ 392,000
Upgrade Existing Tank to STEG Unit -	EA	50	$5,000	$ 250,000
New or Upgraged STEP Unit - Residential	EA	29	$13,500	$ 391,500
Commercial STEG/STEG Units	LS	1	$60,000	$ 60,000
			On-lot Collection Sub-total	$ 1,093,500
			Contingency @ 15%	$ 164,025
			On-Lot Facilities Total	**$ 1,257,525**
			Cost per Parcel	**$ 8,273**

Estimated Total Effluent Sewer Cost	**$ 2,811,750**
Estimated Cost per Parcel (ESD)	**$ 18,498**

Table E-7. Gravity Sewer Collection Alternative - Hybrid Village Eastside Sewer
Dillon Beach Village

Parcels: 72 + commercial (24 ESDs) **Design Flow: 7,150 gpd**

Public Sewer Facilities				
Description	**Units**	**Est Qty**	**Unit Cost ($)**	**Total Cost ($)**
6-inch gravity sewer	LF	3,110	$200	$ 622,000
Manholes	EA	9	$10,000	$ 90,000
Lampholes	EA	5	$1,500	$ 7,500
4" Force Main	LF	1,300	$140	$ 182,000
Lift Station (incl easement)	LS	1	$500,000	$ 500,000
Public Collection Subtotal				$ 1,401,500
Miscellaneous & Contingency @ 15%				$ 210,225
Engineering, Permitting, Administration @ 30%				$ 420,450
Collection System Total				**$ 2,032,175**
Cost per Parcel				**$ 21,168**

Oceana Marin Connection Fees and Facility Expansion				
Sewer Connection Fee - Residential	EA	72	$ 30,000	$ 2,160,000
Sewer Connection Fee - Commercial*	EA	24	$ 30,000	$ 720,000
Annexation	AC	7	$ 5,000	$ 35,000
Leachfield Expansion	LS	1	$ 252,000	$ 238,000
Total Oceana Marin Sewer Connection Costs				$ 3,153,000
Estimated Total Project Cost				**$ 5,185,175**
Estimated Cost per Parcel				**$ 54,012**

***** Connection fee for commercial properties not currently established by NMWD; to be determined based on wasteater loading equivalency; preliminary assumption of 24 ESDs for Beach Restroom, Rental Cabins,Store, Deli & Café

Appendix F

Oceana Marin

Waste Discharge Requirements
Order No. 92-57

California Regional Water Quality Control Board
North Coast Region

ORDER NO. 92-57
ID NO. 1B80173MAR

WASTE DISCHARGE REQUIREMENTS

FOR

NORTH MARIN WATER DISTRICT
OCEANA MARIN

Marin County

The California Regional Water Quality Control Board, North Coast Region (hereinafter the Board), finds that:

1. The North Marin Water District (hereinafter referred to as the discharger) submitted a report of waste discharge on March 21, 1991. The report of waste discharge was considered complete after the discharger submitted additional information on November 20, 1991.

2. The discharger owns and operates the wastewater treatment and disposal facilities for the Oceana Marin Subdivision in the SE 1/4 of Section 21, T5N, R10W, MDB&M near the community of Dillon Beach in Marin County as shown on Figure 1. The effluent disposal facilities lie within the watershed of the Estero de San Antonio.

3. The treatment and disposal facilities at Oceana Marin consist of an aerated pond followed by a storage pond. Solids are retained and reduced in the aerated pond. This facility has no sludge handling facility. Disinfected secondary effluent is disposed using a shallow trench, pressure distribution system. The majority of the wastewater is discharged to the disposal system during the dry summer months. Additional disposal may occur during dry periods in the winter. The projected maximum rate of effluent disposal to the pressure distribution system is 53,000 gallons per day.

4. The Board adopted Water Quality Control Plans for the Klamath River Basin (1A) and the North Coastal Basin (1B) on March 20, 1975. The Klamath River Basin Plan (1A) was combined with the North Coastal Basin Plan (1B) to form the Water Quality Control Plan for the North Coast Region. The Plan for the North Coast Region was adopted by the Board on April 28, 1988 and approved by the State Water Resources Control Board on November 15, 1988. The Plan includes water quality objectives and receiving water limitations.

5. The beneficial uses of the Estero de San Antonio and its tributaries include:

   a. municipal and domestic supply

b. agricultural supply
c. water contact recreation
d. noncontact water recreation
e. ocean commercial and sport fishing
f. wildlife habitat
g. marine habitat
h. fish spawning
i. shellfish harvesting

6. The beneficial uses of areal groundwaters include:

a. domestic water supply
b. agricultural water supply

7. The discharge is presently governed by Waste Discharge Requirements, Order No. 86-49, adopted by the Board on April 10, 1986.

8. This project consists of the operation or minor alteration of an existing facility which involves minimum change in use beyond that previously existing. Furthermore, a negative declaration for construction and operation of the disposal facilities was prepared and approved by the North Marin Water District on September 18, 1990. The Board has determined that compliance with this Order will mitigate any potential adverse water quality impact.

9. The Board has notified the discharger and interested agencies and persons of its intent to prescribe waste discharge requirements for the discharge and has provided them with an opportunity to submit their written comments and recommendations.

10. The Board, in a public meeting, heard and considered all comments pertaining to the discharge.

THEREFORE, IT IS HEREBY ORDERED that Waste Discharge Requirements, Order No. 86-49 are rescinded and the discharger, in order to meet the provisions contained in Division 7 of the California Water Code and regulations adopted thereunder, shall comply with the following:

A. DISCHARGE PROHIBITIONS

1. The discharge of waste to land that is not under the control of the discharger is prohibited.

2. The discharge of any waste not specifically regulated by this Order is prohibited.

3. Creation of a pollution, contamination, or nuisance, as defined by Section 13050 of the California Water Code (CWC), is prohibited. [Health and Safety Code, Section 5411]

4. The discharge of untreated waste from anywhere within the collection, treatment, or disposal facility is prohibited.

5. The discharge of waste from the Oceana Marin Wastewater Treatment and Disposal Facilities to the Estero de San Antonio or its tributaries is prohibited.

6. The discharge of waste to the surface of the ground is prohibited.

B. DISCHARGE SPECIFICATIONS

1. The maximum daily discharge to the disposal system shall not exceed 53,000 gallons per day.

2. Wastes discharged to the disposal system shall not contain constituents in excess of the following limits:

Constituent	Units	Mean	Maximum
BOD (20°C, 5-day)	mg/1	50*	80
Nonfilterable Residue	mg/1	50*	80
Coliform Organisms	MPN/100 ml	--	230

3. The discharge shall not impart taste, odor, or color to areal groundwater.

---

* The arithmetic mean of the values for effluent samples collected in a period of 30 consecutive days.

C. PROVISIONS

1. A copy of this Order shall be maintained at the discharge facility and be available at all times to operating personnel.

2. Severability

   Provisions of these waste discharge requirements are severable. If any provision of these requirements is found invalid, the remainder of these requirements shall not be affected.

3. Operation and Maintenance

   The discharger must maintain in good working order and operate as efficiently as possible any facility or control system installed by the discharger to achieve compliance with these waste discharge requirements.

4. Change in Discharge

The discharger must promptly report to the Board any material change in the character, location, or volume of the discharge.

5. Change in Ownership

In the event of any change in control or ownership of land or waste discharge facilities presently owned or controlled by the discharger, the discharger must notify the succeeding owner or operator of the existence of this Order by letter, a copy of which must be forwarded to the Board.

6. Vested Rights

This Order does not convey any property rights of any sort or any exclusive privileges. The requirements prescribed herein do not authorize the commission of any act causing injury to persons or property, nor protect the discharger from his liability under federal, State, or local laws, nor create a vested right for the discharger to continue the waste discharge.

7. Monitoring

The discharger must comply with the Contingency Planning and Notification Requirements Order No. 74-151 and the Monitoring and Reporting Program No. 92-57 and any modifications to these documents as specified by the Executive Officer. Such documents are attached to this Order and incorporated herein. Chemical, bacteriological, and bioassay analyses must be conducted at a laboratory certified for such analyses by the State Department of Health Services. In the event a certified laboratory is not available to the discharger, analyses performed by a noncertified laboratory will be accepted provided:

a. A quality assurance/quality control program is instituted by the laboratory. A manual containing the steps followed in this program must be kept in the laboratory and available for inspection by staff of the Board. The quality assurance/quality control program must conform to EPA guidelines or procedures approved by the Board.

b. The laboratory will become certified within the shortest practicable time if the State Certification Program is resumed.

8. Inspections

The discharger shall permit authorized staff of the Board:

a. entry upon premises in which an effluent source is located or in which any required records are kept;

b. access to copy any records required to be kept under terms and conditions of this Order;

c. inspection of monitoring equipment or records; and

d. sampling of any discharge.

9. Noncompliance

In the event the discharger is unable to comply with any of the conditions of this Order due to:

a. breakdown of waste treatment equipment;
b. accidents caused by human error or negligence; or
c. other causes such as acts of nature;

the discharger must notify the Executive Officer by telephone as soon as he or his agents have knowledge of the incident and confirm this notification in writing within two weeks of the telephone notification. The written notification shall include pertinent information explaining reasons for the noncompliance and shall indicate what steps are being taken to prevent the problem from recurring.

10. Revision of Requirements

The Board requires the discharger to file a report of waste discharge at least 120 days before making any material change or proposed change in the character, location, or volume of the discharge.

11. Operator Certification

Supervisors and operators of municipal wastewater treatment plants shall possess a certificate of appropriate grade in accordance with Title 23, California Code of Regulations, Section 3680. The State Board may accept experience in lieu of qualification training. In lieu of a properly certified wastewater treatment plant operator, the State Board may approve use of a water treatment plant operator of appropriate grade certified by the State Department of Health Services where reclamation is involved.

12. Adequate Capacity

Whenever a publicly owned wastewater treatment plant will reach capacity within four years, the discharger shall notify the Board. A copy of such notification shall be sent to appropriate local elected officials, local permitting agencies, and the press. The discharger must demonstrate that adequate steps are being taken to address the capacity problem. The discharger shall submit a technical report to the Board showing how flow volumes will be prevented from exceeding capacity, or how capacity will be increased, within 120 days after providing notification to the Board, or within 120 days after receipt of Board notification, that the POTW will reach capacity within four years. The time for filing the required technical report may be extended by the Board. An extension of 30 days may be granted by the Executive Officer, and longer extensions may be granted by the Board itself. (CCR Title 23, Section 2232)

13. The discharger shall comply with the following time schedule to assure compliance with the terms and conditions of this Order:

	Task	Date
a.	Implement a study program to develop a long-term wastewater treatment and disposal plan for the Oceana Marin Subdivision.	August 1, 1992
b.	Select and complete a long-term master plan for wastewater treatment and disposal. This plan shall include a time schedule for implementation of the long-term master plan.	May 1, 1994

Certification

I, Benjamin D. Kor, Executive Officer, do hereby certify that the foregoing is a full, true, and correct copy of an Order adopted by the California Regional Water Quality Control Board, North Coast Region, on June 25, 1992.

Benjamin D. Kor
Executive Officer

(wdromarin)

California Regional Water Quality Control Board
North Coast Region

MONITORING AND REPORTING PROGRAM NO. 92-57

FOR

NORTH MARIN WATER DISTRICT
OCEANA MARIN SUBDIVISION

Marin County

INFLUENT MONITORING

Constituent	Units	Sampling Frequency
Average Daily Flow	Gallons per Day	Continuously

DISPOSAL FIELD MONITORING

During periods when wastes are discharged from the Oceana Marin Treatment System to the effluent disposal field, water level measurements shall be taken weekly in monitoring wells located in the disposal field. The monitoring well locations shall be approved by the Executive Officer.

EFFLUENT MONITORING

During periods when wastes are discharged fromthe Oceana Marin Treatment System to the effluent disposal field, the following monitoring shall be conducted:

Constituent	Units	Type of Sample	Sampling Frequency
BOD (20°C, 5-Day)[1]	mg/l	Grab	Monthly
Nonfilterable Residue	mg/l	Grab	Monthly
Coliform Organisms	MPN/100ml	Grab	Monthly
Chlorine Residual	mg/l	Grab	Weekly
Average Daily Flow	gpd	--	Continuously

REPORTING

Monitoring reports shall be submitted monthly by the 15th day of the following month. In reporting the monitoring data, the discharger shall arrange the data in tabular form to clearly illustrate compliance with the waste discharge requirements. In any month that no waste is discharged to the effluent disposal field, the monthly monitoring report shall specify no discharge.

---

[1] COD monitoring may be substituted for BOD monitoring if the discharger can demonstrate a correlation between these parameters. This change must be approved, in writing, by the Executive Officer.

In addition to the above, the discharger shall have all flow measuring devices tested annually and their accuracy certified. This certification shall be submitted annually with the monitoring report for the month of October.

Ordered by
Benjamin D. Kor
Executive Officer

June 25, 1992

(omarin.m&r)

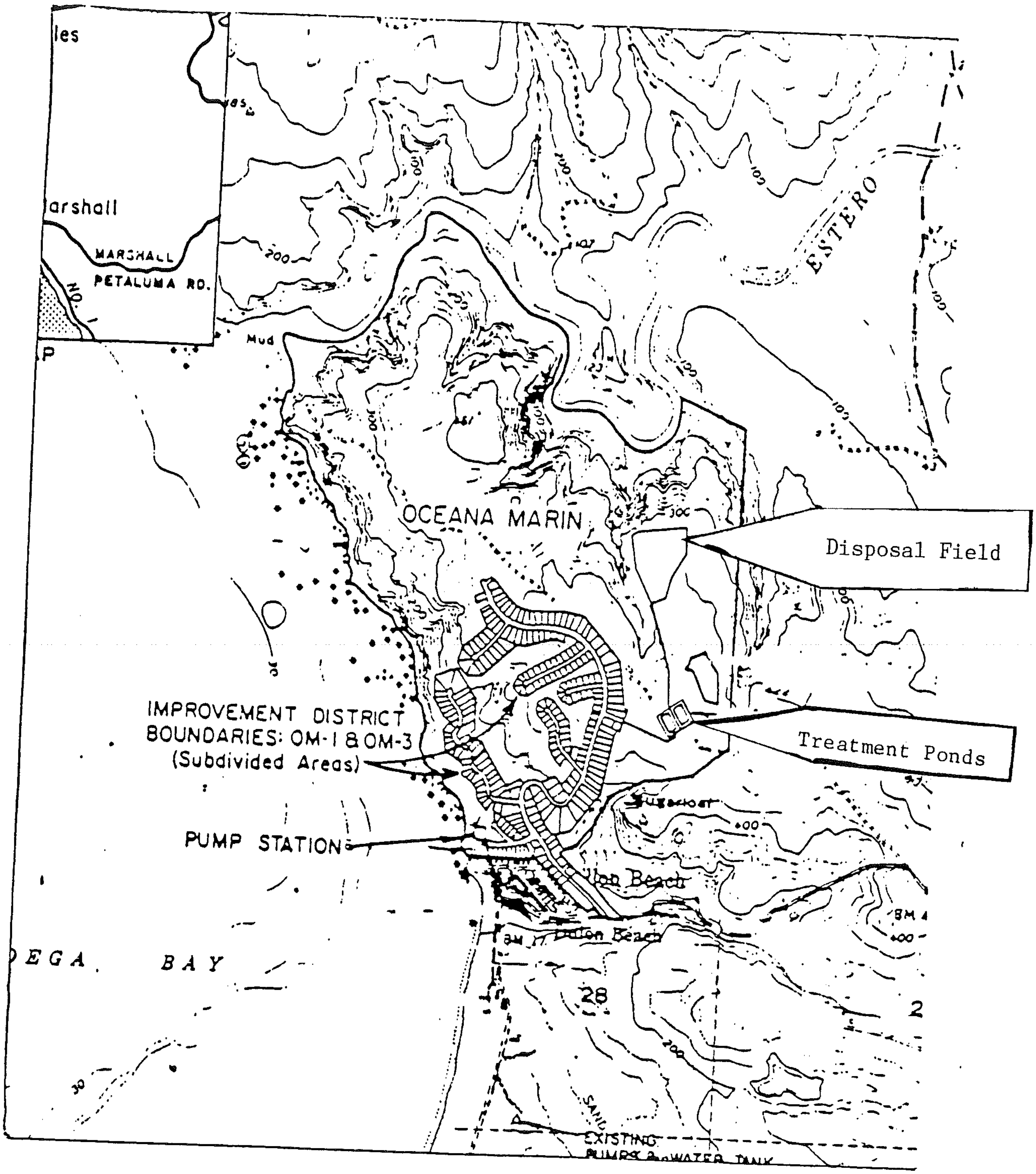


FIGURE 1

Location of Oceana Marin Wastewater Treatment and Disposal Facilities

Calif(ia Regional Water Quality Control ,ard
North Coast Region

CONTINGENCY PLANNING AND NOTIFICATION REQUIREMENTS

FOR

ACCIDENTAL SPILLS AND DISCHARGES

ORDER NO. 74-151

The California Regional Water Quality Control Board, North Coast Region, finds that:

1. Section 13225 of the Porter-Cologne Water Quality Act requires the Regional Board to perform general duties to assure positive water quality control.

2. The Regional Board has been advised of situations in which preparations for, and response to accidental discharges and spills have been inadequate.

3. Persons discharging waste or conveying, supplying, storing, or managing wastes or hazardous materials have the primary responsibility for contingency planning, incident reporting and continuous and diligent action to abate the effects of such unintentional or accidental discharge.

THEREFORE, IT IS HEREBY ORDERED THAT:

I. All persons who discharge wastes or convey, supply, store, or otherwise manage wastes or other hazardous material shall:

   A. Prepare and submit to this Regional Board, according to a time schedule prescribed by the Executive Officer, a contingency plan defining the following:

      1. Potential locations and/or circumstances under which accidental discharge incidents might be expected to occur,

      2. Possible water quality effects of accidental discharges,

      3. The conceptual plan for cleanup and abatement of accidental discharge incidents, including:

         a. The individual who will be in charge of cleanup and abatement activities on behalf of the discharger,

         b. The equipment and manpower available to the discharger to implement the cleanup and abatement plans,

   B. Immediately report to the Regional Board any accidental discharge incidents. Such notification shall be made by telephone as soon as the responsible person or his agent has knowledge of the incident.

   C. Immediately begin diligent and continuous action to cleanup and abate the effects of any unintentional or accidental discharge. Such action shall include temporary measures to abate the discharge prior to completing permanent repairs to damaged facilities.

D. Confirm the telephone notification in writing within two weeks of the telephone notification. The written notification shall include: reasons for the discharge, duration and volume of the discharge, steps taken to correct the problem and steps being taken to prevent the problem from recurring.

II. Upon original receipt of phone report (I.B.), the Executive Officer shall immediately notify all affected agencies and known users of waters affected by the unintentional or accidental discharge.

III. Provide updated information to the Regional Board in the event of change of staff, size of the facility, or change of operating procedures which will affect the previously established contingency plan.

IV. The Executive Officer or his employees shall maintain liaison with the discharger and other affected agencies and persons to provide assistance in cleanup and abatement activities.

V. The Executive Officer shall transmit copies of this Order to all persons whose discharges of waste handling activities are governed by Waste Discharge Requirements or an NDPES permit. Such transmittal shall include a current listing of telephone numbers of the Executive Officer and his key employees to facilitate compliance with Item I.B of this Order.

Ordered by ____________________
Benjamin D. Kor
Executive Officer

July 24, 1974
(Retyped February 15, 1990)

Your primary notification should be to the Regional Board office in Santa Rosa at (707) 576-2220. During off hours, you will be able to leave a recorded message at that number and, if you have a spill or discharge emergency, you will also be referred to the State Office of Emergency Services (OES) at (800) 852-7550. OES maintains a roster of key employees and will relay your notification to Regional Board staff.

California Regional Water Quality Control Board
North Coast Region

GENERAL MONITORING AND REPORTING PROVISIONS

February 3, 1971
(Retyped June 13, 1989)

GENERAL PROVISIONS FOR SAMPLING AND ANALYSIS

Unless otherwise noted, all sampling, sample preservation, and analyses shall be conducted in accordance with the current edition of "Standard Methods for the Examination of Water and Waste Water" or approved by the Executive Officer.

All analyses shall be performed in a laboratory certified to perform such analyses by the California State Department of Health or a laboratory approved by the Executive Officer.

All samples shall be representative of the waste discharge under the conditions of peak load.

GENERAL PROVISIONS FOR REPORTING

For every item where the requirements are not met, the discharger shall submit a statement of the actions undertaken or proposed which will bring the discharge in full compliance with requirements at the earliest time and submit a timetable for correction.

By January 30 of each year, the discharger shall submit an annual report to the Regional Board The report shall contain both tabular and graphical summaries of the monitoring data obtained during the previous year. In addition, the discharger shall discuss the compliance record and the corrective actions taken or planned which may be needed to bring the discharge into full compliance with the waste discharge requirements.

The discharger shall file a written report within 90 days after the average dry weather flow for any month that equals or exceeds 75 percent of the design capacity of the waste treatment or disposal facilities. The report shall contain a schedule for studies, design, and other steps needed to provide additional capacity or limit the flow below the design capacity prior to the time when the waste flow rate equals the capacity of the present units.