North Marin Water District

2015 MASTER PLAN UPDATE

Final Report

For the Oceana Marin Wastewater System

NMWD Job File 8 4046.00

January 13, 2016

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NUTE ENGINEERING
Civil & Sanitary Consultants

January 13, 2016

Mr. Drew McIntyre, Chief Engineer
North Marin Water District
999 Rush Creek Place
Novato, CA 94948

Re: Oceana Marin Wastewater System
2015 Master Plan Update
NMWD Job File 8 4046.00

Letter of Transmittal

Dear Drew:

As authorized we have completed the 2015 Master Plan Update for the Oceana Marin Wastewater System.

In brief summary, we have identified improvements to the gravity sewer system necessary to reduce the entrance of extraneous water due to infiltration/inflow as well as improvements to the main pump station and the treatment and storage ponds necessary to improve their reliability. We also recommend construction of a parallel force main from the main pump station to the ponds to improve reliability and provide redundancy. The effluent disposal field requires additional study to determine if improvements might be necessary.

The most critical project involves upgrading the main pump station by relocating the motor control center and other electrical equipment out of the pump pit to a new small building next to the engine generator set building. This will eliminate the possibility that the electrical work will be flooded out which would render the pump station inoperable.

The estimated cost of these improvements in 2015 dollars is $3.12 million, not including any improvements to the disposal field. If these improvements are undertaken over a 20 year period the annual expenditure would be $156,000, plus the adjustment for inflation.

We appreciated the opportunity to assist the NMWD on this planning effort and hope to keep involved as these projects are implemented.

Very truly yours,

NUTE ENGINEERING

By: _____
Mark T. Wilson, P.E.

By: _____
W. Edward Nute, P.E.

NORTH MARIN WATER DISTRICT
OCEANA MARIN WASTEWATER SYSTEM 2015 MASTER PLAN UPDATE

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BACKGROUND

The Oceana Marin subdivision was originally developed in the 1960s and is located just north of the older unincorporated community of Dillon Beach. The streets in Oceana Marin are private and patrolled but the community is not gated.

Wastewater in Oceana Marin is collected by gravity sewers and then pumped to a treatment facility consisting of two ponds and a subsurface disposal field. Since all treated wastewater is retained on land the Oceana Marin facility is able to operate under Waste Discharge Requirements which were adopted in 1992. Except for nine homes, the community of Dillon Beach is not connected to the Oceana Marin sewer system.

The current Oceana Marin wastewater system now serves 229 single family homes with a build out potential of approximately 300 homes. Potable water is provided to Oceana Marin residents by the Estero Mutual Water Company and the Cal Water Service Company, depending on location.

Oceana Marin is situated on a hillside above the Pacific Ocean overlooking a popular recreational beach. Any sewage spill would flow directly onto the beach and into the Pacific Ocean. Fines assessed for a spill could be very large. For this reason it is important to assure there is sufficient redundancy and reliability in the wastewater collection, pumping, treatment and disposal system.

A Long Range Plan Update, dated December 2005, was prepared for the Oceana Marin Wastewater System by Bracewell Engineering, Inc. The 2005 Long Range Plan updated previous plan reports prepared in 1990 and 1996. These earlier plans provided background information on the wastewater flows and operational data on the pumping, treatment and disposal trenches.

The wastewater treatment system consists of two ponds, one of which is used primarily for storage. The overall capacity of the Oceana Marin sewer system is limited by the ability of the trench disposal system to dispose of the treated effluent, which includes extraneous infiltration/inflow (I/I) to the sewer system, rainwater falling on the ponds and pond seepage return flows. The 2005 Long Range Plan concluded that the capacity of the pond treatment system was adequate for the projected growth through 2015.

The recommendations of the 2005 report focused on improving and optimizing the effluent disposal field. In addition, the report recommended that a study be conducted of how best to minimize the I/I to the sewer system to allow more efficient operation of the pump station and to increase the margin of safety in the operation of the disposal field.

There are also concerns about the wind erosion of the banks of two treatments ponds and there have been instances of plugging of the drip irrigation lines going to the leach field by algae from the ponds. It may be necessary to line the ponds or at least control the bank erosion. The ponds are close to various potable water well sites so it is important to make sure there is no cross contamination.

The disposal capacity of the trench field was tested in 1995 and found to be 63,000 gallons per day (gpd). The 2005 report did not test the trench field but concluded that the disposal capacity was 29,600 gpd based on actual operation. Apparently, the lesser disposal capacity is adequate for the present needs but it may be advisable to set up another test. The original testing was conducted twice, once during the spring and a second time during the summer. Each test was conducted over a 30 day period.

OBJECTIVE

The objective of the 2015 Master Plan Update for the Oceana Marin Wastewater System is to update the previous Master Plans including an evaluation of the capacity and future demands over a 20 year planning period and to provide a list of recommended capital improvement projects.

APPROACH

The operational success of the Oceana Marin sewage system depends on the disposal of all the sewage and any extraneous water generated in the sewer system. The approach to developing the 2015 Master Plan Update will consist of analyzing and updating the available flow and monitoring data in the previous master plans, reviewing the present condition of the various pumping, treatment and disposal facilities and developing a program of capital improvements.

The following are considered critical factors in the operation of the Oceana Marin system:

- Minimize inflow/infiltration of extraneous storm water and groundwater which enter the sewer system.
- Ensure reliability of the pump stations.
- Provide redundancy in the mechanical systems as well as the force main. Construction of a second parallel force main might be advisable.
- Maintain the pond treatment and storage capacity of the two ponds including controlling bank erosion.
- Maintain the effectiveness of the trench disposal system as necessary to dispose of all the wastewater generated in Oceana Marin.

Because of the close proximity of Oceana Marin to beaches the Long Range Plan Update summarized below focuses on providing redundancy and reliability for the Oceana Marin sewer system.

PREVIOUS STUDIES

Since its construction in the 1970s the following studies have been conducted on the Oceana Marin wastewater system:

- Bracewell Engineering, "*Disposal System Capacity at Oceana Marin Final Report*", 1990
- Bracewell Engineering, "*Long Range Master Plan for Oceana Marin Wastewater System*", 1996
- Bracewell Engineering, "*Long-Range Master Plan Update for Oceana Marin Wastewater System*", December 2005

The 1990 report evaluated the capacity of the disposal field and recommended modifications to the pond treatment system and disposal field to increase the effluent disposal capacity. These improvements were completed in 1991.

The 2005 Master Plan Update reviewed the operation data of the Oceana Marin system and concluded that the capacity of the existing disposal system is the limiting unit process.

FACILITY INSPECTION

As a part of developing the Master Plan an inspection of the Oceana Marin facilities was made on April 16, 2015. Inspections were made of the two pump stations, the treatment and storage ponds, dosing siphon and disposal field. We also walked the sewer alignment along the cliff below Kailua Way. In attendance were Robert Clark, Brad Stompe and Vernon Stafford of the NMWD staff, Todd Beecher of Beecher Engineers, Troy Pearce of AYS Engineering Inc. and Mark Wilson and W. Edward Nute of Nute Engineering.

SERVICE NEEDS

The Oceana Marin service area is shown on Figure 1, which shows the NMWD Improvement District of Oceana Marin and Dillon Beach and the annexations. The Oceana Marin service area comprises all of Oceana Marin and nine homes along Ocean View Ave in the older section of Dillon Beach.

Land Use in Oceana Marin is governed by the Dillon Beach Community Plan dated August 1989, which was approved by the California Coastal Commission in June 1989. Oceana

1"=200'

FIGURE 1

NO.	DATE	REVISION	BY	APP.
2	9/3/13	ADDED ANNEXATION NO. 11 TO OM-3	AC	CC
1	01/04/07	ADDED ANNEXATION NO. 10 TO OM-3	AC	CC
0	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	CH	SCALE	: 1"=200'
	CC		DATE	: 11/01/04
APPROVED: CHIEF ENGINEER			SHEET NO.	: 1 OF 1 SHEETS
R.E. C40936			SERVICE AREA	JOB.NO. NO.001

Jan 14, 2014 - 3:01pm W:\MAPPING\ANNEXATIONS\OCEANA MARIN AERIAL>_recover.dwg User: ALANTILLER

Marin is a planned community with single family homes and a potential for multiple units. Table 1 summarizes the potential dwelling units in the Oceana Marin service area.

TABLE 1 – OCEANA MARIN SERVICE AREA – SERVICE CONNECTIONS

	Potential Homes	Existing Homes
Oceana Marin		
Original subdivision unit	262	216
Parcel J	3	3
Parcel K zoning	14 – 38	0
Parcel L zoning	5 – 13 (act = 4)	0
Parcel M	1	1
Old Dillon Beach homes	17	11
TOTALS	**302 – 334**	**231**

Even though Parcels K and L are zoned for as many as 38 and 13 homes respectively it is likely that the actual number will be on the low end. In fact Parcel L, zoned for 5 – 13 homes, was subdivided into only 4 parcels in 2006. The number of lots was restricted because of a jurisdictional wetlands on the parcel.

Assuming the low numbers of homes for Parcels K and L the potential build out of the present service area would be 302 units. For the purpose of this study it is estimated that the total number of connections to the present service area of the Oceana Marin sewer system will be around 300 homes.

The vacant lots in the original subdivision are slowly being built out. Historically NMWD estimates that the rate of growth in Ocean Marin has been approximately 1 new home connection per year.

The occupancy of the homes in Oceana Marin is difficult to estimate. There are some full time residents, weekenders, renters as well as seasonal weekenders and renters. The Bracewell Master Plan of 2005 analyzed the flow records between 1973 and 2005 and concluded that the average occupancy was 1.35 persons per home with a flow of 76 gallons per capita per day (gpcd). In the ten years since 2005 there h have been only 13 new connections and the conditions in Oceana Marin have not changed except for the recent drought. For the purpose of this report it is concluded that the occupancy of 1.35 persons per connection appears to be reasonable.

Table 2A

NMWD OCEANA MARIN WASTEWATER SYSTEM

INFLUENT FLOWS TO PONDS, Gallons

YEAR	2009	2010	2011	2012	2013	2014	2015	ADF
JAN	330,000	914,000	790,000	475,000	930,000	382,000	930,000	21,894
FEB	663,000	581,180	577,000	432,000	426,000	658,000	564,350	19,906
MAR	383,000	649,000	875,330	640,000	422,000		449,036	18,378
APR	420,000	533,000	577,000	558,000	498,000	590,439	405,011	17,055
MAY	440,000	276,000	522,000	416,000	390,000	410,000		13,194
JUNE	448,000	641,000	484,000	408,000	408,000	455,000		15,800
JULY	614,000	589,000	799,000	434,000	751,000	610,307		20,416
AUG	440,000	651,000	535,000	547,000	376,000	532,004		16,565
SEPT	441,000	388,000	414,000	432,000	404,000	370,491		13,608
OCT	386,000	411,000	424,000	422,000	421,000	381,494		13,148
NOV	361,000	414,000	467,000	425,000	460,000	438,000		14,250
DEC	419,000	924,000	535,000	783,000	237,000	1,035,200		21,146
TOTALS	5,345,000	6,971,180	6,999,330	5,972,000	5,723,000	5,862,935	2,348,397	

Table 2B

NMWD OCEANA MARIN WASTEWATER SYSTEM

DISCHARGE TO IRRIGATION FIELDS OCT - SEPT

YEAR	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15
OCT	0	0	637,000	559,000	0	212,000
NOV	0	699,000	662,000	0	0	344,000
DEC	647,000	718,000	632,000	0	0	0
JAN	347,000	591,000	0	818,000	0	992,000
FEB	738,000	858,000	0	809,000	0	254,000
MAR	924,000	1,190,000	0	770,000		725,000
APR	592,000	880,000	0	0	892,560	98,000
MAY	782,000	1,010,000	0	529,000	542,000	
JUN	0	0	294,000	156,000	489,000	
JUL	555,000	400,100	582,000	304,000	0	
AUG	1,040,000	771,000	757,000	359,000	459,000	
SEP	0	0	603,000	377,000	0	
TOTALS	5,625,000	7,117,100	4,167,000	4,681,000	2,382,560	2,625,000

WASTEWATER FLOWS

The main Oceana Marin pump station is equipped with a flow meter as is the discharge to the effluent disposal field. Table 2A summarizes the monthly influent flows pumped to the treatment pond between 2010 and 2015 and Table 2B summarizes the monthly flows to the disposal field between the months of October through September of the next year for the years 2010 – 2015.

As described above Oceana Marin has some full time residents, including renters and some vacation rentals. The higher flow for June, July and August would correspond with vacation rentals during the summer. Because of its remote location and uncertain weather, Oceana Marin will probably never be fully occupied with permanent residents.

Table 3 gives two projections of the average dry weather flow (ADWF) and two projections of the per capita flow rate. The first projection includes only the months of June July and August and the second includes the months of May through September. As can be seen in Table 2A the three summer months and particularly the month of July have higher flows than May and September, probably due to higher summer occupancy. The three month ADWF is approximately 10% higher than the five month ADWF.

TABLE 3 DRY WEATHER FLOW ASSUMPTIONS

Connections	229
Average Occupancy Rate, persons/connection	1.35
Average Population	309
ADWF June, July, August, 2009–2014, gallons	17,612
Per capita flow, gpcd	57
ADWF May through September, 2009-2014, GPD	15,917
Per capita flow, gpcd	51.5
Biochemical Oxygen Demand (BOD), mg/l	200
Suspended Solids, mg/l	200

Using the Bracewell assumption of 1.35 persons per connection and the existing 229 connections to the Oceana Marin sewer system the per capita flow rate is computed to be 57 gpcd for June July and August which represents a 25% reduction from the 76 gpcd projected by Bracewell in 2005. This reduction may be explained by the prolonged drought in the area. For the five months between May and September the per capita flow rate computes to be 51.5 gpcd. Once the drought subsides the per capita sewage discharge may rebound closer to the 76 gpcd.

For the purpose of projecting annual base sewage flows we have assumed that the May through September ADWF is more appropriate. For the existing development of 229 homes the annual base sewage flow @15,917 GPD will be 5,809,705 gallons.

At a full build-out the Oceana Marin development of an estimated 300 homes at the Bracewell occupancy rate of 1.35 persons/connection and a per capita flow rate of 51.5 gpcd would produce a dry weather flow of around 20,858 god producing an annual base flow of 7,612,988 gallons. If the per capita flow rate increases to 76 gpcd the annual base flow will be 11,234,700 gallons.

Infiltration/Inflow – The flow pumped to the ponds is influenced by infiltration/inflow (I/I) into the sewer system. The County maintains a weather station at Oceana Marin. Graphs of the daily rainfall for 2010 through 2015 are shown in Appendix A. The recorded rainfall totals between October 1 and September 30 for these years together with the measured sewage flow and flow to the disposal field are shown in Table 4.

The flows to the disposal field are managed so that the ponds are as low as possible at the end of the dry season, i.e. in October. This maximizes the ability to store winter flows in the ponds and minimizes the loading on the disposal field in the winter. During the summer and over a prolonged drought water is lost through evaporation, which accounts for the lower flow applied to the disposal field than comes into the ponds.

TABLE 4 – RAINFALL VERSUS TOTAL ANNUAL FLOWS

Time period	Rainfall	Total flow to ponds, gal	Excess flow over base flow*, gal	Total flow to disposal field, gal
10/1/09–9/30/10	30.93”	6,338,180	528,475	5,625,000
10/1/10–9/30/11	36.01”	7,322,330	1,512,625	7,117,100
10/1/11–9/30/12	23.95”	5,768,000	(41,705)	4,167,000
10/1/12–9/30/13	23.82”	6,235.000	425,295	4,681,000
10/1/13–9/30/14	18.12”	5,126,241	(190,037)	2,382,560
10/1/14–4/15/15	22.69”	4,203,091	828,687	2,625,000

*Base flow for the existing 229 connections is estimated to be 5,809,705 gallons or as prorated for missing data.

It should be noted that 2014 and 2015 were considered drought years and the domestic water usage and I/I would have been lower than the historic normal. During these years the flow to the disposal field was about half that of other years.

Although this is less than six full years of data it is apparent that the total flow to the ponds is greatly influenced by the rainfall. The average rainfall for Oceana Marin is probably

around 30". The last four years had less than normal rainfall. It should be noted that for the period between October 1, 2014 and April 2015, a total of 12.69" of rain was recorded in December 2014 and 3.58" of rain fell over three days in February 2015. These two concentrated storms probably account for the 868,687 gallons of excess sewage flow over the prorated base flow even though the total rainfall October 1, 2014 to April 2015 was only 22.69".

Based on the six years of data summarized in Table 4, during a normal year the excess sewage flow over the base flow, which is pumped to the ponds on an annual basis, is estimated to account for an additional 1,000,000 gallons. During a wet year the excess annual flow could constitute approximately 2,000,000 gallons. These excess flows represent the I/I entering the system and it should be emphasized that these I/I amounts are only estimates to be used for planning the operation of the disposal field.

Projected annual wastewater flows – Based on the above analysis Table 5 gives the existing and projected annual wastewater flows for dry and wet years and assuming an occupancy of 1.35 persons per connection and 51.5 gpcd flow rate and no change in the I/I rates.

TABLE 5 – PROJECTED ANNUAL WASTEWATER FLOWS, gallons

	Existing 229 homes	**Build-out 300 homes**
Dry year		
Domestic wastewater flow	5,809,705	7,612,988
I/I flow	1,000,000	1,000,000
Totals	6,809,705	8,612,988
	Existing 229 homes	**Build-out 300 homes**
Wet year		
Domestic wastewater flow	5,809,705	7,612,988
I/I flow	2,000,000	2,000,000
Totals	7,809,705	9,612,988

WASTEWATER FACILITIES

The Oceana Marin Wastewater Facilities consist of a conventional sewer collection system, two pump stations, pressure force mains, a pond treatment system and a subsurface land disposal field. Many of these facilities were constructed with the initial development and various improvements have been made over the years.

The collecting sewers are located on generally west facing slopes where any spills would drain toward the Pacific Ocean and the beaches below the cliffs. The disposal field is located on a north facing slope which drains toward the Estero de San Antonio which discharges to the Pacific Ocean.

The treatment ponds and disposal field are located on the top of the hill above the development. Estero Mutual Water Company and the Cal Water Service Company maintain potable water facilities nearby, including wells and a storage pond.

REGULATORY ISSUES

The Oceana Marin sewer system is under the jurisdiction of the California Regional Water Quality Control Board North Coast Region. Waste discharge requirements (WDR) have been issued rather than a NPDES Permit. Since the Oceana Marin system discharges treated effluent to the land through an underground disposal field there is no discharge to receiving waters.

The current WDR for the Oceana Marin system are set forth in Order No. 92-57, ID No. 1880173MAR (see Appendix B) and references a project which involved minor changes to the original facilities. This order describes the project location and the treatment and disposal system in use. The Water Quality Control Plan for the North Coast Region adopted April 28, 1988 is referenced as the basis for this order.

The Oceana Marin disposal system is within the watershed of the Estero de San Antonio. The listed beneficial uses of the Estero de San Antonio and its tributaries include municipal and domestic water supply, water contact recreation, fish spawning and shellfish harvesting. These beneficial uses are very restrictive and dictate the discharge requirements set forth in Order No. 92-57.

Sewage from Oceana Marin is treated in an aerated pond and the treated effluent is disposed of through underground leach lines. The disposal field is to be operated so that no water surfaces or runs off. Order No. 92-57 requires that the pond effluent be disinfected after the pond treatment and prior to going to the leach field. Since no effluent surfaces or runs off, disinfection does not seem to serve any purpose. In fact, the residual chlorine may be affecting the micro biology in the soil.

Waste Discharge Requirements Review Procedures – The current WDR is now 23 years old and the Water Quality Control Plan for the North Coast Region now in effect is dated May 2011. This plan includes a policy on the control of water quality with respect to onsite waste treatment and disposal practices, which primarily pertains to individual septic tanks and leach fields but would also apply to the Oceana Marin disposal system, since there are no specific policies regarding large disposal fields.

In order to get an idea of the way the State handles WDRs we contacted Blair Allen of the San Francisco Bay Regional Water Quality Control Board. He explained that the Oceana Marin WDR is very old and that WDRs do not have fixed expiration dates, or a mandated renewal schedule. Internally, the Water Boards have an administrative protocol for periodic review of WDRs, with a 3-tiered schedule of 5, 10 or 15 years between reviews, based on the case's assigned "Threat-to-Water-Quality" rating.

In the past decade actual implementation of WDR reviews has been hampered by limited budget and staff. So in reality the individual Water Boards may be seriously back-logged on their formal review schedule.

Aside from a standard review protocol, the alternate approach is to consider the actual discharges, the discharge facility, infrastructure, natural surroundings, who is operating it, and so forth, and compare that with the WDR. If the WDR does not reflect current water quality requirements or the facility has a history of non-compliance, then it deserves attention. If the WDR is even partially in tune with current requirements, then perhaps the WDR does not have to be reconsidered very often.

Statewide General Waste Discharge Requirements for Sanitary Sewer Systems – On May 2, 2006 the State Water Resources Board adopted Order No. 2006-0003-DWQ which set forth requirements for all publically owned sewer systems greater than one mile in length. These Statewide General Waste Discharge Requirements focused on preventing sanitary sewer overflows (SSOs) to receiving waters and required each agency to develop a Sewer System Management Plan (SSMP).

In December 2013 NMWD adopted an SSMP for the Oceana Marin sewer system. The SSMP set forth management, operation and maintenance goals for the sewer system together with specific measures and procedures for containing any sewage spills. Required spill notification procedures and report forms are also included.

State Water Board Policy for Onsite Wastewater Treatment Systems – State Water Board policy regulates onsite wastewater treatment systems (OWTS). The policy was adopted June 19, 2012 and will be incorporated in the next update of the Water Quality Control Plan for the North Coast Region.

Recommendation – It is recommended that NMWD initiate discussions with the staff of the North Coast RWQCB regarding updating the WDR to conform to any new State policies regarding land disposal facilities applicable to the Oceana Marin system. Oceana Marin has a good record of compliance so the update may not be a high priority. The RWQCB staff should be kept apprised of improvements made to the Oceana Marin wastewater facilities and the issue of disinfection by chlorination prior to final disposal in the effluent disposal field be reviewed.

2015 MASTER PLAN ESTIMATED COSTS

The facility improvements described below are intended to be incorporated into the 20 year Master Plan for Oceana Marin. The cost estimates are planning level estimates based on 2015 construction costs for the San Francisco Bay Area representing an ENR construction cost index of 11,160. The allowance for contingencies and incidentals does not include costs for project design and construction management. The construction costs for future years are escalated on a 5% annual inflation factor to the year of construction.

SEWAGE COLLECTION SYSTEM

The Oceana Marin development is located at Dillon Beach in West Marin County and was developed in the 1960's and 1970's. The publicly owned sewage collection system is about 5 miles long and generally consists of gravity sewer mains, the majority of which are asbestos cement pipe (ACP). Over the years there has been some root intrusion, internal deterioration and pipe failures due to ground movement. Where repairs have been made sections of PVC or ductile iron pipe have been installed. As described below three sewers were rehabilitated in 2012 using cured in place pipe (CIPP) liners.

All sewage is pumped to a wastewater treatment facility consisting of a treatment pond and a storage pond. The treated effluent from these ponds is applied to the land via subsurface disposal. In order not to overload the subsurface disposal field it is important to limit the entrance of extraneous infiltration and inflow (I/I) into the sewer system.

The sewer system also includes sewer laterals which are privately owned. The length of the private laterals is roughly equivalent to the length of the publically owned sewer mains.

The Oceana Marin development is located on very steep terrain and many of the public sewage collection lines are located both in paved roads and in easements below the homes. Some of the slopes where the sewers are in easements range in grade from 20 to 35%, Some manholes can only be accessed by foot. The steeper easement areas are generally grassy and brushy and in some areas there has been some local ground movement. Along the cliff above the ocean the backyards are mostly covered with heavy ice plant. There are no backyard fences and few private property improvements to restrict access.

I/I Reduction – I/I is defined as excess groundwater or rainwater which enters the sewer system. Infiltration is defined as groundwater which enters pipes underground. Inflow is rain water which enters the sewer system through illegal drainage connections. A third component is rainfall induced I/I which is water that can enter the sewers through underground pipe defects during intense rainfall events.

Unlike pressure pipes such as water mains, leaks do not come to the surface to evidence themselves but must be detected through various technologies. As a practical matter it will never be possible to completely eliminate I/I from a gravity sewer system. Rehabilitation projects are never perfect and some leaks will remain or will increase because other nearby leaks have been "bottled up". In other words, expectations of I/I reduction need to be tempered with reality. The greatest I/I reductions will be achieved by assigning the highest priority to repairing or rehabilitating those sewers or manholes which are discovered to have identifiable defects.

I/I can be reduced by rehabilitating the sewers including the private laterals. If it is assumed that sewer mains and laterals are equally leaky and that the public sewer mains represent about half of the pipeline length in the ground then rehabilitation projects that focus on the sewer mains will only address half of the problem. In some cases when the sewer main is

rehabilitated so it is relatively watertight the groundwater will migrate to enter defects in the private laterals.

Many sanitation agencies have spent years and many dollars rehabilitating their sewers with very little to show for it in terms of I/I reduction. Some agencies rehabilitate the private laterals along with sewer main rehabilitation projects or require homeowners to repair their laterals when defects are found. In the San Francisco Bay Area sanitation agencies are adopting ordinances which require homeowners to inspect and test their lateral on sale of the property and rehabilitate it if it is found defective. This "point of sale" lateral inspection requirement results in a lengthy time to reduce I/I from laterals since there are generally not many home sales in any one year.

The main tools for locating leaks in sewers are closed circuit televising (CCTV) and smoke testing. NMWD already has a well-developed program for CCTV of the sewer mains on a regular schedule. The last smoke testing was done in 2014.

Smoke Testing – Smoke testing involves blowing non-toxic smoke into a section of sewer through a manhole while making observations of smoke coming out of the ground indicating a defect or coming out of a drain indicating an illegal drainage connection. The defects are documented and the smoke coming out of the ground is photographed. Where defects or illegal drainage connections are found in private laterals notices are sent to the property owner with a request to repair the defect. This procedure requires notification of homeowners of the smoke test, conducting the smoke testing, documentation of the defects, sending notices to the property owners to repair the defect found, and follow up with smoke testing to make sure the repair has been made and is successful.

Pipe Segment Inventory and CCTV – NMWD cleans and televises one fifth of the sewer pipe segments in Oceana Marin each year. Televising is done with a closed circuit TV (CCTV) camera and the results are summarized in a spreadsheet which is updated every two years. The inventory spreadsheet of 2014 is included as the NMWD OM Master Sewer List, Appendix C. Private laterals have not been inspected.

The Appendix C spreadsheet identifies sewer defects and problems together with recommendations for repairs. The length of the different pipe types in the system, the number of structures and the number of various types of defects found are summarized in Table 6 below.

Joint offset, joint separation, cracks and exposed gasket make up more than a third of the defects found and slightly less than one third of the defects are roots in the pipe joints even though there are very few trees in Oceana Marin. If there were more trees this total would be much higher. Grease and sags constitute about 14% of the defects.

TABLE 6– CCTV INVENTORY OF PUBLIC SEWER MAINS – 2014

PIPE TYPE	Length, feet	Percent
ABS	113	0.4
ACP	16,841	61.8
PVC	4,290	15.8
CIPP	3,257	12.0
Not reported	2,698	10.0
TOTALS	**27,199**	**100.0**
STRUCTURES		
Manholes	103	
Rodholes (Main line cleanouts)	36	
MAJOR DEFECTS FOUND BY CCTV		
Joint offset, joint separation, crack, gasket exposed	47	38.5
Sag in pipe or grease accumulation	17	14.0
Roots in joint	40	32.8
Infiltration/Inflow	7	5.7
Lateral problem at main	9	7.4
Camera can't get through pipe	2	16
TOTALS	**122**	**100.0**

There are some 103 manholes and 36 rodholes in the Oceana Marin sewer system. NMWD regularly inspects and smoke tests these structures and schedules repairs as necessary. NMWD inspection reports for work done on February 28, 2014 and dated 6/1/15 are listed in Appendix D.

Recommendations – It is recommended that reduction of I/I be continued as a long term objective. CCTV and smoke testing are tools to inventory the condition of sewer lines and locate leaks and identify repair locations and sewer rehabilitation projects as described below.

SEWER REHABILITATION

Rehabilitation of sewer mains and manholes will eliminate some of the I/I and should be continued on an on-going basis. The more I/I that can be reduced the less wastewater that needs to be pumped, treated and stored and ultimately discharged to the disposal field. Wet years will produce more wastewater because of the I/I generated in the sewers.

Some defects found in the CCTV are sags or grease accumulation. These types of defects are not necessarily related to I/I but may require more frequent maintenance to keep the sewer from becoming restricted. Sags will accumulate debris and grease and if the sewer

plugs up it could result in an overflow. CIPP lining or pipebursting will take the same alignment of the original sewer so a sewer with a sag must be dug up and a section re-laid to eliminate the defect.

The private sewer laterals will also contribute I/I. Smoke testing described above will be able to locate some of the points of direct inflow. The homeowner will need to be requested to fix the leak. However, since laterals are considered the property of the homeowner it will be difficult to require further lateral rehabilitation. Adopting an ordinance requiring that laterals be tested upon the sale of a home will be a way to test the laterals and get defective ones fixed over the long term.

The following is information on the sewer rehabilitation methods and a list of proposed sewer main rehabilitation projects which should be included in the Long Range Capital Improvement Plan (CIP).

Asbestos Cement Pipe (ACP) – The fact that the majority of the sewers in Oceana Marin are ACP limits the rehabilitation options. ACP was a common sewer and water pipeline material in the 1960's and 1970's. However, in the last several decades there is increasing awareness that asbestos can be a serious public health concern when friable and air borne and its disposal is now regulated by the EPA.

When it is underground and in use ACP is not considered to pose any public health risk because it is non-friable. However, if AC pipe is crushed, pulverized or reduced to a powder it is then considered to be friable and becomes a regulated asbestos containing material (RACM) waste. In 1991 the EPA took the position that "crushing" AC pipe with mechanical equipment would cause the crushed material to become RACM and that pipe crushed and left in place would cause the location to be considered an active waste disposal site. Pipebursting could cause the AC pipe to be categorized as regulated waste. Inactive lines should be kept on the agency's maps and marked as a USA line so contractors don't dig through it and break it up or crush it.

The owner of every site where AC pipe was pipeburst would need to notify the EPA of the owner's intent to become an active asbestos landfill, meet deed restrictions, submit closure requirements and mapping documentation. In addition, future excavation work in the vicinity would require an additional 45 day notification of intent to disturb landfill material. Other Federal, State or local permit conditions may apply.

ACP Sewer Rehabilitation Methods – In order to avoid the regulatory issues described above ACP sewers should be rehabilitated by a method other than pipebursting such as replacement or with some type of lining such as cured-in-place-pipe (CIPP) lining. CIPP involves inserting a resin impregnated liner into an existing sewer. The liner takes the shape of the sewer and the pipe ends up slightly smaller in diameter than the original pipe. The lining thickness can be specified for a fully deteriorated pipeline where the liner must take the full external load. For 6" diameter sewers the CIPP lining is generally about 4.5

mm thick, which will only reduce the inside diameter by 3/8 of an inch. The resin impregnated liner can be cured with either steam or UV light depending on the product manufacturer. Laterals must be reconnected to the CIPP liner, which can become a point where infiltration/inflow can enter. CIPP lining is an appropriate trenchless technology for rehabilitation of ACP sewers because it leaves the ACP in place as the host pipe.

Inverting a CIPP liner in a 6" pipe is difficult because it tends to hang up on slight joint offsets. Consequently, contractors do not like to use CIPP lining on 6" pipe so the cost will be about the same as CIPP lining of an 8" or even 10" pipe.

2012 Sewer Rehabilitation Project – The District has rehabilitated three of the cross country sewers on steep gradients in Oceana Marin using the CIPP lining process totaling 2,850 feet of 6" and 8" pipe. The purpose of the project was to prevent further deterioration, eliminate potential separation at bell and spigot joints, reduce infiltration/inflow and minimize the potential for sewer spills. The three sewers which were lined ran from Kameha Way to Kailua Way, Kona Lane to Kailua Way and Waikiki Lane to Kailua Way. The greatest elevation difference from top to bottom of one of the sewers was 320 feet. The sewer laterals were not rehabilitated but re-connected to the CIPP liner.

Identified Rehabilitation Projects – Based on the CCTV results NMWD routinely undertakes maintenance and repairs as indicated such as cutting roots and digging down and repairing cracks and other isolated defects. Some lines have multiple defects and it is advisable to undertake a capital improvement project to rehabilitate one or more segments of sewers. The following is a list of recommended sewer rehabilitation projects, also shown on Figure 2, together with their estimated costs:

Project S-1 – Pump Station to Kailua Way: MH 1 through MH 3 to MH 10 Kailua Way (477') – The CCTV revealed several sags, infiltration and a separated joint. Part of this line crosses a gully in an above ground pipe. According to the original plans this is 10" diameter ACP except that 40' of ductile iron (DI) pipe was used to span the gully. The plans show a grade of 0.005 which should be adequate. It is unclear why there are sags; either the pipe was improperly laid originally or there has been some ground movement. This line is near the edge of the cliff above the ocean so ground movement is a possibility. If the ground is moving the line may need relocation away from the cliff, which would also probably mean relocating the pump station. A geotechnical investigation would be appropriate to check on the stability of the cliff. This also applies to Project S-2 described below. If the sag is not a major problem and the line is judged to be adequate then it could be CIPP lined. The estimated cost of the CIPP lining of this sewer is given below:

477 LF CIPP lining of 10" ACP	@$75/LF	$35,775
Contingencies and Incidentals (35%)		12,525
TOTAL ESTIMATED CONSTRUCTION COST		$48,300

Project S-2 – Kailua Way Ocean Side: MH 12 thru MH 13, MH 14, MH 15, MH 16, MH 17 to CO 8 (1,125') – This series of sewers runs along the top of the cliff behind the homes on the west side of Kailua Way. The cliff is covered with heavy ice plant so it is difficult to see if there are any cracks or ground movement. The CCTV revealed a number of sags and separated joints in this line. This line is noted as all 6" PVC so it should not be as fragile as ACP. CIPP lining or pipebursting using an HDPE liner would seal up this pipe but unless the sags are dug up and re-laid they will remain. The estimated cost of the CIPP lining of this sewer is given below:

1,125 LF CIPP lining of 6" PVC	@$75/LF	$84,375
Contingencies and Incidentals (35%)		29,625
TOTAL ESTIMATED CONSTRUCTION COST		$114,000

If the cliff becomes unstable and this sewer is threatened it might be necessary to abandon it and require the property owners to install pumps that pump to the existing sewer in Kailua Way. This could involve up to 15 homes. The cost of installing a high end duplex (2 pump) home pumping system can be $25,000. Sometimes the home service is inadequate to add a pump and needs to be upgraded. Even if NMWD pays for the pump installation it can be a difficult process to require home owners to take on the ongoing maintenance and electric cost.

Project S-2A – Kailua Way Segment Replacement: MH 12 to MH 13 and MH 16 to MH 17 (380') – The only pipe segments in Project S-2 with noted sags and joint offsets are between MH 12 to MH 13 and MH 16 to MH 17. These segments could be rehabilitated with a CIPP lining or pipeburst but the sags will remain unless they are dug up and re-laid. The estimated cost of digging up and replacing these two sewers is given below:

380 LF Replace 6" PVC	@$200/LF	$76,000
Contingencies and Incidentals (35%)		26,000
TOTAL ESTIMATED CONSTRUCTION COST		$102,000

Project S-3 – Oceana Drive CIPP Lining: MH 23 to MH 24 (Oceana Drive) thru MH 25, MH 26, to CO 6 (1,005') – This series of sewers are all 6"ACP and the CCTV notes many separated joints and roots with a comment "potential slip line". It is not clear why there are so many roots entering this line unless it was defective or if there has been ground movement. MH 23 is located in an easement behind 320 Oceana Drive and runs uphill to MH 24, which is in Oceana Drive. This series of lines could be rehabilitated with CIPP lining. The distance between MH 26 and CO 6 is almost 450 feet, which is longer than the industry standard of 200 feet and an intermediate manhole should be added. The estimated cost of the CIPP lining of this sewer plus an additional manhole is given below:

1,005 LF CIPP lining of 6" ACP	@$75/LF	$75,375
Manhole	@$5,000	5,000
Subtotal		$80,375
Contingencies and Incidentals (35%)		27,625
TOTAL ESTIMATED CONSTRUCTION COST		$108,000

Project S-4 – Ocean Drive Rear Easement: MH 28 thru MH 29, MH 30, to MH 31 (933') – This is a 6" ACP easement sewer behind homes #360 and #380 Oceana Drive. The CCTV inspection reported sags and joint separations in this line. There was also a note that there appeared to be I/I in this line even though it does not serve many homes. If the line is judged to be adequate then it could be CIPP lined. The estimated cost of the CIPP lining of this sewer is given below:

933 LF CIPP lining of 6" ACP	@$75/LF	$69,975
Contingencies and Incidentals (35%)		24,025
TOTAL ESTIMATED CONSTRUCTION COST		$94,000

PUMP STATIONS

Two sewage pump stations serve Oceana Marin. The smallest pump station on Ocean View Ave, the North Street Lift Station, serves a localized area of old Dillon Beach and the main pump station pumps sewage from Oceana Marin to the ponds at the top of the hill. The pump stations were inspected on April 13, 2015 which included an inspection of the electric equipment by Todd Beecher of Beecher Engineering. The Electrical System Assessment Report by Beecher Engineering is reproduced in Appendix E.

North Street Lift Station – The North Street lift station serves 9 homes in old Dillon Beach along Ocean View Ave. The lift station consists of two ¾ horsepower submersible pumps located inside a manhole at the intersection of Ocean View Ave and North Street. Sewage is pumped through a 2-inch diameter force main one block on North Street to the gravity sewer on Oceana Drive with a vertical rise of about 16 feet. The electric meter and control panel is located in a free standing enclosure facing Oceana Drive next to 21 North Street.

The reserve capacity of the North Street Lift Station is just the volume of the manhole containing the pumps. A 4' diameter manhole has a volume of 94 gallons per foot of depth. Assuming a 3' deep manhole the storage volume is 283 gallons, which is less than the daily discharge volume from two homes. If there is a prolonged power outage NMWD should be prepared to provide a gas driven pump or tanker truck to pump out the lift station manhole.

Oceana Marin Main Pump Station – The Oceana Marin main pump station is located between the cul-de-sacs of Tahiti Way and Lanai Way and pumps sewage from all of the Oceana Marin service area to the treatment ponds on the top of the hill. This is a vertical rise of over 380 feet and requires special high head pumps. The pump station consists of a

below grade concrete structure and a small building housing a standby engine generator set. A flow meter is provided on the discharge force main.

The pump station is located at an elevation of approximately 66 feet and is near a cliff which leads down to the beach. The cliff is a type of sandstone and is eventually erodible, particularly as the sea level rises. At some point it may be necessary to relocate the pump station away from the cliff if it erodes to a point which is threatening the operation of the station. The incoming sewers, particularly from the north, should be monitored for damage from erosion.

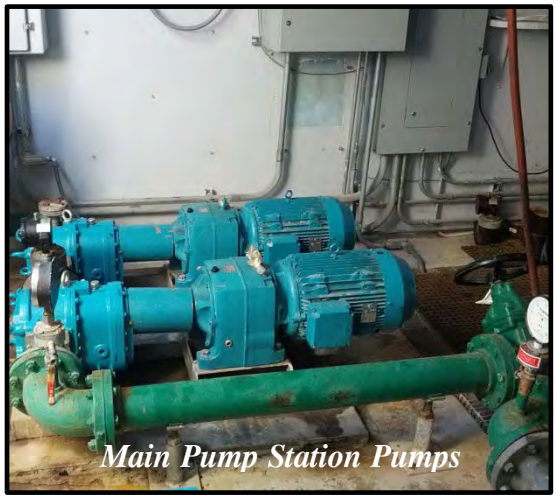
The pump station itself consists of a wet well which is separated from the dry well containing the pumps and electrical work by a wall. There is a grit catchment area in the wet well which is pumped out once a year. Aeration is provided for the sewage in the wet well to keep it fresh and reduce odors.

Oceana Marin Main Pump Station

The dry well part of the pump station contains two sets of rotary lobe pumps; four pumps total. Each set of two pumps are connected in series to be able to overcome the high pumping head. Each pump has a capacity of 100 gallons per minute (gpm) at a discharge pressure of 180 psi. Each set (Set A & B) have two pumps (Pump 1 & 2) the set of pumps (1 & 2) operate together. The lead pump 1 starts at 6' and stops at 2' The two sets of pumps A & B are in a lead lag operation and switch after every pump cycle. If one of the individual pumps (1 or 2) fails, that set automatically shuts off and the other set is called to run.

Doghouse Shed

The flowmeter is an Rosemont magnetic type with a 4" diameter flow tube, located in a pit outside the pump station. There is a single sump pump in the pump pit, which also contains the pump motors and critical electrical panels.


Main Pump Station Pumps

Main Pump Station Condition Assessment
The main pump station is one of the two most critical elements of the Oceana Marin system, the force main being the other critical element. Any overflow from a pump failure will flow directly down to the beach.

Most of the mechanical equipment appears to be well maintained and in good working order. The main concern with the existing pump station is that most of the electrical work and pump motors are all below grade so that if a pipe were to break or a leak were to occur and the sump pump could not handle the water all the major electrical equipment could become inoperable. In some cases a second sump pump has been installed to provide some redundancy. The assessment of the electrical equipment in the main Oceana Marin pump station is summarized in the Beecher Engineering report in Appendix E.

In order to improve the reliability against accidental flooding of the pump pit, which would damage the pump motors as well as any electrical work it is recommended that a second sump pump be installed as a backup to the existing sump pump.

Contingency Planning – In the event that the pumps and/or electrical work are flooded or otherwise fail or force main fails it will be necessary to transport the incoming sewage up the hill to the ponds. The very high static head from the pump station to the ponds precludes the use of conventional trash pumps as emergency pumps. The best method to deal with the sewage will be to hire tanker trucks to pump from the wet well and discharge to the ponds at the top of the hill. This contingency is addressed in the Sewer System Management Plan (SSMP) for Oceana Marin.

If a standby pump were to be used it would have to be a match of the existing pumps such as two dual rotary lobe pumps on a skid. However, the temporary pumps would have to be either connected to the electrical starters which are in the pump pit and difficult to work on or connected to the standby engine generator set with its own separate starter. The pumps are probably not readily available and this arrangement would not be easy to set up in an emergency. Consequently, use of tanker trucks would be the most expedient procedure.

The daily flow at Oceana Marin is estimated to be 15,000 gallons during dry weather. In wet weather the sewage flow could be much higher, even 30,000 gallons. The wet well if fully flooded has a storage capacity of around 12,000 gallons so it could hold almost 80% of a full day's flow during dry weather. Tank truck capacities will range from 3,000 gallons to 5,000 gallons and higher. The large capacity trucks are difficult to maneuver so it is probably not convenient for the Oceana Marin streets.

Accordingly, in dry weather during an emergency the sewage can be held in the flooded wet well and be pumped out with a 3,000 gallon tank truck five times a day until the repair is made. It should not be necessary to set up an emergency pump unless the shutdown is going to be prolonged.

Recommended Pump Station Improvements

The recommended improvements to the main pump station mostly involve improving reliability by upgrading some of the electrical equipment and relocation of the existing electrical equipment out of the pump pit to a new building which is above grade.

Project PS 1 – Miscellaneous Reliability Upgrades – The following reliability upgrades to the pump station are recommended:

Install redundant sump pump	$12,000
Install low pressure alarm on discharge force main	5,000
Estimated miscellaneous improvements	15,000
Subtotal	32,000
Contingencies and Incidentals (35%)	11,000
TOTAL ESTIMATED CONSTRUCTION COST	$43,000

Project PS 2 – Oceana Marin Pump Station PG&E Meter/Main Replacement – The existing PG&E meter and main circuit breaker enclosures have deteriorated beyond repair and require replacement. It is recommended that an outdoor, 316 stainless steel "meter/main" pedestal, rated for outdoor use, be installed within the existing "Doghouse" shed location (e.g., Tesco pedestal). This replacement will not require any modification to the existing PG&E service entrance other than engagement of PG&E to disconnect the existing meter and re-connect the new pedestal meter once it is installed. The estimated installed cost for this replacement is as follows:

Demolition of Existing Metering and Main Breaker Enclosure	$3,000
316 Stainless Steel Pedestal Meter/Main Enclosure	15,000
PG&E Cost:	3,000
Subtotal	21,000
Contingencies and Incidentals (35%)	9,000
TOTAL ESTIMATED CONSTRUCTION COST	$30,000

Project PS 3 – Relocation of Electrical Equipment to Aboveground Block Building – The location of the sewage pump LCP, PLC control panel, bubbler panel and main panelboard are all prone to failure due to below grade structure flooding. During discussions with NMWD, there seemed to be a comfort level that keeping the flowmeter, grinder LCP and blower equipment in the below grade structure would be acceptable since the operation of this equipment is not as critical to overall pump station operability as the level control system and sewage pumping. To mitigate these

vulnerabilities, it is recommended that the LCP/PLC/bubbler panel/main panelboard equipment be relocated to an above grade "add on" room, attached to the existing above grade block building. This new room could essentially become the "Electrical Equipment Room", constructed with block walls and an industrial type personnel door that provides a good seal from the outside elements. Based on preliminary measurements, existing equipment relocation to the interior of the existing standby generator room may not be possible due to National Electrical Code (NEC) clearance requirements. Additionally, the ventilation system within the generator room will expose the electrical panels to outside salt air on a regular basis (i.e., ventilation fan and louver system). Thus, an "add on" room to the existing building is recommended over using existing wall space within the existing standby generator room. Also included as part of this recommendation is the replacement of the existing ventilation louver and addition of flexible propane fuel piping connections for the existing engine generator. All motor control cabinets and hardware, even inside the building, should be type 314 stainless steel. Where possible items should be plastic.

The estimated installed cost for this recommendation is as follows:

Construct three sided block addition to engine generator building	$50,000
Relocate ATS from "Doghouse" to Electrical Room	25,000
New small panelboard to replace panelboard in "Doghouse"	5,000
Relocate Pump LCP's (Quantity 2)	15,000
Relocate PLC Control Panel	10,000
Relocate Bubbler Panel	10,000
Relocate Main Panelboard	15,000
Miscellaneous Electrical Costs	10,000
Subtotal	140,000
Contingencies and Incidentals (35%)	50,000
TOTAL ESTIMATED CONSTRUCTION COST	$190,000

FORCE MAIN

The force main from the main pump station to the ponds is 6" diameter epoxy lined ACP approximately 3,890 feet long. According to the plans the force main has two different pressure classes, Class 150 and Class 200 (rated at 150 and 200 psi respectively). The 380 foot elevation difference from the pump station to the ponds means that at the pump station end the static head is 164 psi, which together with friction losses when the pumps are pumping could approach the 200 psi rating of the pipe.

Although this force main has provided good service it is now some 50 years old. Also, since it is only a single pipe there is no redundancy in case something happens to the existing force main. Although isolated repairs can be made with full circle clamps any leakage will flow directly through the storm drainage system to the beach below. In order to provide redundancy it is recommended that a second force main be installed.

The route of the existing force main includes two easements as a short cut bypassing the large curve in Oceana Drive. However, this easement would be too crowded to accommodate a second new force main. The estimated cost of a new force main from the Oceana Marin pump station to the ponds, shown on Figure 2, assuming conventional trench restoration is given below.

Project FM-1 – Parallel Force Main (Entire force main)

4,610 LF 6" Force Main	@$200/LF	$922,000
Est. Connection at the pump station		5,000
Est. Connection at the ponds		3,000
Subtotal		$930,000
Contingencies and Incidentals (35%)		325,000
TOTAL ESTIMATED CONSTRUCTION COST		$1,255,000

It would be possible to stage the construction of this force main by connecting back to the existing force main in a couple of locations at the end of each phase. Starting at the pump station the force main could be constructed in three phases as follows:

Project FM-1A – Pump Station to 360 Oceana Drive

1,980 LF 6" Force Main	@$200/LF	$396.000
Est. Connection at the pump station		5,000
Est. Intermediate connection		5,000
Subtotal		406,000
Contingencies and Incidentals (35%)		142,000
TOTAL ESTIMATED CONSTRUCTION COST		$548,000

Project FM-1B – 360 Oceana Drive to Ocean View Blvd.

1,390 LF 6" Force Main	@$200/LF	$278,000
Est. Intermediate connection		5,000
Subtotal		283,000
Contingencies and Incidentals (35%)		99,000
TOTAL ESTIMATED CONSTRUCTION COST		$382,000

Project FM-1C – Ocean View Blvd to Treatment Ponds

1,240 LF 6" Force Main	@$200/LF	$248,000
Est. Connection at the ponds		3,000
Subtotal		251,000
Contingencies and Incidentals (35%)		89,000
TOTAL ESTIMATED CONSTRUCTION COST		$340,000

Recommendations – It is recommended that Project FM-1A be assigned a high priority. This initial segment will be located in streets and will provide a redundant force main to the existing segment which is located partially in easements and thus is more vulnerable to external damage. Furthermore, this segment has the highest internal pressure and the new replacement pipe will provide greater reliability.

The existing force mains paralleling the remaining two projects are subject to less internal pressure and are located in streets where they are less subject to external damage. Thus, Projects FM-1B and FM-1C should be assigned a lower priority.

POND TREATMENT AND STORAGE

The Oceana Marin treatment system consists of two ponds. The west pond is aerated and provides the treatment of the raw wastewater. The east pond is the storage pond and receives effluent from the treatment pond and provides storage of the treated wastewater prior to discharge to the effluent disposal field. Treated effluent is discharged from the north end of the storage pond and flows by gravity through a dosing siphon to disposal field leach lines.

A small chlorinator is used to disinfect the pond effluent prior to flowing to the disposal field. Since the effluent is disposed of underground, it is uncertain whether or not the chlorination has any adverse or beneficial effect on the biology in the disposal field. However, chlorination of effluent going to a leach filed is not a normal practice. The need to continue to disinfect should be brought up in discussions with the Regional Water Quality Control Board about renewing the waste discharge requirements.

The two ponds are constructed with dirt berms and are not lined. A gravel interceptor trench was installed for the length of the base of the southern berms of both ponds to intercept pond seepage and any surrounding groundwater. The intercepted water flows to a sump where a sump pump recycles it back to the east storage pond. Occasional gopher holes in the berms can be a problem that is monitored.

The date on the original plans for the ponds is 1972, which indicates they have been in service for over 40 years. There is no record of any cleaning of the ponds, so there will be some accumulation of undigestable sludge and algae.

Original Pond Design Characteristics – The original design characteristics of the treatment pond and storage pond from Table 1 of the 2005 Bracewell report are listed in Table 7 below.

TABLE 7 - OCEANA MARIN ORIGINAL POND DESIGN CHARACTERISTICS

Original Design	Treatment Pond (West Pond)	Storage Pond (East Pond)
Bottom width, feet	120	120
Bottom length, feet	240	240
Bottom area, sq. ft.	28,800	28,800
Side slopes	3:1	3:1
Surface area at 10' depth	54,000	54,000
Storage volume @ minimum (4') depth, gallons	997,000	997,000
Storage volume @ maximum (10') depth*, gallons	3,052,000	3,052,000
Aerators (3 hp each), number	2	0
Aeration capacity @ 2 lbs O_2/hp-hr	288	0

*Design freeboard when pond full = 2'

Pond Operation – The pond operation strategy involves using the disposal field during dry periods to lower the pond levels and maximize the available storage prior to rainy periods so the disposal field can rest and not become waterlogged.

If work has to be done on one of the ponds it should be possible to take it out of service by diverting the incoming flow to the other pond. Ideally this diversion should be done during dry weather when the incoming flows are low. This diversion would require installation of some temporary piping.

Treatment Pond Loading – Treatment ponds for domestic wastewater are generally designed to provide 30 day detention and a conservative organic loading of 35# to 50# BOD/acre/day. The pond detention times are much longer than 30 days as given in Table 8 below.

TABLE 8 - TREATMENT POND DETENTION TIMES VERSUS ANNUAL FLOWS

	Existing 229 homes	Build-out 300 homes
Dry year wastewater flow, gallons	6,475,000	8,074,000
Detention time, pond full (3,052,000 gal)	172 days	138 days
Detention time, pond half full	86 days	69 days
Wet year wastewater flow, gallons	7,475,000	9,074,000
Detention time, pond full (3,052,000 gal)	149 days	123 days
Detention time pond half full	75 days	62 days

The organic loading at full buildout of 300 homes with an assumed 44% occupancy and 2.5 persons per home and 0.17# BOD5/person calculates to be 56# BOD5/day. This represents a BOD5 loading of 45#/day when the pond is full, which is within the general design guidelines for a treatment pond. The aeration and excessively long detention times serve to further reduce the organic loading. The storage pond provides additional detention time which further reduces the organic loading with natural processes. This second pond provides polishing of the effluent prior to injection into the disposal field.

As a conclusion the treatment and storage ponds are well within design guidelines for the loading they receive now and at full buildout.

Berm Erosion – Some of the pond berms are eroding, probably from wind generated waves. The wind is primarily from the northwest which means that the southern and east berms are most eroded. The eroded soil has moved into the ponds and reduced their capacity.

Treatment Pond

If the ponds remain unlined at least the south and east berms should be stabilized. There are different ways to stabilize the banks. Stabilization can be "natural stabilization" by planting vegetation such as willows and cattails. However, this can make the ponds more difficult to maintain and control. An engineering bank stabilization approach can involve placing rip rap over a geofabric or geofabric placed over berms restored with compacted soil.

For budgeting purposes the cost of placing rip rap over stabilizing fabric on the upper 10 feet of all four berms around one pond, totaling 26,000 square feet, is given below.

P-1A & 1B - Pond Berm Repair using Rip Rap over Stabilization Fabric

Mobilization, bank preparation		$12,000
8 rolls Stabilization geofabric	@$500/roll	4,000
1,600 tons rock rip rap in place	@$125/ton	200,000
Labor		20,000
Miscellaneous		12,000
Subtotal		248,000
Contingencies and Incidentals (35%)		87,000
TOTAL ESTIMATED CONSTRUCION COST		$335,000

This cost is for stabilizing all four berms on one pond or stabilizing two berms on both ponds. Stabilization of all four berms on both ponds is estimated to cost $670,000.

An alternate, less expensive strategy which has been used on other ponds involves placing fabric and rip rap on the worst eroded sections. This can be done in sections over the years as the budget allows and would keep the protected berms from eroding to the point that threatens its structural integrity.

Pond Dredging – NMWD staff took soundings of the two ponds on May 20, 2015 and found that the ponds have silted in approximately a third of their depth. . This accumulated material will consist of the soil eroded from the eroded pond berms and accumulated sludge and dead algae. The pond soundings are shown in Appendix F and the depth and estimated volume of the sediment is given in Table 9 below.

TABLE 9 – ESTIMATED POND SEDIMENT DEPTH AND VOLUME

	Treatment pond	Storage pond
Average depth of sediment/sludge, feet	3.4	2.4
Est. volume of sediment/sludge, cubic yards	4,000	2,800

The minimum design water depth for the two ponds is 4' so the sediment/sludge has taken up most of this reserve. Although it appears that the ponds have lost storage volume the sediment eroded from the berms has settled in the pond bottom and the berm slopes have been reconfigured making the storage volume essentially the same when the pond is full. The storage volume is gone from the lower 2 to 3 feet of the ponds because of the sediment but there will be more storage volume available at the higher levels because of the eroded upper berms. However, to make use of the upper storage volume means that the water level in the ponds must be kept higher which will make the berms more vulnerable to further wind erosion.

The treatment pond appears to have about 1,200 cubic yards more of sediment/sludge than the storage pond, which could be caused by more erosion of the berms and/or an accumulation of undigested sludge and algae over its 40+ years of operation.

We contacted several companies which do pond dredging. Dredging can be done in several ways. One company would use a floating suction pump so the pond would need enough water in it to float the pump. The sludge slurry would either be pumped to another pond to eventually dry out or it can be mechanically dewatered so it can be trucked to a disposal site. Mechanical dewatering can involve a belt filter press using polymers or a large filter bag. If the dewatered sludge is to be trucked away it should be as dry as possible to minimize the trips and disposal costs. Mechanical dewatering may dewater the sludge to 25% solids, which means that 75% remains as water. Hauling to the Redwood Landfill together with their tipping fees would make this alternative even more expensive.

A local contractor, Poncia Fertilizer, cleans out small ponds for dairies and wineries and does work for the City of Santa Rosa. Without looking at the job site Andy Poncia estimated that if the ponds are dewatered as well as they can be he could use a long reach excavator and mud cat to load the sediment/sludge material to two on-site trucks to take it to a nearby disposal area, possibly on NMWD property adjacent to the existing ponds. His estimate for this work was $35,000 per pond. If the sludge/sediment had to be hauled to Redwood Landfill he estimates the trucking cost would be $125,000 per pond plus the tipping fees. He thought that the sediment/sludge from the pond would be too wet to be used to restore the eroded berms.

At Oceana Marin it may take several months to dry out the ponds so the sediment has a sufficiently low moisture level to allow it to be scooped up and trucked away without a lot of dripping and extra tipping fees. If the pond is going to be lined as described below it will need to be dried out so it can be graded smooth. During the drying period the storage pond will need to be used for treatment and it will be important that the effluent does not contain too much suspended material that might clog the leach lines in the disposal field.

Since this is a sewage pond, disposal of the sludge will need to conform to the requirements of EPA Part 503 Biosolids Rule (EPA/R-92/013). This rule is mainly concerned with heavy metals, stabilization of pathogens and attraction of vectors. Tests will need to be made for heavy metals, but since the sludge is from a residential area there should not be a problem. Stabilization of pathogens can be achieved by holding the sludge for a matter of time and vector attraction relates to how the sludge is handled.

In West Marin there is a lot of agricultural land and a land owner might want to accept the dredged material from the ponds. This will require permitting. If the sludge must be hauled to an appropriately permitted landfill it will probably have to go to the Redwood Landfill north of Novato. This is at least a 2 hour round trip. Per an email dated 6/29/15 from Waste Management the disposal cost pricing for this project will be $21.00 per ton with taxes and fees included if the soil qualifies for daily cover and $47.00 per ton with taxes and fees included if it is approved for disposal. If the sludge is not dewatered very well the total tipping fee will be high because the tonnage will include the water.

In order to dispose of the sediment/sludge on-site it will be necessary to excavate another pond nearby or find a local farmer who could accept the material. Both of these will require appropriate permits. Even disposal at the Redwood landfill will require testing of the material to make sure it does not contain heavy metals or other hazardous materials.

An onsite sediment holding pond could be constructed on NMWD property north of the existing ponds. The volume of this new pond will depend on the method of dewatering and whether or not the sediment will have a high water content. For the purpose of the cost estimate it is assumed that the holding pond will have a volume of 8,000 cubic yards which will hold an estimated 4,000 cubic yards of sediment from the treatment pond initially and then an additional 2,800 cubic yards from the storage pond. After the passage of time this material could be removed and spread out on adjacent land to make room for the next pond dredging if necessary.

The 8,000 cubic yard sediment holding pond would have the dimensions of approximately 140' x 200' x 8' deep with 1:1 or 1.5:5 sloping banks. The top 12" of soil which contains the organic material would be scarified, stripped off and placed on adjacent land. The lower material would be reserved in a separate pile to be used to reconstruct the slope of the pond berms.

As a caution the original 1972 plans for the pond construction show a "3" PVC and cables" running through the southwest corner of the west pond (treatment pond). The plans show a shallower excavation over these utilities to provide 30" of cover. According to the assessor's maps these utilities may run between two wells owned by the Estero Mutual Water Co. Any excavation work to clean out this pond will need to be careful not to damage these utilities or they should be relocated out from under the pond. In the estimate below it is assumed that the 3" PVC and cables will be relocated out of NMWD property, which may require a new easement on the adjacent private property.

Alternative A – Pond dredging using a holding pond for onsite disposal of the sediment

Project P-2A – Dredging of Treatment Pond (first pond)

Mobilization			$15,000
Relocation of 3" PVC and cables	630 LF	@ $80/LF	50,400
Construct sediment holding pond	8,000 cy	@ $6/cy	48,000
Dredge pond			35,000
Wooden Pier for support of instrumentation			15,000
Subtotal			163,400
Permitting cost			50,000
Contingencies and Incidentals (35%)			57,600
TOTAL ESTIMATED CONSTRUCTION COST			$271,000

Project P-2B - Dredging of Storage Pond (second pond)

Mobilization	$5,000
Dredge pond	35,000
Wooden piers for access to the valve and instrument support	20,000
Subtotal	60,000
Contingencies and Incidentals (35%)	21,000
TOTAL ESTIMATED CONSTRUCTION COST	$81,000

The total estimated cost for dredging the two ponds including construction of a nearby holding pond for the sediment is $352,000.

As an alternative project the sediment/sludge could be hauled to the Redwood landfill for disposal so that the sediment holding pond would not need to be constructed. However, there will be trucking costs and tipping fees. The estimated cost for pond dredging, hauling and disposal at the Redwood Landfill, assuming an average tipping fee of $47/ton, is given below.

Alternative B – Pond dredging with sediment disposal at the Redwood Landfill

Relocation of 3" PVC and cables	630 LF	@ $80/LF	$50,400
Dredge and haul sludge from the treatment pond (est. 4,000 cy)			125,000
Dredge and haul sludge from the storage pond (est. 2,800 cy)			125,000
Redwood landfill tipping fees	11,000 tons	@ $47/ton	517,000
Subtotal			817,400
Contingencies and Incidentals (35%)			286,600
TOTAL ESTIMATED CONSTRUCTION COST			$1,104,000

The hauling of the sediment and tipping fees at the Redwood Landfill make this alternative very expensive. Furthermore, if the ponds are dredged and the sludge/sediment is hauled to the Redwood landfill there will be no stockpile of excavated material from the holding pond excavation to be used to restore the pond berms. This soil would need to come from a separate excavation unless new soil is hauled in, which would be an added cost.

Pond Lining – The existing treatment and storage ponds are unlined. Ponds can be lined with a plastic material which can extend up the slope of the surrounding berms. A liner will prevent any exfiltration of water from the ponds and also prevent erosion of the berms.

In order to restore the berm slope so that the pond liner can be installed the pond will need to be dewatered and the sludge and sediment will need to be removed as described above. Before installing the liner the pond will need to be dry with smooth sides and no angular rock that may puncture the liner. A geofabric under the liner will provide some protection against rocks.

The various types of liners available include reinforced polypropylene, hypalon, low density or high density polyethylene and PVC. Reinforced polypropylene and hypalon have the best resistance to UV degradation. Reinforced polypropylene is seamed together with a hot wedge welder. The estimated cost of installing a pond liner in one of the ponds, assuming dimensions of the top of the berms are 300' x 180' is given below.

Pond Lining (300' x 180') – one pond

Mobilization			$10,000
Bank restoration and fine grading	3,000 cy	@ $15/cy	45,000
Geofabric			15,000
Polypropylene liner			42,000
Installation			18,000
Miscellaneous			10,000
Subtotal			140,000
Contingencies and Incidentals (35%)			50,000
TOTAL ESTIMATED CONSTRUCTION COST			$190,000

The estimated cost for lining both ponds will be around $380,000. As a practical matter, in order to dry out the pond bottom and keep one pond in service during the lining process, probably only one pond could be lined in a season. This work should be done during the summer months when there is no I/I. (Reference: Carson Manufacturing Co., P.O. Box 549, Cotati, CA 94931, 1-800-423-2380, Curtis 707-795-3141; (www.carsonliners.com).

It should be noted that a percentage of the sediment in the ponds probably comes from erosion of the pond berms. A liner extending onto the berms will prevent berm erosion but sludge will still accumulate. As determined above it took 40 years for the unlined ponds to fill in by 23% with a combination of sediment from the berms and sludge. If the ponds are lined the rate of deposition of sludge only should be much lower.

A pond liner should last 30 – 40 years. The unlined ponds have gone 40 years without major repair work except for the erosion of the berms and accumulation of sediment/sludge, which is now taking up space. A major problem with a pond liner is that it makes cleaning the ponds more difficult, although there should be less sediment because the berms would not be eroding. According to Andy Poncia the usual pond cleaning methods he uses tend to tear up plastic liners, which would need to be restored after cleaning. It may be necessary to use a floating suction dredge for the cleaning of a lined pond.

Electrical Equipment – The electrical equipment at the ponds is likely 30+ years old and is obsolete. Despite this obsolescence the equipment has been well maintained. Additionally, the motor controller panel construction is quite simple and future retrofitting of failed components within the existing controller compartments can likely be performed without too much difficulty. NMWD personnel reported that reliability of the electrical equipment at this site has been very good and no operational issues currently exist.

The PLC panel at this site is essentially new and in very good condition. NMWD personnel stated that this equipment is working well and no operational issues exist at this time.

Project P-3 – Electrical Equipment Replacement at Treatment Ponds – Due to the age of the motor controller equipment at the Treatment Ponds, it is recommended that NMWD plan for upgrading the existing electrical equipment with new components within the next 5-year time frame. The estimated cost of motor control equipment replacement at the treatment ponds is given below:

Electrical equipment replacement	$50,000
Contingencies and Incidentals (35%)	18,000
TOTAL ESTIMATED CONSTRUCTION COST	$68,000

Recommendations – It is recommended that the two ponds be dredged out and lined with a plastic liner. The most economical dredging method requires on site storage of the dredged material in an excavated holding pond. The excavated material from the holding pond will provide the necessary dirt for rebuilding the berm slopes prior to lining. Hauling the dredged out sludge to the Redwood Landfill would be very expensive.

A more expedient alternative would be to repair the eroded pond berms with rock rip-rap placed over geofabric. This could be done on an as needed basis. However it would not address the accumulated sediment and loss of storage volume in the ponds. Eventually the ponds should be dredged out and possibly lined.

The electrical equipment at the ponds is old and becoming obsolete so at some point it will need to be replaced.

EFFLUENT DISPOSAL SYSTEM

The Oceana Marin effluent disposal system consists of a pressure distribution/shallow gravel trench system. This type of system is suited for areas with high groundwater, steep slopes and low infiltration rates. Treated effluent is spread out over a wide area to enhance the infiltration and minimize the seepage to the surface. An automatic dosing siphon provides flow to the pressure distribution pipe network.

Dosing Siphon Tank

The disposal system was inspected on April 16, 2015 by Troy Pearce of AYS Engineering Group, Inc. The AYS report is included in Appendix G.

Automatic Disposal Field Valves

Disposal Field Description – The disposal field consists of 7 shallow pressure distribution leach lines located in moderately sloping terrain with shallow soils and perched seasonal ground water due to the underlying less permeable clay soils. The disposal trenches are fed by a dosing siphon with an average dose of approximately 2,200 gallons at a rate of around 25 gallons per minute. Effluent is conveyed to each of the 7 operating drain lines over 24 hours and is controlled via an irrigation control panel and automated valves. The individual drain lines average 530 feet long in trenches 1.5 feet wide with 24 inches of gravel and 8 inches of soil cover.

According to AYS the soils found in the area of the disposal field are not ideal for use as a drain field. However, with proper management this system could last for a very long time, although disposal fields can start to develop issues over time that will need to be addressed.

Disposal Field

The AYS report includes two tables of piezometer readings, one for 2003-04 and the other for 2014-15. The winter of 2003-04 was relatively wet and the winter of 2014-15 was a drought year. For 2003-04 the piezometer readings showed a relatively saturated field, whereas in 2014-15 the field was not saturated. With only two years of data there is insufficient information to make an evaluation of the capacity of the disposal field to dispose of effluent. AYS recommends that additional monitoring data be collected at more frequent intervals over a year so an evaluation can be made. It is proposed that most of this work be done by NMWD staff. The estimated cost for AYS to oversee this work is around $3,000.

Recommendations – Based on the AYS Report the following are recommendations for improvements to the disposal field and its operation.

1. Undertake additional monitoring of the piezometer levels and rainfall data which will provide insight to the operation of the system and provide data to establish the disposal capacity of the existing disposal system. The estimated cost for AYS to oversee this effort is $3,000.

2. Continue to maintain the fencing to keep the cows out of the disposal field area so the trenches don't get compacted.

3. Have a geotechnical engineer review the slide downslope of Line #1 to determine if the slide may have been caused by the use of the area above as a drain field.

4. Make the minor corrective work to the boxes that have been damaged by the cattle.

5. Undertake a trial to reduce the time each line is in service from 24 hours to 12 hours while increasing the monitoring to twice weekly. During this time take one of the lines out of service for a month to allow it to rest while monitoring the remaining field to see how the increase in effective loading is being tolerated.

6. Begin to prepare a system upgrade/failure plan for the disposal field in which new lines would be installed between the existing lines, which have wide spacing. The spreadsheet monitoring of the piezometers will be very useful in developing this plan. The cost for this project would have to be determined at a later date.

Although the existing effluent disposal system has functioned well there are some minor corrective actions which should be undertaken. It is recommended that the frequency of monitoring of the piezometers be increased to provide insight to the operation of the system and provide data to establish the disposal capacity of the existing disposal system.

It is also recommended that NMWD begin preparation of a system upgrade/failure plan for the disposal field in which new lines would be installed between the existing lines, which have wide spacing. The cost of this upgrade plan is yet to be determined.

RECOMMENDED ADDITIONAL STUDIES

In addition to the capital improvement projects described above it is recommended that NMWD undertake the following additional studies:

Project ST-1 – Electrical Power System Arc Flash Hazard Study – Arc flash hazard warning labels are required by NFPA 70E for power distribution equipment to enhance maintenance personnel safety. Modeling the existing power distribution systems at the Oceana Marin Pump Station and Treatment Pond sites will involve comprehensive field investigation to determine existing power system equipment ratings, connections, conductor sizes and conductor lengths. Once the systems are modeled within the software, short circuit analyses are performed to determine if the existing, installed equipment is adequately rated to withstand a fault condition at any point in the power system. After the short circuit analyses are completed, protective device coordination studies and arc flash hazard studies will be performed simultaneously to optimize system protection while minimizing arc flash hazard at all points in each system. Arc flash hazard warning labels are a code requirement. It is recommended that the District initiate the development of this labeling immediately to warn maintenance personnel about potentially dangerous locations within each facility with respect to electrical equipment arc flash hazard. The estimated cost for the Project ST-1 electrical power system studies is $25,000.

Project ST-2 – Site Reconnaissance of Geologic Hazard Along Ocean Bluff and Slide Below Effluent Disposal Field – It is recommended that NMWD undertake a preliminary study of the geologic hazard along the ocean bluff in the vicinity of the backyard sewer along Kailua Way and the main pump station. This would be a preliminary evaluation to determine if there is need for further investigations. Scott Stephens of Miller Pacific Engineering Group in Novato provided a budget for a geologic and geotechnical evaluation pand opinions on a conceptual level for these two features of $3,300.

Project ST-3 – Oversee Monitoring of the Disposal Field Piezometers – Oversee additional piezometer monitoring by AYS for an estimated cost of $3,000.

LONG RANGE IMPROVEMENT MASTER PLAN

The recommended Long Range Improvement Master Plan for the Oceana Marin wastewater system is shown in Figure 2 and includes an estimated $3.12 million dollars of improvements to the following facilities:

- Sewer collection system improvements primarily to reduce I/I
- Improvements to the main Oceana Marin pump station to improve its reliability and redundancy

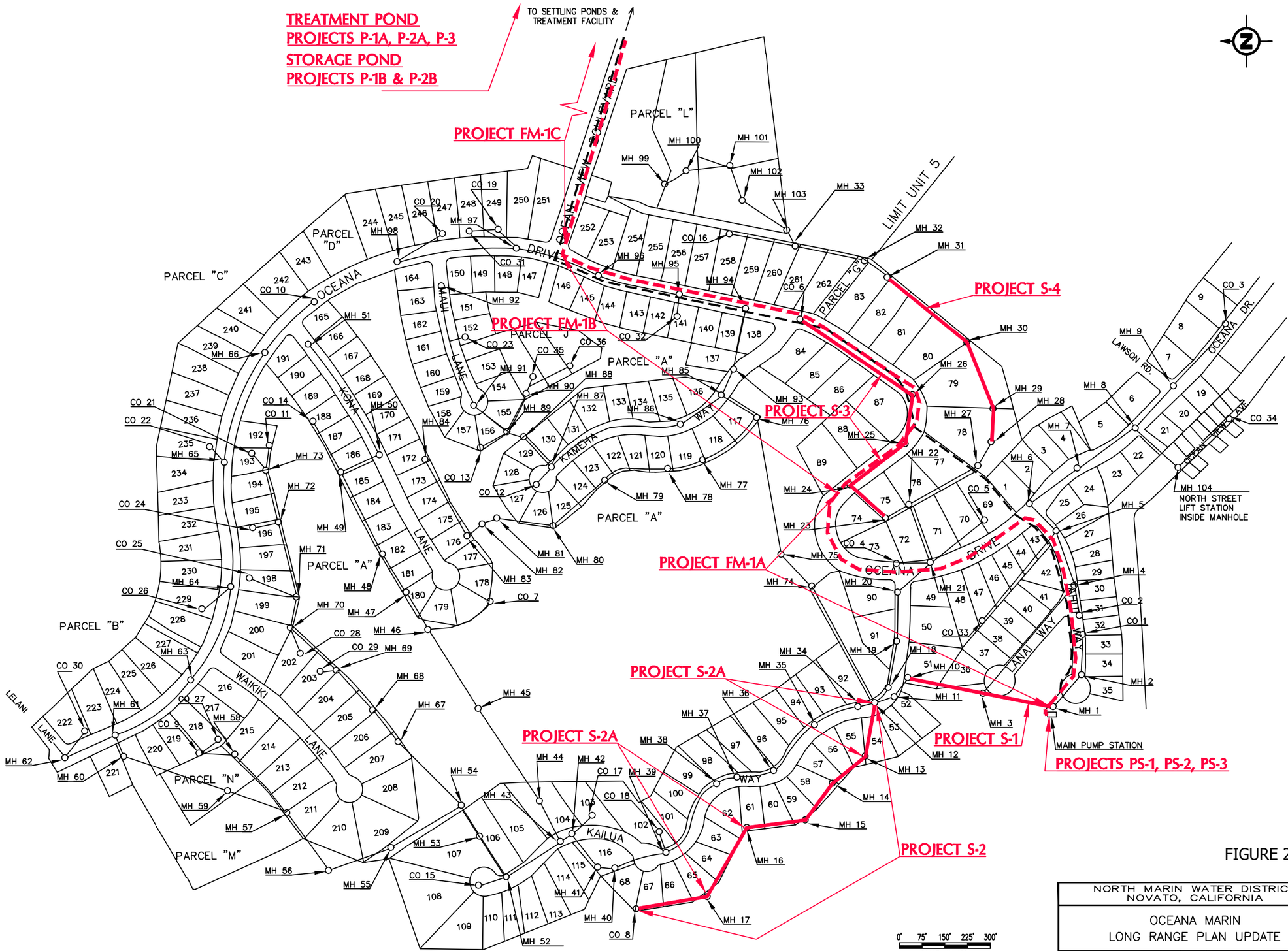


FIGURE 2

NORTH MARIN WATER DISTRICT NOVATO, CALIFORNIA			
OCEANA MARIN LONG RANGE PLAN UPDATE			
DATE CREATED:	BY:		SCALE: 1" = 150'
REVISION DATE:	BY:		DRAWING NO.
APPROVED DATE:	BY:		

Jan 19, 2016 - 2:04pm L:\District\NMWD\8464 Oceana Marin Long Range Plan\OM Sewer System CCTV Map.dwg User: PRISCILLA

- Force main improvements consisting of construction 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 effluent disposal field
- Additional studies of different aspects of the wastewater system

Priorities have been assigned to these projects in the following order:

- Improve unit process functioning
- Improve critical reliability and redundancy
- Reduce I/I from the sewer system

The list of improvement projects and their assigned priorities is given in Table 10 below.

It is recommended that NMWD begin to budget for these improvements to the Oceana Marin sewer system.

TABLE 10 – CAPITAL IMPROVEMENT PROGRAM PRIORITIES AND ESTIMATED PROJECT COSTS

Project Desig.	Description	Priority		
		High	Medium	Low
SEWER IMPROVEMENT PROJECTS				
S-1	Pump Station to Kailua Way: MH through MH 3 to MH 10 Kailua Way (477 feet)		$48,300	
S-2	Kailua Way Ocean Side: MH 12 thru MH 13, MH 14, MH 15, MH 16, MH 17 to CO 8 (1125')		$114,000	
S-2A Optional	Kailua Way Segment Replacement: MH 12 to MH 13 and MH 16 to MH 17 (380')			$102,000

Project Desig.	Description	Priority		
		High	Medium	Low
S-3	Ocean Drive CIPP Lining: MH 23 to MH 24 (Oceana Drive) thru MH 25, MH 26, to CO 6 (1,005')		$108,000	
S-4	Ocean Drive Rear Easement: MH 28 thru MH 29, MH 30, to MH 31 (933')		$94,000	
PUMP STATION IMPROVEMENT PROJECTS				
PS-1	Miscellaneous Reliability Upgrades	$43,000		
PS-2	Oceana Marin Pump Station PG&E Meter/Main Replacement	$30,000		
PS-3	Relocation of Electrical Equipment to Aboveground Block Building	$190,000		
FORCE MAIN IMPROVEMENT PROJECTS				
FM-1A	Pump Station to 360 Oceana Drive	$548,000		
FM-1B	360 Oceana Drive to Ocean View Blvd.		$382,000	
FM-1C	Ocean View Blvd to Treatment Ponds			$340,000
POND IMPROVEMENTS				
P-1A	Treatment Pond Berm Repair with Riprap	$335,000		
P-1B	Storage Pond Berm Repair with Riprap		$335,000	
P-2A	Dredging of Treatment Pond (first pond)	$271,000		
P-2B	Dredging of Storage Pond (second pond)		$81,000	
P-3	Electrical Equipment Replacement at Treatment Ponds		$68,000	
DISPOSAL FIELD IMPROVEMENTS			TBD	
STUDIES				
ST-1	Electrical Power System Arc Flash Hazard Studies	$25,000		
ST-2	Site Reconnaissance of Geologic Hazard along Ocean Bluff and Slide Below Effluent Disposal Field	$3,300		
ST-3	Disposal field piezometer Study	$3,000		
	TOTAL ESTIMATED COSTS	**$1,448,300**	**$1,230,300**	**$442,000**

APPENDIX A

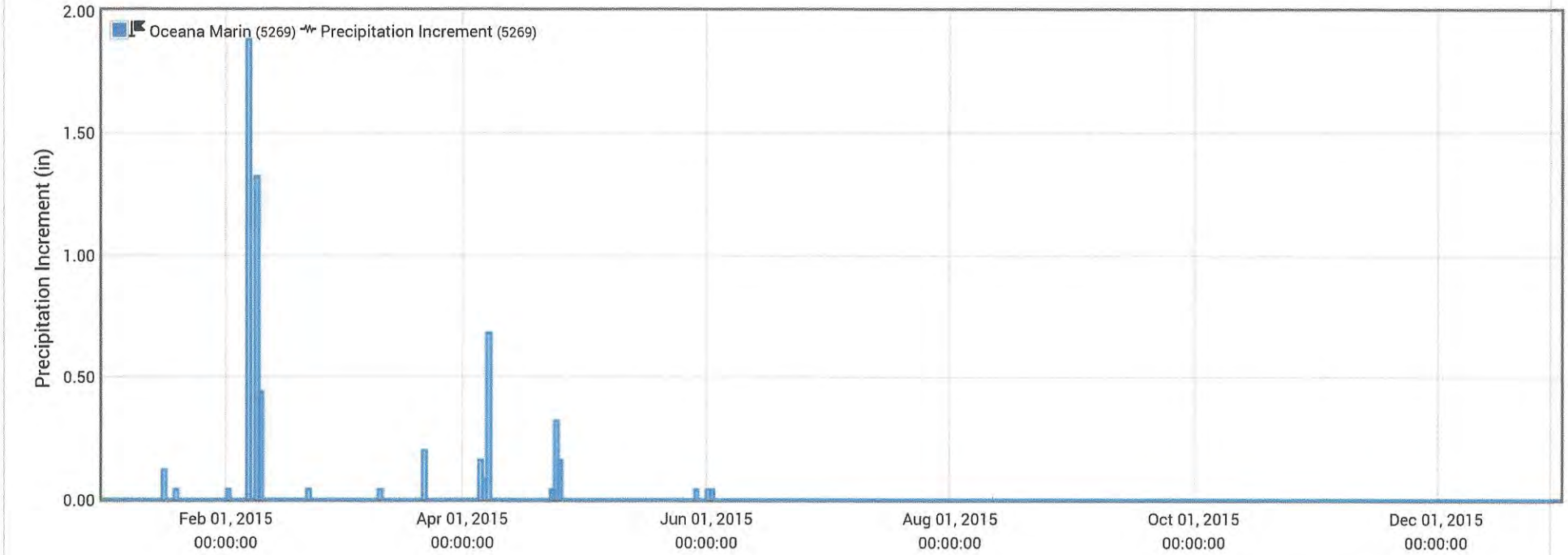
COUNTY OF MARIN
Rainfall Data 2010-2015

COUNTY OF MARIN

Home / Sites / Oceana Marin (5269) / Precipitation Increment (5269) / Graph

Precipitation Increment (5269)

January 1, 2015 - December 31, 2015



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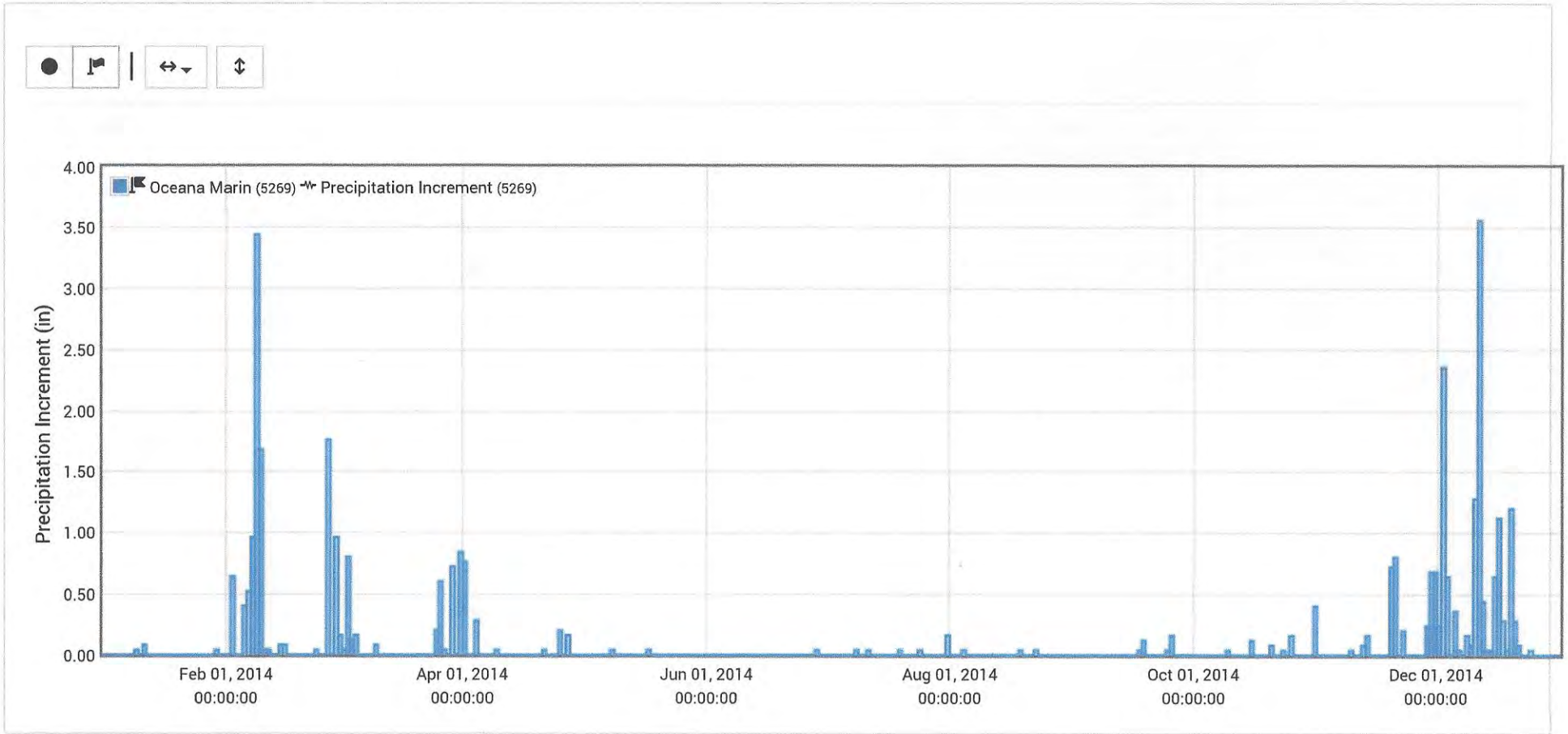
Precipitation Increment (5269)

January 1, 2014 - December 31, 2014



COUNTY OF MARIN

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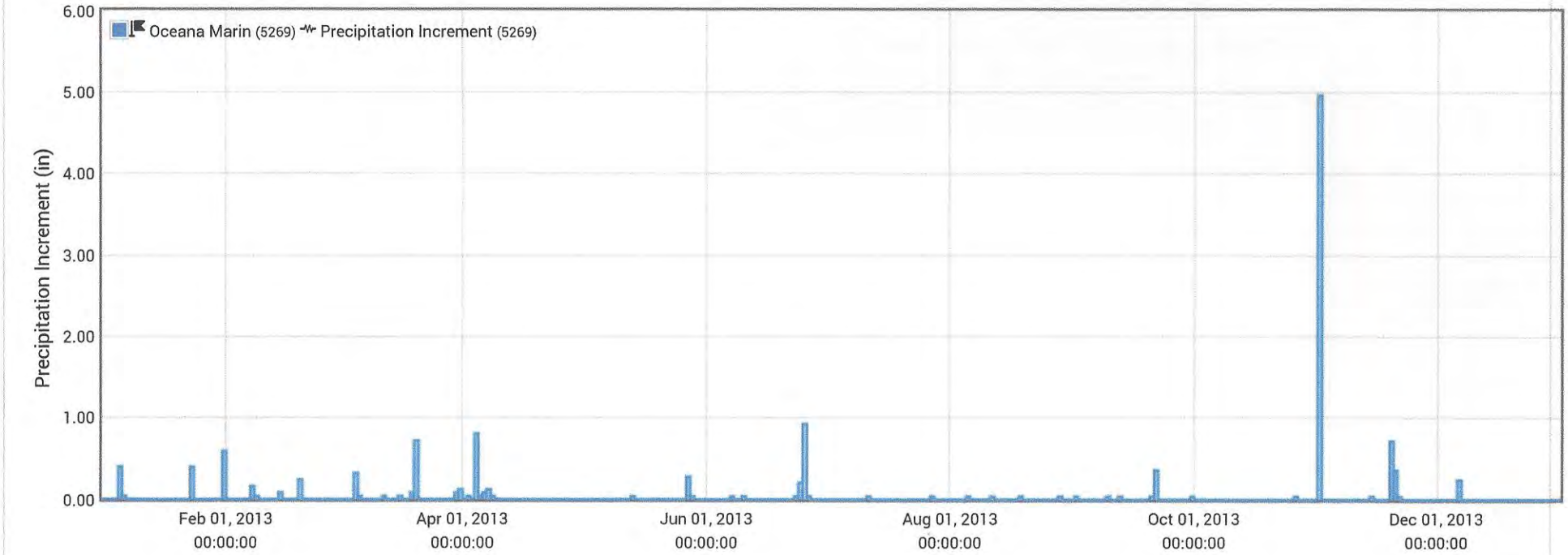
Precipitation Increment (5269)

January 1, 2013 - December 31, 2013

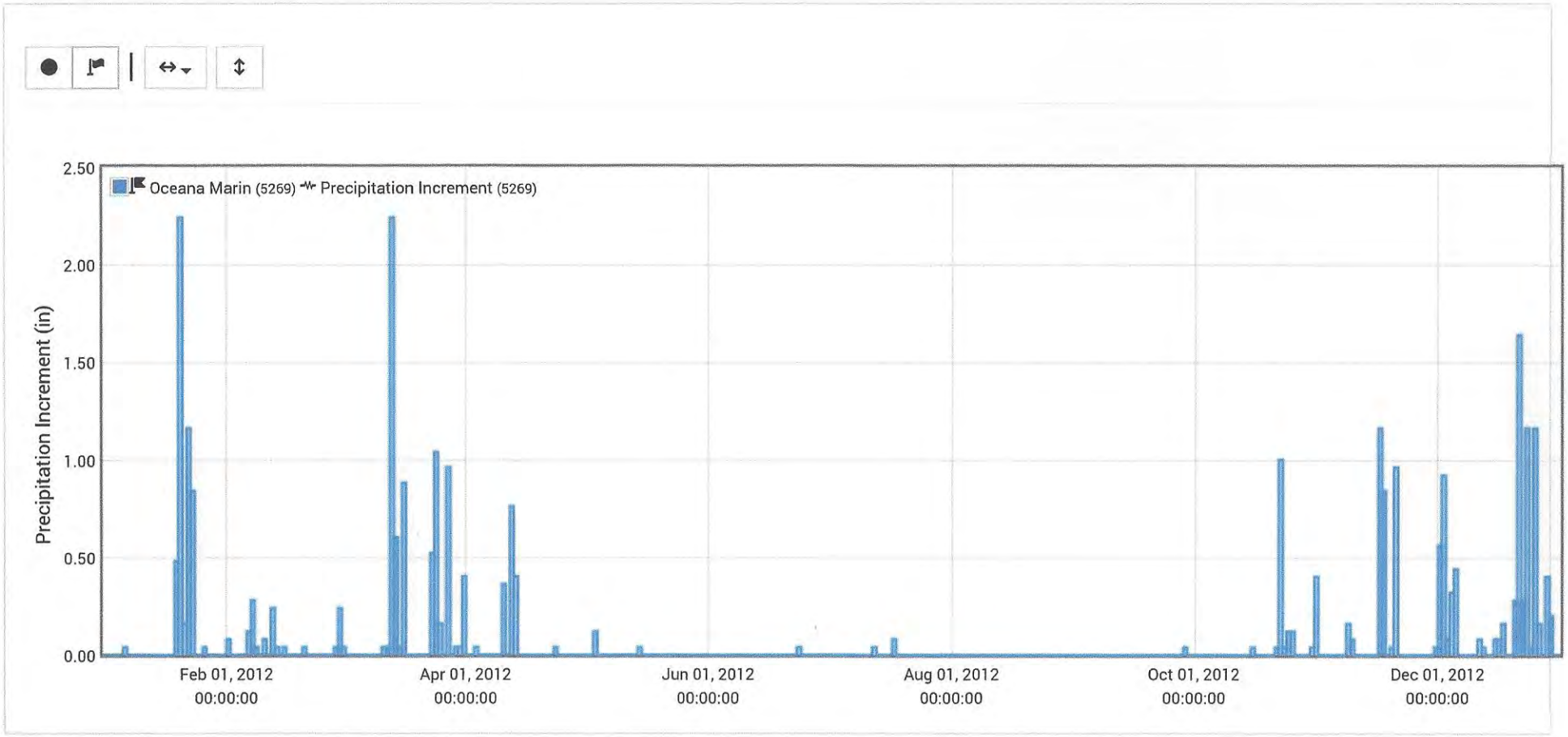


COUNTY OF MARIN

Home / Sites / Oceana Marin (5269) / Precipitation Increment (5269) / Graph

Precipitation Increment (5269)

January 1, 2012 - December 31, 2012

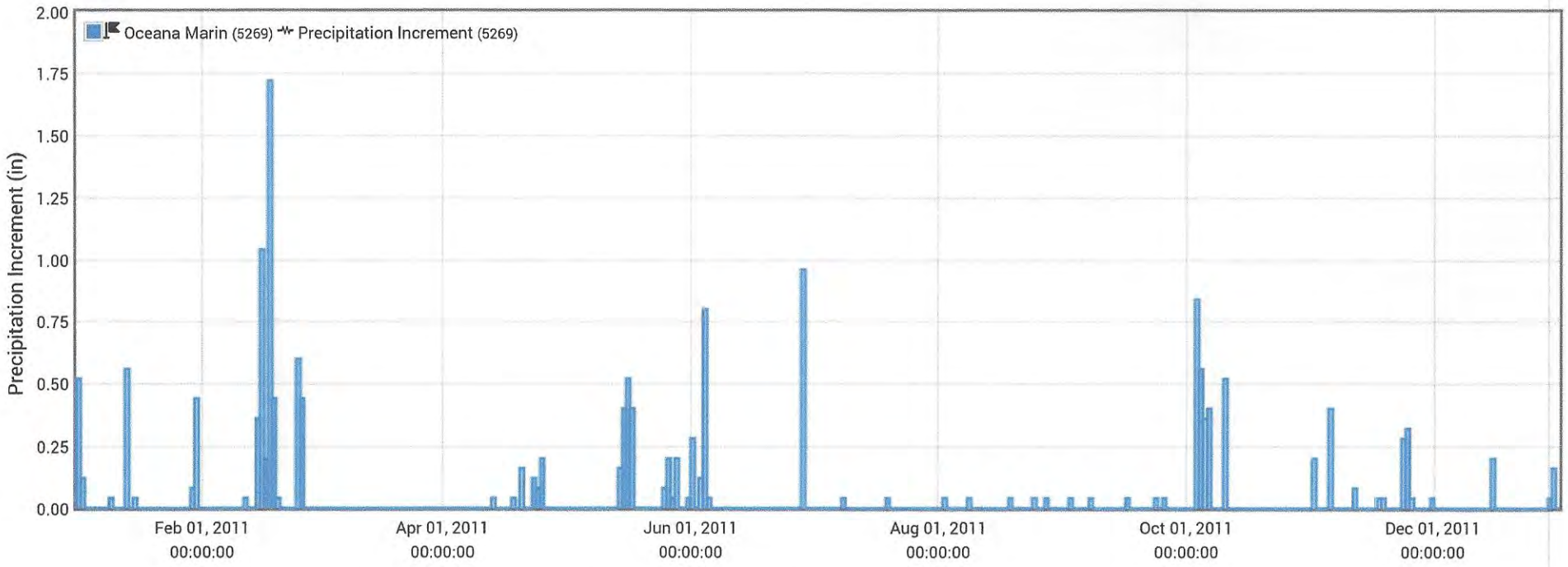


COUNTY OF MARIN

Home / Sites / Oceana Marin (5269) / Precipitation Increment (5269) / Graph

Precipitation Increment (5269)

January 1, 2011 - December 31, 2011

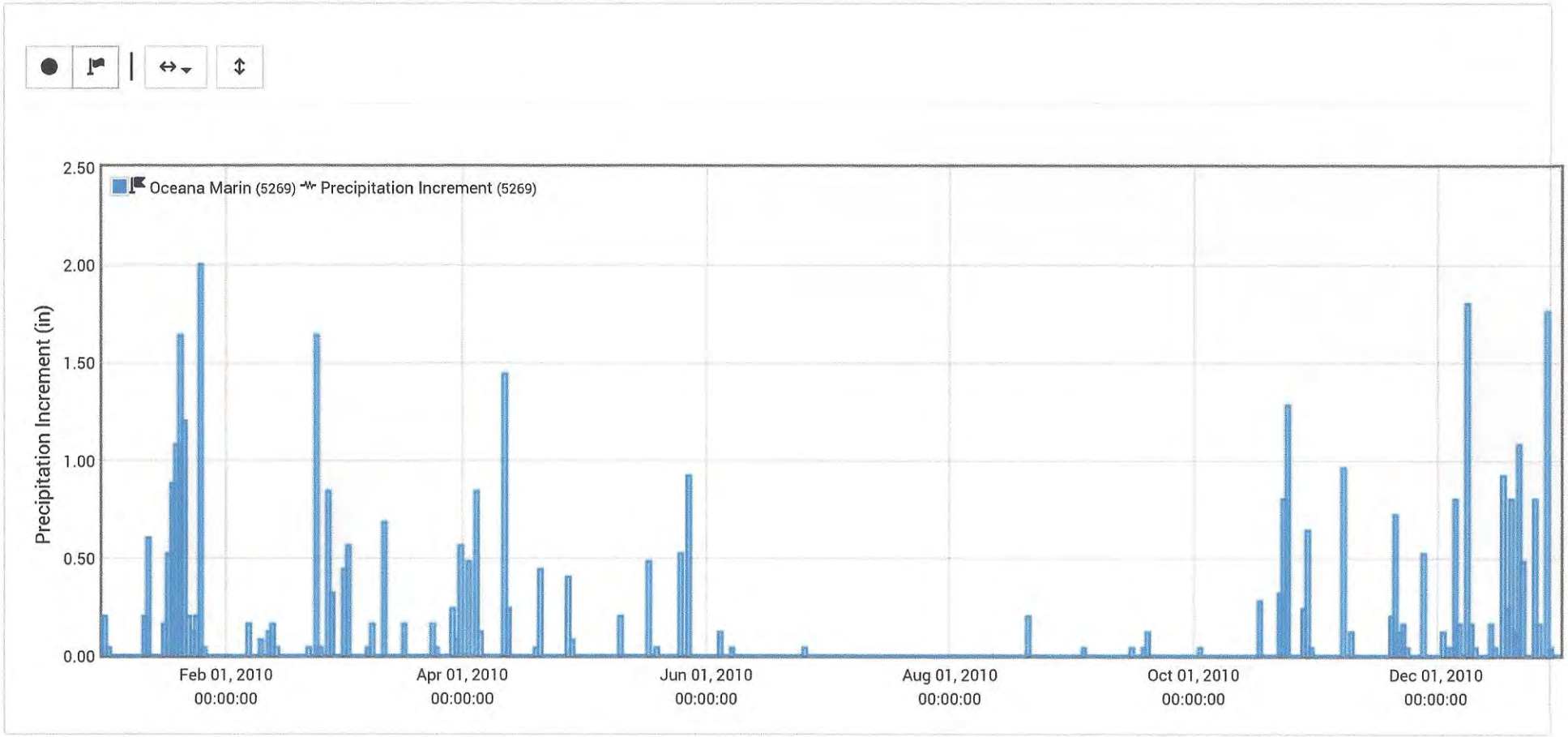


COUNTY OF MARIN

Home / Sites / Oceana Marin (5269) / Precipitation Increment (5269) / Graph

Precipitation Increment (5269)

January 1, 2010 - December 31, 2010



APPENDIX B

WASTE DISCHARGE REQUIREMENTS FOR OCEANA MARIN 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.

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[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)

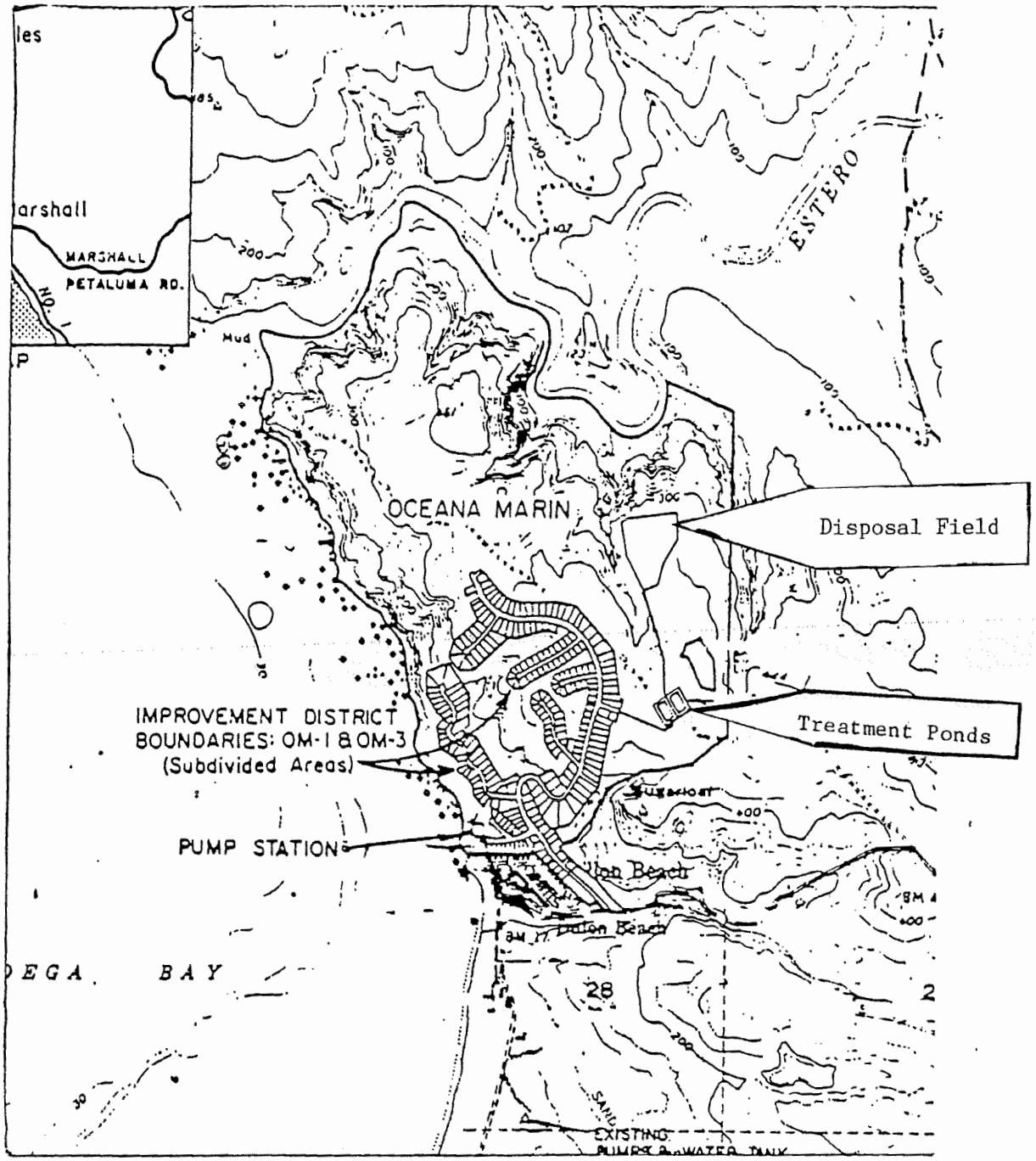

FIGURE 1

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.

APPENDIX C

OCEANA MARIN
Master Sewer List

OCEANA MARIN SEWER SYSTEM (Pipe Segments)

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PIPE SEGMENT				PHYSICAL LOCATION						PROBLEMS?							REPAIRS?	
FROM	TO	# of Upstream Services	Service rating	FROM	TO	PIPE SIZE	TYPE OF PIPE	LENGTH OF SECTION (in feet)	YEAR(s) T.V.'d	Date rating	Distance (in feet)	Direction (From MH/CO to MH/CO)	Problem Found	Wt. of Problem	Priority	Recommended Action & Date	Date	Work Done
MH 1	MH2	4	1	Approx. 38' NW from end of cul-de-sac on Tahiti Way, adjacent to lift station	Between 21 and 23 Tahiti Way, near end of cul-de-sac	6"	PVC	126.0	1-2012	2			No issues to report	0	2	TV	2019	
MH 1	MH 3	257	5	Approx. 38' NW from end of cul-de-sac on Tahiti Way, adjacent to lift station	Approx. 20' past end of cul-de-sac on Lanai Way	6"	ACP	239.5	2-2012	0	37.7	MH3 - MH1	Sag in the pipe	2	10	TV	2019	
			5							0	68.1		Infiltration in the pipe	3	15	Patch	FY13	
			5							0	116.2		Sag in the pipe	2	10	TV	2019	
			5							0	149.4		Grease in the pipe	2	10	Clean	FY13	
			5							0	181.2		Sag in the pipe	3	15	TV	2019	
MH 2	CO 1	3	1	Between 21 and 23 Tahiti Way, near end of cul-de-sac	Between 17 and 19 Tahiti Way	6"	PVC	128.0	1-2012	1	125.7	MH2 - CO1	Dirt and Rocks -- pipe has dirt and rocks at bottom	3	4	Clean	FY13	
MH 3	MH 4	43	1	Approx. 20' past end of cul-de-sac on Lanai Way	NE corner of 11 Tahiti Way	6"	PVC	449.7	1-2012	1			No issues observed	0	1	TV	2019	
MH 3	MH 10	219	5	Approx. 20' past end of cul-de-sac on Lanai Way	NW corner of 5 Kailua Way	6"	ACP	237.5	2-2012	1	59.6	MH10 - MH3	Sag in the pipe	2	11	TV	2019	
			5							1	117.3		Sag in the pipe	2	11	TV	2019	
			5							1	119.1		Joint separated in the pipe	4	21	Patch	FY13	
			5							1	151.6		Sag in the pipe	2	11	TV	2019	
MH 4	CO 2	2	1	NE corner of 11 Tahiti Way	NW corner of 15 Tahiti Way	6"	PVC		10-97, 2-12	12			No issues observed	0	12	TV	2013	
MH 4	MH5	28	2	NE corner of 11 Tahiti Way	In front of 3 Tahiti Way	6"	PVC	167.1	1-2012	1			No issues observed	0	1	TV	2019	
MH 5	MH 6	25	1	In front of 3 Tahiti Way	In front of 200 Oceana Drive	6"	PVC	146.9	1-2012	1	145.7	MH6 - MH5	Root problem in joint	3	4	Cut	FY13	
MH 5	CO 33	6	1	In front of 3 Tahiti Way	Rear of property, 267 Oceana Drive	6"	PVC	373.4	1-2012	1	315.7	MH5 - CO33	Joint Offset in the Pipe	3	4	TV	2019	
MH 6	MH 7	24	1	In front of 200 Oceana Drive	Middle of street, between 150 and 170 Oceana Drive					15			No issues observed	0	15	TV	2019	
MH 7	MH 8	19	1	Middle of street, between 150 and 170 Oceana Drive	Between 100 and 130 Oceana Drive, @ entrance to lift station	6"	PVC	238.3	1-2012	1			No issues observed	0	1	TV	2019	
MH 8	MH 9	4	1	Between 100 and 130 Oceana Drive, @ entrance to lift station	Intersection of Oceana Drive and Lawson Rd.	6"	PVC	183.8	1-2012	1			No issues observed	0	1	TV	2019	
MH 8	MH 104	12	1	Between 100 and 130 Oceana Drive, @ entrance to lift station	Intersection of Ocean View and North St Dillon Beach					15				0	15	TV	2013	
MH 104	CO34	12		Intersection of Ocean View and North St Dillon Beach	In front of 42 Ocean View Dillon Beach	6"	PVC	341.8	1-12	1			No issues observed	0	1	TV	2019	
MH 9	CO 3	2	1	Intersection of Oceana Drive and Lawson Rd.	Front of 50 Oceana Drive					15				0	15	TV	2013	
MH 10	MH 11	217	5	NW corner of 5 Kailua Way	Front of 7 Kailua Way	6"	ACP	119.0	2-2012	1			No issues observed	0	1	TV	2019	
MH 11	MH 12	216	5	Front of 7 Kailua Way	Near SW corner of 12 Kailua Way	6"	ACP	34.8	2-2012	1			No issues observed	0	1	TV	2019	
MH 12	MH 13	15	1	Near SW corner of 12 Kailua Way	On lot line, between 11 and 15 Kailua Way, near rear of properties	6"	PVC	145.8	12/08	1	128.3	MH13 - MH12	Sag in the pipe	1	2	TV	2015	
MH 12	MH 34	99	3	Near SW corner of 12 Kailua Way	In front of 12 Kailua Way	6"	ACP	60.0	2-2012	1	54.8	MH34 - MH12	Joint Offset in the Pipe	3	10	TV	2019	
											7.1		Joint separated in the pipe		7	CIP	2013	Repair with liner FY13
											110.8		~~Root problem in joint~~		0	CIP	2013	Repair with liner FY13

OCEANA MARIN SEWER SYSTEM (Pipe Segments)

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PIPE SEGMENT				PHYSICAL LOCATION							PROBLEMS?						REPAIRS?	
FROM	TO	# of Upstream Services	Service rating	FROM	TO	PIPE SIZE	TYPE OF PIPE	LENGTH OF SECTION (in feet)	YEAR(s) T.V.'d	Date rating	Distance (in feet)	Direction (From MH/CO to MH/CO)	Problem Found	Wt. of Problem	Priority	Recommended Action & Date	Date	Work Done
MH 12	MH 74	71	2	Near SW corner of 12 Kailua Way	Northern end of "vacant" lot between 6 @ 12 Kailua Way	8"	ACP	433.6	12/08	1	280.6	MH74 - MH12	~~Root problem in joint~~	3	0	CIP	2013	Repair with liner FY13
											293.6		~~Root problem in joint~~		0	CIP	2013	Repair with liner FY13
											320.3		Joint separated in the pipe		0	CIP	2013	Repair with liner FY13
											346.5		~~Root problem in joint~~		0	CIP	2013	Repair with liner FY13
											386.3		~~Root problem in joint~~		0	CIP	2013	Repair with liner FY13
											428.7		Sag in the pipe		0	CIP	2013	Repair with liner FY13
MH 13	MH 14	14	1	On lot line, between 11 and 15 Kailua Way, near rear of properties	On lot line, between 19 and 21 Kailua Way, near rear of properties	6"	PVC	165.6	12/08	1	165.6	MH14 - MH13		0	1	TV	2015	
MH 14	MH 15	11	1	On lot line, between 19 and 21 Kailua Way, near rear of properties	Rear of property, 23 Kailua Way	6"	PVC	142.8	12/08	1	57.8	MH15 - MH14	Root in lateral	2	3	TV	2015	
MH 15	MH 16	9	1	Rear of property, 23 Kailua Way	NW corner, rear of property, 27 Kailua Way	6"	PVC	189.9	12/08	1	189.9	MH16 - MH15		0	1	TV	2015	

OCEANA MARIN SEWER SYSTEM (Pipe Segments)

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PIPE SEGMENT				PHYSICAL LOCATION								PROBLEMS?						REPAIRS?
FROM	TO	# of Upstream Services	Service rating	FROM	TO	PIPE SIZE	TYPE OF PIPE	LENGTH OF SECTION (in feet)	YEAR(s) T.V.'d	Date rating	Distance (in feet)	Direction (From MH/CO to MH/CO)	Problem Found	Wt. of Problem	Priority	Recommended Action & Date	Date	Work Done
MH 16	MH 17	7	1	NW corner, rear of property, 27 Kailua Way	Rear of property, 35 Kailua Way	6"	PVC	233.9	12/08	1	109.5	MH17 - MH16	Crack in the pipe	4	5	TV	2015	
											113.0		Joint gasket exposed		0	TV	2015	
											233.9		Joint offset in pipe		0	TV	2015	
											233.9		Camera unable to get thru		0	TV	2015	
MH 17	CO 8	3	1	Rear of property, 35 Kailua Way	Westernmost corner of property @ 53 Kailua Way	6"	PVC	246.6	12/23/08	1				0	1	TV	2015	
MH 12	MH 18	32	1	Near SW corner of 12 Kailua Way	Front of vacant (?) lot across from 7 Kailua Way	6"	ACP	77.0	10-97,12-09	5	69.7'	18-12	Root in joint	3	8	CUT	FY13	TV in 2014
MH 18	MH 19	32	1	Front of vacant (?) lot across from 7 Kailua Way	Front of 6 Kailua Way	6"	ACP	169.6	10-97,12-09	5	25'-28'	19-18	Pipe type change at lateral	0	5	TV	2014	
MH 19	MH 20	30	1	Front of 6 Kailua Way	Front of 2 Kailua Way	6"	ACP	180.5	10-97,12-090	5	95'-98'	20-19	Pipe type change at lateral	0	5	TV	2014	
MH 20	MH 21	28	1	Front of 2 Kailua Way	SW corner, front of 298 Oceana Drive	6"	ACP	130.1	10-97,12-09	5			None to report	0	5	TV	2014	
MH 21	MH 22	24	1	SW corner, front of 298 Oceana Drive	SW corner, near lot line between 320 & 330 Oceana Drive	6"	ACP	215.1	12-09	5	158.5	22-21	Root in Joint	2	7	TV	2014	Cut at next inspection
MH 21	CO 4	2	1	SW corner, front of 298 Oceana Drive	SW end of 310 Oceana Drive, close to #298					15				0	15	TV	2013	
MH 21	CO 5	2	1	SW corner, front of 298 Oceana Drive	At 220 Oceana Drive, approx. 40' from street	6"	ACP	214.8	10-97,12-09	5	58.4	21-CO5	Root in joint	2	7	TV	2014	Cut at next inspection
MH 22	MH 23	8	1	SW corner, near lot line between 320 & 330 Oceana Drive	NW corner, rear of property, 320 Oceana Drive	6"	ACP	96.5	06-07	2	2.0	MH23 - MH22	Root in joint	4	6	CUT	FY13	
											19.7		Root in joint		0	CUT	FY13	
MH 22	MH 27	17	1	SW corner, near lot line between 320 & 330 Oceana Drive	NW corner, rear of property, 360 Oceana Drive				06-07	2				0	2	TV	2014	
MH 23	MH 24	7	1	SW corner, rear of property, 320 Oceana Drive	Front of 325 Oceana Drive	6"	ACP	166.0	06-07	0	30.6	MH24 - MH23	Joint separated in the pipe	11	11	`	2019	(Potential reline)
			1							0	99.9		Joint separated in the pipe	11	11	TV	2019	(Potential reline)
			1							0	113.4		Joint separated in the pipe	11	11	TV	2019	(Potential reline)
			1							0	126.4		Joint separated in the pipe	11	11	TV	2019	(Potential reline)
			1							0	133.6		Root in joint	11	11	TV	2019	Cut 6-13
			1							0	138.8		~~Pipe collapsed; can't get camera through; joint separated in pipe~~	11	11	TV	2019	Repaired offset 10/07
			1							0	2.0	MH23 - MH24	Root in joint	11	11	TV	2019	Cut 6-13
			1							0	28.1		~~Joint separated; can't get through~~	11	11	TV	2019	(see repair for 138.8, above)
			1						13-14	0	34		Grease in sag	1	1	TV	2019	Roots cut & Grease washed out 6-14 (Potential reline)
MH 24	MH 25	6	1	Front of 325 Oceana Drive	Front of 350 Oceana Drive	6"	ACP	231.1	06-07	0	88.0	MH25 - MH24	Joint separated in the pipe	3	3	TV	2019	
			1								185.0		Joint separated in the pipe		0	TV	2019	
			1								223.0		Joint separated in the pipe		0	TV	2019	
			1						13-14	0		MH25 - MH24	Root in joint	2	2	TV	2019	Roots cut 6-14 (Potential reline)
			1						13-14	0			Root in joint	2	2	TV	2019	Roots cut 6-14 (Potential reline)
			1						13-14	0			Root in joint	2	2	TV	2019	Roots cut 6-14 (Potential reline)
			1						13-14	0		MH25 - MH24	Root in joint	2	2	TV	2019	Roots cut 6-14 (Potential reline)
			1						13-14	0			Root in joint	2	2	TV	2019	Roots cut 6-14 (Potential reline)
			1						13-14	0			Root in joint	2	2	TV	2019	Roots cut 6-14 (Potential reline)
			1						13-14	0			Root in joint	2	2	TV	2019	Roots cut 6-14 (Potential reline)

OCEANA MARIN SEWER SYSTEM (Pipe Segments)

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PIPE SEGMENT				PHYSICAL LOCATION						PROBLEMS?							REPAIRS?	
FROM	TO	# of Upstream Services	Service rating	FROM	TO	PIPE SIZE	TYPE OF PIPE	LENGTH OF SECTION (in feet)	YEAR(s) T.V.'d	Date rating	Distance (in feet)	Direction (From MH/CO to MH/CO)	Problem Found	Wt. of Problem	Priority	Recommended Action & Date	Date	Work Done
			1						13-14	0		MH25 - MH24	Root in joint	2	2	TV	2019	Roots cut 6-14 (Potential reline)
			1						13-14	0			Root in joint	2	`	TV	2019	Roots cut 6-14 (Potential reline)
MH 25	MH 26	4	1	Front of 350 Oceana Drive	Front of 365 Oceana Drive	6"	ACP	160.3	06-07	0	132.5	MH26 - MH25	Joint separated	1	1	TV	2019	None
									13-14	0	26.1	MH26 - MH25	Roots in joint	2	0	TV	2019	Roots cut 6-14 (Potential reline)
									13-14	0	39.0	MH26 - MH25	Roots in joint	2	0	TV	2019	Roots cut 6-14 (Potential reline)
									13-14	0	52.3	MH26 - MH25	Roots in joint	2	0	TV	2019	Roots cut 6-14 (Potential reline)
									13-14	0	65.2	MH26 - MH25	Roots in joint	2	0	TV	2019	Roots cut 6-14 (Potential reline)
									13-14	0	91.7	MH26 - MH25	Roots in joint	2	0	TV	2019	Roots cut 6-14 (Potential reline)
											104.8	MH26 - MH25	Roots in joint	2	0	TV	2019	Roots cut 6-14 (Potential reline)
											144.4	MH26 - MH25	Roots in joint	2	0	TV	2019	Roots cut 6-14 (Potential reline)
									13-14	0	156.7	MH26 - MH25	Joint offset med	1	0	TV	2019	None
MH 26	CO 6	3	1	Front of 365 Oceana Drive	In street in front of 416 Oceana Drive	6"	ACP	447.9	06-07	8	9.1	MH26 - CO6	Joint separated	1	9	TV	2019	
			1							8	22.4			1	9	TV	2019	
			1							8	443.9			1	9	TV	2019	
			1							8	446.4			1	9	TV	2019	
			1						13-14	8	60.0	MH26 - CO6	Camera unable to get up hill	1	9	TV	2019	
MH 27	MH 28	15	1	NW corner, rear of property, 360 Oceana Drive	Rear of property, 360 Oceana Drive, approx. 75' E of MH #27	6"	ACP	89.6	06-07	2	84.5		Joint separated	1	3	TV	2019	
MH 28	MH 29	14	1	Rear of property, 360 Oceana Drive, approx. 75' est of MH #27	On lot line, between 360 & 370 Oceana Drive, near rear of properties	6"	ACP	129.4	06-07	2	99.7		Root in joint	2	4	CUT	FY13	
											129.4		~~Joint offset; root in joint. Camera not able to get through~~	4	0	TV	2014	Offset repaired
MH 28	MH 30			Rear of property, 360 Oceana Drive, approx. 75' est of MH #27	On lot line, between 370 and 380 Oceana Drive, rear of properties	6"	ACP	361	Inspection by Dan Garrett and Jeff Corda 2/28/2014				Even though MH29 is in this group, and the main culprit, I believe there is more intrusion in this area. It cannot be seen from a parrticular manhole, but I do vbelieve that this area should be tv'd in our nextg TW sewer line inspection sequence.					
MH 29	MH 30	14	1	On lot line, between 360 & 370 Oceana Drive, near rear of properties	On lot line, between 370 and 380 Oceana Drive, rear of properties	6"	ACP	231.2	06-07	2	12.3	MH30 - MH29	Joint separated	4	6	TV	2014	
											54.0		Sag		0	TV	2014	
											99.3		Sag		0	TV	2014	
											168.1		Sag		0	TV	2014	

OCEANA MARIN SEWER SYSTEM (Pipe Segments)

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PIPE SEGMENT				PHYSICAL LOCATION						PROBLEMS?							REPAIRS?	
FROM	TO	# of Upstream Services	Service rating	FROM	TO	PIPE SIZE	TYPE OF PIPE	LENGTH OF SECTION (in feet)	YEAR(s) T.V.'d	Date rating	Distance (in feet)	Direction (From MH/CO to MH/CO)	Problem Found	Wt. of Problem	Priority	Recommended Action & Date	Date	Work Done
MH 30	MH 31	13	1	On lot line, between 370 & 380 Oceana Drive, rear of properties	SE corner, rear of property, 410 Oceana Drive	6"	ACP	340.7	06-07	2	6.3	MH31 - MH30	Root in joint	14	16	CUT	FY13	
											33.2		Joint separated		0	TV	2014	
											47.1		Joint separated		0	TV	2014	
											85.9		Lateral separated		0	TV	2014	
											106.5		Root in joint		0	CUT	FY13	
											153.8		Joint separated		0	TV	2014	
											180.5		~~Lateral separated~~		0	TV	2014	Offset repaired
											204.8		Root in joint		0	CUT	FY13	
											211.0		Root in joint		0	CUT	FY13	
											310.6		Joint separated		0	TV	2014	
MH 31	MH 32	10	1	At rear of property of 410 Oceana Drive, near lot line of #400	Rear of "Parcel G", between 410 & 416 Oceana Drive	6"	ACP	84.7	06-07	2	180.5	MH32 - MH31	~~Lateral separation~~	1	3	TV	2014	Repaired 10/09
MH 32	MH 33	9	1	At rear of Parcel "G"	SE corner, rear of property, 424 Oceana Drive	6"	ACP	238.0	06-07	2	78.9	MH33 - MH32	Root in joint	2	4	CUT	FY13	
											121.6		Lateral separation; crack	5	0	TV	2014	
MH 33	MH 104	4	1							15				0	15	TV	2014	
MH 33	CO 16	2	1	At rear of property of 424 Oceana Drive, near lot line of #420	Rear of property @ 432 Oceana Drive				06-07	2				0	2	TV	2014	
MH 34	MH 35	98	3	In front of 12 Kailua Way	In front of 16 Kailua Way	6"	ACP	148.8	2-2012	1			None to report	0	1	TV	2019	
MH 35	MH 36	96	3	In front of 16 Kailua Way	In front of 24 Kailua Way (near lot line of 22 Kailua Way)	6"	ACP	200.6	2-2012	1	8.9	MH36 - MH35	Joint separated in the pipe	3	10	TV	2019	
			3							1	30.3		Sag in the pipe	2	7	TV	2019	
			3							1	96.9		Sag in the pipe	2	7	TV	2019	
MH 36	MH 37	94	3	In front of 24 Kailua Way (near lot line of 22 Kailua Way)	In front of 28 Kailua Way (near "vacant" lot)	6"	ACP	135.1	2-2012	1	114.2	MH37 - MH36	Joint separated in the pipe	3	10	TV	2019	
MH 37	MH 38	93	3	In front of 28 Kailua Way (near "vacant" lot)	Between 28 & 30 Kailua Way	10"	ACP	70.0	10-97,12-09	3			None to report	0	3	TV	Dec-16	
MH 38	MH 39	92	3	Between 28 & 30 Kailua Way	In front of 38 Kailua Way (before street swings to the R)	10"	ACP	304.3	10-97,12-09	3			None to report	0	3	TV	Dec-16	
MH 39	MH 40	88	3	In front of 38 Kailua Way (before street swings to the R)	SW side of 45 Kailua Way, along lot line between 45 & 41, approx. 40' from street	10"	ACP	182.9	10-97,12-09	3			None to report	0	3	TV	Dec-16	
MH 39	CO 18	1	1	In front of 38 Kailua Way (before street swings to the R)	On property @ 38 Kailua Way, approx. 75' from MH #39					15				0	15	TV	2013	
MH 40	MH 41	88	3	SW side of 45 Kailua Way, along lot line between 45 & 41, approx. 40' from street	NW side of 45 Kailua Way, near rear of property, approx. 40' N of #40	10"	ACP	55.5	10-97, 12-09	3			None to report	0	3	TV	Dec-16	
MH 41	MH 42	87	3	NW side of Kailua Way, near rear of property, approx. 40' N of #40	In front of 48 Kailua Way	10"	ACP	123.2	10-97, 12-09	3			None to report	0	3	TV	Dec-16	
MH 42	MH 43	85	3	In front of 48 Kailua Way	In front of 49 Kailua Way	8"	ACP	52.0	10-97, 12-09	3			None to report	0	3	TV	Dec-16	
MH 42	CO 17	1	1	In front of 48 Kailua Way	Near front of property @ 44 Kailua Way				6/00	12				0	12	TV	2013	
MH 43	MH 52	63	2	In front of 49 Kailua Way	In front of 56 Kailua Way	8"	ACP	214.7	10-97,12-09	3			None to report	0	3	TV	Dec-16	
MH 43	MH 44	22	1	In front of 49 Kailua Way	Middle of property @ 48 Kailua Way, approx. 125' from street	6"	DIP	148.9	06-00, 02-08	1				0	1	CIP	2013	Repair with liner FY13
MH 44	MH 45	21	1	Middle of property @ 48 Kailua Way, approx. 125' from street	NW side of Parcel "A", approx. 300' from rear of "vacant" lot between 53 & 54 Kona Lane	6"	DIP	384.5	06-00, 02-08	1	309.5	MH45 - MH44	Joint pulled apart; MH 45 needs replacement	5	6	CIP	2013	Repair with liner FY13
MH 45	MH 46	21	1	NW side of Parcel "A", approx. 300' from rear of "vacant" lot between 53 & 54 Kona Lane	Behind 54 Kona Lane, approx. 30' front lot line	6"	DIP	330.0	06-00, 02-08	1	309.5	MH46 - MH45	Root in joint (RSS indicates that MH #45 needs to be replaced)	7	8	CIP	2013	10' section replaced 20 above MH45 with PVC. Repair with liner FY13
MH 46	MH 47	19	1	Behind 54 Kona Lane, approx. 30' front lot line	Rear of 50 Kona Lane, NE corner, adjacent to lot line of #46	6"	DIP	109.2	1-2012	1			None to report	0	1	CIP	2013	Repair with liner FY13

OCEANA MARIN SEWER SYSTEM (Pipe Segments)

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PIPE SEGMENT				PHYSICAL LOCATION						PROBLEMS?							REPAIRS?	
FROM	TO	# of Upstream Services	Service rating	FROM	TO	PIPE SIZE	TYPE OF PIPE	LENGTH OF SECTION (in feet)	YEAR(s) T.V.'d	Date rating	Distance (in feet)	Direction (From MH/CO to MH/CO)	Problem Found	Wt. of Problem	Priority	Recommended Action & Date	Date	Work Done
MH 46	CO 7	2	1	Behind 54 Kona Lane, approx. 30' front lot line	At rear of property @ 53 Kona Lane, on lot line	6"	ACP	236.5	06-00	9	6.5	MH46 - CO7	Lateral & roots		13	CUT	FY 13	
											183.0		Unable to push camera any more	4	0	TV	2013	
											73.5	CO7 - MH46	Lateral - overlapped line		0	TV	2013	
MH 47	MH 48	18	1	Rear of 50 Kona Lane, NE corner, adjacent to lot line of #46	Rear of 42 Kona Lane, approx. 30' W of lot line of #38	6"	ACP	212.1	1-2012	1			None to report	0	1	TV	2019	
MH 48	MH 49	16	1	Rear of 42 Kona Lane, approx. 30' W of lot line of #38	Rear of 26 Kona Lane, adjacent to lot line of #30	6"	ACP	168.6	1-2012	1			None to report	0	1	TV	2019	
MH 49	MH 50	10	1	Rear of 26 Kona Lane, adjacent to lot line @ #30	Middle of street between 26 & 27 Kona Lane	6"	ACP	134.7	1-2012	1	131.8	MH50 - MH49	Root problem in joint	3	4	Cut	2013	
MH 49	CO 14	2	1	Rear of 26 Kona Lane, adjacent to lot line @ #30	Rear of property @ 14 Kona Lane	3"	ABS	112.7	1-2012	1			None to report	0	1	TV	2019	
MH 50	MH 51	10	1	Middle of street between 26 & 27 Kona Lane	In front of 511 Oceana Drive, near entrance to Kona Lane	6"	ACP	434.8	1-2012	1	17.4	MH51 - MH50	Crack in the pipe	4	5	Patch	2013	
			1							1	353.4		Joint Offset in the Pipe	4	5	TV	2019	
MH 52	MH 53	54	2	In front of 56 Kailua Way	On lot line between 56 & 60 Kailua Way, approx. 175' from street	8"	ACP	186.0	06-00	9	16.0	MH53 - MH52	~~Pipe blocked by roots~~	2	13	CIP	2013	Repair with liner FY13
											18.7		Fish mouth rubber		0	CIP	2013	Repair with liner FY13
											87.6		Offset joint		0	CIP	2013	Repair with liner FY13
MH 52	CO 15	3	1	In front of 56 Kailua Way	End of cul-de-sac on Kailua Way, in front of #65	6"	ACP	105.3	12-09	3			None to report	0	3	TV	Dec-16	
MH 53	MH 54	53	2	On lot line between 56 & 60 Kailua Way, approx. 175' from street	On lot line between 56 & 60 Kailua Way, just past rear lot line	8"	ACP	131.0	06-00,12-09	3			None to report	0	3	CIP	2013	Repair with liner FY13
MH 54	MH 55	37	1	On lot line between 56 & 60 Kailua Way, just past rear lot line	Small NW section of Parcel "A", just past center of rear lot line of 30 Waikiki Lane	6"	ACP	305.0	06-00, 12-09	3	49.2	55-54	crack in line	3	6	TV	Dec-16	Repair at next inspection
									06-00,12-09	3	279.1	55-54	crack in line	3	6	TV	Dec-16	Repair at next inspection
									06-00,12-09	3	302.4	55-54	Small separation	3	6	TV	Dec-16	Repair at next inspection
MH 55	MH 56	34	1	Small NW section of Parcel "A", just past center of rear lot line of 30 Waikiki Lane	Approx. 75' behind rear lot line of 26 Waikiki Lane	6"	ACP	200.5	06-00, 12-09	3	164.0	55-56	Small Seperation	3	6	TV	Dec-16	Repair at next inspection
MH 56	MH 57	34	1	Approx. 75' behind rear lot line of 26 Waikiki Lane	On lot line at rear of properties @ 18 & 22 Waikiki Lane	6"	ACP	239.6	06-00, 12-09	3	118.6	MH57-MH56	root in joint	5	8	TV	Dec-16	Cut and repair at next inspection
MH 57	MH 58	7	1	On lot line at rear of properties @ 18 & 22 Waikiki Lane	Rear of property @ 6 Waikiki Lane	6"	ACP	263.2	06-00, 12-09	3	943.2	MH58 - MH57	Top of pipe damaged; roots growing through joint	5	8	TV	Dec-16	Cut and repair at next inspection
											181.7	MH58 - MH57	Top of pipe damaged; roots growing through joint	5	8	TV	Dec-16	Cut and repair at next inspection
											260.5	MH58 - MH57	root in joint	5	8	TV	Dec-16	Cut and repair at next inspection
MH 57	MH 59	26	1	On line at rear of properties @ 18 & 22 Waikiki Lane	Approx. 85' behind 10 Waikiki Lane, on Parcel "N"	6"	ACP	213.0	06-00,12-09	3			None to report	0	3	TV	Dec-16	
MH 57	CO 27								Inspection by Dan Garrett and Jeff Corda 2/28/2014				There seems to be a good amount of intrusion coming uphill of MH 57 and needs to be tv'd in our next TV inspection sequence. If I remember correctly, this was inspected a couple of years ago, and it had root penetration, but I cannot remember if they ever were cleaned out.					
MH 58	CO 9	3	1	Rear of property @ 6 Waikiki Lane	Rear of property @ 581 Oceana Drive, near lot line for #577	6"	ACP	107.0	06-00,12-09	3	8.2	MH58 - CO9	Pipe separation at 3', Sag 3-10', joint separation 46', Roots in joint	2	5	TV	Dec-16	Cut and repair at next inspection
MH 58	CO 27	3	1	Rear of property @ 581 Oceana Drive, near lot line for #577	Rear of property @ 577 Oceana Drive, near lot line for #573	6"	ACP	62.7	12-09	3	41'	MH58-CO27	Roots at 41'	3	6	TV	Dec-16	Cut at next inspection
MH 59	MH 60	26	1	Approx. 85' behind 10 Waikiki Lane, on Parcel "N"	Near front of Parcel "M", between 585 & 591 Oceana Drive	6"	ACP	365.0	06-00,12-09	3	234.6	MH60 - MH59	Lateral - appears to be infiltrating, roots	5	8	TV	Dec-16	Notice to Resident
MH 60	MH 61	25	1	Near front of Parcel "M", between 585 & 591 Oceana Drive	In front of 584 Oceana Drive	6"	ACP	75.3	06-00,12-09	3			None to report	0	3	TV	Dec-16	

OCEANA MARIN SEWER SYSTEM (Pipe Segments)

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PIPE SEGMENT				PHYSICAL LOCATION						PROBLEMS?						REPAIRS?	
FROM	TO	# of Upstream Services	Service rating	FROM	TO	PIPE SIZE	TYPE OF PIPE	LENGTH OF SECTION (in feet)	YEAR(s) T.V.'d	Date rating	Distance (in feet)	Direction (From MH/CO to MH/CO)	Problem Found	Wt. of Problem	Priority	Recommended Action & Date	Date	Work Done
MH 61	MH 62	2	1	In front of 584 Oceana Drive	Intersection of Oceana Drive & Lelani Lane	6"	ACP	175.8	12-09	3			None to report	0	3	TV	Dec-16	
MH 61	MH 63	22	1	In front of 584 Oceana Drive	In front of 568 Oceana Drive	6"	ACP	312.4	12-09	3			None to report	0	3	TV	Dec-16	
MH 62	CO 30	1	1	Intersection of Oceana Drive & Lelani Lane	Front of property @ 588 Oceana Drive, near lot line for #584	6"	ACP	158.8	12-09	3			None to report	0	3	TV	Dec-16	
MH 63	MH 64	18	1	In front of 568 Oceana Drive	In front of 556 Oceana Drive	6"	ACP	354.5	12-09	3	241.6	64-63	Grease	1	4	TV	Dec-16	
MH 64	MH 65	14	1	In front of 556 Oceana Drive	In front of 541 Oceana Drive	6"	ACP	407.2	12-09	3			None to report	0	3	TV	Dec-16	
MH 64	CO 26	1	1	In front of 556 Oceana Drive	Near front of property @ 560 Oceana Drive					3				0	3	TV	Dec-16	
MH 65	MH 66	8	1	In front of 541 Oceana Drive	In front of 511 Oceana Drive	6"	ACP	404.8	12-09	3			None to report	0	3	TV	Dec-16	
MH 65	CO 22	1	1	In front of 541 Oceana Drive	Near front of property @ 536 Oceana Drive					3				0	3	TV	Dec-16	
MH 66	CO 10	3	1	In front of 511 Oceana Drive	In street between 504 & 508 Oceana Drive	6"	ACP	247.2	12-09	3	200.0	MH66-CO10	Some dirt, offset	2	5	TV	Dec-16	
MH 54	MH 67	16	1	On lot line between 56 & 60 Kailua Way, approx. 175' from street	Located at rear of property @ 27 Waikiki Lane	6"	122' ACP, 150' DIP	272.6	06-00	9	84.8	MH67 - MH54	42° pushing through joint	1	10	CIP	2013	Repair with liner FY13
MH 67	MH 68	15	1	Located at rear of property @ 27 Waikiki Lane	Rear of property @ 19 Waikiki Lane (adjacent to lot line for #23)	6"	DIP	174.0	06-00	9				0	9	CIP	2013	Repair with liner FY13
MH 68	MH 69	14	1	Rear of property @ 19 Waikiki Lane (adjacent to lot line for #23)	Rear of property @ 11 Waikiki Lane (adjacent to lone line for #15)	6"	DIP	189.6	06-00	9	187.6	MH69 - MH68	~~Cement in line~~	0	9	TV	2013	Roys SS removed
MH 69	MH 70	11	1	Rear of property @ 11 Waikiki Lane (adjacent to lot line for #15)	Rear of property @ 565 Oceana Drive (SE corner, adjacent to lot line for #563)	6"	DIP	216.3	06-00	9	214.9	MH70 - MH69	Infiltration just before manhole	2	11	TV	2013	
MH 69	CO 29	1	1	Rear of property @ 11 Waikiki Lane (adjacent to lot line for #15)	Near rear of property @ 11 Waikiki Lane, approx. 40' N of MN #69									0	0	TV	2013	
MH 70	MH 71	9	1	Rear of property @ 565 Oceana Drive (SE corner, adjacent to lot line for #563)	At rear of property, on lot line between 561 & 563 Oceana Drive	6"	ACP	90.0	06-00	9	3.0	MH71 - MH70	3 ft. in offset joint	2	11	TV	2019	
											89.4		Infiltration @ joint		0	TV	2019	
									1-2012	1				0	1	TV	2019	
MH 70	CO 28	2	1	Rear of property @ 565 Oceana Drive (SE corner, adjacent to lot line for #563)	Near rear of property @ 7 Waikiki Lane					15				0	15	TV	2013	
MH 71	MH 72	7	1	At rear of property, on lot line between 561 & 563 Oceana Drive	SE corner @ rear of property at 553 Oceana Drive	6"	ACP	278.2	1-2012	1	8.5	MH72 - MH71	Infiltration in the pipe	2	3	Repair	FY13	
										1	82.5		Joint offset in the pipe	3	1	Repair	FY13	
										1	146.1		Joint offset in the pipe	3	1	Repair	FY13	
										1	166.1		Joint Offset in the Pipe	5	1	Repair	FY13	
										1	274.5		Infiltration in the pipe	2	1	Repair	FY13	
MH 71	CO 25	1	1	At rear of property, on lot line between 561 & 563 Oceana Drive	Near front of property @ 561 Oceana Drive					15				0	15	TV	2013	
MH 72	MH 73	4	1	SE corner @ rear of property at 553 Oceana Drive	At rear of property, on lot line between 541 & 545 Oceana Drive	6"	ACP	168.8	1-2012	1			None to report	0	1	TV	2019	
MH 72	CO 24	1	1	SE corner @ rear of property at 553 Oceana Drive	On property @ 553 Oceana Drive, approx. 40' from street					15				0	15	TV	2013	
MH 73	CO 11	1	1	At rear of property, on lot line between 541 & 545 Oceana Drive	Rear of property @ 537 Oceana Drive, near lot line of #541	4"	ACP	76.9	1-2012	1			None to report	0	1	TV	2019	
MH 73	CO 21	1	1	At rear of property, on lot line between 541 & 545 Oceana Drive	Middle of property @ 541 Oceana Drive, near lot line for #537	4"	ACP	38.2	1-2012	1			None to report	0	1	TV	2019	
MH 74	MH 75	71	2	Northern end of "vacant" lot between 6 @ 12 Kailua Way	In Parcel "A", approx. 150' NE of MH #74	6"	DIP	146.0	12-08	1	127.8	MH75 - MH74	~~Root problem in joint~~	0	1	CIP	2013	Repair with liner FY13
									12-08		24.4	MH76 - MH75	~~Joint Offset~~		1	CIP	2013	Repair with liner FY13
											125.9		~~Root problem in joint~~		0	CIP	2013	Repair with liner FY13
											136.5		~~Root problem in joint; camera unable to get thru~~		0	CIP	2013	Repair with liner FY13

OCEANA MARIN SEWER SYSTEM (Pipe Segments)

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PIPE SEGMENT				PHYSICAL LOCATION						PROBLEMS?							REPAIRS?	
FROM	TO	# of Upstream Services	Service rating	FROM	TO	PIPE SIZE	TYPE OF PIPE	LENGTH OF SECTION (in feet)	YEAR(s) T.V.'d	Date rating	Distance (in feet)	Direction (From MH/CO to MH/CO)	Problem Found	Wt. of Problem	Priority	Recommended Action & Date	Date	Work Done
MH 75	MH 76	71	2	In Parcel "A", approx. 150' NE of MH #74	SE corner @ rear of property at 11 Kameha Way	6"	DIP100' ACP 357'	400.0		1	44.1	MH75 - MH76	~~Root problem in joint; camera unable to get thru; concrete in the bottom~~	0	0	CIP	2013	Repair with liner FY13
									1-09		125.7	MH76 - MH75	~~Root problem~~		0	CIP	2013	Repair with liner FY13
											135.8		~~Root problem~~		0	CIP	2013	Repair with liner FY13
											145.7		~~Root problem~~		0	CIP	2013	Repair with liner FY13
											156.0		~~Root problem~~		0	CIP	2013	Repair with liner FY13
											166.9		~~Root problem~~		0	CIP	2013	Repair with liner FY13
											177.4		~~Root problem~~		0	CIP	2013	Repair with liner FY13
											227.0		~~Repair area~~		0	CIP	2013	Repair with liner FY13
											231.7		~~Can't get thru~~		0	CIP	2013	Repair with liner FY13
MH 75	CO 35	71	2	In Parcel "A", approx. 150' NE of MH #74	In Parcel "A", approx. 217 NE from MH 75	6"	~~DIP 10~~ 0' ACP 117'	217'	1-09	3			Installed Clean out 35	1	5	CIP	2013	
CO 35	MH 76	71	2	In Parcel "A", approx. 217 NE from MH 75	SE corner @ rear of property at 11 Kameha Way	6"	ACP	240'	1-09	3			Installed Clean out 35	1	5	CIP	2013	
MH 76	MH 77	17	1	SE corner @ rear of property at 11 Kameha Way	At rear of property @ 19 Kameha Way, near lot line for #15	6"	ACP	234.1	06-00	9	221.3	MH77 - MH76	Lateral is broken behind the Y	1	10	Patch	FY13	
			1						2-2012	1	198.7		Crack in the pipe	2	3	Patch	FY13	
			1						2-2012	1	203.9		Joint offset in the pipe	3	4	TV	2019	
MH 76	MH 85	54	2	SE corner @ rear of property at 11 Kameha Way	In front of 11 Kameha Way, near Parcel "A"	6"	DIP	135.6	06-00,12-08	4			None to report	0	4	CIP	2013	Repair with liner FY13
MH 77	MH 78	14	1	At rear of property @ 19 Kameha Way, near lot line for #15	Rear of property @ 23 Kameha Way, near lot line for #19	6"	ACP	114.7	2-2012	1	105.4	MH78 - MH77	Joint separated in the pipe	3	4	TV	2019	
MH 78	MH 79	13	1	Rear of property @ 23 Kameha Way, near lot line for #19	At rear of property @ 35 Kameha Way, center of lot line	6"	ACP	258.9	1-2012	1	2.2	MH79 - MH78	Root in joint	3	4	Cut	FY 13	
										1	30.3		Joint offset in the pipe	3	1	TV	2019	
										1	178.6		Joint offset in the pipe	3	1	TV	2019	
										1	254.8		Infiltration in the pipe	2	1	Patch	FY 13	
MH 79	MH 80	10	1	At rear of property @ 35 Kameha Way, center of lot line	On lot line at rear of properties @ 43 & 45 Kameha Way	6"	ACP	208.1	06-00	9	82.4	MH79 - MH80	Offset joint	1	10	TV	2019	
			1						1-2012	1	82.3	MH80 - MH79	Joint offset in the pipe	5	6	TV	2019	
MH 80	MH 81	8	1	On lot line at rear of properites @ 43 & 45 Kameha Way	In Parcel "A", approx. 40' beyond rear lot line of #48 Kameha Way	6"	ACP	181.3	1-2012	1			None to report	0	1	TV	2019	
MH 81	MH 82	6	1	In Parcel "A", approx. 40' beyond rear lot line of #48 Kameha Way	In Parcel "A", approx. 40' N of MH #80	6"	ACP	65.2	1-2012	1			None to report	0	1	TV	2019	
MH 82	MH 83	6	1	In Parcel "A", approx. 40' N of MH #80	At rear of property @ 43 Kona Lane	6"	ACP	57.2	1-2012	1	57.2	MH83 - MH82	Infiltration in the pipe	2	3	Patch	FY 13	
MH 83	MH 84	4	1	At rear of property @ 43 Kona Lane	At rear of property at 31 Kona Lane, adjacent to lot line for #35	6"	ACP	270.2	06-00	9	67.5	MH84 - MH83	Lateral @ 2:00 offset behind the Y w/roots in joint	3	12	Cut	FY 13	
			1						1-2012	1	69.9		Root problem in lateral	3	4	Cut	FY 13	
MH 85	MH 86	27	1	In front of 11 Kameha Way, near Parcel "A"	In front of 18 Kameha Way	6"	ACP	171.7	1-2012	1			None to report	0	1	TV	2019	
MH 85	MH 93	27	1	In front of 11 Kameha Way, near Parcel "A"	In front of 6 Kameha Way	6"	ACP	92.0	1-2012	1	0.2	MH93 - MH85	Roots in the pipe	3	4	Cut	FY 13	
			1							1	23.6		Joint Offset in the Pipe	3	4	TV	2019	
MH 86	MH 87	25	1	In front of 18 Kameha Way	In front of 42 Kameha Way	6"	ACP	482.0	1-2012	1			None to report	0	1	TV	2019	
MH 87	MH 88	19	2	In front of 42 Kameha Way	At rear of property @ 42 Kameha Way, near lot line for #38	6"	ACP	142.6	1-2012	1			None to report	0	1	TV	2019	
MH 87	CO 12	1	1	In front of 42 Kameha Way	End of cul-de-sac on Kameha Way, in front of #48					15				0	15	TV	2019	
MH 88	MH 89	18	2	At rear of property @ 42 Kameha Way, near lot line for #38	At rear of properties on lot line between #31 and #34 Maui Lane	6"	ACP	61.4	1-2012	1	1.5	MH89 - MH88	Roots in the pipe	3	7	Cut	FY 13	

OCEANA MARIN SEWER SYSTEM (Pipe Segments)

C:\Users\Barbara\Desktop\[Book2.xlsx]Pipe Segments 14

PIPE SEGMENT				PHYSICAL LOCATION						PROBLEMS?						REPAIRS?	
FROM	TO	# of Upstream Services	Service rating	FROM	TO	PIPE SIZE	TYPE OF PIPE	LENGTH OF SECTION (in feet)	YEAR(s) T.V.'d	Date rating	Distance (in feet)	Direction (From MH/CO to MH/CO)	Problem Found	Wt. of Problem	Priority	Recommended Action & Date	Date	Work Done
MH 89	MH 90	5	1	At rear of properties on lot line between #31 and #34 Maui Lane	NW corner of Parcel "J", just behind rear lot line for #27 Maui Lane	6"	ACP	134.9	1-2012	1	124.1	MH89 - MH90	Infiltration in the pipe	2	3	Patch	FY 13	
MH 89	MH 91	11	1	At rear of properties on lot line between #31 and #34 Maui Lane	End of cul-de-sac of Maui Lane	6"	ACP	147.1	1-2012	1			None to report	0	1	TV	2019	
MH 89	CO 13	2	1	At rear of properties on lot line between #31 and #34 Maui Lane	On lot line between 30 & 34 Maui Lane, rear of properties	6"	ACP	117.5	1-2012	1	9.3	MH89 - CO13	Joint offset in the pipe	3	4	TV	2019	
			1							1	114.7		Joint Offset in the Pipe	3	4	TV	2019	
MH 90	CO 35	1	1	NW corner of Parcel "J", just behind rear lot line for #27 Maui Lane	Approx. 60' SW of MH90	4"	ACP	59.9	1-2012	1	34.5	MH90 - CO35	Sag close to MH	0	1	TV	2019	
MH 90	CO 36	1	1	NW corner of Parcel "J", just behind rear lot line for #27 Maui Lane	Approx. 60' SW of MH90	4"	ACP		1-2012	1	17.8	CO36-MH90	Sag	0	1	TV	2019	
MH 91	MH 92	11	1	End of cul-de-sac of Maui Lane	Near from of Maui Lane, adjacent to #6	6"	ACP	420.7	1-2012	1			None to report	0	1	TV	2019	
MH 91-92	CO 23	1	1		Near front of property @ 15 Maui Lane					15				0	15	TV	2019	
MH 93	MH 94	26	1	In front of 6 Kameha Way	In street between 425 & 427 Oceana Drive	6"	ACP	213.7	1-2012	1			None to report	0	1	TV	2019	
MH 94	MH 95	24	1	In street between 425 & 427 Oceana Drive	In front of 435 Oceana Drive	6"	ACP	230.8	1-2012	1			None to report	0	1	TV	2019	
MH 95	MH 96	20	2	In front of 435 Oceana Drive	In front of 451 Oceana Drive	6"	ACP	280.2	1-2012	1			None to report	0	1	TV	2019	
MH 95	CO 32	1	1	In front of 435 Oceana Drive	On property @ 435 Oceana Drive, approx. 40' W of MH #95					15				0	15	TV	2019	
MH 96	MH 97	13	1	In front of 451 Oceana Drive	In street between 463 & 464 Oceana Drive	6"	ACP	295.4	1-2012	1			None to report	0	1	TV	2019	
MH 97	MH 98	5	1	In street between 463 & 464 Oceana Drive	In street between 484 & 490 Oceana Drive	6"	ACP			15			None to report	0	15	TV	2019	
MH 97	CO 19	2	1	In street between 463 & 464 Oceana Drive	Near front of property @ 468 Oceana Drive					15				0	15	TV	2013	
MH 98	CO 20	4	1	In street between 484 & 490 Oceana Drive	Near front of property @ 468 Oceana Drive	4"	PVC	33.7	1-2012	1			None to report	0	1	TV	2019	
MH 99	MH 100	2	1							15				0	15	TV	2019	
MH 100	MH 101	3	1							15				0	15	TV	2019	
MH 101	MH 102	4	1							15				0	15	TV	2019	
MH 102	MH 103	4	1							15				0	15	TV	2019	
CO 19	CO 31	1	1	Near front of property @ 468 Oceana Drive	Near front of property @ 472 Oceana Drive					15				0	15	TV	2013	
MH 104	CO 34	12	1	@ Lift Station on Ocean View Drive (inside manhole)	Approx. 225' SE of MH 104	6"	PVC	341.8	1-2012	1	59.7	MH104 - CO 34	Joint separated in the pipe	3	4	TV	2019	

APPENDIX D

OCEANA MARIN INTRUSION INSPECTION REPORT
Work Done on February 28, 2014

Oceana Marin Intrusion Inspection Report

Work done on February 28th 2014
Work Done By Dan Garrett and Jeff Corda
Report Done By: Jeff Corda

The purpose of the investigation it the intrusion areas of rain water at Oceana Marin was to try and unearth the reasons for high flows within the sewer system during a rain event and locate the major areas on intrusion. Having been on scene during previous rain events and during our last few rounds of TVing, I have come to the realization that there are miniscule intrusion areas throughout the system. On the 28th of February Dan and I went out and tried to find the areas that contributed the largest amount of water into the system, this is what we found.

MH 59- This manhole had been injected with foam by Christian Brothers recently. The walls of the manhole look fine, the intrusion is coming from where the wall meets the floor. The water is coming in from everywhere, I am not sure if the foam injection will work in this area. We might have to try and grind out the base and mortar around the entire area.

MH 23- It looks like there is a significant amount of intrusion coming in from the consumers lateral. The flow looked clean and did not have any bubbles so it is not a washing machine or bath tub. It is my recommendation that we TV the consumers lateral to know for certain if there is a problem. It is relatively easy access to the lateral considering it daylights directly into the manhole.

MH 90- There is a lot of intrusion within this manhole, from the base all the way up the walls. Christian brothers will probably work on the walls but it might end up like MH 59 in regards to the base. Also if I remember correctly a couple years ago we tv'ed this line and there was a leak in the top of the sewer pipe leaving mh 90 and going to mh 89. I believe it was within 10ft of mh 90.

MH 65- Good size leak up high on the wall in this manhole, this one seems like it would be perfect for Christian brothers to do.

MH 29- The intrusion coming into the manhole is entering on top of the pipe coming from the upper manhole 30. The pipe looks to be newer than other pipes in the system. For this leak to be fixed I believe we need to break out the mortar around the pipe and put new mortar in its place.

The next two sets are areas that look to have intrusion other than what can be identified through looking at the manholes in the area.

MH-28 to MH-30

Even though manhole 29 is in this group, and the main culprit, I believe there is more intrusion in this area. It can not be seen from a particular manhole but I do believe that this area should be tv'ed in our next TV sewer line inspection sequence.

MH-57 to CO-27

There seems to be a good amount of intrusion coming uphill of manhole 57 and needs to be tv'ed in our next TV inspection sequence. If I remember correctly this was inspected a couple years ago and it had root penetration but I can not remember if they ever where cleaned out.

In conclusion I believe that the major areas of intrusion that Dan and I located account for around 10GPM. If we can correct these problem areas it should significantly reduce the rate of intrusion within our Oceana Marin sewer system.

APPENDIX E

BEECHER ENGINEERING
Electrical System Assessment Report

North Marin Water District

Oceana Marin Wastewater System

Electrical System Assessment Report

May 2015

Prepared By:

Todd Beecher, P.E.

Beecher Engineering, Inc.

Beecher Engineering, Inc.

Table of Contents

Purpose of Assessment

The purpose of this assessment is as follows:

- Identify aspects of the existing Oceana Marin Pump Station power distribution and control system which require repair or modification based on visual field inspection.

- Identify aspects of the existing North Street Lift Station power distribution and control system which require repair or modification based on visual field inspection.

- Identify aspects of the existing Treatment Ponds power distribution and control system which require repair or modification based on visual field inspection.

- Provide recommendations and associated cost estimates for each of the three (3) sites listed above.

Existing Electrical System Installation Assessment

On April 16, 2015, a site inspection was conducted by Mr. Todd Beecher, P.E. (Beecher Engineering, Inc.), accompanied by personnel from NMWD and Nute Engineering for the purpose of investigating the existing NMWD wastewater system sites. The assessment of each site's power distribution and control system installations was based on visual site inspection and discussions with NMWD personnel.

In general, the following assessment factors are applied to existing, installed electrical systems and comprise the basis for the recommendations included within this report:

- **Equipment Age** – In general, electrical power distribution equipment is typically designed for a maximum service life of approximately 30 years.
- **Visual Condition** – Equipment was inspected for signs of enclosure corrosion, excessive dirt or dust buildup and discoloration on internal components and terminals.
- **Code and Standard Compliance** – Existing equipment and installations were checked for compliance with applicable codes and standards including NFPA 70 (i.e. National Electrical Code) and NFPA 70E (i.e. Standard for Electrical Safety in the Workplace).
- **System Reliability** – A general analysis of existing power system equipment interconnections to assess overall power system reliability.
- **Personnel Safety Concerns** – Based on visual inspection of the existing electrical installations, any concerns related to personnel safety were noted and are included as part of this report.
- **Obsolescence** – Determine if new replacement components and parts are still commercially available for existing power distribution equipment.
- **NMWD Maintenance Staff Input** – Informal interviews with Maintenance Staff were conducted to determine background and historical information for several pieces of equipment and installations and asked to report on reoccurring component and equipment failures.

- **Opportunity for Replacement** – Electrical equipment which is nearing the end of its useful service life but still in good working condition should be considered for replacement if an upcoming improvement project is planned for an area which encompasses the electrical equipment or installation.

Time frames for implementation of the recommendations included in this report are based on the following criteria:

- **Immediate**:
  a. Equipment or current installation conditions present a potential safety hazard to Operations and Maintenance personnel.
  b. Equipment or current installation conditions present a high degree of risk that facility operational reliability may be compromised unless immediate action is taken.
  c. Equipment is well beyond its useful service life and should be planned for immediate replacement.
- **Within Next 5 Years** – This equipment is currently in good working condition but is approaching the end of its useful service life within the next five years. It is recommended that the Owner include replacement of this equipment over the next five year planning time frame.
- **Beyond 5 Years** – This equipment is in good working condition and the useful service life extends beyond the next five years. No recommendations for replacement within the next five years are recommended for this equipment.

Listed below are specific parts of the electrical power system which were inspected:

Oceana Marin Pump Station

The existing pump station is supplied utility power from a pad-mounted PG&E transformer at 240 volts, 3-phase. Standby power is supplied from an 80kW/100kVA, propane gas engine-driven generator (Generac) and automatic transfer switch (ATS). The electrical equipment at the site is housed in three (3) different structures:

- "Doghouse" Shed: PG&E meter, main circuit breaker, ATS, circuit breaker for the main panelboard (installed below-grade) and generator auxiliary power panelboard.

- Above-Grade Block Building: Standby generator.

- Below-Grade Pump Station: Pumps, motor controls, programmable logic controller (PLC) pump station control system, level controls, flowmeter transmitter, grinder local control panel (LCP), ventilation blower controls and main panelboard.

Figure 1: "Doghouse" Shed Interior

The "Doghouse" Shed enclosure is constructed of wood and has not provided adequate protection from the corrosive salt air. Although all of the enclosures within this structure are showing signs of corrosion, the PG&E meter enclosure and main circuit breaker enclosure are the most deteriorated and are both beyond repair. The ATS enclosure, which is fabricated from stainless steel, has some surface corrosion but the enclosure integrity has not been compromised. The small panelboard located in the "Doghouse" Shed includes circuit breakers for powering the standby generator equipment building. This panelboard and the circuit breaker enclosure (i.e. feeder breaker for the main panelboard in the below-grade structure) are starting to show signs of corrosion but the degree of rust appears to be cosmetic at this time.

The above-grade block building that houses the standby generator appears to have provided a good degree of protection for the interior equipment. There is, however, a ventilation louver located along the north wall of the structure which is designed to gravity-close when the ventilation fan is not running (i.e. the ventilation fan is activated when the generator runs). The louver was found to be hung up in the "open" position due to linkage hardware corrosion. Thus, with the louvers stuck in the "open" position, corrosive salt air has been permitted to freely enter the interior of the block building. This is evidenced by surface corrosion on the standby generator enclosure. NMWD personnel reported that the generator enclosure was recently painted due to corrosion that accumulated when the generator was originally installed outdoors. The interior generator and engine equipment appear to be in good

visual condition. NMWD personnel reported that the generator is tested regularly (i.e. once per month) and that no operational or maintenance issues have been reported.

Figure 2: Standby Generator Enclosure Surface Corrosion

The standby generator is fueled by a propane fuel source. During a seismic event, this piping is prone to shearing, particularly at the wall penetration and equipment connection locations.

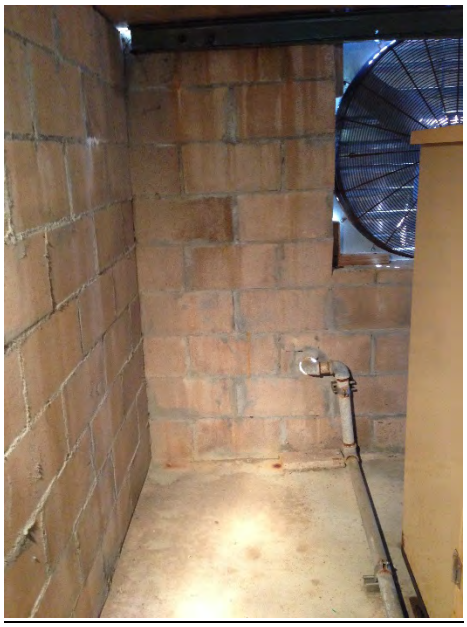


Figure 3: Standby Generator Fuel Piping

The below-grade pump station includes the pump motor control, bubbler level control system and instrumentation equipment. This location is prone to flooding should a piping system failure occur

within the below-grade structure. The existing pump motors are floor-mounted and have totally-enclosed fan-cooled (TEFC) enclosures which are not rated for submersion.

The motor control LCP is wall-mounted within the below-grade structure, appears to be relatively new and is in very good condition. NMWD personnel did not report any operational issues with this equipment. The PLC control panel also appears to be relatively new and in very good condition.

The main panelboard located in the below-grade structure includes circuit breakers for supplying power to the pumping equipment, PLC panel, grinders, structure lighting/receptacles and the structure sump pump. This panelboard is in good condition.

Although the electrical equipment and instrumentation located in the below-grade structure is in good condition and has been well maintained, pump station operability is vulnerable to flooding of this structure. The location of the pump LCP, PLC control panel and non-submersible rated motors within the below-grade structure could render the pump station non-operational if there were to be a piping system failure.

North Street Lift Station

According to NMWD personnel, it is likely that this lift station will be eliminated due to planned modifications for the existing sewage collection system underground piping. Thus, the below-grade lift station was not entered and inspected. NMWD personnel reported that the station level sensor is installed in the below-grade structure. The existing PG&E metering enclosure and level controller were inspected (i.e. this equipment is currently housed in a wood cabinet adjacent to the street). This equipment is in good condition and NMWD did not report any operational issues.

Figure 4: North Street Lift Station Level Controller and PG&E Meter

Treatment Ponds

The motor control equipment at the Treatment Ponds is likely 30+ years of age and is obsolete. Despite this obsolescence condition, however, the equipment has been well maintained. Additionally, the motor controller panel construction is quite simple and future retrofitting of failed components within these existing controller compartments can likely be performed without too much difficulty. NMWD

personnel reported that reliability of the electrical equipment at this site has been very good and no operational issues currently exist.

The PLC panel at this site is essentially new and in very good condition. NMWD personnel stated that this equipment is working well and no operational issues exist at this time.

Figure 5: Treatment Ponds Motor Controller Compartment

Recommendations

Based on the observations noted during the site investigation, the following recommendations have been developed for consideration:

Recommendation No.1: Oceana Marin Pump Station PG&E Meter/Main Replacement:

As noted, the existing PG&E meter and main circuit breaker enclosures have deteriorated beyond repair and require replacement. It is recommended that an outdoor, 316 stainless steel "meter/main" pedestal be installed within the existing "Doghouse" Shed location (e.g. Tesco pedestal). The pedestal equipment is rated for outdoor use. The 316 stainless steel enclosure coupled with installation within the "Doghouse" Shed will provide prolonged service life in the corrosive, salt air environment. This replacement will not require any modification to the existing PG&E service entrance other than engagement of PG&E to disconnect the existing meter and re-connect the new pedestal meter once it is installed.

The estimated installed cost for this replacement is as follows:

- Demolition of Existing Metering Enclosure and Main Breaker Enclosure: $3,000
- 316 Stainless Steel Pedestal Meter/Main Enclosure: $15,000
- PG&E Cost: $3,000

Recommendation No.1 Total Estimated Cost: $21,000

Recommendation No.2: Relocation of Electrical Equipment to Generator Block Building:

As noted in the discussion above, the existing automatic transfer switch and small panelboard located in the "Doghouse" Shed are prone to salt air corrosion due to the type of construction of the shed. Furthermore, the location of the sewage pump LCP, PLC control panel, bubbler panel and main panelboard are all prone to failure due to below-grade structure flooding. During discussions with NMWD, there seemed to be a comfort level that keeping the flowmeter, grinder LCP and blower equipment in the below-grade structure would be acceptable since the operation of this equipment is not as critical to overall pump station operability as the level control system and sewage pumping.

To mitigate these vulnerabilities, it is recommended that the LCP/PLC/bubbler panel/main panelboard equipment be relocated to the above-grade standby generator block building. Although it may be possible to relocate this equipment to locations within the interior of the existing standby generator block building, a better option would be to build an "add on" room, attached to the above-grade block building. This new room could essentially become the "Electrical Equipment Room", constructed with block walls and an industrial type personnel door that provides a good seal from the outside elements. Based on preliminary measurements, existing equipment relocation to the interior of the existing standby generator room may not be possible due to National Electrical Code (NEC) clearance requirements. Additionally, the ventilation system within the generator room will expose the electrical panels to outside salt air on a regular basis (i.e. ventilation fan and louver system). Thus, an "add on" room to the existing building is recommended over using existing wall space within the existing standby generator room.

Also included as part of this recommendation is the replacement of the existing ventilation louver and addition of flexible propane fuel piping connections.

Recommendations regarding the existing pumping equipment are included in the Nute Engineering assessment report.

The estimated installed cost for this recommendation is as follows:

- ATS Relocation (from "Doghouse" to Electrical Room): $25,000
- New "Small Panelboard" (to replace panelboard located in "Doghouse"): $5,000
- Pump LCP Relocation: $15,000
- PLC Control Panel Relocation: $10,000
- Bubbler Panel Relocation: $10,000

- Main Panelboard Relocation: $15,000
- Misc. Electrical Costs: $10,000

Recommendation No.2 Total Estimated Cost: $90,000

*** (Note: Electrical Room addition, louver replacement, and flexible fuel piping connection construction costs are included in Nute Engineering report and are not included in the above estimates)*

Figure 6: Possible "Electrical Room" Location (Generator Building West Wall)

<u>Recommendation No.3: Electrical Power System Studies:</u>

Arc flash hazard warning labels are required by NFPA 70E for power distribution equipment to enhance maintenance personnel safety. In order to develop this labeling, power system software modeling and analysis is required utilizing specialized electrical engineering software (i.e. SKM Systems).

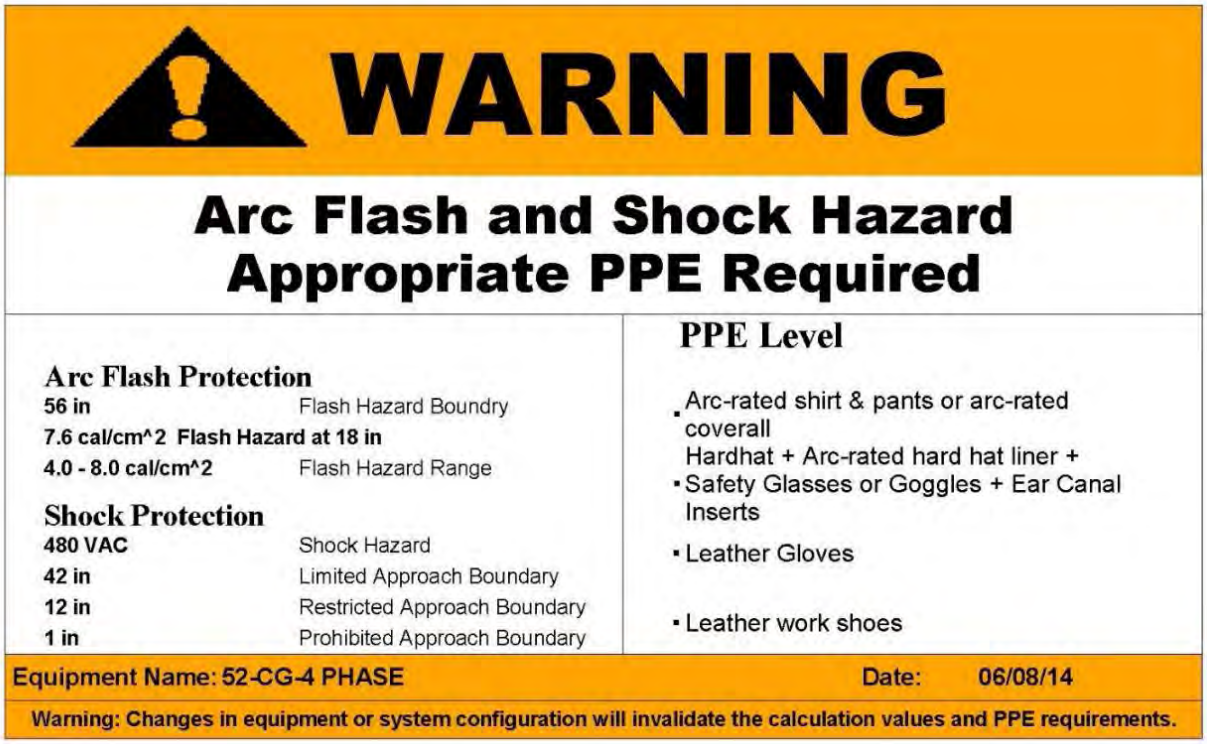


Figure 7: Arc Flash Hazard Warning Label Example

Modeling the existing power distribution systems at the Oceana Marin Pump Station and Treatment Pond sites will involve comprehensive field investigation to determine existing power system equipment ratings, connections, conductor sizes and conductor lengths. Once the systems are modeled within the software, short circuit analyses are performed to determine if the existing, installed equipment is adequately rated to withstand a fault condition at any point in the power system.

After the short circuit analyses are completed, protective device coordination studies and arc flash hazard studies will be performed simultaneously to optimize system protection while minimizing arc flash hazard at all points in each system.

Arc flash hazard warning labels are a code requirement. It is recommended that the District initiate the development of this labeling immediately to warn maintenance personnel about potentially dangerous locations within each facility with respect to electrical equipment arc flash hazard.

The estimated cost for this recommendation is $25,000.

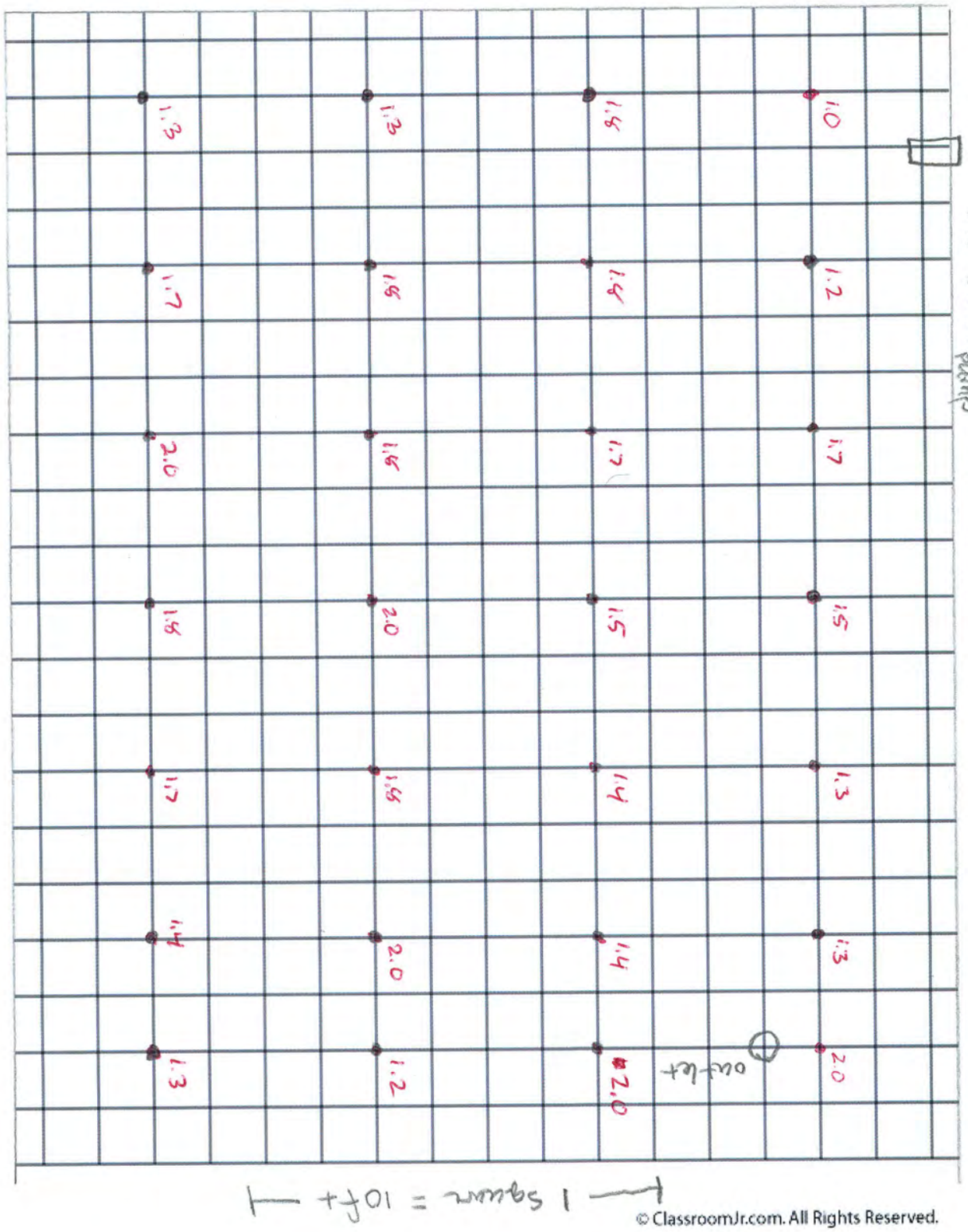
Recommendation No.4: Motor Control Equipment Replacement at Treatment Ponds:

Due to the age of the motor controller equipment at the Treatment Ponds, it is recommended that NMWD include planning within the next 5-year time frame for upgrading the existing motor controls with new equipment.

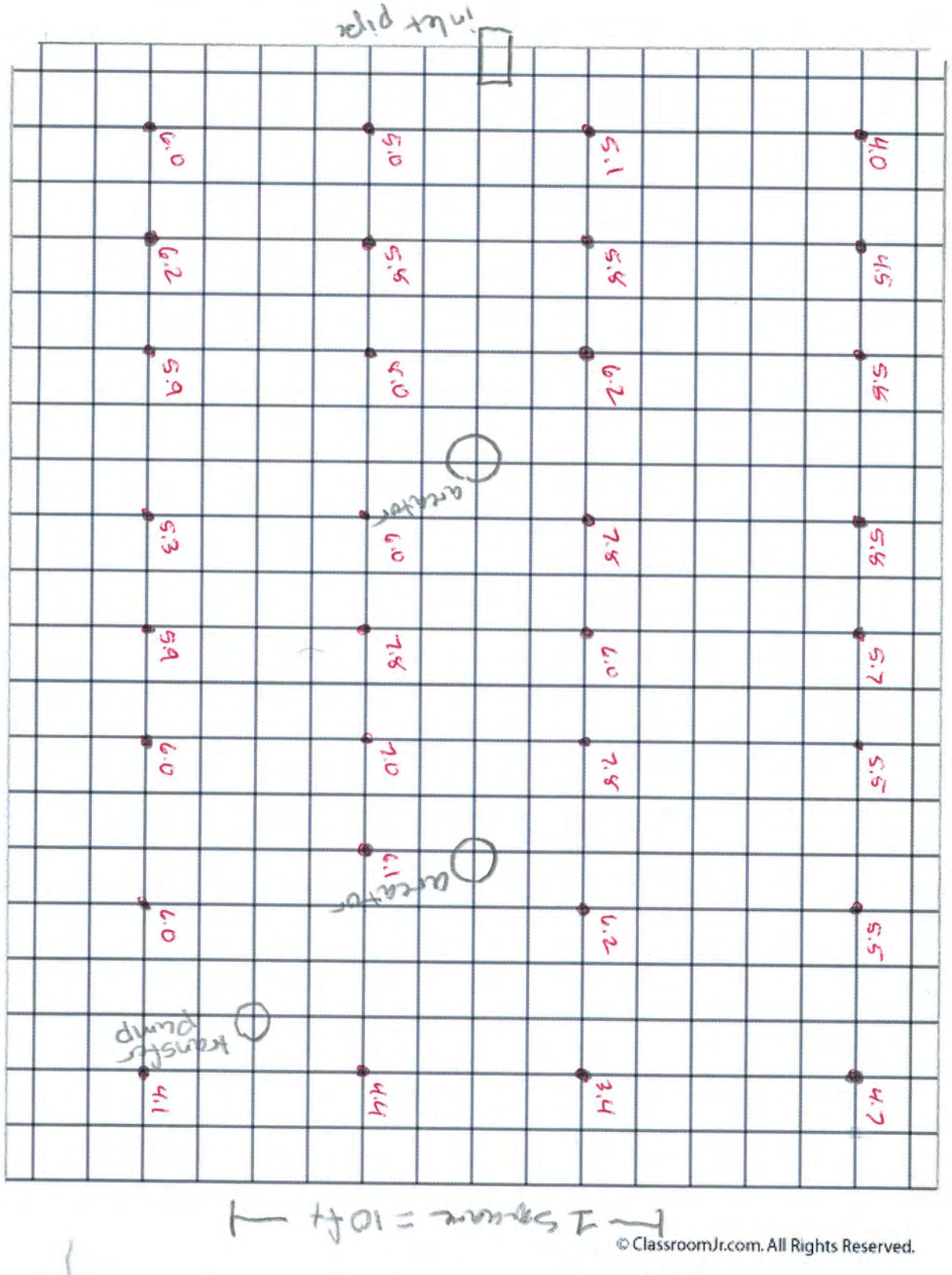
The estimated cost for this recommendation is $50,000.

APPENDIX F

POND SOUNDINGS



measurements taken on 5/27/15
1 square = 15ft
8' of free board



APPENDIX G

AYS ENGINEERING GROUP, INC.
Review of Dispersal Field Oceana Marin
Sewer System, Oceana Marin
Dillon Beach, California, 5-19-15

Review of Dispersal Field
Oceana Marin Sewer System
Oceana Marin, Dillon Beach California

5-19-15

PO Box 5693, Petaluma, CA 94955, Voice (707) 763-6620, Fax (707) 781-8061

AYS is reporting our review of the dispersal field portion of the sewer collection and treatment system for the Oceana Marin subdivision located in Dillon Beach, California. Our review is part of a larger report for the operators of the sewage system for the subdivision, North Marin Water District. This overall report is to review and update the long range master plan for the sewer facilities. Our work is limited to the dispersal field and its operation. AYS is working with Nute Engineering who is reporting on the sewer system as a whole.

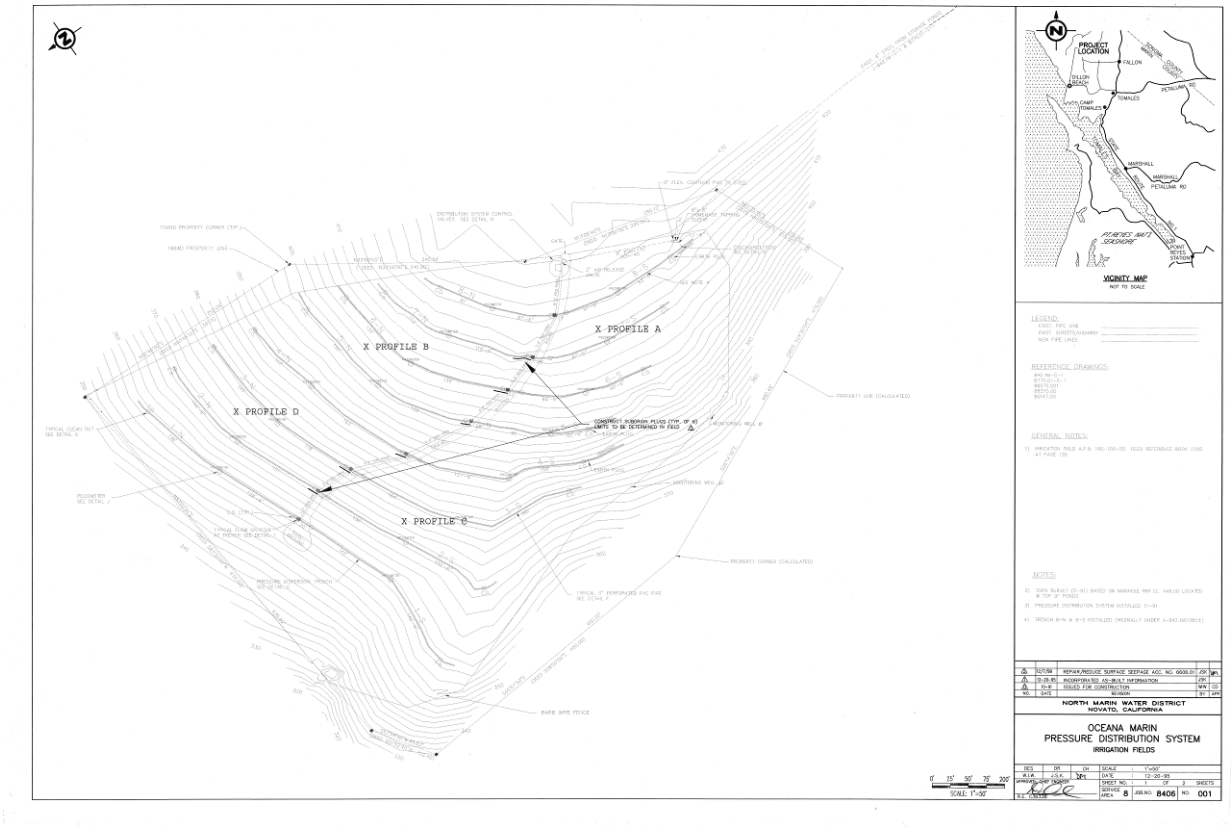
The review team, Nute Engineering and AYS Engineering, met with the North Marin Water Districts personnel 4-16-15 to observe and to review the sewer system for the subdivision. The meeting promptly split up with Ed Nute observing the main pump station and then portions of the sewer collection system and Troy Pearce moving to the dispersal field facility with Vernon Stafford to observe the dispersal field and talk about the operation of the field and how it is conducted. I had already reviewed the "Long-Range Master Plan Update" (Bracewell Engineering December 2005) and had many questions for Mr. Stafford.

The dispersal field is made up of 7 shallow pressure distribution leach lines located in an area with moderately sloping terrain with shallow soils and perched seasonal ground water due to the underlain less permeable clay soils. Another older trench exists at the upper portion of the field which does not match the newer design and is not used as it does not accept much effluent. The dispersal trenches are fed by a dosing siphon with an average dose of approximately 2,200 gallons at an approximate rate of 25 gallons per minute. Effluent is conveyed to each of the 7 operating drain lines for 24 hours and is controlled via an irrigation control panel and automated valves. The individual drain lines average 530 feet long 1.5 feet wide with 24 inches of gravel and 8 inches of soil cover.

The appearance of the drain field looked to be in relatively good condition. Some evidence of cattle in the field was apparent with some of the diversion boxes broken and areas that looked to be trampled in wet conditions. Down slope on the north side of the field showed a small slide that had recently occurred outside of the fence and about 75 to 100 feet from the south end of line #1. The area of the drain field appeared relative dry and was not spongy and no surfacing effluent was apparent.

We rejoined the group at the treatment and storage ponds and to the dosing siphon tanks. The dosing siphon is housed in a concrete cylindrical tank connected to a steel tank just upslope of the dosing chamber. These two tanks connect to act hydraulically as one larger tank. They store effluent from the ponds for a short period of time until the siphon is activated and the dispersal fields are dosed emptying and then refilling via gravity from pipes from the ponds. Staff reports that the steel tank is painted frequently in order to limit corrosion. This area also the injection site for the chlorination system using the tanks as the contact chambers.

At the completion of the tour of the facilities I returned to the dispersal fields and excavated 4- 4" diameter profile holes to a depth of 72 inches to observe the soil conditions at the dispersal field.



Profile A was excavated between drain line 7 and 8 on the South end of the field. The soil was found to have a high clay content very close to the surface and to the total depth of 72 inches. Mottling was noticed with 12 to 24 inched below grade which indicates that this area spends most of the year saturated. Typically areas with these conditions are not good candidates for use as dispersal fields. This may explain why line #8 is not accepting much effluent and is a good reason to abandon this line altogether.

Profile B was excavated between lines 6 and 5 on the north side of the field and found much better soil with 27 inches of very permeable silty loam topsoil over a permeable highly weathered sandstone with no indication of mottling.

Profile C was excavated between lines 2 and 3 on the south side of the field with similar topsoil to 24 inches as in profile B and then a sandy clay that showed some mottling although not nearly as strongly as profile A.

Profile D was excavated between lines 3 and 4 on the North side of the field. The shallow topsoil was very similar to profile B, upslope of it, with a depth of 29 inches then similar soils as B except that they were more clay and had some apparent mottles at 57 inches and deeper. The soil was also moist in this profile possibly as a result of the drain line above having dosed recently.

I would not suggest that my soil work be completely satisfactory for design level work

but they do give an indication to the workings of this system. The soils found here are not ideal for use as a drain field by today's standards. The soil found would not be allowed for use as a septic system of this design for residential use. We would only be able to use mound type septic system in this area with the exception of the area surrounding Profile B which may support a cover fill or shallow pressure distribution type system limited in depth of trench to 36 inches or so (this matches your current design) but in the other areas we would be forced to utilize mound type system in order to satisfy the vertical setback of 36" to suitable soil or ground water. This may be one of the reasons why you are mandated to chlorinate your effluent before dispersing in the field. Attached is the map of the profile holes that were excavated.

I requested as much piezometer well monitoring data as I could get in order to review and summarize this data to determine if any trends could be noticed as to the overall permeability of the soils in the dispersal area. Studies show that permeability of the soils surrounding the trenches of dispersal fields lose permeability over time. This loss varies widely from a very little loss over time with fresh water to clogging being more aggressive with higher strength waste streams. The clogging mechanism appears to be a byproduct of the microbes that aid in the cleansing of effluent. Higher strength waste streams seem to accelerate the clogging process as does high hydraulic loading, less permeable soils and anaerobic soil conditions brought on by ponding effluent inside of the drain field trenches. Current design standards tend to encourage aerobic soil conditions by limiting the use of less permeable soil, using the generally more permeable soil closer to the surface grade and to dose each trench in as small a dose as possible while still providing enough flow to pressurize the laterals of the trenches.

I have not come across much information as to what effect using chlorinated effluent has on the slowing permeability over time effect but would think that with the small residual that you aim for in the field will have a negligible effect on both the beneficial microbes in the soil as well as the anaerobic microbes which appear to have been blamed for the decrease in permeability.

I have been provided the piezometer data from the years '03 and '04 as well as '14 and '15 for my review. While this is not all of the information you have for the dispersal field it does show quite a bit of change over the years in the operation of the dispersal field and gives enough insight to the operation to make some recommendations for the continued operation of the system.

The piezometer data is recorded largely weekly when the dispersal field is in operation. Staff tells me that the system was operated in a manual fashion in the past and I have to assume that the earlier data was during this period of manual operation or that the fields were operated until it was noticed that they were filled and then the next line was put into service. I would also think that this must have been done on a weekly basis.

An irrigation controller and automated valves were more recently added to the system allowing each of the lines to be dosed for a 24 hour period and then taken out of

service with the next line is sequence going into service. The more current data ’14 and ’15 show a more even loading that is more consistent with current design standards of smaller more controlled dosing.

There are clearly differences in the data for this two time periods. One is the current drought conditions for Northern California compared to the normal rainfall totals for the ’03 and ’04 seasons. The other difference is the automated dosing of the more current data versus the manual dosing of the lines during the ’03 ’04 seasons.

I would consider hydraulic overloading of a leach line to occur when it is loaded so heavily that the effluent reaches the cover of the trench. I would say that a system is normally loaded when water reaches the mid point of the effect wall of the trench or the middle of the rock section of a dispersal trench. If we look at the two periods of ’03 and ’04 versus the ’14 and ’15 seasons we see a pretty big difference. The ’03,’04 seasons show hydraulic overloading occurring in 34.82 percent of all the piezometer reads as opposed to 14.76 percent for the more recent period. The difference probably is not due to just the automation of the system but also the drought and also your continued effort to correct infiltration though the conveyance system.

I also received NMWD’s Operations worksheets which show the gallons through the system. The gallons that were conveyed to the dispersal field are represented along with the doses and the meter reads. I received this information for the ’14, ’15 season and not the earlier period with the provided information. It is a simple task to arrive at the gallons per day for which the system is loaded during the monitoring period. This is shown on the attached spreadsheet for the piezometer readings and the data included from the operations worksheet for the loading to the dispersal field.

The data from the piezometer reads and the data from the operation worksheet for the dispersal field loading are the best information available to estimate the effectiveness of your dispersal field. Even with the limited information NMWD has provided it gives some insight to how the system is working. You can, with enough information, also determine the amount of effluent the field can disperse without adverse effect by looking at the loading versus the overall effluent level through the field. Weather, of course, has a great deal to do with the effectiveness of the dispersal field and is not part of the recorded data. Inferences from this data also can be made of the effective infiltration of each of the lines during wet and dry periods with a little more effort.

If rainfall data, such as weekly totals, could make this data even more useful a tool for the determining the basic health of the dispersal field. One could determine how the field reacts to high loadings during both wet and dry weather although it seems that your operation of the dispersal field are mostly a dry weather occurrence.

Recommendations:

I would strongly recommend that someone responsible for the dispersal field be given the task of entering all of your data from the dispersal field piezometers including the active dispersal trench and the loadings from the operations worksheets to a simple

spreadsheet; this along with rainfall data would give NMWD the best indicator of the relative health of the dispersal field. While this spreadsheet is not going to be able to predict with certainty your ultimate capacity it will help toward it by showing how much effect wastewater loading and rainfall effects your overall piezometer levels. The spreadsheet also can show if any decreases over time are appearing in year over year changes. This task would be best for whoever is responsible for the monitoring as it will give them insight to the operation of the system acting like a fuel gauge in a car and the data should be reviewed at first every quarter while the system is in operation.

The cows should be restricted from the dispersal field especially in the wet season weather the field is in operation or not. With only 8 to 12 inches of cover this is especially important to keep the effluent in the trenches not on the surface. Cattle also can cause compaction of the surface of the field especially when wet limiting gas transfer to the trenches which can promote the anaerobic conditions that must be avoided to extend the useful lifespan of the system to its maximum.

The slide adjacent (downslope of the field) should be looked at by a geotechnical engineer to see how much a problem it may be. It also appears to be off the property which may complicate things. I cannot say if the slide has occurred due to the use of the area upslope of it as a drain field. I can say, however, that the hydraulic loading of this area did not help stabilize the area. If the slide area is on another property it may be wise to notify the owner if this has not been done.

The minor corrective work to the distribution boxes that are broken should be corrected but as time allows as it is not an emergency.

I would suggest that you consider reducing the time each line is in service from 24 hours to 12 hours. I would also suggest this be done as a trial while increasing the monitoring (and recording in the spread sheet) to twice weekly. I would expect the hydraulic overloading of each trench to be reduced even more than the 3.5 percent of the reads noticed during the ’14, ’15 season.

During the above period I would also suggest that one of the lines be taken out of service for a period of a month to allow it to rest while watching the rest of the field to see how the increase in effective loading to the remaining lines is tolerated. If this is tolerated during the trial I would suggest that each season one of the seven lines be rested to reduce any bio-slime buildup aiding in the longevity of the system. The data(spreadsheet) for this period should be reviewed carefully to determine if the dosing regimen and the resting of one of the lines should be continued. We will need a good amount of data to see the effects in the system.

The last recommendation would be to come up with a system upgrade/ failure plan. The dispersal field has a huge spacing between individual lines. Normal residential spacing is 7.5 to 10 feet. The spacing between lines in the dispersal field is much greater than this some approaching 50 feet or more. Should the lines of the system begin to fail individually or collectively it could be reinstalled in the space between lines provided this is agreed to by Regional Water Quality Control Board. I would even suggest that this be negotiated now for the future. They may not agree to ahead of

time as they may want to see if better treatment / dispersal technology would be more appropriate in the future but it would be wise to start the planning in the event that this system develop issues over time. Your spreadsheet review will be your best tool in estimating how your system is doing. When your year over years indicate that the effluent levels in the piezometer are not dropping at rates shown in the past then it will be time to come up with your replacement plan. With proper management if is feasible that this system could last for a very long time but even with our best efforts dispersal fields can start developing issues over time.

Date	1A	1B	2A	2B	3A	3B	4A	4B	5A	5B	6A	6B	7A	7B	Active	Sump	Cl2	Meter gal	GtF	DtF	Rate	Notes
							inches from grade															
Tot Depth	36	34	34	38	36	34	32	26	33	25	33	34	32	31								
9/18/2002	dry	dry	32	dry	31	dry	19	28	12	11	7	11	14	13		52	0.5					
3/5/2003	dry	dry	26	dry	24	dry	21	dry	29	30	8	13	17	20		51	1.8					
3/12/2003																51	0.4					No inspection because of impending storm.
4/17/2003	35	35	19	34	19	30	15	24	23	23	2	13	17	16		51	.7/1.35					
5/14/2003	dry	dry	dry	dry	27	dry	15	dry	28	23	4	13	18	16		50	1					
5/21/2003	dry	dry	21	dry	22	26	14	18	31	28	dry	dry	dry	dry		50	0.8					Excellent condition
5/30/2003	dry	dry	dry	repair	dry	dry	dry	dry	25	20	22	19	16	16		53						
6/4/2003	dry	dry	dry	dry	31	dry	18	dry	23	26	9	9.5	17	15		51						
6/11/2003	34	dry	21	dry	18	18	11	17	26	25	dry	dry	dry	dry		50						
6/25/2003	29	dry	9	30	13	15	dry	dry	dry	dry	dry	dry	dry	dry		52	not done					
7/9/2003	dry	dry	9	off	14	29	dry	dry								49	0.14					
7/16/2003	dry	dry	26	31	13	15	9	16	19	22	dry	dry	dry	dry		52	0.7					
7/23/2003	dry	dry	28	dry	31	dry	18	27	16	19	8	12	16	16		52	0.4					
7/30/2003	28	dry	8	29	15	16	dry	dry	dry	dry	dry	dry	dry	dry		48						
8/6/2003	dry	dry	32	dry	28	32	17	dry	20	23	3	5	12	12		51	0.44					
8/13/2003	26	dry	6	30	14	14	dry	dry	dry	dry	29	dry	dry	dry		50	0.2					
8/20/2003	dry	dry	dry	dry	27	dry	17	dry	19	24	6	7	15	14		50	0.91					
8/27/2003	25	dry	2	dry	15	14	dry	dry	dry	dry	dry	dry	dry	dry		52	0.16					
9/3/2003	32	dry	8	32	12	11	7	12	13	17	dry	dry	dry	dry		49	not done					
9/10/2003	dry	dry	17	dry	25	29	17	dry	12	13	3	7	13	14		51	0.7					Field soggy at 7N and 6N water seeping down road 7N to 5S Rained day before.
9/17/2003	26	dry	5	32	13	13	dry	dry	dry	dry	dry	dry	dry	dry		49	0.3					
9/24/2003	35	0	8	off	12	11	11	14	17	15	29	0	0	0		50	0.23					
10/1/2003	dry	dry	dry	dry	29	dry	12	16	11	9	3	6	10	13		49	out					
10/8/2003	25	0	4	31	12	12	0	0	0	0	31	31	0	0		49	1					
10/15/2003	dry	dry	19	dry	12	12	10	13	16	17	dry	dry	dry	dry		51	1.2					
10/22/2003	dry	dry	17	dry	28	dry	28	dry	15	17	6	10	13	12		50	not done					A few soggy spots lines 6-7 middle
10/29/2003	dry	dry	29	dry	dry	dry	dry	dry	dry	dry	dry	dry	dry	dry		51						Turned off for season
2/25/2004	31	26	7	23	9	10	3	7	8	9	4	5	14	8		44						field very wet and soggy from discharge and heavy rain
3/3/2004	29	dry	14	31	17	17	5	11	28	27	28	30	dry	dry		39	>2.2					
3/10/2004	32	dry	14	dry	7	dry	16	dry	18	27	10	14	20	18		N/A	1.5					
3/17/2004	27	dry	12	31	18	18	dry	dry	dry	dry	dry	dry	dry	dry		41	1					Wet area below 2N
3/24/2004	33	34	16	31	17	17	15	18	32	30	32	33	33	31		47	1.57/2.00					
3/31/2004	32	34	16	34	18	29	14	24	21	28	10	15	18	18		47	0.78					
4/7/2004																43	0.25					
4/14/2004	34	34	16	34	18	23	16	28	25	32	8	14	17	18		48	1.02/1.82					
4/22/2004	28	dry	7	31	15	15	dry	dry	dry	dry	dry	dry	dry	dry		44	1.2					
4/28/2004	34	34	24	34	22	34	14	27	26	27	5	11	14	15		48	.60/1.2					
5/5/2004	dry	dry	11	31	14	14	8	12	17	17	dry	dry	dry	dry		49	0.4					
5/12/2004	25	dry	5	31	12	11	dry	dry	dry	dry	dry	dry	dry	dry		46	0.66					Soggy aroune #2N
5/20/2004	34	34	30	34	26	34	18	27	28	34	2	4	14	16		51	.21/1.58					
5/26/2004																	not done					Not inspected just rotated trenches
overloaded	0	2	22	1	22	16	22	14	15	12	17	18	17	17			195	40	14		560	34.82%

_	1A	1B	2A	2B	3A	3B	4A	4B	5A	5B	6A	6B	7A	7B	Sump	Cl2	Meter gal	GtF	gall/day	DtF	Rate	Notes
							inches from grade															
Tot Depth	36	34	34	38	36	34	32	26	33	25	33	34	32	31								
4/16/2014	32	28	22	33	17	14	12	12	32	33	29	32	off	off	32	0.57	69117.339	221088	31,584.00	105	23	
4/22/2014	33	35	22	31	26	34	26	20	15	17	30	34	32	32	36	1.37	69298.216	180877	30,146.17	86	22	Standing water at sump
4/30/2014																	69298.216	0		0	0	No flow to fields
5/7/2014	36	34	34	38	36	34	32	26	33	25	33	34	32	31	42	off	69300.118	2		0	0	All Fields dry
5/14/2014	23	30	34	34	34	35	27	25	30	35	30	32	33	32	42		69494	194152	27,736.00	99	19.5	
5/21/2014	34	34	31	32	32	30	35	33	25	30	33	30	24	16		0.73	69681	187000	26,714.29	94	14.6	
5/28/2014	35	32	26	33	35	34	16	12	33	35	30	34	32	32	36	1.02	69842	161000	23,000.00	91	17.9	
6/4/2014	35	34	33	34	30	31	28	24	17	18	33	34	32	32	39	8.8	69998	156000	22,285.71	80	18.6	
6/11/2014	35	34	34	34	35	33	29	25	28	32	3	10	32	32	40	8.8	70143	145000	20,714.29	82	15	
6/18/2014	35	35	34	34	35	33	30	25	31	34	24	23	28	26	42	6.5	70291	148000	21,142.86	76	12.5	
6/25/2014	34	34	34	34	36	35	32	25	33	35	33	32	32	32	42	>20	70331	40000	5,714.29	24	2.1	Turned off discharge to fields
7/2/2014															dry	no dischrg	70331	0		0	0	No discharge
7/16/2014															52	off	70331					
7/23/2014																no dischrg	70331					
7/30/2014																	70331					
8/2/2014																	70339	8000	2,666.67		25	
8/13/2014	34	34	31	34	34	33	31	25	24	26	34	34	31	31	43	0.6	70493	154000	14,000.00	83	15	Water boiling up out of hole by Sta 5. Cows in field
8/20/2014	35	34	33	32	35	33	29	27	33	34	16	19	32	31	44	0.4	70627	134000	19,142.86	75	14	
8/27/2014	35	34	26	34	25	34	25	20	33	35	34	34	32	32	36		70733	106000	15,142.86	59		
9/3/2014	35	36	34	34	35	30	32	29	32	35	32	39	32	32	44	off	70789	56000	8,000.00	27	off	discharge to field off
9/10/2014																	70789	0		0	0	
9/17/2014																	70789	0		0	0	
9/24/2014															58	off	70789	0		0	0	
10/1/2014																	70789	0		0	0	
10/8/2014																	70789	0		0	0	
10/15/2014	35	35	35	32	35	35	29	25	33	38	33	35	32	35	71	1.83	70864	75000	10,714.29	41	20	
10/22/2014	35	35	35	32	35	35	30	25	33	35	33	35	32	31	60		70915	51000	7,285.71	27	13	
10/28/2014	35	35	34	34	35	34	32	25	34	34	20	25	32	31	50	4.2	71001	86000	14,333.33	45	9	
11/5/2014																0.1	71171	170000	21,250.00	86	16	Cows in field
11/12/2014	35	31	34	34	36	32	24	29	33	36	21	30	32	32	48	1.08	71324	153000	21,857.14	79	15	
11/20/2014																	71515	191000	23,875.00	92	8	#5 box crushed full of water, 4B mushy cows inside

Date	1A	1B	2A	2B	3A	3B	4A	4B	5A	5B	6A	6B	7A	7B	Sump	Cl2	Meter	GtF	gall/day	DtF	Rate	Notes
	inches from grade																gal					
Tot Depth	36	34	34	38	36	34	32	26	33	25	33	34	32	31								
11/26/2014																	71515	0		0	0	
12/3/2014																	71516	1000	142.86	1		
12/10/2014																off	71516	0		0	0	Bull inside, no standing water
12/17/2014																	71516	0		0	0	
12/23/2014																	71516	0		0	0	
1/2/2015																	71516	0		0	0	
1/7/2015	34	34	32	34	35	34	28	25	29	30	7	11	31	31	40	2.2	71666	150,000.00	30,000.00	72	23	Standing water in hoof prints in field 6
1/14/2015	34	34	30	26	34	32	26	31	17	10	18	20	4	10	44	.	71957	291,000.00	41,571.43	114	35	
1/21/2015	17	20	23	34	34	33	19	16	22	26	19	15	29	32	38		72296	339,000.00	48,428.57	120	28	
1/26/2015	26	29	20	23	27	30	11	10	33	36	29	31	32	32	31	0.5	72508	212,000.00	42,400.00	79	28	
2/4/2015	33	dry	32	30	dry	dry	30	dry	dry	dry	35	dry	34	34	30	1.44	72884	376,000.00	41,777.78	143	30	Fields soaking wet, probably from cows, turning off irrigation because of storm coming.Large slide below sump
2/11/2015	29	dry	20	31	31	32	24	24	24	33	21	21	dry	dry	30		72884	off		0	0	Lots or cow evidence still mushy, starting to dry out after storm
2/18/2015	33	dry	32	30	dry	dry	30	dry	dry	dry	35	dry	34	34	38		72884	0.00		0	0	Starting to dry out, Trench 4 south has lost 11" of Pizo depth now measures 25" top to bottom
2/25/2015	dry	dry	dry	dry	dry	dry	dry	dry	dry	dry	dry	dry	dry	dry	44		72884	0.00		0	0	No water in any field all in good condition, Irrigation restarted #4 first field
3/4/2015																none	73138	254,000.00	36,285.71	111		replaced hydro pump
3/11/2015	34	34	27	34	32	34	28	25	34	29	11	10	32	32	40	.85/2.2	73287	149,000.00	21,285.71	82		
3/18/2015	dry	dry	dry	dry	dry	dry	26	dry	20	25	20	21	16	16	43	1.1	73498	211,000.00	30,142.86	100	25	
3/25/2015	19	27	33	dry	dry	dry	28	dry	30	28	26	26	24	28	N/A	na	73701	203,000.00	29,000.00	101	25	Good condition, cows getting in sometimes.
4/1/2015	31	36	12	15	36	33	32	25	33	32	28	30	32	31	36	2.2	73890	189,000.00	27,000.00	N/A	19	
4/8/2015																	73961	71,000.00	10,142.86	141	0	
4/15/2015																	73961	0.00		0	0	Field is off
4/22/2015																	70961	0.00		0	0	
	3	1	5	2	1	1	6	7	6	3	11	9	4	3	62	30	14	420		14.76%		