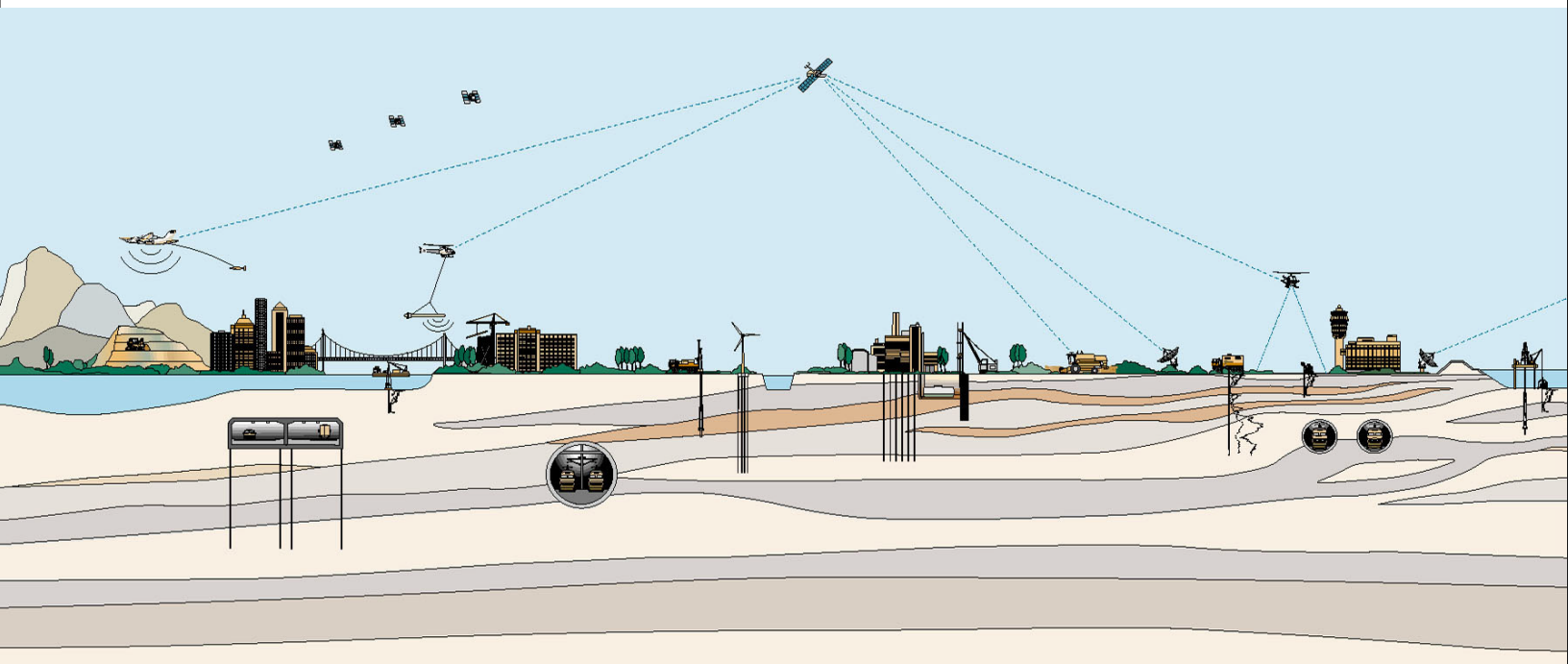
FUGRO CONSULTANTS, INC.

ANNUAL REPORT
JULY 2011 THROUGH JUNE 2012
MALIBU ROAD LANDSLIDE ASSESSMENT DISTRICT
MALIBU, CALIFORNIA

Prepared for:
CITY OF MALIBU

September 2012
Fugro Project No. 04.B3399004



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September 26, 2012
Project No. 04.B3399004

City of Malibu
23825 Stuart Ranch Road
Malibu, California 90265

Attention: Mr. Rob Duboux

Subject: Annual Report, July 2011 through June 2012, Malibu Road Landslide Assessment District

Dear Mr. Duboux,

Fugro is pleased to present this annual report for the Malibu Road Landslide Assessment District. This report summarizes the monitoring and maintenance activities completed during the period of July 2011 through June 2012.

Fugro appreciates the opportunity to be of service to the City of Malibu and the District homeowners. Please contact Danya Pollard at (805) 289-3813 if you have any questions regarding this report.

Sincerely,

FUGRO CONSULTANTS, INC.

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CONTENTS

TABLES

PLATES

CONTENTS - CONTINUED

APPENDICES

1.0 INTRODUCTION

1.1 AUTHORIZATION

Fugro Consultants, Inc. (Fugro), performed the work summarized in this report in accordance with our contract with the City of Malibu (City) and consistent with the cost estimate document "Exhibit A - FY 2011-2012 Maintenance Cost Estimate" presented in the Annual Assessment Report (Taussig, 2011).

1.2 BACKGROUND

The Malibu Road Landslide Assessment District (Assessment District) was established in 1981 by the County of Los Angeles (County) following the activation of a landslide on the west end of Malibu Road in 1978 (Plates 1 and 2). The assessment district provides permanent funding to maintain and monitor dewatering facilities with the purpose of stabilizing the landslide to the extent feasible using dewatering methods only. The County administered the assessment district until 1991 when the City incorporated. The Assessment District was reauthorized in June 1998 under Resolution AD No. 98-3. The City has administered the assessment district, utilizing consultants to maintain and monitor the district facilities.

1.3 SCOPE OF WORK

This annual report summarizes the monitoring and maintenance of the geotechnical instrumentation and dewatering facilities within the Malibu Road Assessment District for the period between July 1, 2011, and June 30, 2012 (hereafter, the "monitoring period").

Routine monitoring data collected during the current monitoring period included the following:

- Review of annual rainfall data from a local rain gauge operated by the County of Los Angeles, Department of Public Works - Water Resources Division;
- Monthly groundwater level measurements from nine standpipes and eight pneumatic piezometers;
- Monthly dewatering production readings from ten dewatering wells owned by the Assessment District and three wells owned by a private homeowner on Bayshore Drive;
- Monthly dewatering production readings from 26 horizontal drains (hydraugers);
- Quarterly ground deformation measurements from five slope inclinometers; and
- Periodic maintenance of dewatering and monitoring facilities.

The operating condition of the instrumentation and dewatering facilities was checked during each field monitoring/observation visit and by evaluating preliminary data in the office as it was received. Maintenance was performed as needed based upon the field observations and preliminary data evaluation.

The scope of services includes monitoring and maintenance of the assessment district facilities. The services provided on an annual basis for the assessment district do not include an engineering evaluation of the stability of the landslide.

1.4 REPORT ORGANIZATION

This report summarizes the monitoring data collected during the current monitoring period and presents conclusions regarding the annual monitoring results. The location of the assessment district is illustrated on Plate 1 - Site Location Map. Locations of the geotechnical instrumentation are shown on Plate 2 - Assessment District Map. Tabulated and graphic summaries of monitoring data are presented in Appendix A through Appendix C as indicated in the Table of Contents.

1.5 REPORT AVAILABILITY

The annual Assessment District reports are available for review at Malibu City Hall. Reports may also be viewed on the City's website at http://www.malibucity.org.

2.0 MONITORING

2.1 RAINFALL DATA

Rainfall totals were tabulated based on recorded values from the Los Angeles County Rainfall Station 1239 - located at Big Rock Mesa. A graph of historical monthly rainfall and average annual rainfall is shown on Plate 3 - Rainfall Graph.

Rainfall data indicate that approximately 11.71 inches of precipitation fell during the monitoring period from July 2011 through June 2012. The average annual rainfall from 1968 to 2012 in the Malibu area for the monitoring period July through June is approximately 16.1 inches.

Rainfall data are usually analyzed in terms of the annual "rain season" that covers the time period October 1 through September 30. Rainfall for October 1, 2011, through June 30, 2012, was approximately 11.67 inches. This is approximately 72 percent of the average annual rainfall of 16.1 inches for the rain seasons of 1968 through 2012.

2.2 GROUNDWATER MONITORING

The groundwater level data collected during the current monitoring period are summarized in Appendix A. Groundwater levels fluctuate throughout the year and from year to year in response to natural and man-made influences. The primary natural influence is varying precipitation. Man-made influences include:

- Recharge from septic systems;
- Recharge from irrigation;
- Alterations to surface drainage by grading, landscaping, storm drains, and rain gutters;

- Accidental water discharges from leaking utilities (water, irrigation, sewer, storm drain), and swimming pools; and
- Dewatering activities including pumping dewatering wells and hydraugers.

Typically, groundwater levels rise relatively quickly following significant rainfall and gradually lower after the wet season ends. Groundwater levels measured in standpipe piezometers (wells) and pneumatic piezometers are depicted on Plates A1 through A5 in Appendix A. Groundwater levels at Malibu Road typically peak around late-March to mid-April and gradually decline through late September to November.

A summary graph of normalized peak groundwater elevations for Malibu Road is presented on the bottom graph of Plate 5. The top graph on Plate 5 shows the average dewatering output (gpd) and the cumulative departure from the mean rainfall. The average annual rainfall used for the chart was computed using all of the data from 1988 through the present. This graph illustrates that although annual rainfall has been generally increasing since 2008, the average dewatering output has been decreasing.

2.2.1 Standpipe Piezometers

Nine standpipe piezometers (W-2A, W-3A, PZ-A, PZ-B, PZ-C, PZ-D, PZ-E, SI-5 and SI-6) were measured regularly over the monitoring period. Slope inclinometers/piezometers SI-5 and SI-6 were installed in 1998 along Bayshore Drive. Los Angeles County installed the other piezometers at earlier dates. The locations of the standpipe piezometers are depicted on Plate 2 - Assessment District Map, and groundwater hydrographs are presented in Appendix A.

2.2.2 Pneumatic Piezometers

Inclinometers installed within the assessment district after 1997 were typically outfitted with one or two pneumatic piezometer sensors. Nine sensors were measured regularly over the monitoring period; one piezometer was added (SI-1A) in August 2006. Each sensor records groundwater elevations by measuring differential air pressure between the instrument sensor and groundwater surface across a flexible bladder. The locations of the piezometers are depicted in Plate 2, and hydrographs are presented in Appendix A.

2.2.3 Groundwater Level Discussion

The groundwater data were reviewed by evaluating changes that occurred during the current monitoring period as well as changes in groundwater levels over extended periods. To analyze trends in seasonal groundwater fluctuations, the average (mean) annual and highest annual recorded groundwater elevation for each piezometer was calculated (Plate A-2).

Groundwater levels rose significantly following record rainfall in the winter of 2004 to 2005. Since about April 2005, groundwater levels generally declined, but are now starting to increase with above average rainfall during the previous two monitoring periods. During the current monitoring period, groundwater levels are at or below average. Groundwater levels at

SI-5 have decreased significantly following the installation of the replacement dewatering well, W-14, in October 2008.

The average and highest annual groundwater levels are indicated below:

Table 1. Summary of Average Groundwater Elevations by Area

Location	Average Groundwater El. 2011-2012	Change from Prior Year Average	Peak Groundwater El. 2011-2012	Change from Prior Year Peak
Malibu Road	7.5	-0.5	8.2	-1.3
Bay Shore Drive	21.4	-1.0	22.2	-1.4

All units are in feet

2.3 DEWATERING PRODUCTION

2.3.1 Dewatering Well Production

A graph of the production rate for all dewatering wells is presented on Plate 4. Graphs showing production rates of individual wells are provided in Appendix B. Production data for the dewatering wells indicates the following:

- The average total well production rate for this monitoring period was approximately 1,168 gallons per day (gpd). That represents an increase of about 2 percent from the previous monitoring period of 1,141 gpd.

2.3.2 Hydrauger Production

A graph of the production rate for all hydraugers is presented on Plate 4. Graphs of individual production rates for all hydraugers are included in Appendix B. Data for the hydraugers indicates the following:

- The average production rate for all hydraugers over the monitoring period is approximately 179 gpd. This represents a decrease of approximately 80 percent from the average production rate of 884 gpd for the previous monitoring period.

2.3.3 Total Dewatering Production

A combined graph of the total dewatering rate for all dewatering wells and hydraugers is presented on Plate 4. Total dewatering production data for the hydraugers and wells indicates the following:

- The average total dewatering rate during the monitoring period was approximately 1,347 gpd. This represents a 33 percent decrease in the average rate relative to the 2,025 gpd average recorded during the previous monitoring period.

2.4 SLOPE INCLINOMETER MEASUREMENTS

Fugro monitored five slope inclinometers on a quarterly basis to measure subsurface ground deformation through June 2012. Slope inclinometer measurement plots are presented in Appendix C for each monitored inclinometer installation. Two plots for each slope inclinometer are presented. The first plot has a baseline reading from the final round of monitoring, showing any ground movement within the 2011 to 2012 monitoring year. The second plot has a baseline reading from the spring of 2005, except for SI-1A and SI-2A (as discussed below). Only readings with validated checksums[1] are presented.

SI-1A was installed in August 2006 and has a baseline reading from September 2006. SI-2A was installed in September of the 2010-2011 monitoring year with a baseline reading in May 2011. Therefore, the first plot of SI-2A shows the current year readings, while the second plot shows the readings of SI-2 from 2005-2008.

Interpretation of inclinometer data along Malibu Road shows no significant movement during the 2011-2012 monitoring year except for SI-4, which showed significant movement at a depth of approximately 30 feet. There continues to be difficulty obtaining data below 28 feet in SI-4, indicating that SI-4 is expected to "shear off" soon. A replacement inclinometer is proposed for the summer of 2012.

Inclinometers SI-5 and SI-6 are located on Bayshore Drive, upslope and outside the defined limit of the most recent 1998 movement. No significant movement was observed during this monitoring year in SI-5 or SI-6.

3.0 DEWATERING FACILITY MAINTENANCE

3.1 FACILITY MAINTENANCE

The operating status of each dewatering well and hydrauger was checked monthly. When necessary, repair work was scheduled and undertaken (typically within a matter of a few hours to a few days of identifying a problem). Generally, repairs and maintenance consisted of well pump and electrical repairs, and cleanout of the hydrauger system. The repairs performed are summarized on the following table:

Table 2. Maintenance Activities

Date	Facility	Work Performed
July 6, 2011	W-12 and Hydraugers	Repair Well W-12; Unclogged HD-21 and HD-11, w/ repairs to pvc connections
July 27, 2011	Wells, SI, and Hydraugers	Maintenance to equipment/storage/facilities
April 4, 2012	Hydraugers	Repaired broken Hydrauger and cleared surrounding brush

[1] Checksums are a data validation technique for slope inclinometers where the "0" (downslope) and "180" (upslope) readings are summed and the theoretical result should be zero.

3.2 CAPITAL IMPROVEMENT PROJECTS

A replacement inclinometer has been proposed to replace SI-4, which has become difficult to read below approximately 30 feet, that replacement slope inclinometer will be named SI-4A and installed in August of 2012.

4.0 SUMMARY AND CONCLUSIONS

4.1 SUMMARY

The status of the Malibu Road Landslide Assessment District can be summarized as follows:

- The 2011 through 2012 monitoring year rainfall was below average with 11.71 inches of precipitation. Rainfall during the monitoring period was below the historical average of 16.2 inches per year measured from 1968 through 2012.
- Groundwater levels in the assessment district area were at or below normal levels.
- Readings for the five slope inclinometers show no significant movement during the 2011 to 2012 monitoring year, except for SI-4, which continues to be difficult to read below approximately 30 feet. A new inclinometer will replace SI-4 on Malibu Road in August of 2012.
- Water conservation is encouraged throughout the Malibu Road area to reduce future groundwater level increases. Control of groundwater levels within the landslide area is critical to maintaining the stability of the landslides. The following are suggested:

  1. Rain Gutters - Installation and Maintenance.
  2. Limit Irrigation.
  3. Use of low-flow toilet and plumbing fixtures.

- Groundwater production from existing dewatering wells and hydraugers should be expected to gradually decline over time as the efficiency of the wells and hydraugers decrease due to mineralization and aging of the facilities.

5.0 REFERENCES

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_____ (1991), "Monitoring, Instrumentation, and Dewatering Facilities at Calle del Barco, Puerco Beach, Latigo Canyon, and Rambla Pacifico (2 wells) Landslide Sites," dated October 4.

David Taussig & Associated, Inc. (2011), "Annual Assessment District No. 98-3 (Malibu Road) FY 2011-2012," dated June 11.

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_____ (2009), "Annual Assessment District No. 98-3 (Malibu Road) FY 2009-10," dated June 8.

_____ (2008), "Annual Assessment District No. 98-3 (Malibu Road) FY 2008-09," dated June 23.

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_____ (2009), "Annual Report, July 2008 through June 2009 Malibu Road Landslide Assessment District, Malibu, California," dated August 2009.

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PLATES

BASE MAP SOURCE: USGS 1:100,000-scale Metric Topographic Map of Los Angeles, California (1979).

NORTH

0 4000 8000

FEET

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SITE LOCATION MAP

Malibu Road Landslide Assessment District
Malibu, California

PLATE 1

City of Malibu
Project No. 04.B3399004

FUGRO

6340750 6341000 6341250 6341500 6341750 6342000

1835500 1835250 1835000

PACIFIC COAST

Bayshore Drive

Malibu Road

Qlsa

Qlsr

25362 25350 25338 25316 25325 25321 25315

HD-1 HD-2 HD-3 HD-4 HD-5 HD-6 HD-7 HD-8 HD-9 HD-10 HD-11 HD-12 HD-13 HD-14 HD-15 HD-16 HD-17 HD-18 HD-19 HD-20 HD-21 HD-22 HD-23

W-12 W-14 W-11 NW-1 NW-2 NW-3

SI-6 SI-5

W-3A W-2A PZ-A W-3 SI-4 W-10 MTD-9 PZ-B PZ-C W-4 SI-2A W-5 W-9 SI-2 PZ-D W-6 SI-3 SI-1 SI-1A PZ-E NHD-A NHD-B NHD-C MTD-10 W-8

N

Scale 1:1,200

100 0 100 Feet

LEGEND

- Dewatering Well
- Slope Inclinometer
- Destroyed Slope Inclinometer
- Standpipe Piezometer
- Storm Drain Outfall
- Producing Hydrauger (solid line showing unobstructed pipe)
- Nonproducing Hydrauger
- Coordinate Grid: California State Plane, Zone 5, NAD 83, Feet
- Assessment District No. 98-3 Boundary
- Qlsr — Recent Landslide of 1978 (Boundary from Leighton, 1979)
- Qlsa — Ancient Landslide (Boundary from Leighton, 1979)

ASSESSMENT DISTRICT MAP
Malibu Road Landslide Assessment District
Malibu, California

PLATE 2

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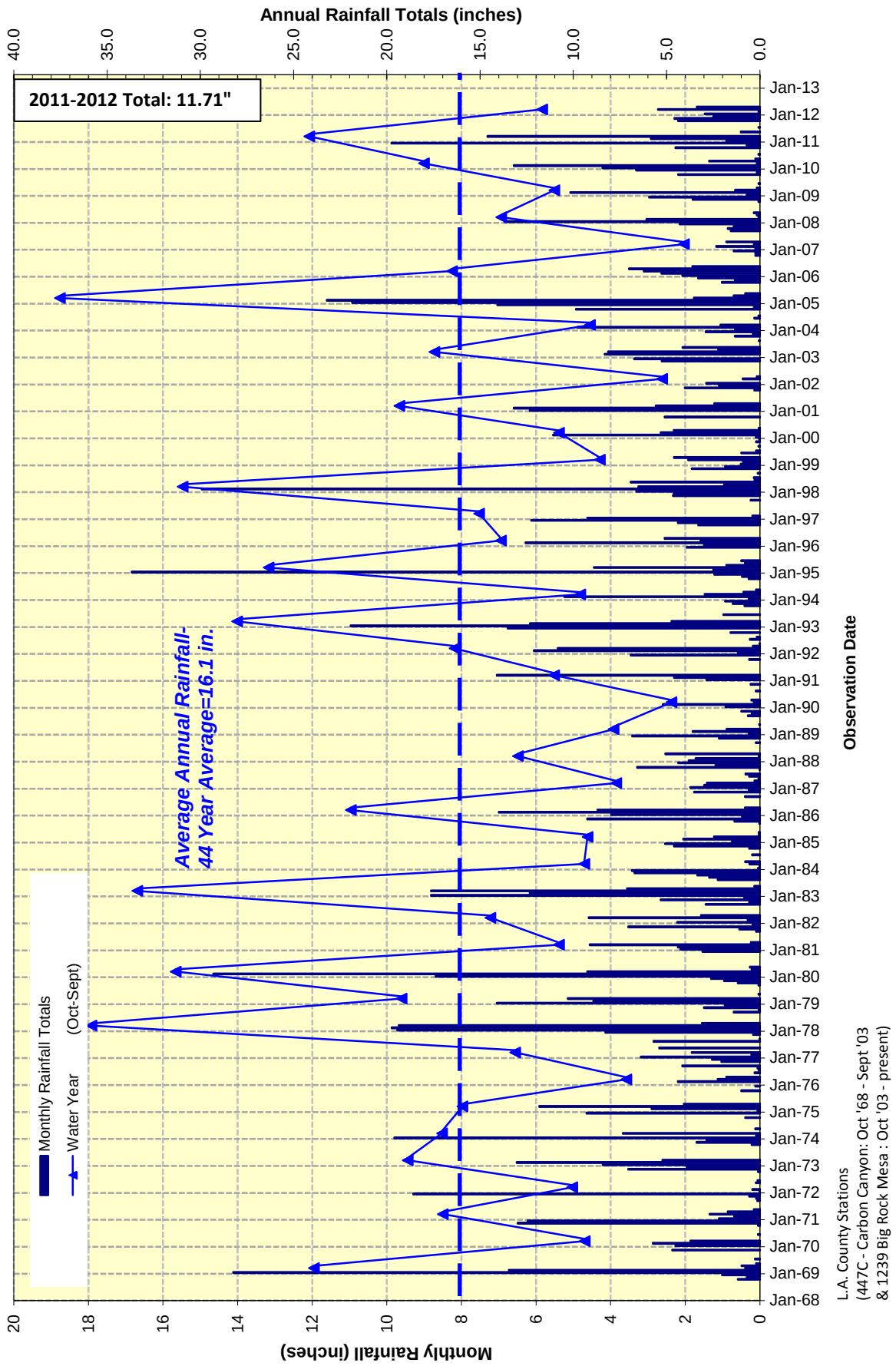
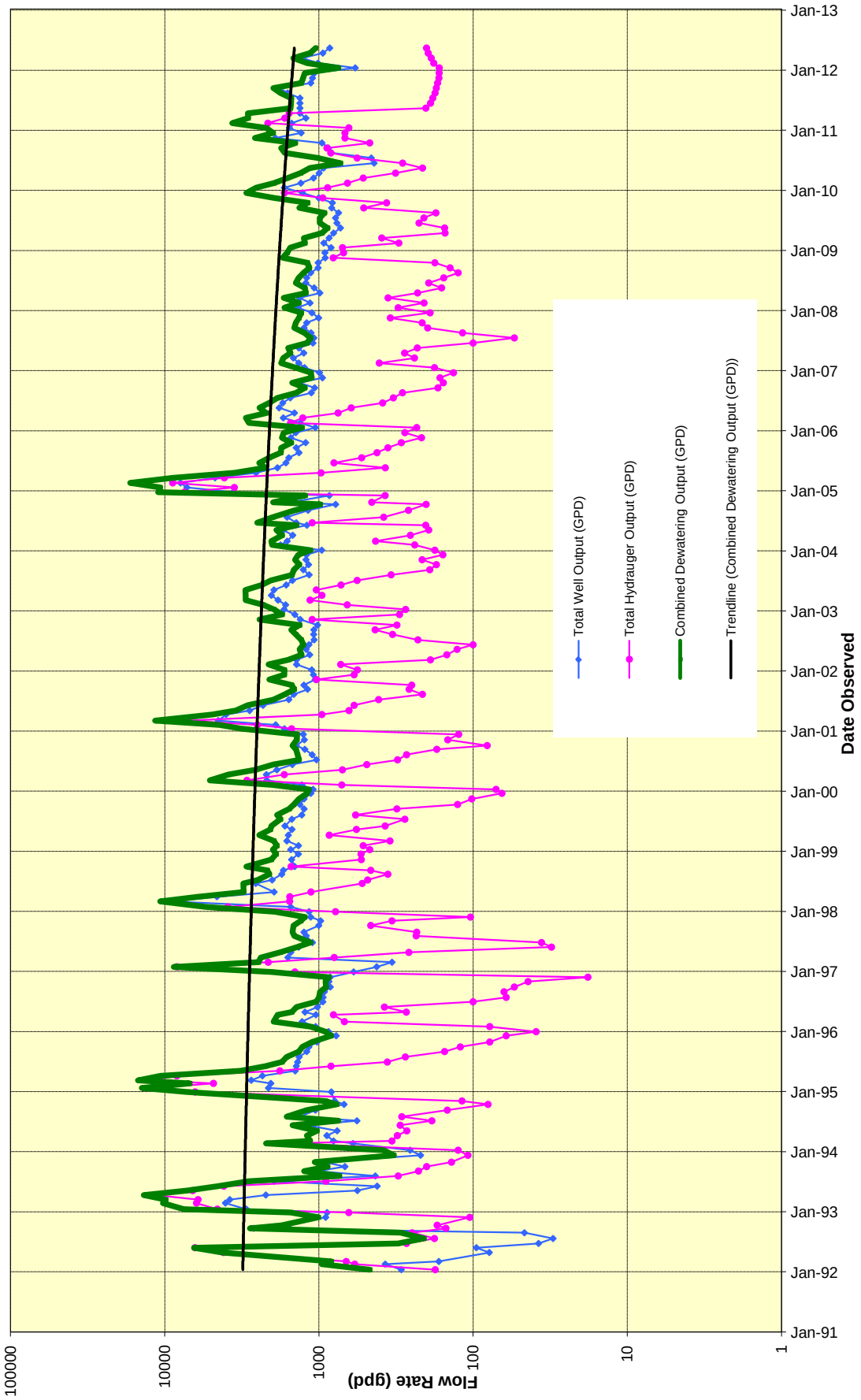


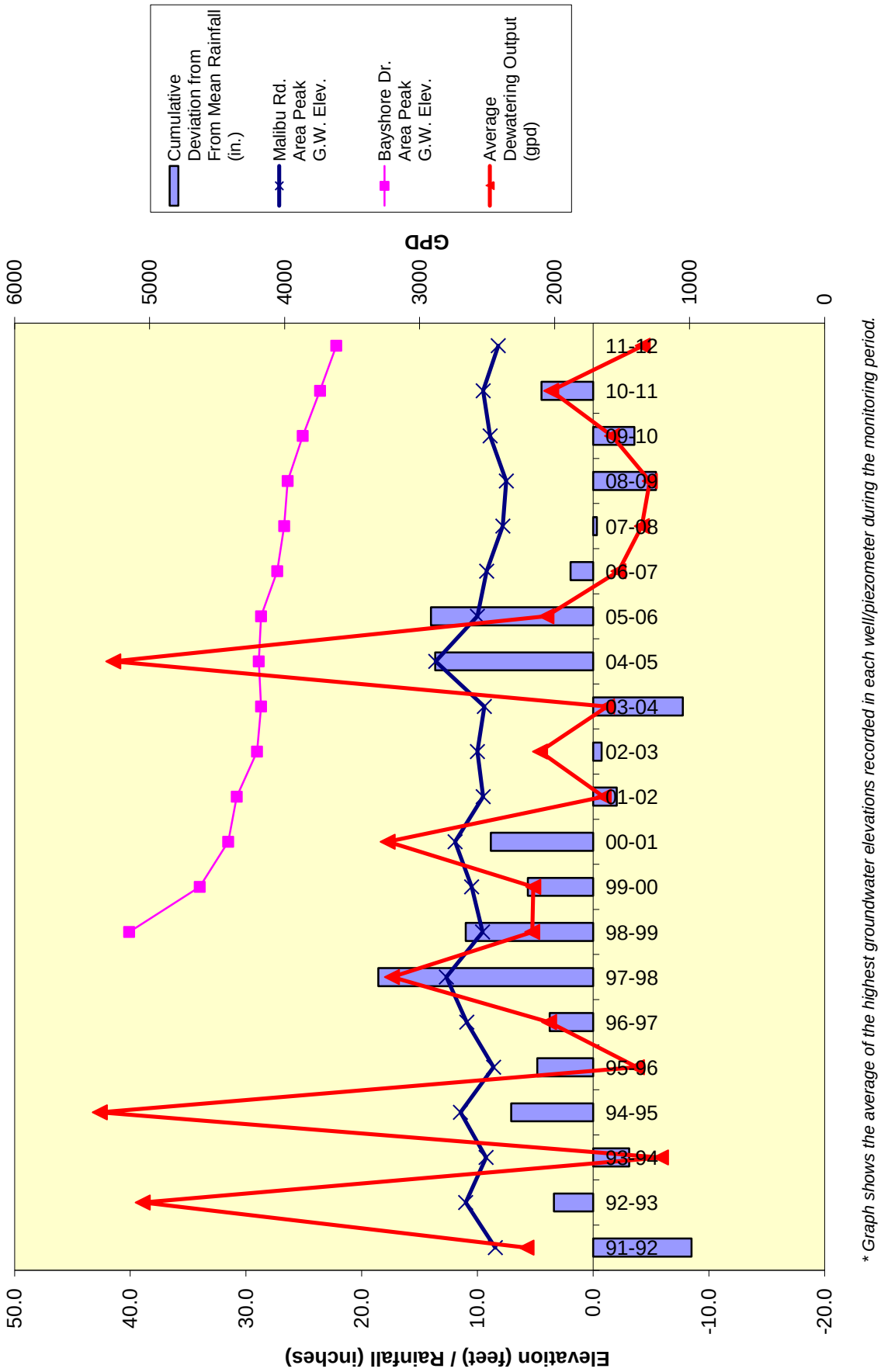
RAINFALL GRAPH
Malibu Road Landslide Assessment District
Malibu, California

PLATE 3



SUMMARY GRAPH
Total Output - All Wells & Hydraugers
Malibu Road Landslide Assessment District
Malibu, California

PLATE 4



SUMMARY GRAPH
Groundwater Levels, Dewatering, & Rainfall
Malibu Road Landslide Assessment District
Malibu, California

** Graph shows the average of the highest groundwater elevations recorded in each well/piezometer during the monitoring period.*

PLATE 5

APPENDIX A
GROUNDWATER DATA

MALIBU ROAD - Standpipe Piezometer Information					
Well Identification	**Previous Reference Elevation (8/91)**	**Updated Reference Elevation (4/00)**	**Depth (ft.)***	**Perforation Interval**	**Installed By**
W-2A	22.6	20.6	9.0	Unknown	LA COUNTY
W-3A	22.0	20.5	32.5	Unknown	LA COUNTY
PZ-A	20.0	19.8	17.2	Unknown	LA COUNTY
PZ-B	20.0	19.1	27.9	Unknown	LA COUNTY
PZ-C	20.0	19.4	29.7	Unknown	LA COUNTY
PZ-D	20.0	19.2	24.7	Unknown	LA COUNTY
PZ-E	20.0	21.4	15.8	Unknown	LA COUNTY
SI-5+	59.0	59.3	78.0	-19.0 to -14.0	BYA
SI-6++	57.0	58.0	78.0	-21.0 to -16.0	BYA

Note: + Formerly designated as MR-5
++ Formerly designated as MR-6

MALIBU ROAD - Pneumatic Piezometer Information					
Well Identification	**Previous Reference Elevation (8/91)**	**Updated Reference Elevation (4/00)**	**Tip Depth (ft.)**	**Tip Elev (ft.)**	**Installed By**
SI-1	20.0	20.1	34.6	-14.6	BYA
SI-2	20.0	19.7	65.1	-45.1	BYA
SI-3	20.0	20.3	49.8	-29.8	BYA
SI-4	22.0	18.9	43.9	-21.9	BYA
SI-5 Tip 1	59.0	59.3	60	-1	BYA
SI-5 Tip 2	59.0	59.3	40	19	BYA
SI-6 Tip 1	57.0	58.0	60	-3	BYA
SI-6 Tip 2	57.0	58.0	40	17	BYA
SI-1A	20.0	20.0	50		FUGRO

Note: SI-1 thru SI-4 were previously designated MR98-1 thru MR98-4
SI-5 and SI-6 were previously designated MR-5 and MR-6

PIEZOMETER INFORMATION
Malibu Road Landslide Assessment District
Malibu, California

PLATE A-1

MALIBU ROAD - SUMMARY OF GROUNDWATER DATA																										
Piezometer I.D.		91-92	92-93	93-94	94-95	95-96	96-97	97-98	98-99	99-00	00-01	01-02	02-03	03-04	04-05	05-06	06-07	07-08	08-09	09-10	10-11	11-12	Mean '91 - '12	Stand Dev.	11-12 vs 97-98	11-12 vs mean
MALIBU ROAD - Standpipe Piezometers																										
W-2A	Mean El.	8.3	12.3	12.1	11.8	11.7	11.2	12.4	12.8	13.5	13.7	12.9	12.6	12.3	12.8	13.4	13.7	--	--		16.1	16.7	*12.8*	*1.8*	--	--
	Highest El.	11.4	13.6	13.1	12.8	12.2	12.3	15.5	14.4	19.5	16.4	13.4	13.8	12.8	14.1	16.6	14.3	--	--		17.1	16.8	*14.5*	*2.1*	--	--
W-3A	Mean El.								14.5	14.4	15.5	15.0	15.3	14.3	16.4	13.9	13.1	13.6	14.3	15.2	14.7	14.0	*14.6*	*0.9*		*-0.6*
	Highest El.								14.6	15.7	18.8	15.4	16.5	14.7	19.8	15.5	13.7	13.9	14.7	16.1	15.3	14.6	*15.7*	*1.7*		*-1.1*
PZ-A	Mean El.	8.6	10.1	10.0	10.4	10.2	10.5	11.1	10.4	10.2	11.1	11.2	11.0	10.3	10.8	10.7	9.9	8.5	8.1	7.9	9.2	8.9	*10.0*	*1.0*	*-2.2*	*-1.0*
	Highest El.	9.3	11.2	10.6	11.7	10.5	11.3	12.2	11.6	10.9	12.1	11.4	11.6	11.6	12.7	11.4	10.6	9.3	8.7	8.3	11.9	9.6	*10.9*	*1.2*	*-2.7*	*-1.3*
PZ-B	Mean El.	4.4	4.5	2.9	3.7	2.6	2.9	3.4	1.0	1.3	2.3	1.3	1.5	1.0	2.8	1.7	2.7	1.3	1.0	1.6	1.8	1.7	*2.3*	*1.1*	*-1.6*	*-0.5*
	Highest El.	5.3	7.6	5.2	7.1	3.5	4.9	6.9	1.3	2.6	4.0	1.9	2.0	3.1	6.9	2.6	3.8	2.0	1.3	3.0	2.9	2.0	*3.8*	*2.0*	*-4.9*	*-1.8*
PZ-C	Mean El.	3.6	4.6	3.9	4.7	4.2	4.2	5.1	4.0	3.6	4.5	3.6	4.1	3.4	5.2	3.9	3.7	3.0	3.0	3.7	3.4	3.1	*3.9*	*0.6*	*-1.9*	*-0.8*
	Highest El.	4.4	6.3	4.9	7.8	4.7	5.3	7.1	4.7	4.3	7.6	4.8	5.1	4.2	8.2	4.6	4.1	3.9	3.4	4.8	4.5	3.4	*5.1*	*1.4*	*-3.7*	*-1.8*
PZ-D	Mean El.	4.4	6.9	5.1	7.6	5.0	5.9	7.8	4.7	4.0	4.8	4.2	4.3	4.1	7.0	4.7	4.2	4.0	4.4	5.1	5.2	5.3	*5.2*	*1.2*	*-2.5*	*0.1*
	Highest El.	5.8	11.4	6.7	13.1	5.8	15.2	18.1	5.9	4.9	8.4	5.3	5.3	4.6	15.3	5.6	4.7	4.9	4.9	6.4	7.1	5.9	*7.9*	*4.1*	*-12.2*	*-2.0*
PZ-E	Mean El.	13.0	14.3	13.9	14.5	14.2	14.6	15.2	12.8	12.7	13.3	12.5	14.1	13.8	15.6	12.1	10.5	10.4	10.4	11.6	13.5	11.7	*13.1*	*1.5*	*-3.5*	*-1.4*
	Highest El.	14.5	16.0	15.0	16.3	14.9	16.5	16.3	14.4	15.6	16.2	14.3	15.6	14.9	17.9	14.0	13.1	12.8	11.8	14.5	15.4	14.1	*15.0*	*1.4*	*-2.2*	*-0.9*
Area Average	Mean El.	7.0	8.8	8.0	8.8	8.0	8.2	9.2	8.6	8.5	9.3	8.7	9.0	8.5	10.1	8.6	8.2	6.8	6.9	7.5	8.0	7.5	*8.3*	*0.8*		*-0.8*
	Highest El.	8.5	11.0	9.3	11.5	8.6	10.9	12.7	9.6	10.5	11.9	9.5	10.0	9.4	13.6	10.0	9.2	7.8	7.5	8.9	9.5	8.2	*9.9*	*1.6*		*-1.7*
Change vs Prior	Mean El.		1.7	-0.8	0.8	-0.8	0.3	0.9	-0.6	-0.1	0.8	-0.6	0.3	-0.5	1.6	-1.5	-0.4	-1.4	0.1	0.6	0.0	-0.5				
	Highest El.		2.6	-1.8	2.2	-2.9	2.3	1.8	-3.1	0.9	1.4	-2.4	0.5	-0.6	4.1	-3.5	-0.9	-1.4	-0.3	1.4	-0.6	-1.3				
Bayshore Drive - Standpipe Piezometers																										
SI-5	Mean El.								35.5	32.2	30.7	30.1	29.3	29.0	28.6	28.2	27.8	27.3	26.3	22.6	18.8	16.4	*27.3*	*5.1*		*-10.9*
	Highest El.								37.8	33.4	31.2	30.4	29.7	29.2	29.0	28.4	28.0	27.5	27.0	24.3	20.5	17.6	*28.1*	*5.0*		*-10.6*
SI-6	Mean El.								38.8	32.6	31.2	29.9	27.9	27.7	27.2	27.9	26.0	25.7	25.4	25.3	26.1	26.4	*28.4*	*3.7*		*-2.0*
	Highest El.								42.4	34.6	31.9	31.2	28.4	28.2	28.8	29.0	26.5	25.9	25.7	25.8	26.7	26.8	*29.4*	*4.6*		*-2.6*
Area Average	Mean El.								37.2	32.4	31.0	30.0	28.6	28.3	27.9	28.0	26.9	26.5	25.8	23.9	22.4	21.4	*27.9*	*4.1*		*-6.5*
	Highest El.								40.1	34.0	31.5	30.8	29.1	28.7	28.9	28.7	27.3	26.7	26.4	25.1	23.6	22.2	*28.8*	*4.5*		*-6.6*
Change vs Prior	Mean El.									-4.7	-1.5	-1.0	-1.3	-0.3	-0.4	0.2	-1.2	-0.4	-0.6	-1.9	-2.5	-1.0				
	Highest El.									-6.1	-2.5	-0.7	-1.8	-0.4	0.2	-0.2	-1.5	-0.6	-0.3	-1.3	-2.9	-1.4				
MALIBU ROAD - Pneumatic Piezometers																										
SI-1	Mean El.							Piezometer Not Functioning																		
SI-1A	Mean El.																5.8	6.9	6.5	6.9	1.1	0.0				
	Highest El.																7.5	6.9	6.9	6.9	1.1	0.0				
SI-2	Mean El.							9.3	13.2	15.6	15.1	14.1	11.9	11.5	10.1	9.9	9.9	10.1	10.2	10.1	10.2	11.0	*11.5*	*2.0*	*1.7*	*-0.5*
	Highest El.							9.6	15.9	15.9	15.9	14.7	13.6	12.4	11.3	11.3	10.1	11.3	10.7	11.3	10.7	11.8	*12.4*	*2.2*	*2.2*	*-0.6*
SI-3	Mean El.							Piezometer Not Functioning																		
	Highest El.							Piezometer Not Functioning																		
SI-4	Mean El.							7.77	6.6	5.7	6.0	5.2	4.8	5.0	4.9	4.5	4.0	4.0	3.9	3.4	1.8	1.6	*4.6*	*1.6*	*-6.2*	*-3.0*
	Highest El.							8.0	8.0	6.9	6.9	5.7	5.7	5.7	5.7	5.1	8.6	4.6	4.6	3.4	2.8	2.8	*5.6*	*1.8*	*-5.2*	*-2.8*
Bayshore Drive - Pneumatic Piezometers																										
SI-5 Tip 1	Mean El.								34.2	34.7	36.3	34.2	33.9	32.7	37.6	33.6	31.8	31.7	26.9	25.1	22.9	21.7	*31.2*	*5.0*		*-9.6*
	Highest El.								34.8	39.4	45.1	35.9	37.1	35.9	44.0	34.8	33.6	34.8	30.1	26.7	24.4	22.6	*34.2*	*6.6*		*-11.6*
SI-5 Tip 2	Mean El.								35.4	36.1	39.1	35.8	36.5	34.0	39.5	33.7	29.8	29.2	26.0	25.2	26.8	26.3	*32.4*	*5.0*		*-6.1*
	Highest El.								37.5	42.1	51.3	37.5	40.9	37.5	49.0	37.5	35.1	40.9	27.1	26.5	27.7	28.8	*37.1*	*7.7*		*-8.3*
SI-6 Tip 1	Mean El.								42.4	Piezometer Not Functioning																
	Highest El.								44.1	Piezometer Not Functioning																
SI-6 Tip 2	Mean El.								44.5	44.6	46.0	44.4	43.0	42.0	43.8	41.0	39.5	39.0	39.0	41.4	40.0	37.7	*41.9*	*2.6*		*-4.2*
	Highest El.								45.7	48.0	51.5	45.7	45.7	43.4	49.1	42.2	42.2	42.8	39.9	42.8	41.6	39.3	*44.3*	*3.5*		*-4.9*

PLATE A-2

SUMMARY OF GROUNDWATER DATA FOR MALIBU ROAD

Malibu Road Landslide Assessment District

Malibu, California

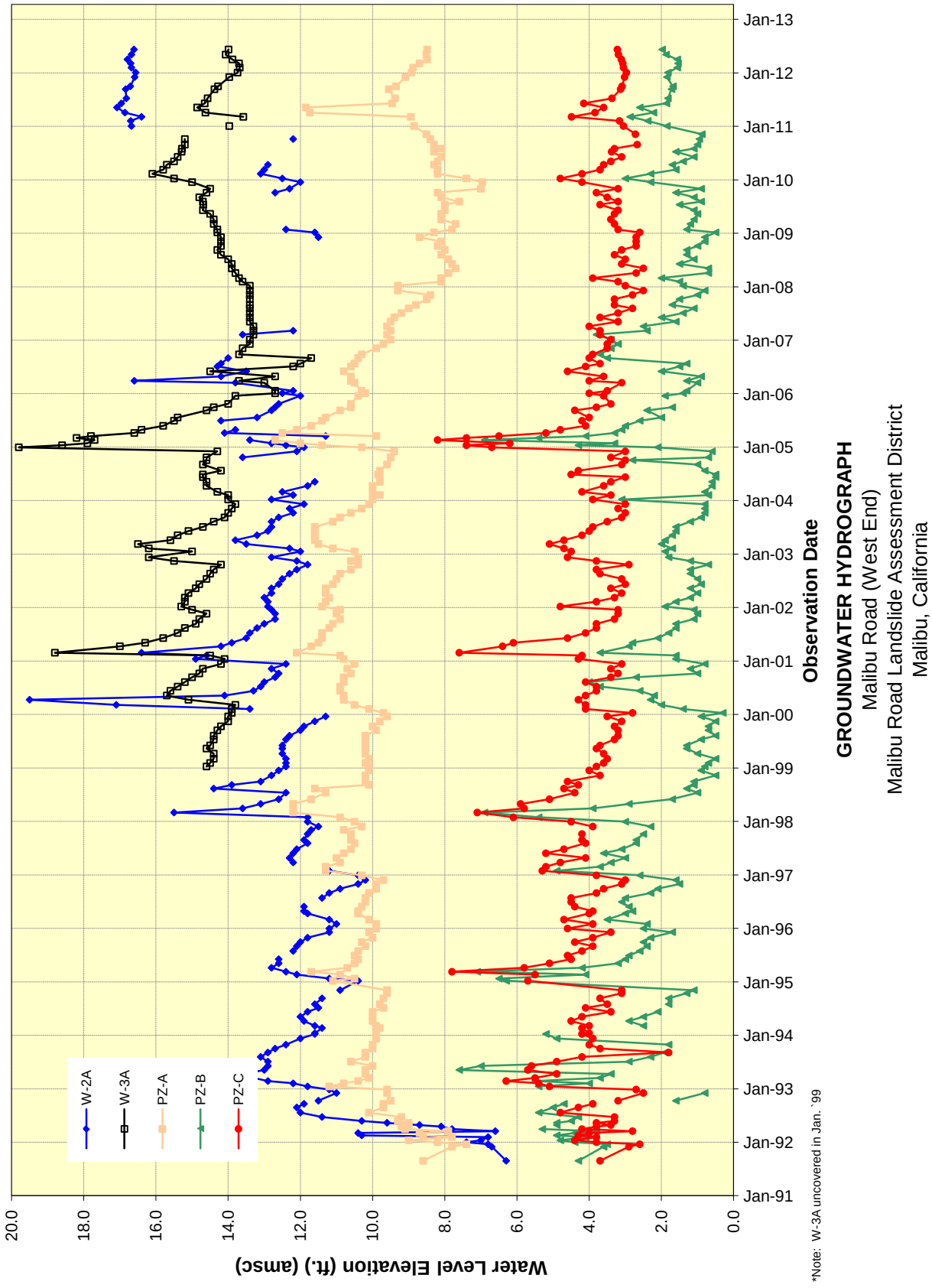
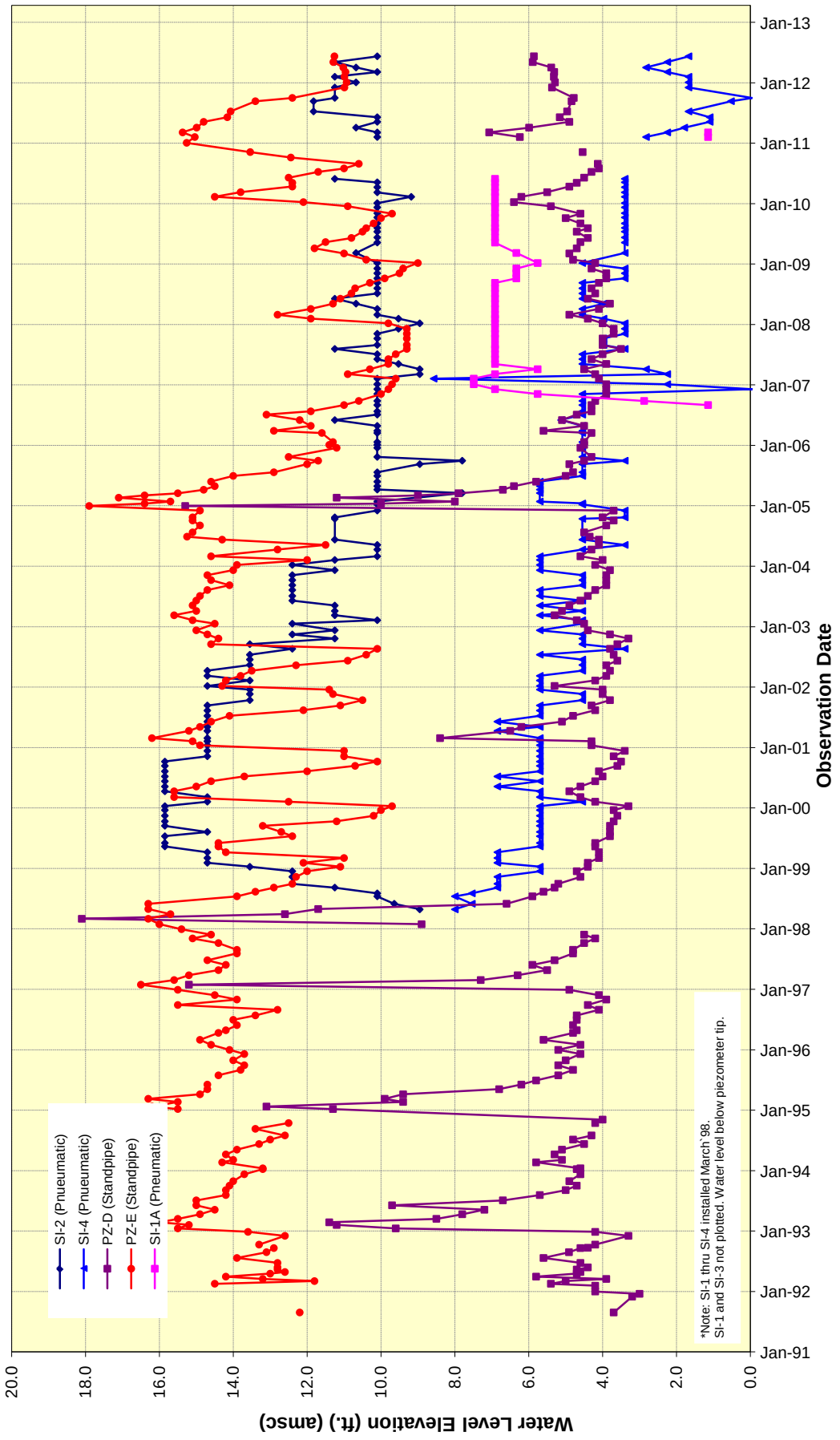
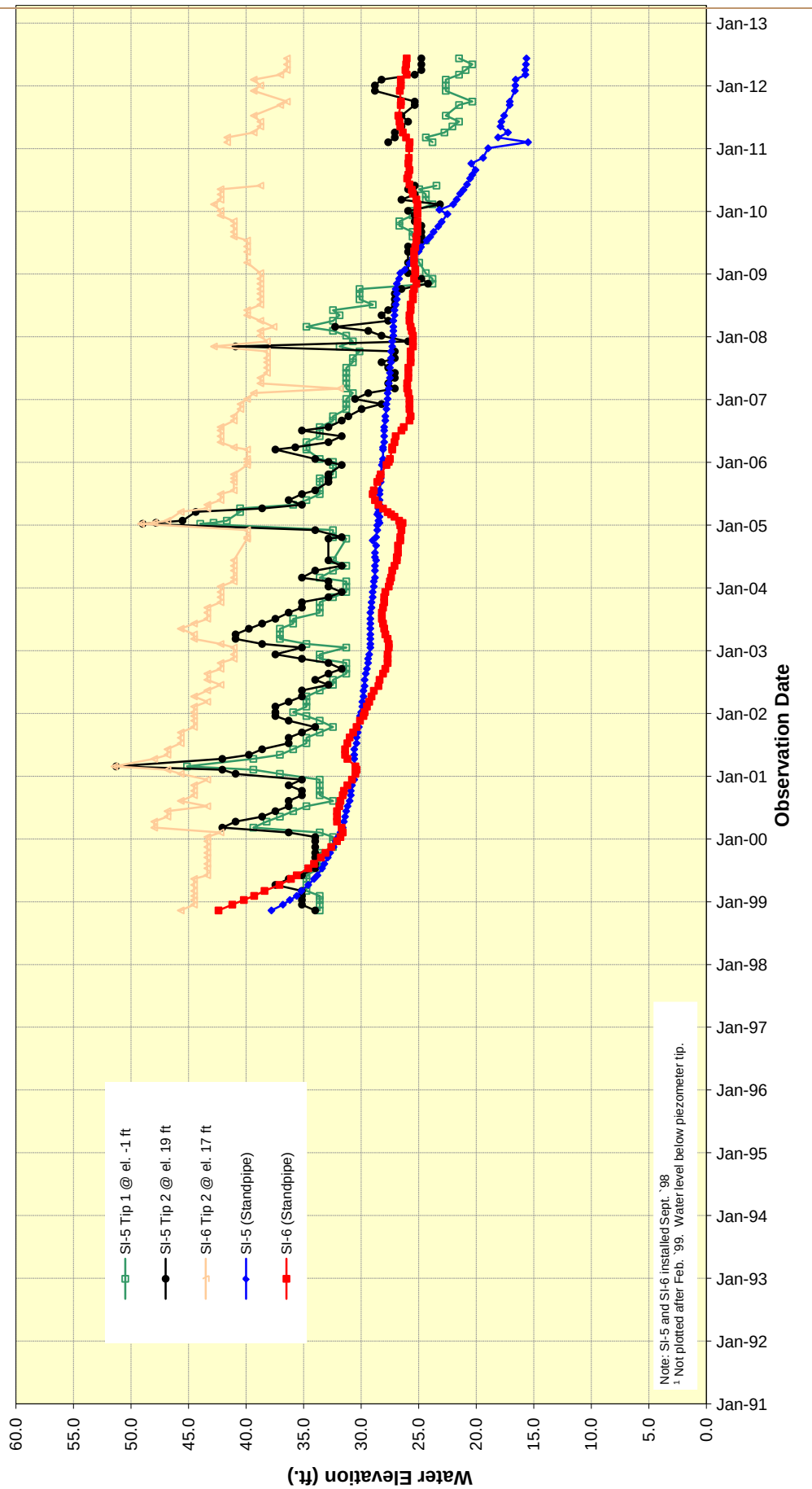

GROUNDWATER HYDROGRAPH
Malibu Road (West End)
Malibu Road Landslide Assessment District
Malibu, California
Water Level Elevation (ft.) (amsc)
Observation Date
W-2A
W-3A
PZ-A
PZ-B
PZ-C
20.0
18.0
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
Jan-13
Jan-12
Jan-11
Jan-10
Jan-09
Jan-08
Jan-07
Jan-06
Jan-05
Jan-04
Jan-03
Jan-02
Jan-01
Jan-00
Jan-99
Jan-98
Jan-97
Jan-96
Jan-95
Jan-94
Jan-93
Jan-92
Jan-91
*Note: W-3A uncovered in Jan. '99

PLATE A-3



GROUNDWATER HYDROGRAPH
Malibu Road (East End)
Malibu Road Landslide Assessment District
Malibu, California

PLATE A-4



GROUNDWATER HYDROGRAPH
Bayshore Drive
Malibu Road Landslide Assessment District
Malibu, California

PLATE A-5

APPENDIX B
DEWATERING DATA

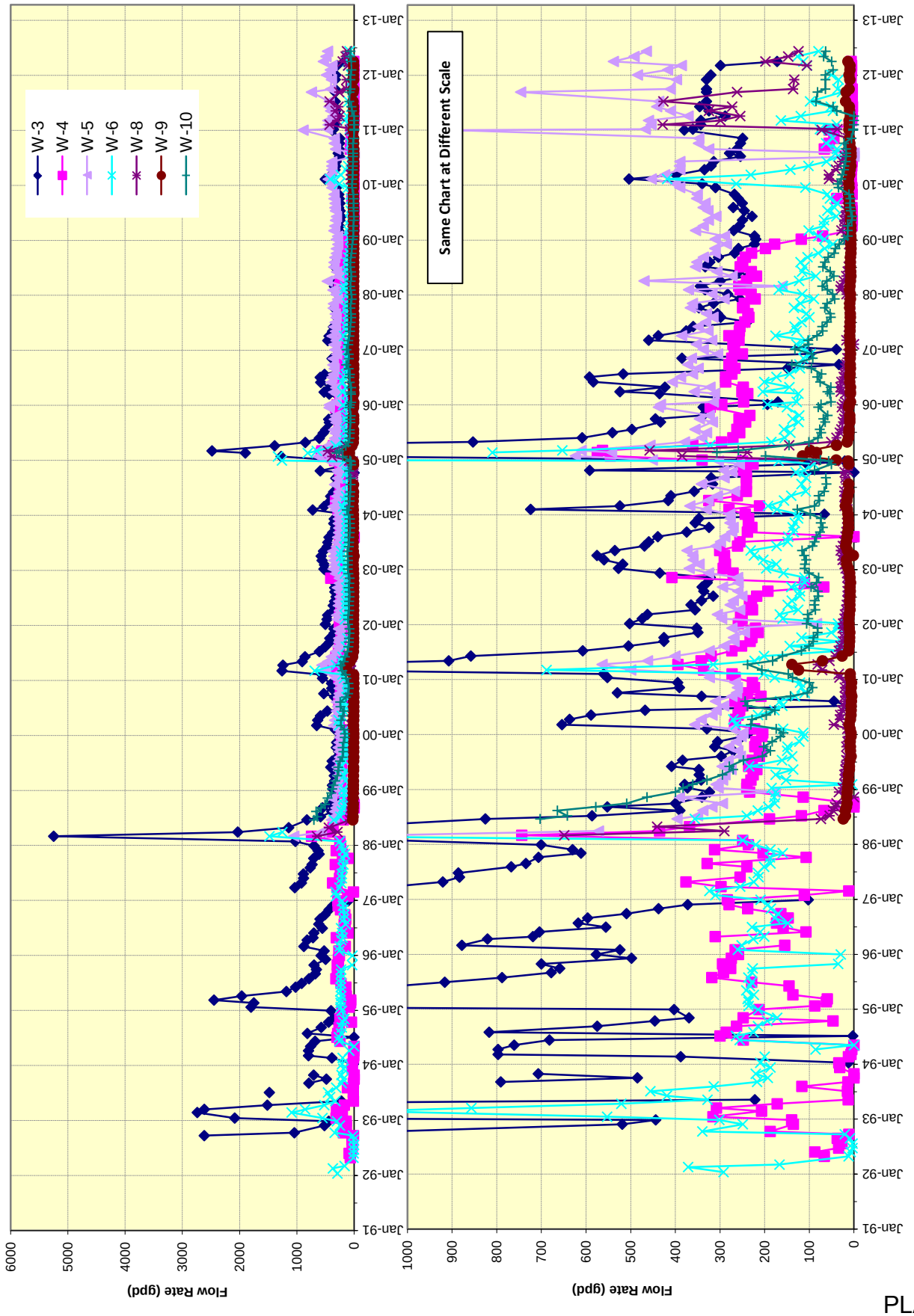
MALIBU ROAD - Dewatering Well Information							
Well ID	Vault Elevation (ft.)	Bottom Elevation (ft.)	Pump Elevation (ft.)	Pump Size (hp)	2011-2012 Pumping Rate (gpd)	% of Total Well Production	Installed By
W-3	19.5	-4.0	Unknown	1/2	302	24%	LA Co.
W-4	20.0	-9.0	Unknown	1/2	5	0%	LA Co.
W-5	19.0	-9.5	Unknown	1/2	478	37%	LA Co.
W-6	20.0	-4.5	Unknown	1/2	75	6%	LA Co.
W-8	27.5	11.0	Unknown	1/2	192	15%	LA Co.
W-9	20.0	-40.0	-35.0	1/3	13	1%	LA Co.
W-10	19.0	-40.0	-35.0	1/3	65	5%	LA Co.
W-11	61.0	1.0	13.0	1/3	41	3%	BYA
W-12	58.0	-2.0	8.0	1/3	13	1%	BYA
W-14	60.0	-20.0	Unknown	1/3	51	4%	Fugro
NW-1					15	1%	Homeowner
NW-2					25	2%	Homeowner
NW-3					8	1%	Homeowner

MALIBU ROAD - Hydrauger Information						
Hydrauger ID	Installed Length (ft.)	Bearing	Funtional Length** (ft)	2011-2012 Flow Rate (gpd)	% of Total Production	Installed By
HD-1	Unknown	N05E	74	0.0	0%	LA Co.
HD-2	Unknown	N21E	34	0.0	0%	LA Co.
HD-3	Unknown	N06E	13	0.0	0%	LA Co.
HD-4	Unknown	N29E	53	0.0	0%	LA Co.
HD-5	Unknown	N13E	41	0.0	0%	LA Co.
HD-6	Unknown	N08W	55	0.0	0%	LA Co.
HD-7	Unknown	N26E	87	0.0	0%	LA Co.
HD-8	Unknown	N19E	92	0.0	0%	LA Co.
HD-9	Unknown	N34E	76	0.0	0%	LA Co.
HD-10	Unknown	N19E	55	0.0	0%	LA Co.
HD-11	Unknown	N11E	78	23.2	13%	LA Co.
HD-12	Unknown	N08E	70	0.0	0%	LA Co.
HD-13	Unknown	N09E	79	0.0	0%	LA Co.
HD-14	Unknown	N08E	80	0.0	0%	LA Co.
HD-15	Unknown	N14E	82	0.0	0%	LA Co.
HD-16	Unknown	N15E	69	0.0	0%	LA Co.
HD-17	150	N15E	150	0.0	0%	BYA
HD-18	150	N18E	150	0.0	0%	BYA
HD-19	150	N10E	150	0.0	0%	BYA
HD-20	150	N09W	150	58.9	33%	BYA
HD-21	150	N22E	150	12.1	7%	BYA
HD-22	180	N13E	180	85.7	48%	FugroWest
HD-23	160	N01E	160	0.0	0%	FugroWest

*Note: * Measured on 4/1/98 (except HD-22 and HD-23 installed 1/22/05)*

DEWATERING WELL / HYDRAUGER INFORMATION
Malibu Road Landslide Assessment District
Malibu, California

PLATE B-1

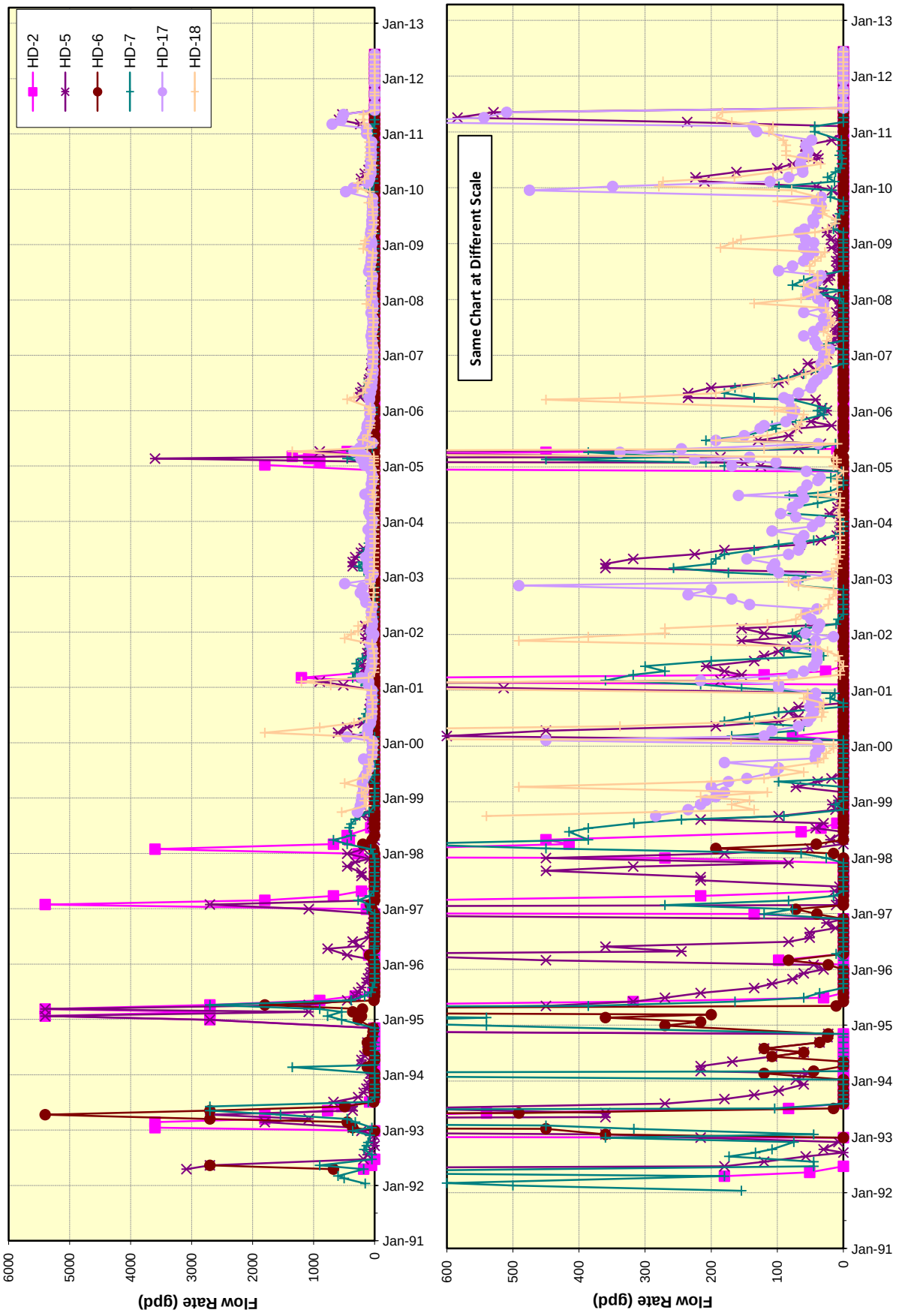


DEWATERING WELL GRAPH
Discharge Rates for Malibu Road Dewatering Wells
Malibu Road Landslide Assessment District
Malibu, California

PLATE B-2a

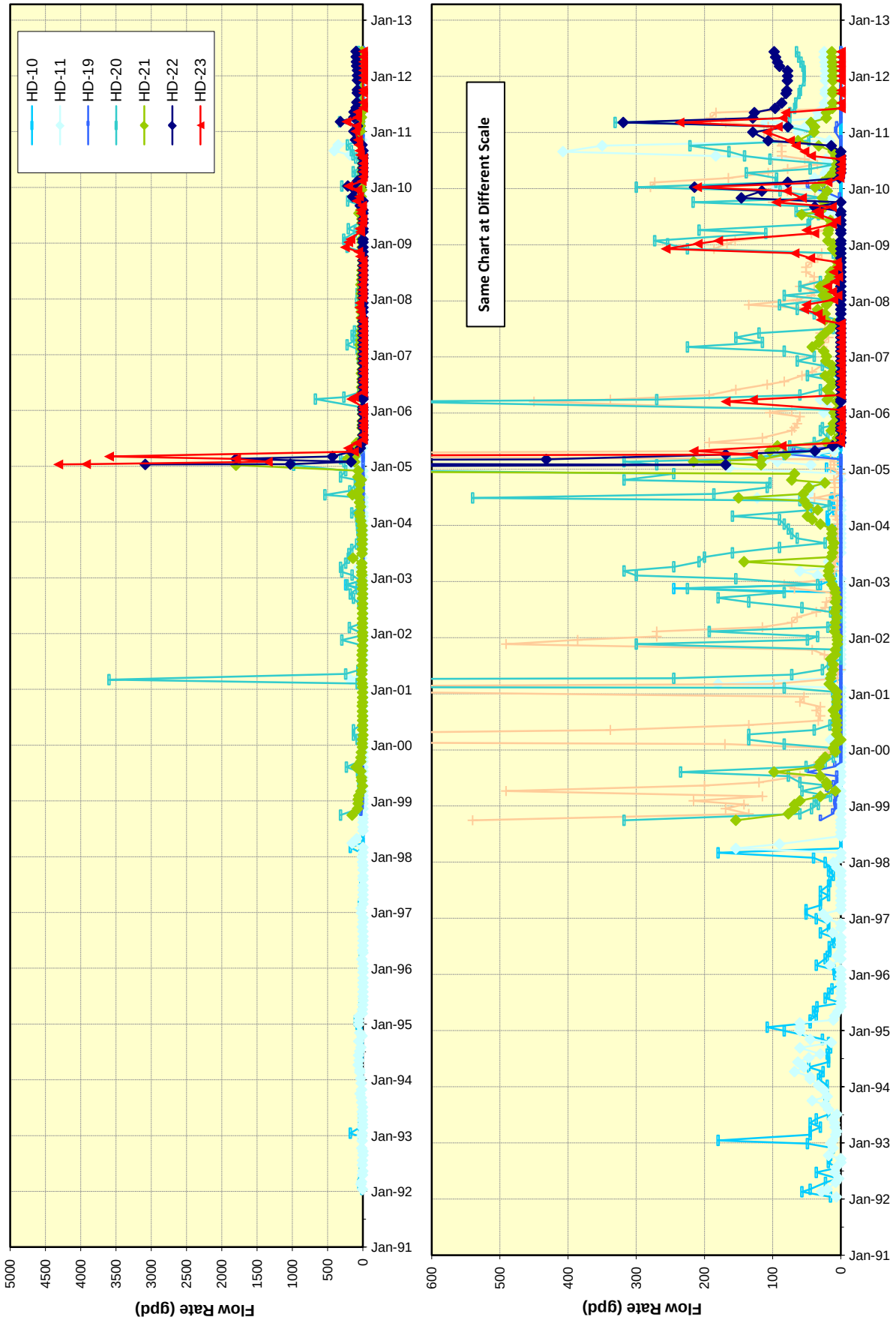
DEWATERING WELL GRAPH
Discharge Rates for Bayshore Drive Dewatering Wells
Malibu Road Landslide Assessment District
Malibu, California

PLATE B-2b



HYDRAUGER GRAPH
Discharge Rates for all Hydraugers (West End)
Malibu Road Landslide Assessment District
Malibu, California

PLATE B-3a



HYDRAUGER GRAPH
Discharge Rates for all Hydraugers (East End)
Malibu Road Landslide Assessment District
Malibu, California

PLATE B-3b

APPENDIX C
SLOPE INCLINOMETER DATA

MALIBU ROAD - Slope Inclinometer Interpretation Summary								
	SI-1 (MR98-1)	**SI-1A**	**SI-2** (MR98-2)	**SI-2A**	**SI-3** (MR98-3)	**SI-4** (MR98-4)	**SI-5**	**SI-6**
Installation Details								
Previous Ref.Elev.(8/91)	20.0	20.0	20.0	20.0	20.0	22.0	59.0	57.0
Updated Ref.Elev.(4/00)	20.1	20.0	19.7	19.7	20.3	18.9	59.3	58.0
Depth (ft.)	34	50	64	64	49	43	78	78
Install Date	Apr-98	Aug-08	Apr-98	Apr-98	Apr-98	Apr-98	Apr-98	Apr-98
A+ Axis orientation (deg)	184	197	201	200	190	204	176	186
Casing	RST	SI	RST	RST	RST	RST	SI	SI
Installer	BYA	FWI	BYA	BYA	BYA	BYA	BYA	BYA
Interpreted Rupture Depth (ft)	30-32	30-32	28-32	28-32	35-38	32-34	unknown	unknown
Status	D	F	D	F	D	F	F	F
Reading Interval	Quarterly	Quaterly	Quarterly	Quarterly	Quarterly	Quarterly	Quarterly	Quarterly
Interpretation Movement (inches)								
2011-2012	**NR**	**--**	**NR**	**--**	**NR**	--	--	--
2010-2011	**NR**	**--**	**NR**	**--**	**NR**	0.6	--	--
2009-2010	**NR**	**--**	**NR**	--	**NR**	--	--	--
2008-2009	**NR**	**--**	<0.1 **(4)**	**NR**	**NR**	--	--	--
2007-2008	**NR**	**--**	--	**NR**	**NR**	--	--	--
2006-2007	**NR**	**NR**	--	**NR**	**NR**	--	--	--
2004-2005	0.5 **(3)**	**NR**	0.4	**NR**	>1**(3)**	0.4 to 0.5	~ 0.2 *	--
2003-2004 **(1)**	--	**NR**	--	**NR**	--	--	--	--
2002-2003	~ 0.2 *	**NR**	~ 0.1 *	**NR**	--	--	--	--
2001-2002	--	**NR**	--	**NR**	--	--	--	--
2000-2001	0.5	**NR**	0.4	**NR**	0.3	0.6	--	--
1999-2000	--	**NR**	--	**NR**	--	--	--	--
1998-1999	3.1	**NR**	1.5	**NR**	4.1	1.3 **(2)**	--	--

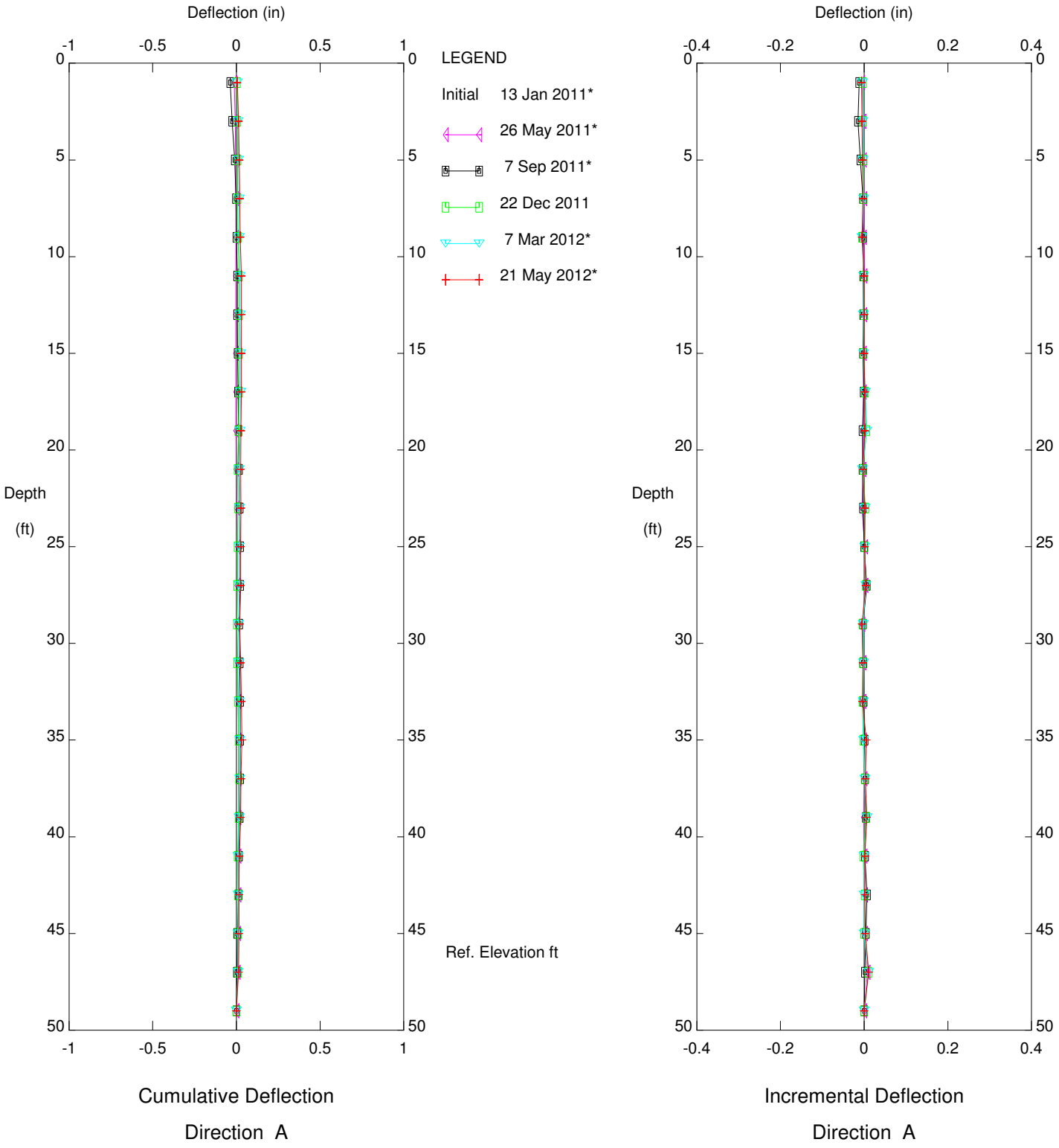
NOTES:

D Destroyed
F Functioning
NI No information
(1) Readings only through March 2004
(2) Readings are through 2000, although majority of movement occurred in 1998
(3) Inclinometer sheared off in January, 2005.
(4) Inclinometer sheared off winter of 2009.
NR No reading
-- No clearly defined interpreted movement.
~ 0.1 * Indicated displacement is less than reliable instrument accuracy. Interpreted movement is theoretical.

SUMMARY OF SLOPE INCLINOMETERS
Malibu Road Landslide Assessment District
Malibu, California

PLATE C-1

Fugro Consultants, Inc. - Ventura, CA



Cumulative Deflection

Direction A

Incremental Deflection

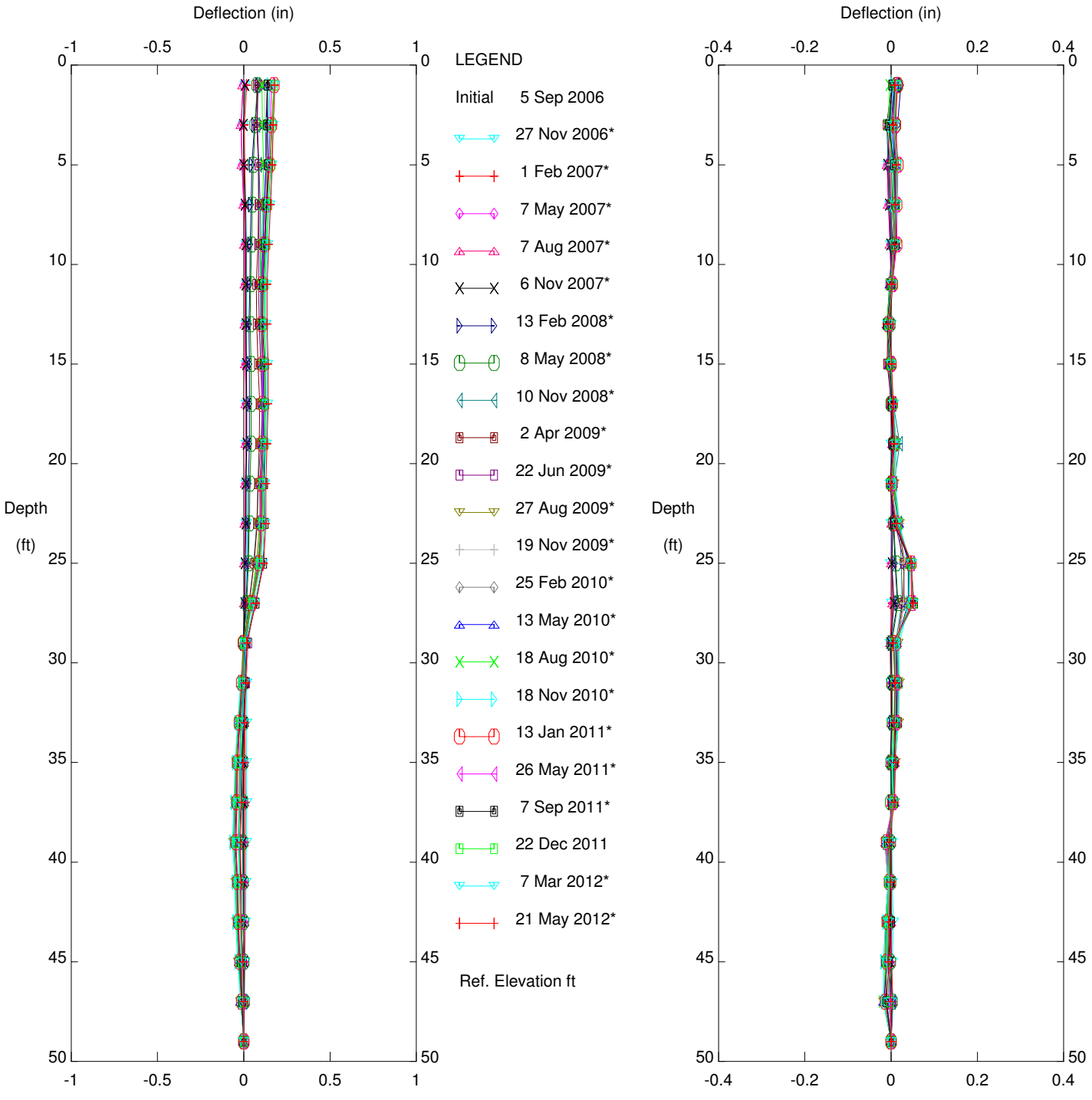
Direction A

MALIBU ROAD, Inclinometer SI-1A

Sets marked * include zero shift and/or rotation corrections.

PLATE C-2a

Fugro Consultants, Inc. - Ventura, CA



Cumulative Deflection

Direction A

Incremental Deflection

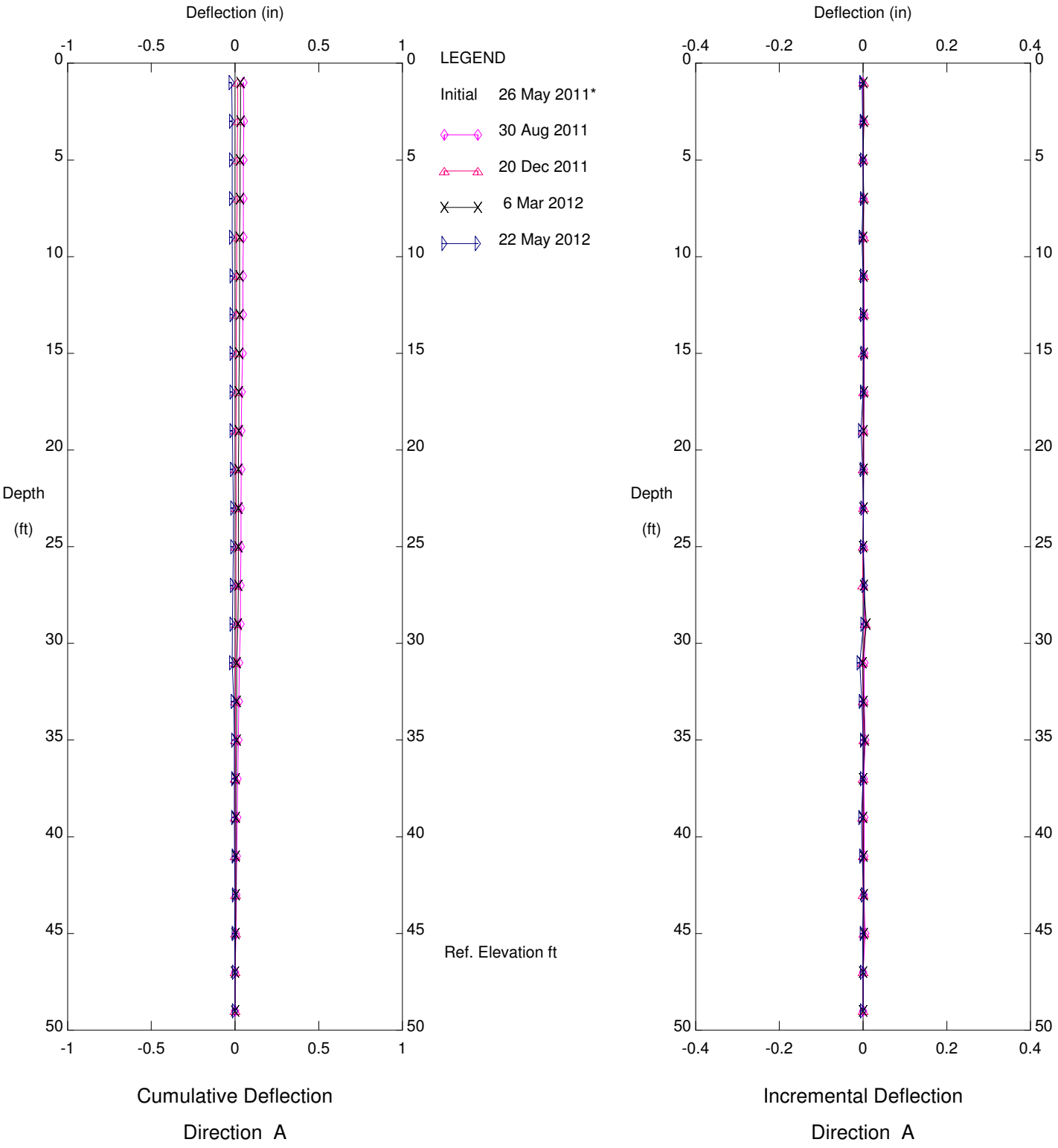
Direction A

MALIBU ROAD, Inclinometer SI-1A

Sets marked * include zero shift and/or rotation corrections.

PLATE C-2b

Fugro Consultants, Inc. - Ventura, CA



Cumulative Deflection

Direction A

Incremental Deflection

Direction A

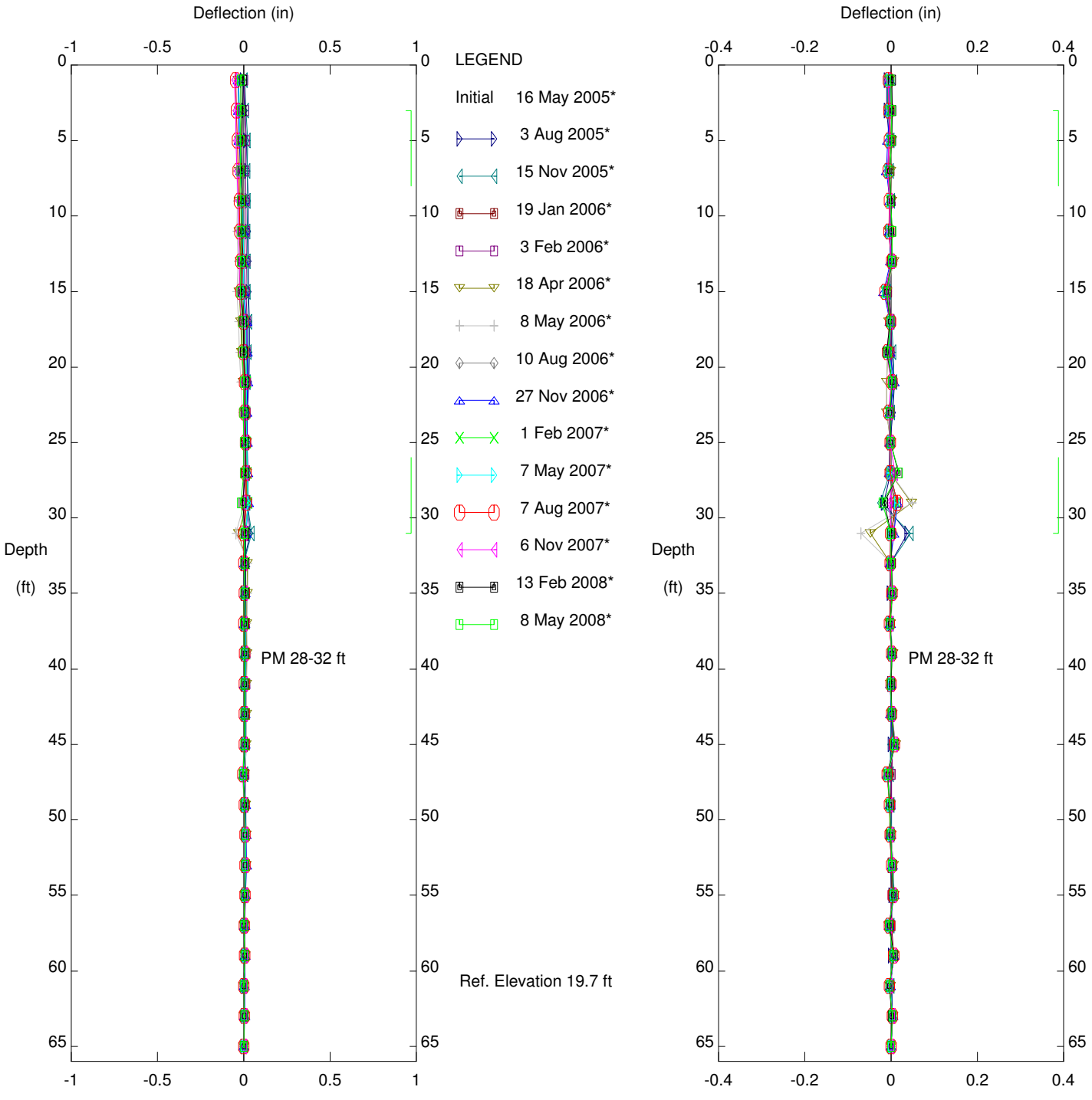
MALIBU ROAD, Inclinometer SI-2A

Depth of Readings = 50 ft

Sets marked * include zero shift and/or rotation corrections.

PLATE C-3a

Fugro Consultants, Inc. - Ventura, CA



Cumulative Deflection

Direction A

Incremental Deflection

Direction A

MALIBU ROAD, Inclinometer SI-2

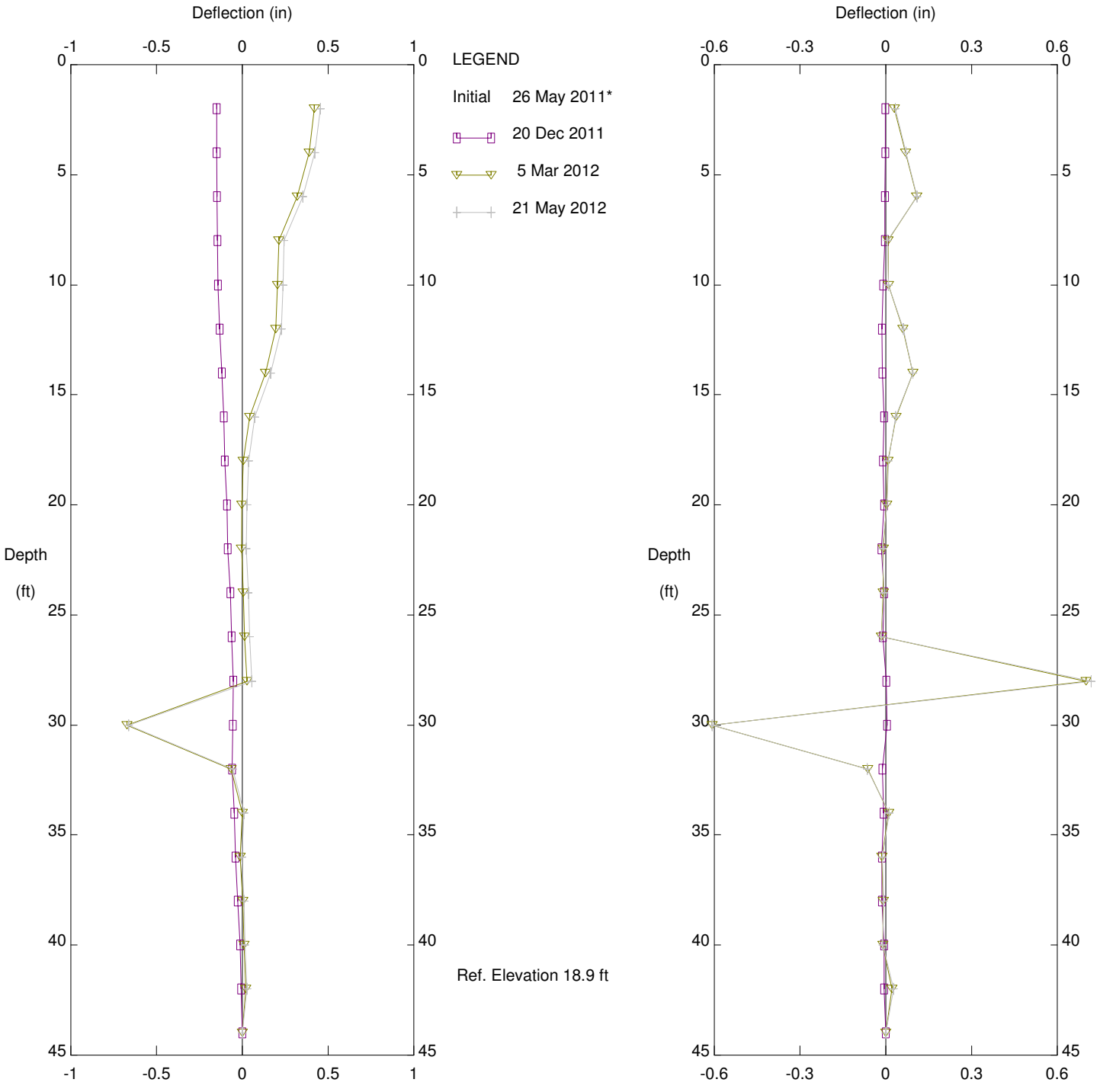
Depth of readings = 66 ft

Sets marked * include zero shift and/or rotation corrections.

PLATE C-3b

O:\Management\3399_Malibu\3399-004_Malibu_Road\03_DATA\SI_Data\2011-2012\SI-2.gtl

Fugro Consultants, Inc. - Ventura, CA



Cumulative Deflection

Direction A

Incremental Deflection

Direction A

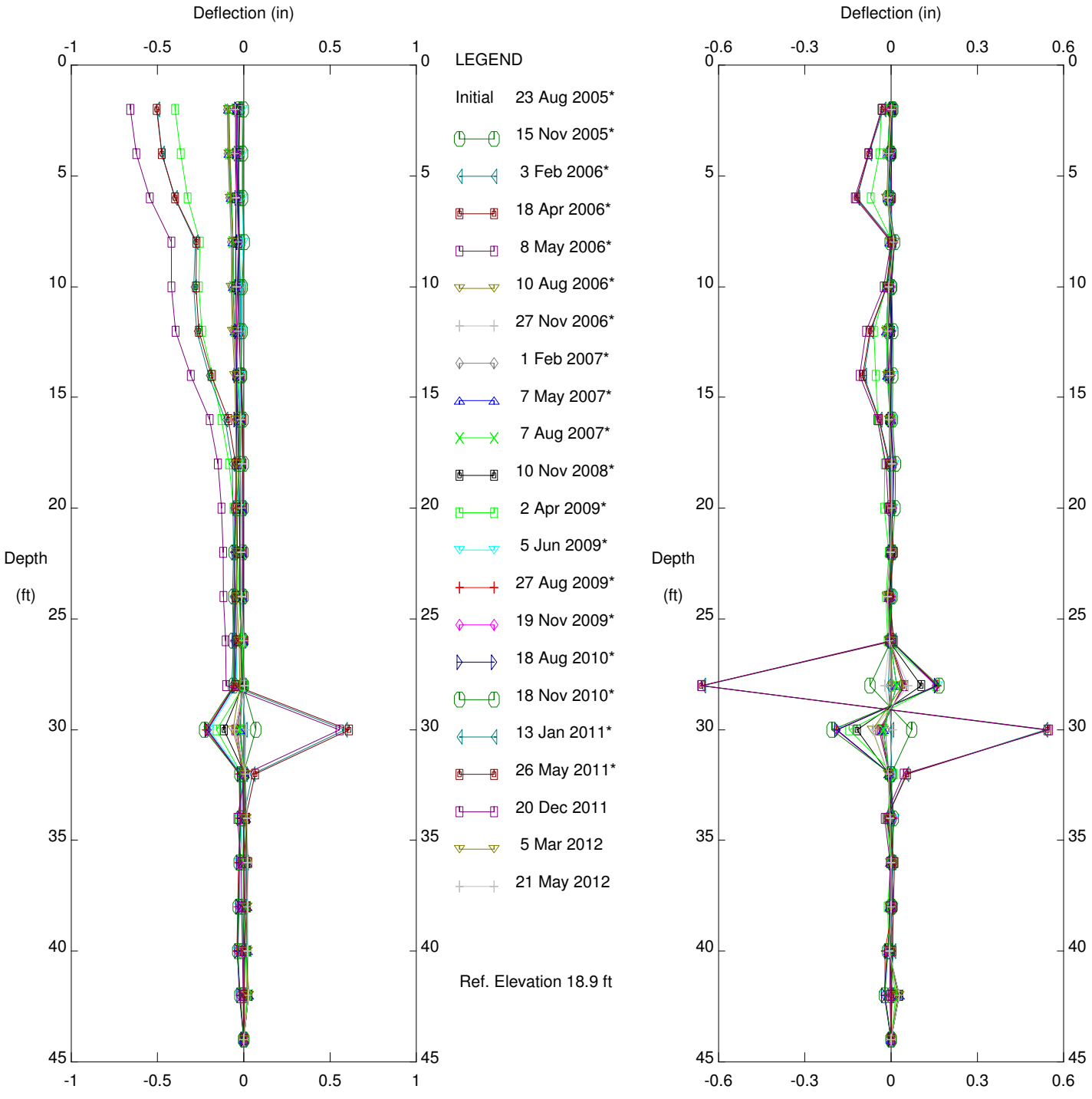
MALIBU ROAD, Inclinometer SI-4

Depth of readings = 41 ft

Sets marked * include zero shift and/or rotation corrections.

PLATE C-4a

Fugro Consultants, Inc. - Ventura, CA



Cumulative Deflection

Direction A

Incremental Deflection

Direction A

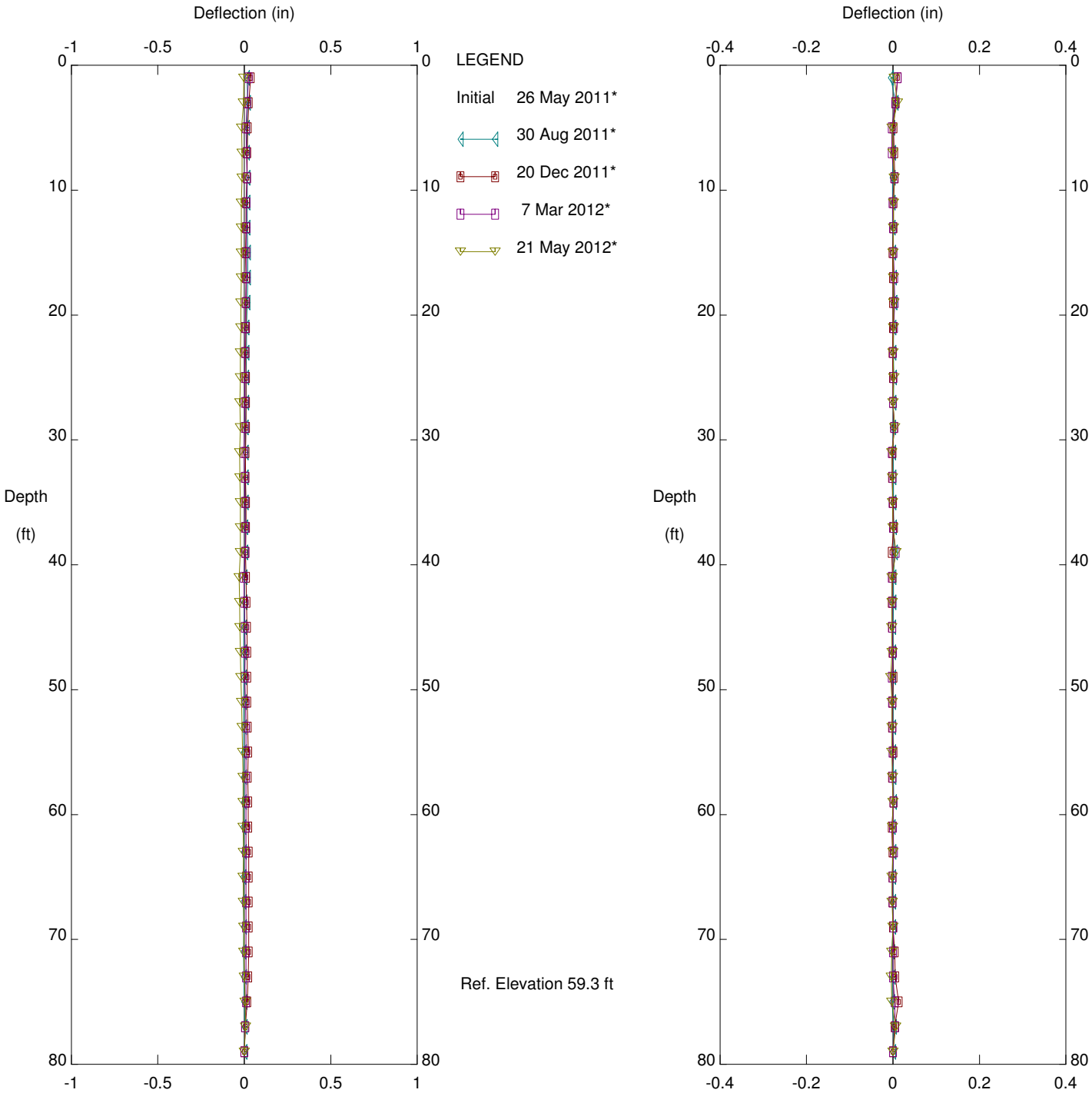
MALIBU ROAD, Inclinometer SI-4

Depth of readings = 41 ft

Sets marked * include zero shift and/or rotation corrections.

PLATE C-4b

Fugro Consultants, Inc. - Ventura, CA



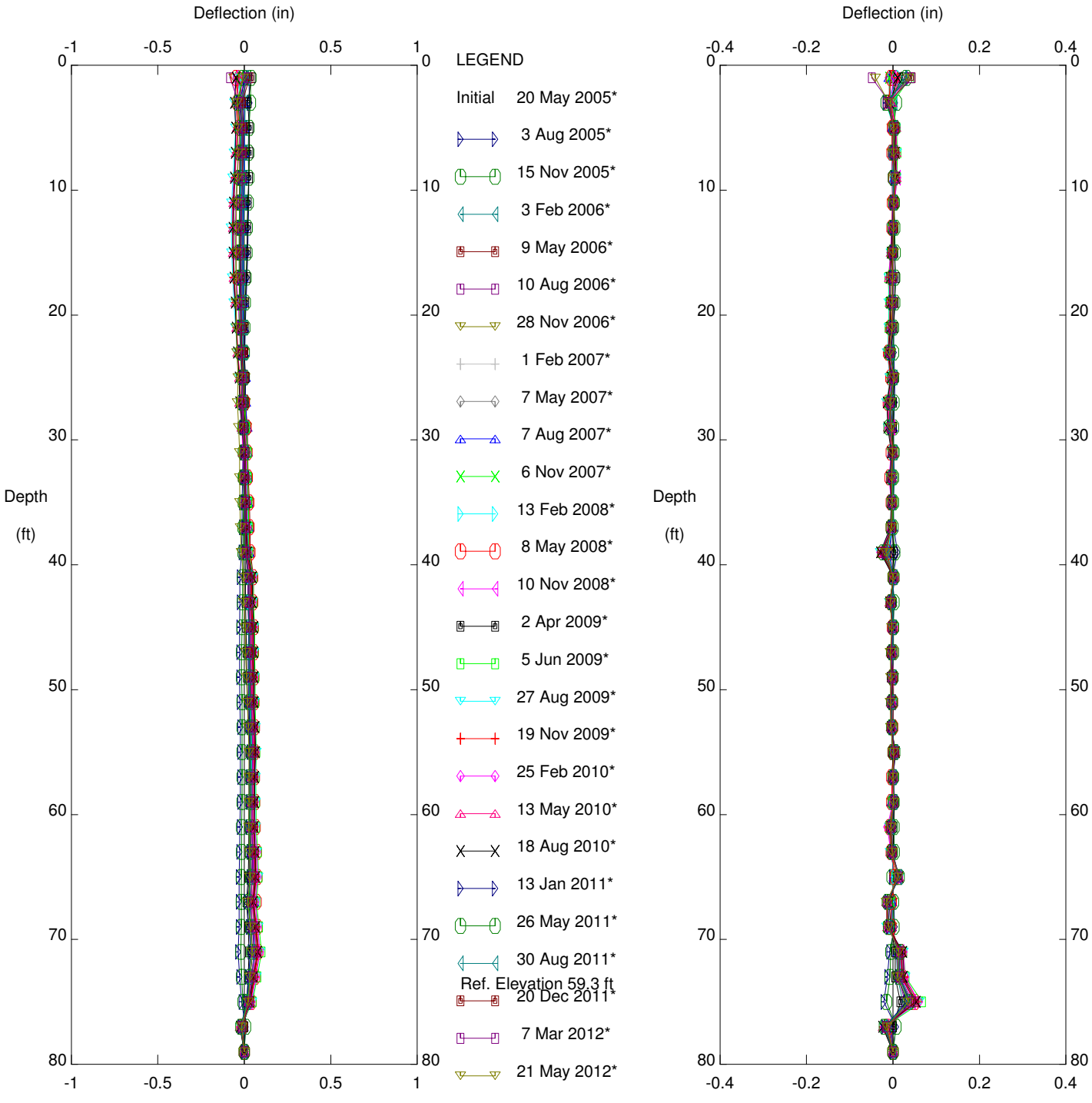
MALIBU ROAD, Inclinometer SI-5

Depth of readings = 78 ft

Sets marked * include zero shift and/or rotation corrections.

PLATE C-5a

Fugro Consultants, Inc. - Ventura, CA



Cumulative Deflection

Direction A

Incremental Deflection

Direction A

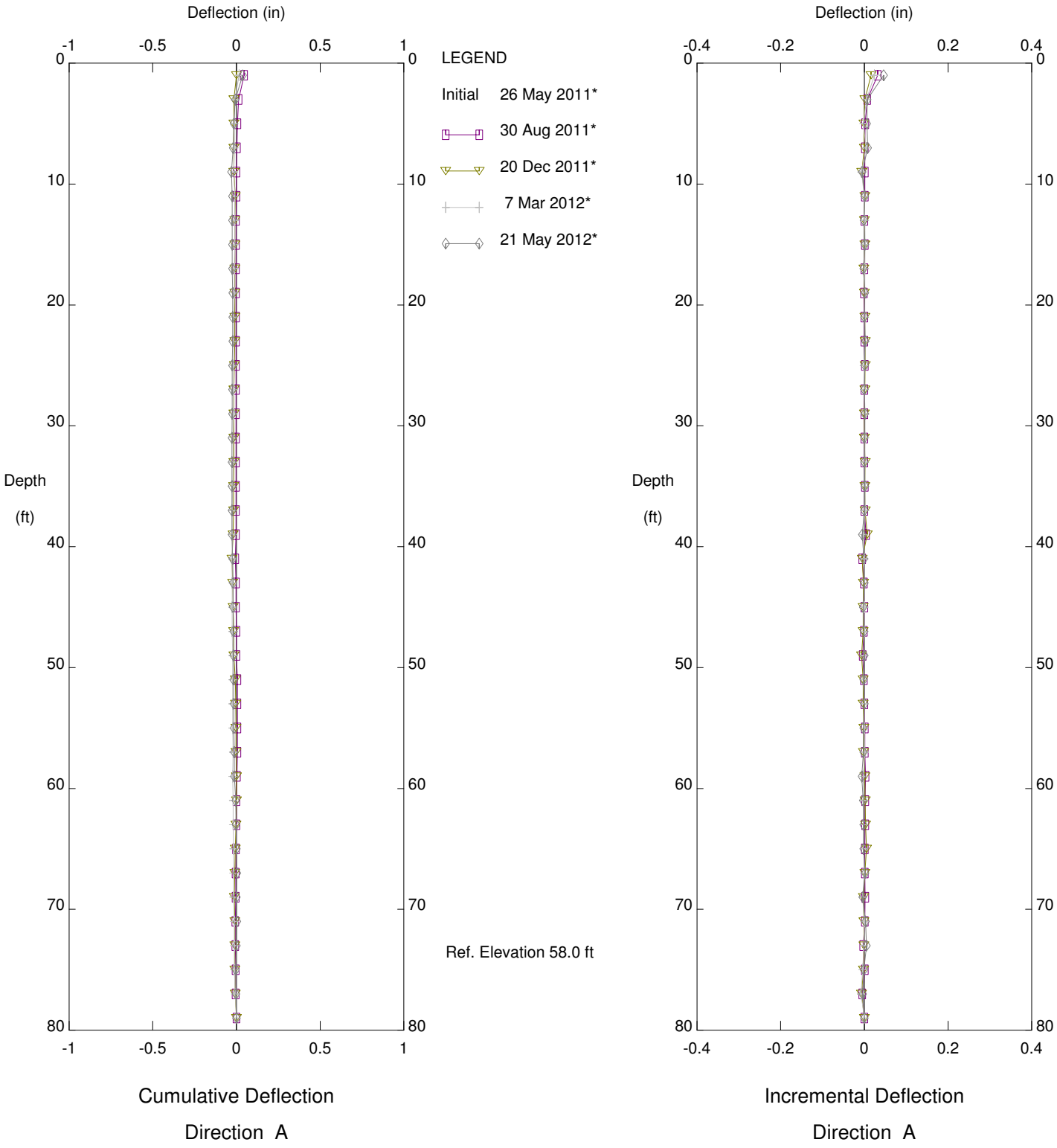
MALIBU ROAD, Inclinometer SI-5

Depth of readings = 78 ft

Sets marked * include zero shift and/or rotation corrections.

PLATE C-5b

Fugro Consultants, Inc. - Ventura, CA



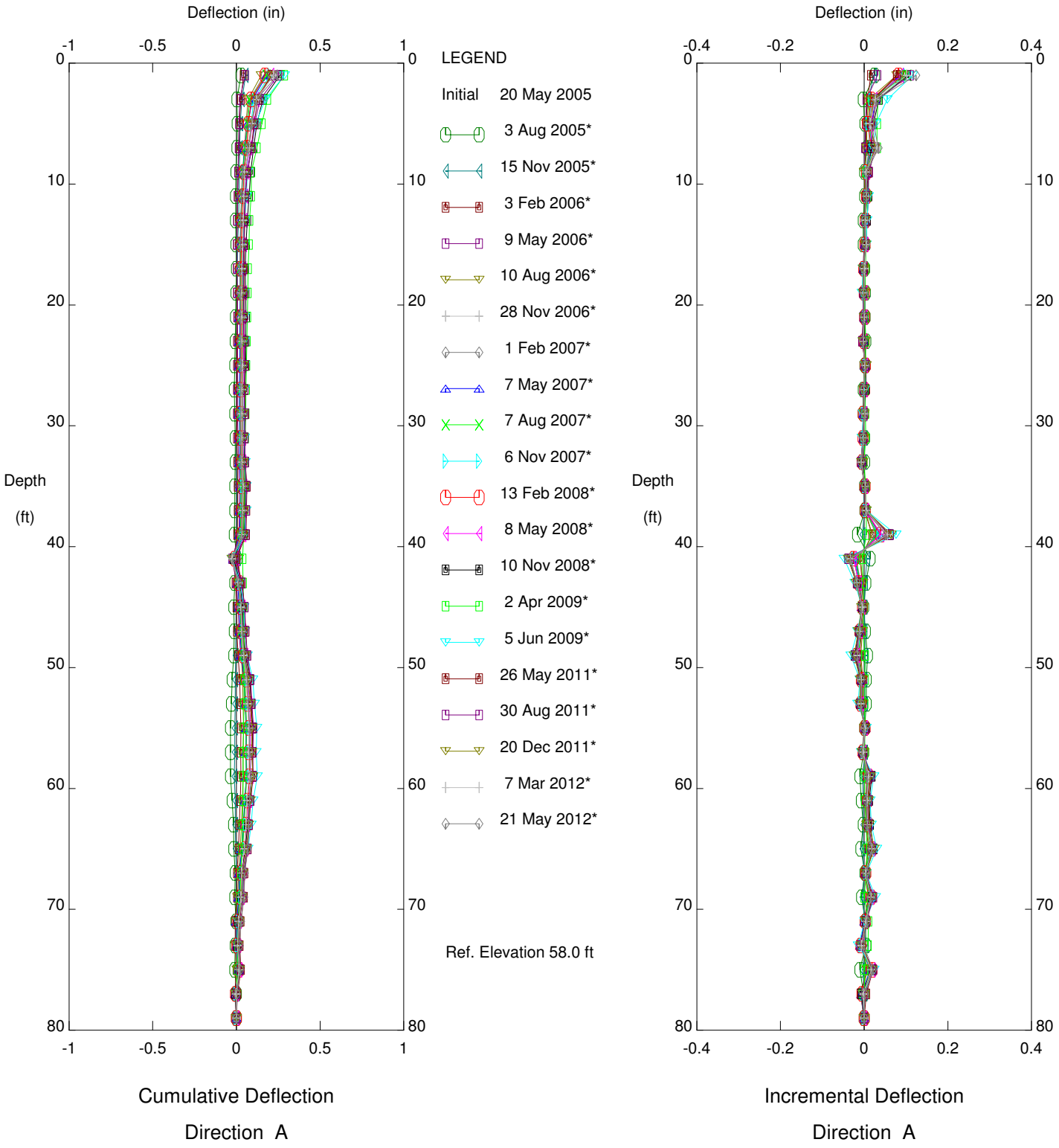
MALIBU ROAD, Inclinometer SI-6

Depth of readings = 78 ft

Sets marked * include zero shift and/or rotation corrections.

PLATE C-6a

Fugro Consultants, Inc. - Ventura, CA



Cumulative Deflection

Direction A

Incremental Deflection

Direction A

MALIBU ROAD, Inclinometer SI-6

Depth of readings = 78 ft

Sets marked * include zero shift and/or rotation corrections.

PLATE C-6b