City of Moss Landing, CA
Sanitary Sewer Flow Monitoring
SFE File #C91-01

Installation Report

Submitted To:

MBARI
Attention: Mr. Keith Raybould
7700 Sandholdt Rd
Moss Landing, CA 95039-9644

Submitted By:

SFE Global NW
4141 Northgate Blvd., Suite 3
Sacramento, California 95834
(866) 332-9876

1.0 INTRODUCTION

This report provides details of the sanitary sewer flow-monitoring project conducted by SFE Global for the City of Moss Landing, under the direction of Mr. Keith Raybould. Enclosed are the details of the installation of one site under the Temporary Flow Monitoring Study. This site was commissioned and commenced data logging for reporting to MBARI as of November 20th, 2007. The anticipated duration of this project is two months.

Mr. Paul Loving, as Project Manager represents SFE Global during this project.

Site #	Location	Meter and Primary Device Used
C91-01-01	Sandholdt Rd	SFE Custom Compound Weir w/ ISCO Meter

2.0 MONITORING PROGRAM

Prior to installing the flow monitoring station, SFE performed a detailed site assessment of the potential site to determine the most appropriate flow monitoring device in achieving optimal results. Factors such as pipe size, channel condition, site location, and site hydraulics were all considered and documented while performing the site assessment. See Appendix #2 of this report for site assessment details.

SFE installed the flow monitoring station in accordance with the approved site assessment documentation. The meter had been calibrated and set to log data at a 5-minute interval. To ensure proper operation of the station, a regular maintenance schedule will be adhered to for the duration of the project. During each site maintenance inspection conducted by SFE, corresponding meter and field readings were obtained and recorded on the field maintenance sheet. These readings provide an indication of the accuracy and operation of the meter. See Appendix #2 of this report for the field report sheets detailing site inspection information, calibrations, and depth verifications.

Confined space entry procedures and general site/traffic safety was adhered to during site installation and site maintenance. SFE utilizes the "DBI SALA" rescue system, a 2800 CFM air induction device and TMX 412 air quality monitors. All of our staff members are thoroughly trained and certified in confined space entry procedures. Certificates are available upon request.

A thorough traffic control plan was established and used by SFE Global crews where required.

2.1 SANITARY METER INSTALLATION LOCATIONS

Site C91-01-01 – Sandholdt Rd: SFE installed a Custom Compound Weir and an ISCO Meter at a depth of 68.5 inches within the manhole to monitor flow from the 350mm pipe.

3.0 FLOW MONITORING RESULT

See Appendix #3 for the flow monitoring results from November 21st to December 20th, 2007. Flow monitoring will resume for the anticipated two-month project duration.

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Report End
January 2008

Appendix 1

Technical Information

SFE's Custom Compound Weir Technology was first developed in 1983. This system consists of the following two components:

- A customized primary device (Custom Compound Weir or CCW), which provides a predictable relationship of "head" versus "flow".
- A water level sensor and data logger

Testing & Awards

The relationship between "head" and "flow" for the primary device was initially established in a hydraulics lab in conjunction with the Canadian Centre for Inland Waterways (CCIW) and published in a report prepared for a local utility. In subsequent years the monitoring techniques were further refined and additional laboratory work was carried out for the primary device. In 1988 the Association of Consulting Engineers in their annual national engineering awards program recognized the work with an Award of Merit.

Any level sensing device may be used reliably measure flows including ultrasonic level indicators, pressure transducers and floats. The system was designed to make it economically feasible for even small utilities to be able to operate a network of stations for a long duration - the low operating costs & high accuracy/reliability prevailing over other measurement systems.

Self-Cleaning

The primary device has a rectangular notch, which then flares out into a "V" section and then a rectangular upper portion. The notch and "V" section have chamfered 38 mm thick "lips" which make them self-cleaning and result in a very high weir flow coefficient.

The self-cleaning properties of these weirs have been amply field proven over the past 18 years at approximately 2200 such stations. Each of our Custom Compound Weirs is custom designed by an open channel hydraulics specialist for the manhole, chamber or channel configuration it is to be used in.

Low Flow Accuracy

For sewers up to 534 mm diameter the notch is typically 100 mm wide and 140 mm deep. This results in a flow rate of roughly 1.0 l/s for a head of 25 mm. Since a 2.5 psi pressure transducer or narrow beam ultrasonic indicator is usually capable of measuring water levels within +/- ¼", flow rates down to 1.0 l/s can readily be measured (a special unit has previously been designed to measure pre-treated wastewater flow rates down to 0.001 l/s).

No Sewer Backups

The lower notch magnifies the variation of the water level with small changes in flow rate (e.g. for the base flow regime). The overall primary device or "weir" normally has an opening greater than the pipe cross sectional area and capacities greater than that of the sewer in which they are placed.

Any Size, Any Shape

SFE has installed custom compound weirs in sewers from 0.15 m to 3.6 m as well as in varying sizes of pond outlets, creeks, WWTP's, etc. Custom designing the primary device for the manhole or channel in which it will be placed means that you have considerable control over the final flow regime. This has allowed many difficult hydraulic situations to be handled including bends, junctions, slopes over 10%, drop connections, and drops in the main pipe invert.

Velocity Measurements Not Required

One of the major advantages of SFE's Custom Compound Weir is that it only requires a depth sensor and logger; a velocity sensor is not used. Many of the problems associated with sewer flow monitoring are related to the velocity sensor and the need to measure average velocity. Velocity sensors are prone to fouling with subsequent "drifting" of the signal whereas pressure sensors will still accurately register variations in water level even if they have debris on them.

No "In the flow" Probes

The use of SFE's Custom Compound Weir further improves the performance of pressure sensors since they no longer represent an effective obstruction in the flow (they are installed behind the weir). They will always have a reasonable "head" on them as the weir lip elevation maintains a minimum depth of 100 mm behind the weir. As pressure transducers are much less accurate when depths approach zero; this situation becomes a problem for Area-Velocity (AV)) type meters in small pipes where base flow rates are low.

Less Expensive

"Level only" monitors such as those used with our Custom Compound Weir are less expensive than AV meters and need less power to operate. Flow profiling is needed for conventional AV meters to ensure that the velocity sensed at a point or across a band of flow is properly transformed into average velocity across the pipe section. Since the Custom Compound Weir does not use velocity, profiling becomes redundant.

High Accuracy

Dye dilution and full-scale lab comparisons have been conducted and the results have been excellent. In most cases +/- 5% is readily achievable without special attention.

Temporary or Permanent

The Custom Compound Weir's are normally located in the manhole chamber about 300 mm from the downstream end.

Material	Life Expectancy	Uses
Lumber/Lexan	1 week to several years	Short Term (E.g. I/I Study)
Plywood	Up to 2 years	Temporary
Pressure Treated Lumber	5 to 8 years	Semi-Permanent
Lexan and 3/16 Stainless	50 Years	Permanent

No Surcharges

Is there a possibility of sewer surcharges causing basement flooding because of the use of such primary devices or weirs? The question has been raised many times over the past 18 years and was addressed on a project when the Custom Compound Weir was first designed in 1984. The purpose of that first project was to determine the cause of persistent sewer related basement flooding. The client was very concerned that the study procedures did not create more flooding since two Custom Compound Weir stations were just downstream of the area receiving the flooding. The design and placement of the Custom Compound Weirs addressed this as follows:

- Each CCW was located in a manhole and not in the pipe, approximately 300 mm from the downstream end so that if the weir were to ever get blocked it could simply overflow safely. (This event has never occurred).
- For manholes with a chamber larger than the pipe (i.e. 450 mm pipe in standard 1065 mm manhole), the weir opening is greater than the pipe area. The flow over the weir is also at critical depth and therefore at a higher velocity than normally occurs in the pipe itself. As a result, the weir capacity is much greater than the pipe capacity in most installations.

- A rating curve was provided for a demo weir that has the standard opening used in pipes up to 450 mm. Table 1 below shows the flow capacity of this weir configuration at selected heads versus the full flow capacity of selected pipe sizes up to 450 mm at a 0.25 % grade. The comparison illustrates that the CCW capacity can be much greater than the pipe capacity.

Flow Capacity of Standard Small Pipe Configuration at Selected Heads		**Full Flow Capacity of Selected Pipes @ 0.25 % Grade**	
Head (mm.)	**Flow (l/s)**	**Pipe Diameter (mm.)**	**Capacity (l/s)**
25	1	200	16
140	12	250	30
200	22	300	48
318	63	380	88
508	145	450	143
610	230		

Laboratory Tested

Hydraulic model testing conducted at the Canada Centre for Inland Waters, provided the opportunity of observing the pipe / weir / manhole performance as the flow rates in the system were increased to the point that it surcharged. As the system started to surcharge, the "control" shifted from the weir to the downstream pipe and there was essentially no drop in the water surface across the weir (i.e. under surcharge, the weir was not influencing the water levels upstream).

Custom Designs

Every Custom Compound Weir is custom designed with a rectangular low flow notch and chamfered lips to give it a high weir flow coefficient. This means that it passes a greater flow for a given head than normal sharp crested weirs. Custom designed means specific concerns are addressed at specific sites.

Appendix 2

Site Information
Including Photos & Field Reports

Site Assessment

CLIENT FLOW MONITORING #:	**1**	**SFE PROJECT #:**	**C91-01**
NAME:	**MBARI**	**SFE SITE #:**	**C91-01-01**
Date / Time:	**11/20/07 8:46 AM**		

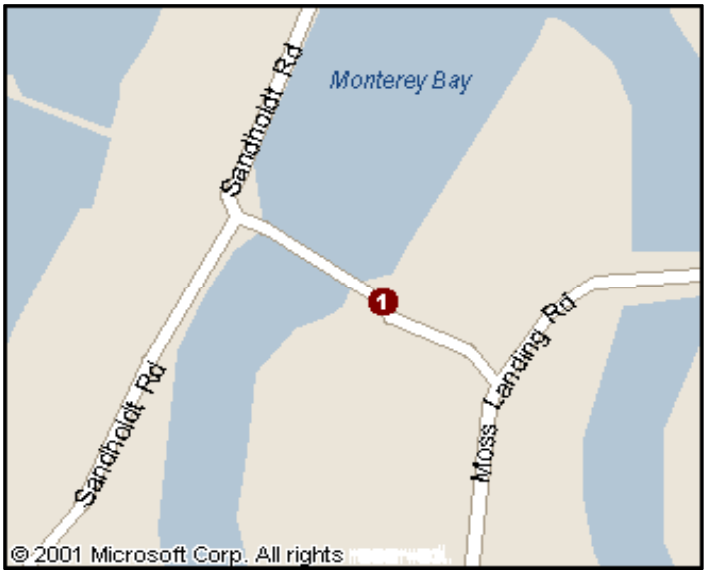
Project Specific Information

Client Name:	MBARI	
End User Name:	MBARI	
Project Name:	Sanitary Sewer Flow Monitoring	
Client Contact:	Keith Raybould	(831) 775-1828
Field Contact:	Art Frolli	(831) 755-4950
SFE PM Contact:	Paul Loving	(604) 992-6792

Site Location Information

Client Manhole #:	
Address (Location):	Sandholdt Rd
City, State:	Moss Landing, CA
GPS (North - West):	N 36° 47.970 W 121° 47.223
Landmarks:	Just East of Bridge
Additional Information:	

Map of Area



Traffic Control Requirements

Provider:	County
Condition	Local
Frequency:	Install / Maintenance / Removal
Speed Limit:	25 MPH
# of Lanes Effected:	2
Lane Configuration:	Road
Additional Information:	In middle of Road

Notes

1 Set up secondary level/flow logging rate. If Level is greater than 4" to log every 30 seconds.

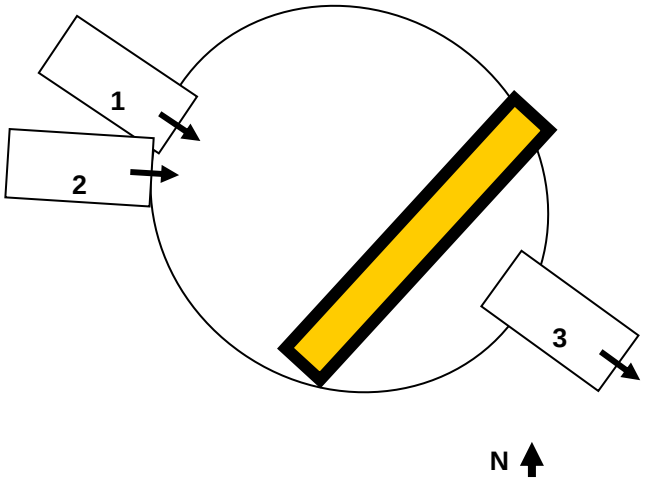
Site Equipment

Install / Remove Date:	11/20/07
Meter Make & Model:	ISCO 2150
Level Type:	Pressure
Velocity Type:	Average
Primary Device:	Weir
Wireless:	No
Redundancy:	No
Logging Rate:	5 Min

Site Profile

Pipe #1 Size:	4	Inches
Pipe #2 Size:	6	Inches
Pipe #3 Size:	8	Inches
Pipe #4 Size:	N/A	Inches
Manhole Depth:	68.5	Inches
Laterals / Rungs:	No	No
Additional Information:		

Manhole Layout



Site Hydraulics

Date & Time:	11/20/07	8:46 AM
Depth:	0.25	Inches
Velocity:	0.5	FPS
Turbulent:	Yes	
Surcharge:	No	
Silting:	No	
Solids:	No	

Notes

2 Down Stream of Lift Station.

3 Very high levels of H2S inside Manhole.

CLIENT FLOW MONITORING #:	**1**	**SFE PROJECT #:**	**C91-01**
NAME:	**MBARI**	**SFE SITE #:**	**C91-01-01**
Date / Time:	**11/20/07**	**8:46 AM**	

Picture 1

Picture 2

Picture 3

Picture 4

Notes

1
2
3

CCW Installation Form

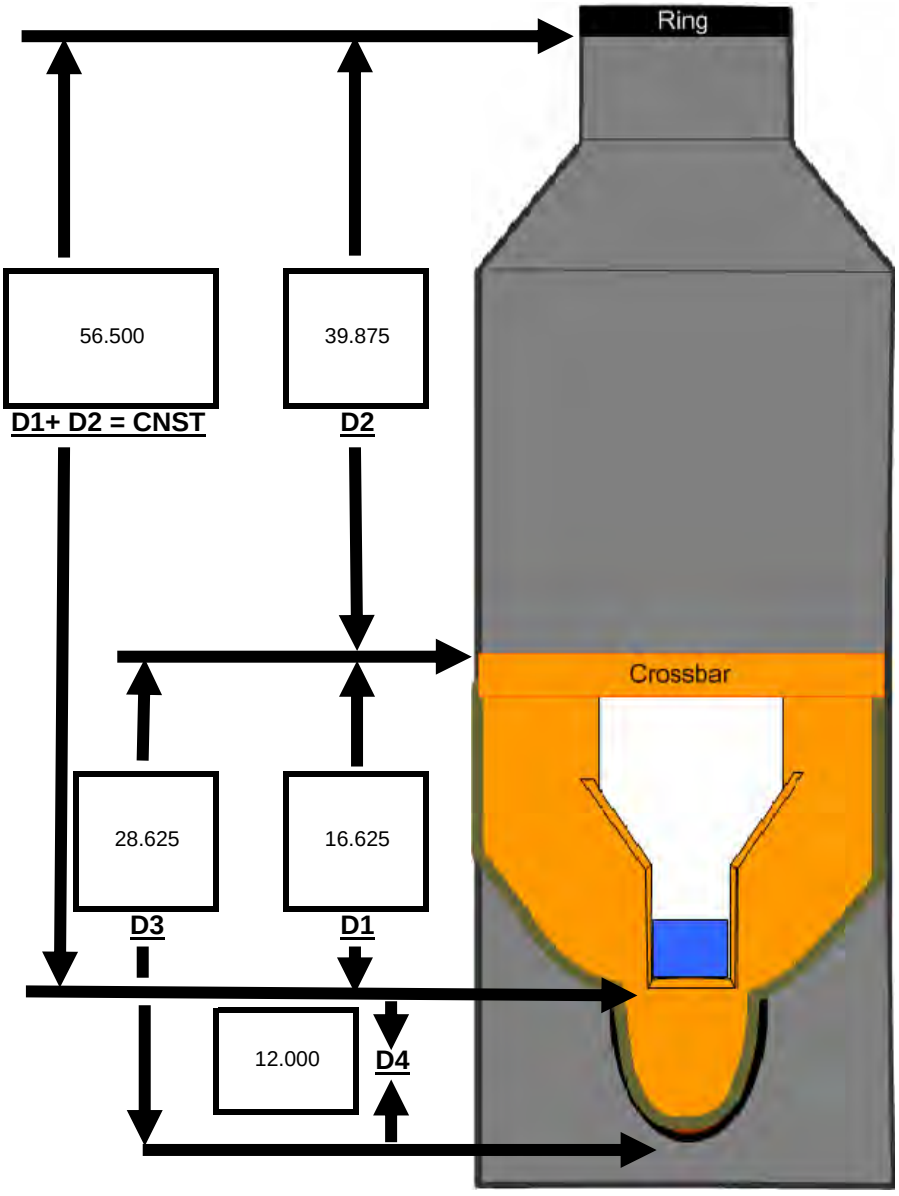
CLIENT FLOW MONITORING #: 1
NAME: MBARI
Date / Time: 11/20/07 11:45 AM

SFE PROJECT #: C91-01
SFE SITE #: C91-01-01
Technician 1: Matt Smith
Technician 2: John Garcia

Meter Depth vs.. Field Depth Calibration / Verification

Reading Number	Date	Time	Field Meas (in.)	Meter Depth (in)	Comments (Zero Meter Level before Installation)
Initial	11/20/2007	12:05	0.250	11.820	Pre Adjust
1	11/20/2007	12:06	0.250	0.230	
2	11/20/2007	12:08	0.250	0.220	
3	11/20/2007	12:12	0.250	0.190	
Average			0.250	0.210	

* Three Continuous Measurements Within 0.5 Inches
* Average Meter vs (WL1 and WL2) Within 5%



Manhole Depth (in) (D2+D3)
68.500

Pipe Diameters (in)

Pipe 1	4
Pipe 2	6
Pipe 3	8
Pipe 4	N/A

Weir Size
350mm

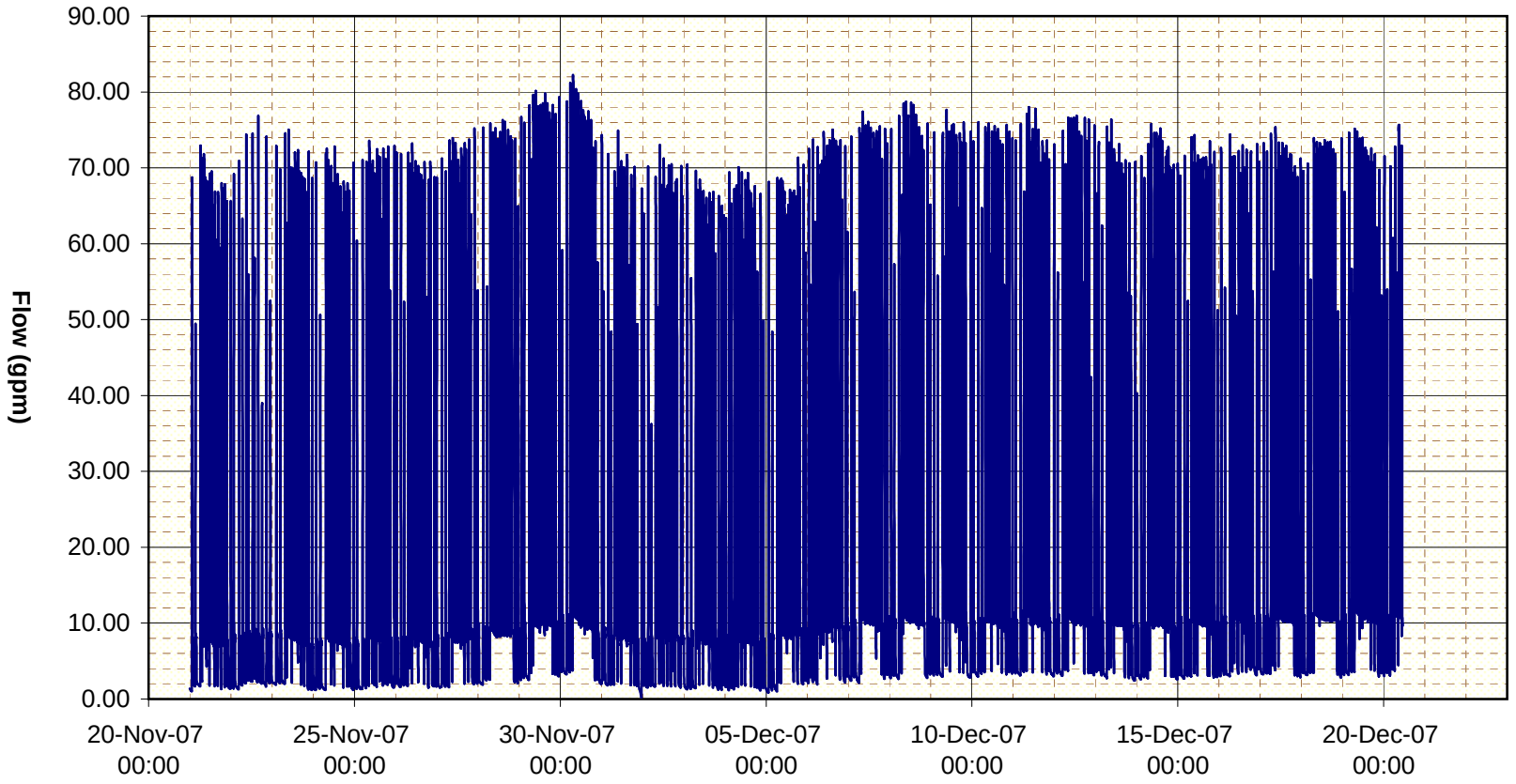
D4=Invert to Weir Lip (D3-D1)
12

Obvert to Weir Lip
N/A

Appendix 3

Site Summary
Including
Hydrograph

City of Moss Landind, CA
C91-01-01
SFE CCW w/ISCO Meter
Sandholdt Rd
November 21 to December 20, 2007



City of Moss Landing
C91-01-01
SFE CCW w/ISCO Meter
Sandholdt Rd
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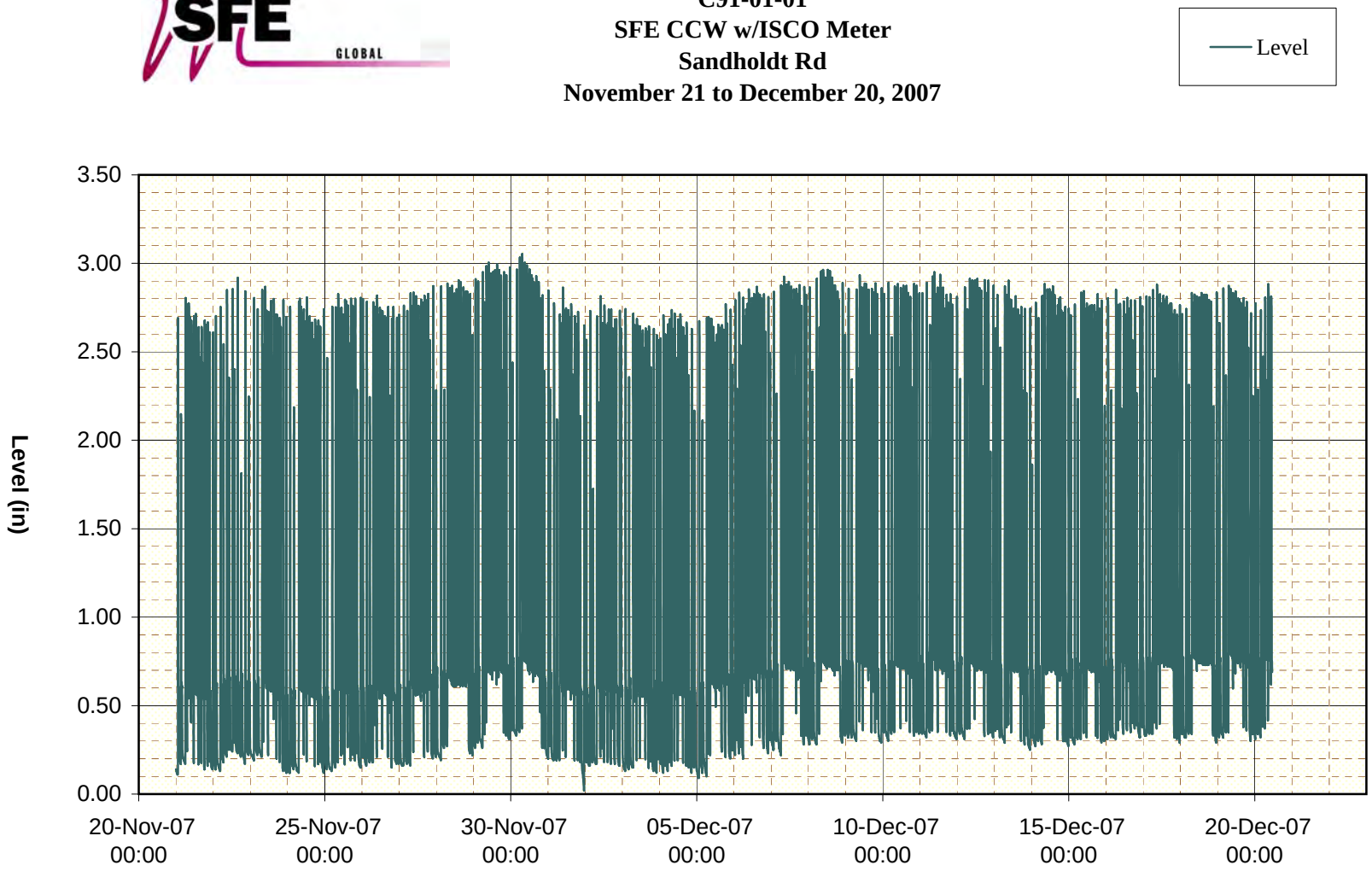

City of Moss Landing, CA
C91-01-01
SFE CCW w/ISCO Meter
Sandholdt Rd
November 21 to December 20, 2007

Date	Avg Flow (gpm)	Min Flow (gpm)	Max Flow (gpm)	Total Flow (mgd)
21-Nov-07	15.43	1.03	72.03	0.022
22-Nov-07	8.90	1.26	75.86	0.013
23-Nov-07	14.49	1.19	74.76	0.021
24-Nov-07	15.45	1.19	72.57	0.022
25-Nov-07	12.47	1.29	73.35	0.018
26-Nov-07	14.28	1.48	72.92	0.021
27-Nov-07	14.96	1.52	74.75	0.022
28-Nov-07	21.55	1.86	76.16	0.031
29-Nov-07	25.94	2.49	79.98	0.037
30-Nov-07	21.33	2.01	82.10	0.031
01-Dec-07	15.64	0.21	74.80	0.023
02-Dec-07	12.93	1.51	72.85	0.019
03-Dec-07	13.31	1.17	69.65	0.019
04-Dec-07	14.22	1.12	69.89	0.020
05-Dec-07	16.60	0.85	71.04	0.024
06-Dec-07	18.61	1.91	74.75	0.027
07-Dec-07	18.44	2.13	77.22	0.027
08-Dec-07	21.60	2.65	78.58	0.031
09-Dec-07	16.50	2.81	77.54	0.024
10-Dec-07	16.68	2.92	75.69	0.024
11-Dec-07	18.06	2.97	77.99	0.026
12-Dec-07	18.59	3.06	76.77	0.027
13-Dec-07	19.45	2.41	76.29	0.028
14-Dec-07	20.47	2.56	75.66	0.029
15-Dec-07	17.84	2.71	74.20	0.026
16-Dec-07	15.04	3.00	73.65	0.022
17-Dec-07	22.20	2.85	75.03	0.032
18-Dec-07	23.42	2.80	73.82	0.034
19-Dec-07	19.45	2.96	75.02	0.028
20-Dec-07	18.77	3.02	75.67	0.027

Statistics

Total Flow (mg)	Min Flow (gpm)	Max Flow (gpm)
0.753	0.210	82.100