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Incoming
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From: "Michael Hansen" <Mhansen@rbgengineering.com>
To: <dshaver@andalex.com>, <jlewis@andalex.com>, <jsorensen@andalex.com>, <James_Kohler@blm.gov>, <Jeff_McKenzie@blm.gov>, <Stan_Perkes@blm.gov>, <Steve_Falk@blm.gov>, <steve_rigby@blm.gov>, <jllewelyn@co.carbon.ut.us>, <ecc@emerytelcom.net>, <suncity@emerytelcom.net>, "Brad Price" <bprice@rbgengineering.com>, "Rob johnson" <robj@rbgengineering.com>, <bretdixon@utah.gov>, <davemarble@utah.gov>, <karlhouskeeper@utah.gov>, <marcstilson@utah.gov>, <pamgrubaughlittig@utah.gov>, <petehess@utah.gov>, <waynehedberg@utah.gov>
Date: 6/5/2006 7:58:47 AM
Subject: Grassy trail Dam seismic update June 3

Michael Hansen
Engineering Geologist

RB&G ENGINEERING Inc.
1435 West 820 North
Provo Ut. 84601

Ph 801-374-5771
SLC 801-521-5771
Fax 801-374-5773

email mhansen@rbgengineering.com

RB&G ENGINEERING
Grassy Trail Dam, Seismic Summary for June 3, 2006

For the one-week period between May 27 and June 3, 2006 the number of MIS (Mining Induced Seismicity) earthquakes recorded near the site by the UUSS increased from 3 to **9**. These MIS earthquakes ranged in magnitude from 1.1 to a high of 2.4, This 2.4 mag earthquake is the second highest magnitude event recorded at the site with the 2.6 mag event in March being the largest event. This increase in seismic activity may be associated with the mining transition into an area with greater overburden. Due to the increased distance between the dam and the current longwall mining the lower 1.1 magnitude event was not recorded on the Dam or Hillside monitoring units.

With the increased magnitude and number of earthquakes the number of events recorded on the Hillside seismic unit also increased during the past week from 30 to 35 seismic events. Only one PGA value greater than 0.1g was recorded on the Hillside. MIS events on the Dam also increased from 22 to 25 events with one PGA value greater than 0.1g. There were also 3 additional events recorded on the dam which were generated by people or other movement directly on the dam, which were not mining related.

During the week the highest Peak Ground Acceleration (PGA) value recorded on the Hillside increased from last weeks high of 0.0223g to **0.108g**. Highest PGA value on the Dam decreased from 0.0223g to **0.113g**. These high PGA values occurred during the 2.4 mag earthquake event on 5/28/06 at ~15:54 (MDT). It should be noted that if this event had occurred closer to the dam the PGA values would likely have been higher. As noted from the graphs a 2.3 mag earthquake on March 24, generated PGA values of 0.242g and 0.182g

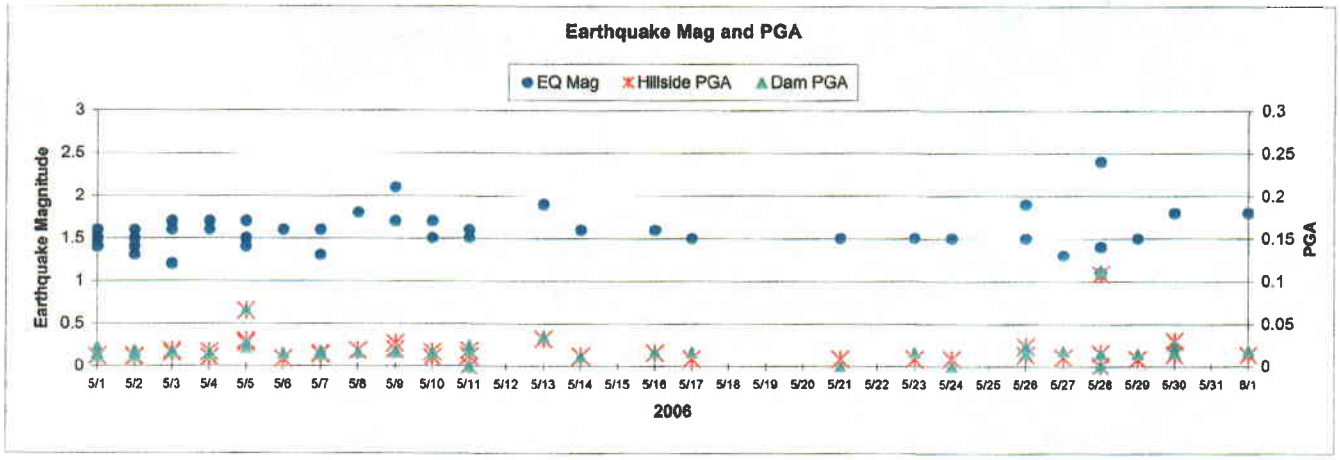
Inclinometers I-2, I-3 and I-4 continue to show an overall decrease in movement when compared with recent weeks. Inclinometer I-1 shows some slight erratic movement and has shifted back closer to the center.

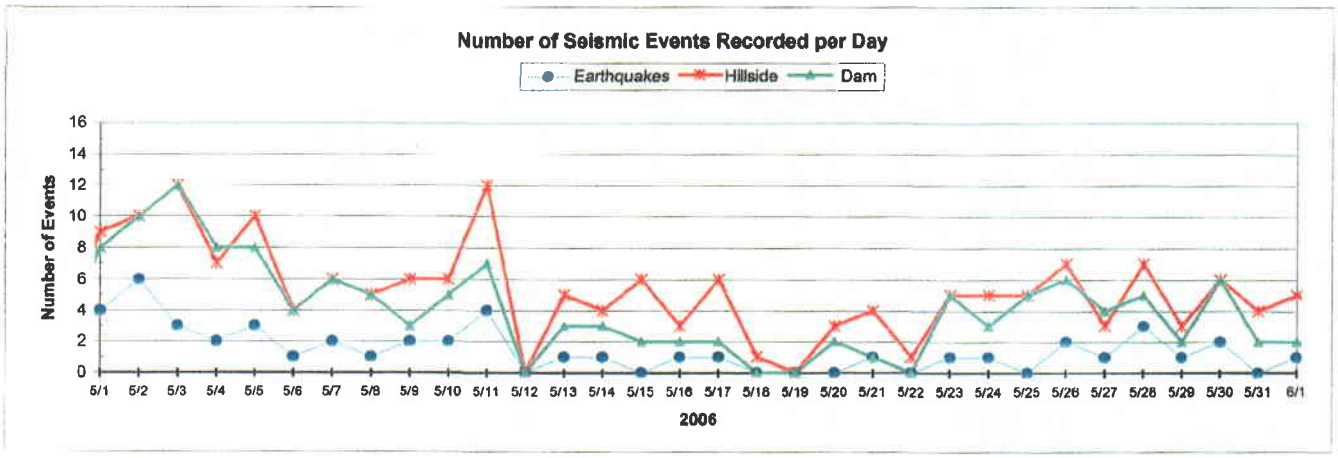
No cracks or signs of movement were noted on the dam or abutments above the dam.

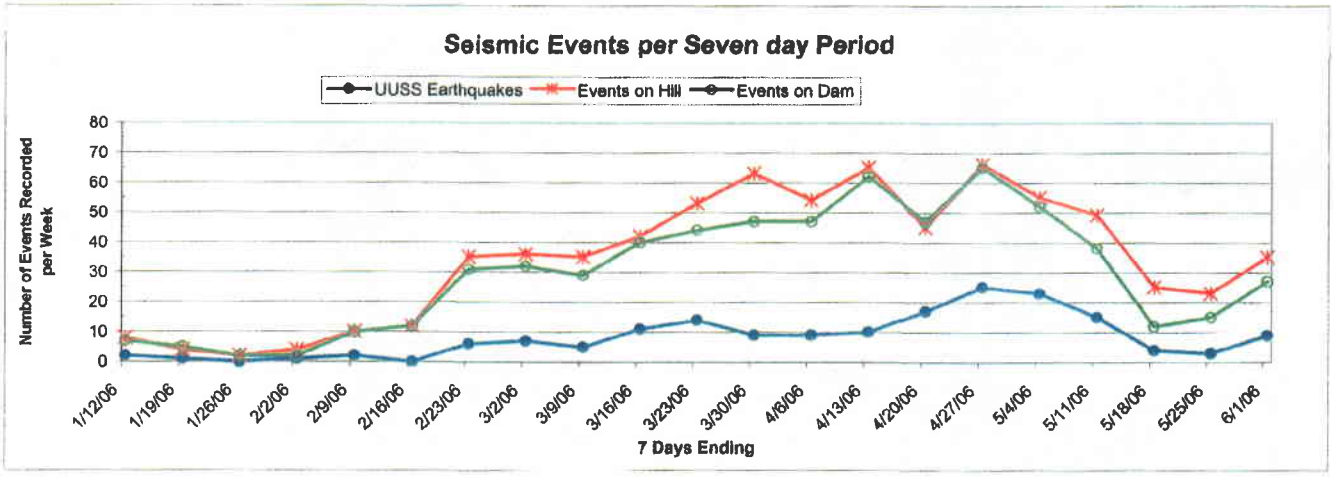
Michael Hansen
RB&G ENGINEERING

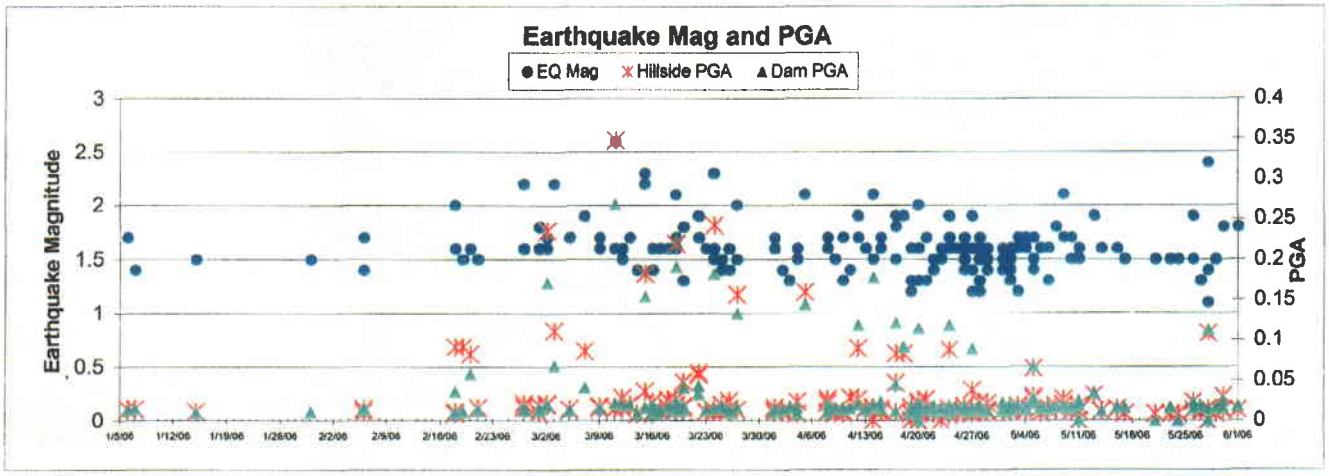
Grassy Trail Dai am, Car bon Coun ty, Utah
63/2006 unit # 9690 Da m #9689
Event Report: Event L ist - c: \blast\even

Type	Serial No.	Date	Time	Tran Peak (mm/s)	Vert Peak (mm/s)	Long Peak (mm/s)	PVS1 (mm/s)	Trigger	Tran Accel (g)	Vert Accel (g)	Long Accel (g)	Description	Post Event Note first line
LOG	BE9689	5/27/06	11:39:04	***	***	***	***	***	***	***	***	Start Monitoring	Start Monitoring
LOG	BE9690	5/27/06	12:01:00	***	***	***	***	***	***	***	***	Start Monitoring	Start Monitoring
W	BE9690	5/27/06	16:00:55	0.397	0.286	0.683	0.696	Long	0.00663	0.00663	0.00829	Hillside	
W	BE9689	5/27/06	16:57:40	0.873	0.651	1	1.15	Long	0.0116	0.0116	0.0182	Grassy Tr. Dam	EQ Mag 1.3
W	BE9690	5/27/06	16:57:41	0.762	0.476	1.06	1.17	Long	0.00829	0.00663	0.00994	Hillside	EQ Mag 1.3
W	BE9689	5/27/06	21:36:24	0.746	0.365	0.397	0.846	Tran	0.00994	0.00663	0.0166	Grassy Tr. Dam	
W	BE9689	5/27/06	22:56:32	0.746	0.413	0.619	0.94	Long	0.00829	0.00663	0.0182	Grassy Tr. Dam	
W	BE9689	5/27/06	23:40:33	0.683	0.397	0.619	0.8	Tran	0.00994	0.00663	0.0166	Grassy Tr. Dam	
W	BE9690	5/27/06	23:40:34	0.651	0.508	1.1	1.12	Long	0.00663	0.00663	0.00994	Hillside	
W	BE9689	5/28/06	0:15:00	0.603	0.381	0.54	0.799	Tran	0.00663	0.00663	0.0166	Grassy Tr. Dam	
W	BE9690	5/28/06	0:15:01	0.571	0.556	1.22	1.23	Long	0.00663	0.00829	0.0116	Hillside	
W	BE9689	5/28/06	6:20:30	0.905	0.651	0.952	1.16	Long	0.00820	0.00663	0.0166	Grassy Tr. Dam	
W	BE9690	5/28/06	6:20:31	1.11	0.54	1.46	1.75	Tran	0.0116	0.00829	0.0133	Hillside	
W	BE9689	5/28/06	12:25:21	1.1	0.889	1.13	1.3	Vert	0.0116	0.00663	0.0149	Grassy Tr. Dam	EQ Mag 1.4
W	BE9690	5/28/06	12:25:22	0.921	0.794	1.4	1.51	Vert	0.00829	0.00994	0.0149	Hillside	EQ Mag 1.4
W	BE9690	5/28/06	15:50:00	0.349	0.397	0.825	0.843	Long	0.00663	0.00663	0.00829	Hillside	
W	BE9689	5/28/06	15:54:08	12.7	7.89	8.64	13.3	Vert	0.113	0.0481	0.0547	Grassy Tr. Dam	**EQ Mag 2.4**
W	BE9690	5/28/06	15:54:08	11	5.29	12.2	11.3	Vert	0.108	0.0514	0.0795	Hillside	**EQ Mag 2.4**
W	BE9690	5/28/06	16:09:18	0.365	0.333	0.857	0.858	Long	0.00663	0.00663	0.00994	Hillside	
W	BE9689	5/28/06	19:32:29	0.587	0.381	0.698	0.782	Long	0.00663	0.00663	0.0149	Grassy Tr. Dam	
W	BE9690	5/28/06	23:38:16	0.81	0.397	0.571	0.843	Tran	0.00829	0.00663	0.00663	Hillside	
W	BE9690	5/29/06	1:05:32	0.429	0.381	0.762	0.793	Long	0.00663	0.00829	0.00829	Hillside	
W	BE9689	5/29/06	9:03:47	0.746	0.587	0.698	1	Long	0.00829	0.00663	0.0149	Grassy Tr. Dam	EQ Mag 1.5
W	BE9690	5/29/06	9:03:47	0.73	0.587	0.937	1.06	Long	0.00829	0.00663	0.00829	Hillside	EQ Mag 1.5
W	BE9689	5/29/06	20:15:53	1.21	0.905	1.87	1.94	Vert	0.0133	0.00829	0.0182	Grassy Tr. Dam	
W	BE9690	5/29/06	20:15:53	1.87	1.08	2.35	2.48	Vert	0.0149	0.0116	0.0215	Hillside	
W	BE9689	5/30/06	8:47:28	0.73	0.429	0.667	0.776	Long	0.00829	0.00663	0.0166	Grassy Tr. Dam	
W	BE9690	5/30/06	8:47:28	0.603	0.302	0.381	0.639	Tran	0.00663	0.00663	0.00663	Hillside	
W	BE9689	5/30/06	11:29:56	0.619	0.381	0.492	0.642	Tran	0.00663	0.00829	0.0182	Grassy Tr. Dam	
W	BE9689	5/30/06	11:42:13	2.89	1.37	2.17	2.96	Vert	0.0249	0.0116	0.0166	Grassy Tr. Dam	EQ Mag 1.8
W	BE9690	5/30/06	11:42:13	2.52	1.21	3.16	3.76	Vert	0.0232	0.0149	0.0298	Hillside	EQ Mag 1.8
W	BE9689	5/30/06	13:25:14	0.794	0.429	0.835	0.855	Long	0.00829	0.00663	0.0133	Grassy Tr. Dam	
W	BE9690	5/30/06	13:25:14	0.571	0.429	0.698	0.782	Long	0.00994	0.00829	0.00829	Hillside	
W	BE9689	5/30/06	15:32:28	0.683	0.619	0.778	0.982	Vert	0.00829	0.00829	0.0149	Grassy Tr. Dam	
W	BE9690	5/30/06	15:32:28	0.762	0.429	1.02	1.12	Tran	0.0116	0.00663	0.00994	Hillside	
W	BE9689	5/30/06	19:11:19	0.143	0.889	0.397	0.894	Vert	0.00829	0.0315	0.0166	Grassy Tr. Dam	Man Made
W	BE9689	5/30/06	19:31:29	0.571	0.349	0.746	0.825	Long	0.00663	0.00663	0.0166	Grassy Tr. Dam	
W	BE9690	5/30/06	19:33:12	0.365	0.365	0.81	0.826	Long	0.00663	0.00663	0.00829	Hillside	
W	BE9689	5/30/06	20:13:36	1.64	1	1.57	2.11	Vert	0.0166	0.00829	0.0166	Grassy Tr. Dam	EQ Mag 1.8
W	BE9690	5/30/06	20:13:36	1.1	1	1.14	1.27	Vert	0.00994	0.00994	0.0133	Hillside	EQ Mag 1.8
W	BE9690	5/31/06	17:30:34	0.333	0.349	0.714	0.725	Long	0.00663	0.00663	0.00829	Hillside	
W	BE9690	5/31/06	18:37:48	0.413	0.508	0.921	0.954	Long	0.00829	0.00663	0.00994	Hillside	
W	BE9690	5/31/06	21:17:57	0.698	0.365	0.825	0.976	Long	0.00994	0.00663	0.0116	Hillside	
W	BE9689	5/31/06	21:17:58	0.778	0.587	0.968	0.969	Long	0.00663	0.00663	0.0182	Grassy Tr. Dam	
W	BE9689	5/31/06	22:37:57	0.825	0.508	0.683	1.04	Long	0.00994	0.00829	0.0166	Grassy Tr. Dam	
W	BE9690	5/31/06	22:37:57	0.698	0.571	1.37	1.39	Long	0.00829	0.00829	0.0133	Hillside	
W	BE9690	6/1/06	0:04:46	0.857	0.333	0.587	0.861	Tran	0.00829	0.00663	0.00663	Hillside	
W	BE9690	6/1/06	2:34:01	0.587	0.651	1.29	1.31	Vert	0.00663	0.00994	0.0133	Hillside	
W	BE9689	6/1/06	2:34:02	0.603	0.444	0.556	0.77	Tran	0.00829	0.00663	0.0133	Grassy Tr. Dam	
W	BE9689	6/1/06	10:20:34	0.317	0.746	0.397	0.818	Vert	0.0249	0.0431	0.0298	Grassy Tr. Dam	Man Made
W	BE9690	6/1/06	12:52:58	0.302	0.333	0.698	0.723	Long	0.00663	0.00663	0.00829	Hillside	
W	BE9690	6/1/06	13:27:28	1.14	0.667	1.64	1.65	Vert	0.00994	0.00994	0.0133	Hillside	EQ Mag 1.8
W	BE9689	6/1/06	13:27:29	1.78	1.02	1.44	2.14	Vert	0.00994	0.00829	0.0182	Grassy Tr. Dam	EQ Mag 1.8
W	BE9689	6/1/06	13:56:32	0.143	0.603	0.222	0.604	Vert	0.00663	0.0215	0.0166	Grassy Tr. Dam	Man Made
W	BE9690	6/1/06	18:57:49	0.286	0.349	0.73	0.752	Long	0.00663	0.00663	0.00994	Hillside	
W	BE9690	6/2/06	10:17:23	0.381	0.317	0.698	0.714	Long	0.00663	0.00663	0.00829	Hillside	
W	BE9690	6/2/06	10:34:14	0.698	0.19	0.397	0.7	Tran	0.00829	0.00663	0.00663	Hillside	
W	BE9690	6/2/06	17:58:56	0.556	0.413	0.825	0.885	Long	0.00663	0.00663	0.0116	Hillside	
W	BE9690	6/2/06	18:11:11	0.714	0.651	1.16	1.2	Vert	0.00663	0.00994	0.0116	Hillside	
W	BE9689	6/2/06	18:11:13	0.81	0.587	0.714	0.874	Tran	0.00994	0.00663	0.0166	Grassy Tr. Dam	
W	BE9690	6/3/06	7:43:29	1.05	0.778	1.65	1.72	Vert	0.00994	0.00994	0.0133	Hillside	
W	BE9689	6/3/06	7:43:31	1.27	0.921	1.32	1.54	Long	0.0133	0.00829	0.0199	Grassy Tr. Dam	
W	BE9690	6/3/06	8:15:42	0.635	0.381	0.635	0.729	Long	0.00663	0.00663	0.00829	Hillside	
W	BE9689	6/3/06	8:15:44	0.698	0.476	0.698	0.903	Long	0.00829	0.00663	0.0182	Grassy Tr. Dam	
LOG	BE9689	6/3/06	11:31:25	***	***	***	***	***	***	***	***	Keyboard Stop	l events recorded.
W	BE9690	6/3/06	11:47:45	0.937	0.952	1.41	1.61	Vert	0.00994	0.0116	0.0133	Hillside	
LOG	BE9690	6/3/06	12:24:10	***	***	***	***	***	***	***	***	Keyboard Stop	l events recorded.


Earthquake Mag and PGA
EQ Mag
Hillside PGA
Dam PGA
Earthquake Magnitude
PGA
2006


Number of Seismic Events Recorded per Day
Earthquakes
Hillside
Dam
Number of Events
2006


Seismic Events per Seven day Period
UUSS Earthquakes
Events on Hill
Events on Dam
Number of Events Recorded per Week
7 Days Ending


Earthquake Mag and PGA
EQ Mag
Hillside PGA
Dam PGA
Earthquake Magnitude
PGA
3
2.5
2
1.5
1
0.5
0
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
1/5/06
1/12/06
1/19/06
1/26/06
2/2/06
2/9/06
2/16/06
2/23/06
3/2/06
3/9/06
3/16/06
3/23/06
3/30/06
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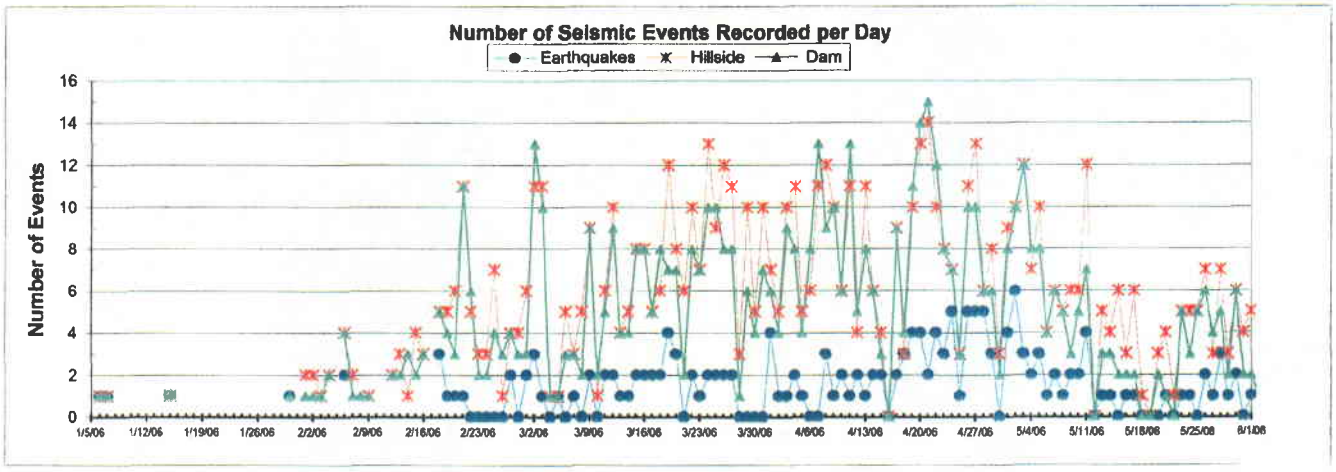
5/25/06
6/1/06


Number of Seismic Events Recorded per Day
Earthquakes
Hillside
Dam
Number of Events
16
14
12
10
8
6
4
2
0
1/5/06
1/12/06
1/19/06
1/26/06
2/2/06
2/9/06
2/16/06
2/23/06
3/2/06
3/9/06
3/16/06
3/23/06
3/30/06
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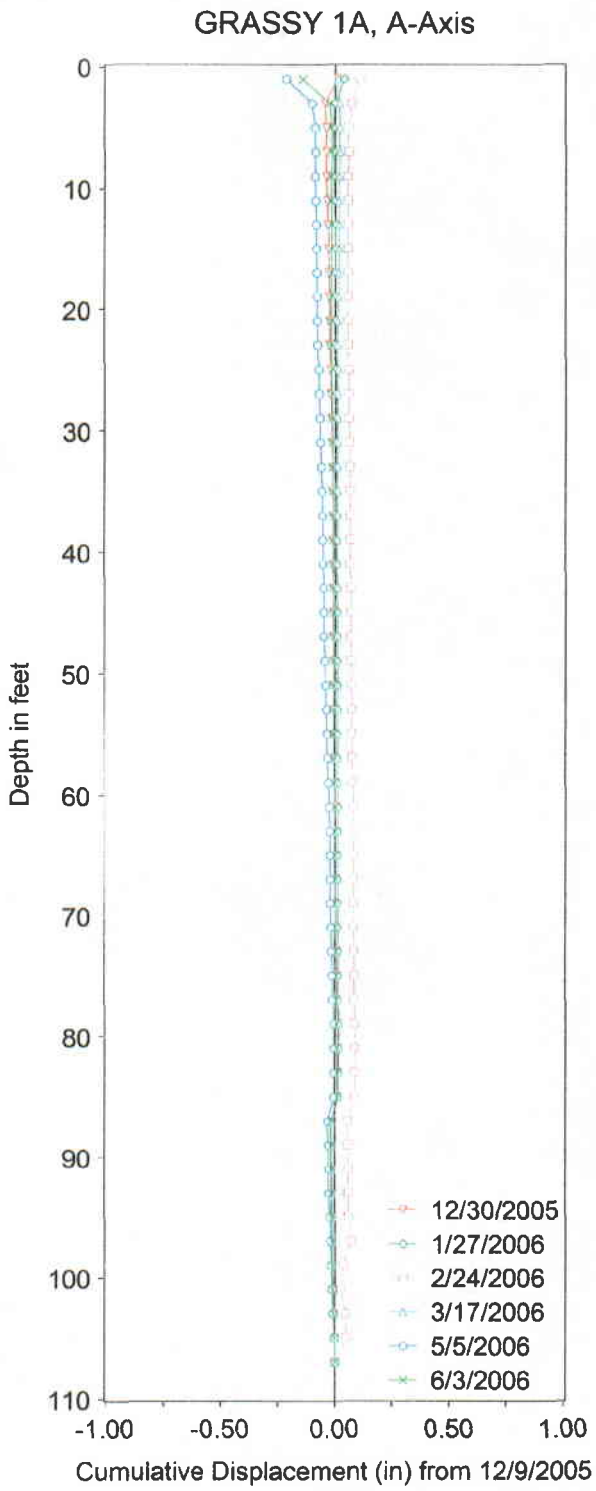
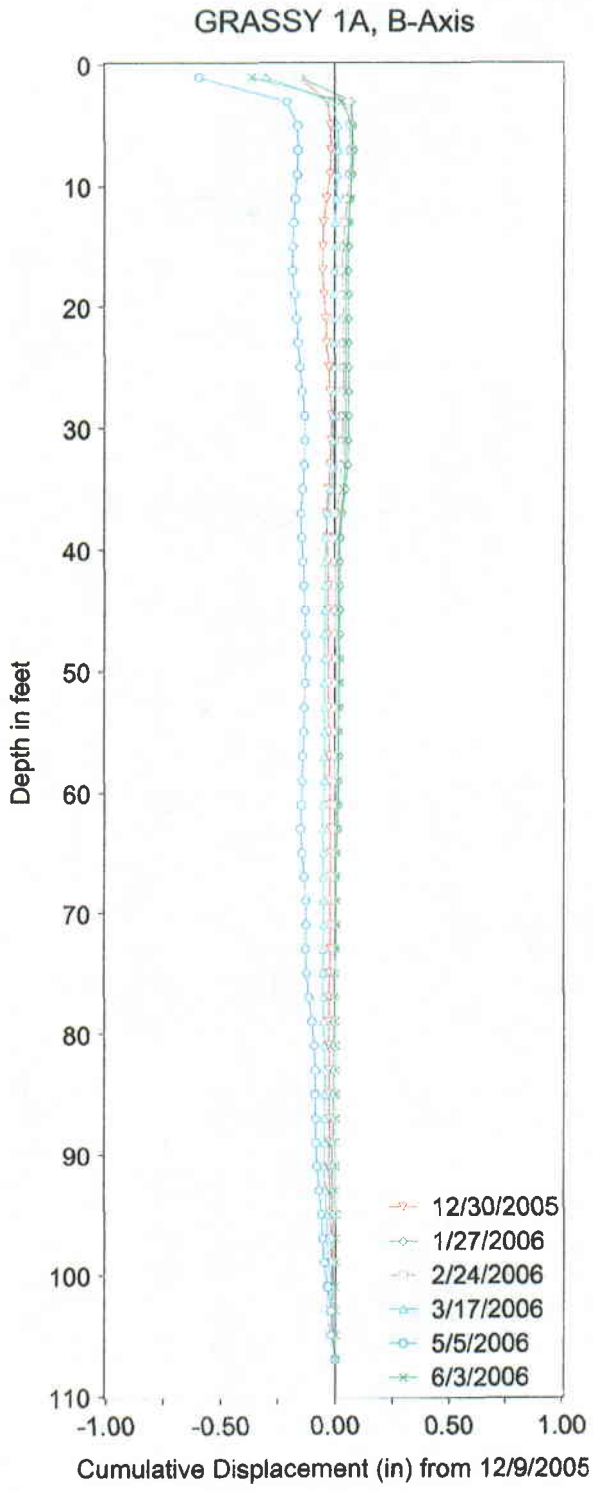
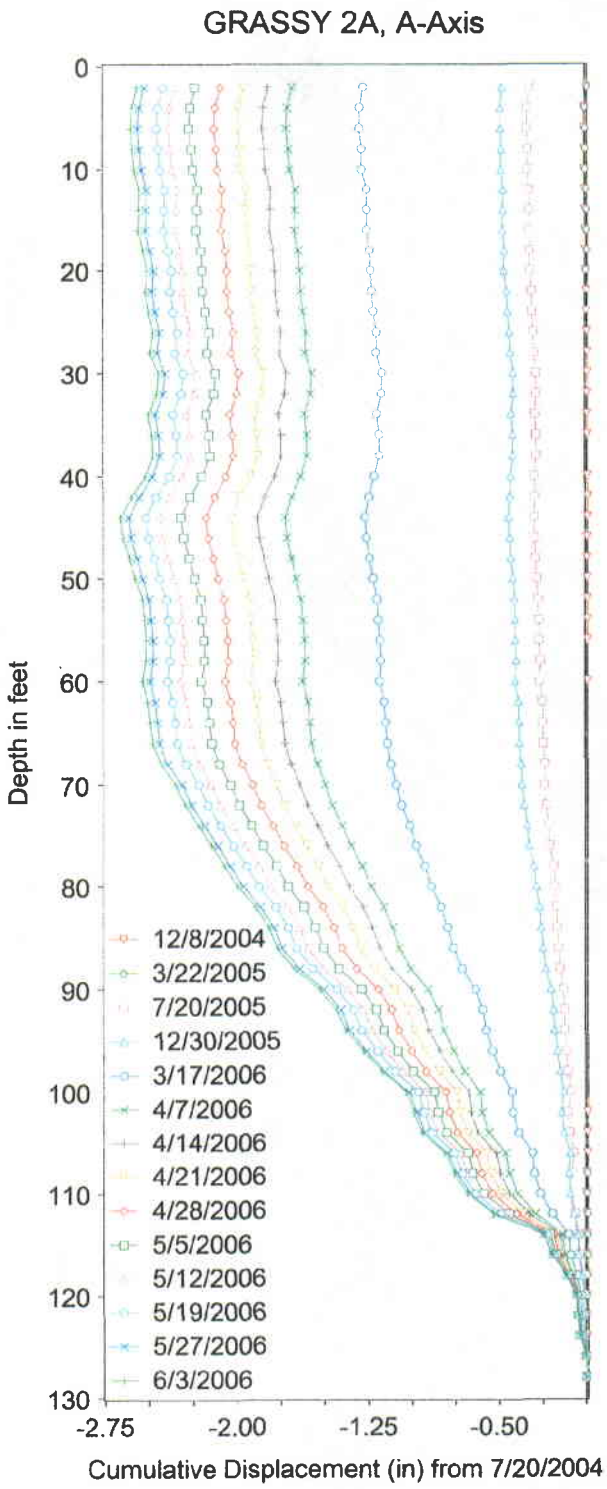
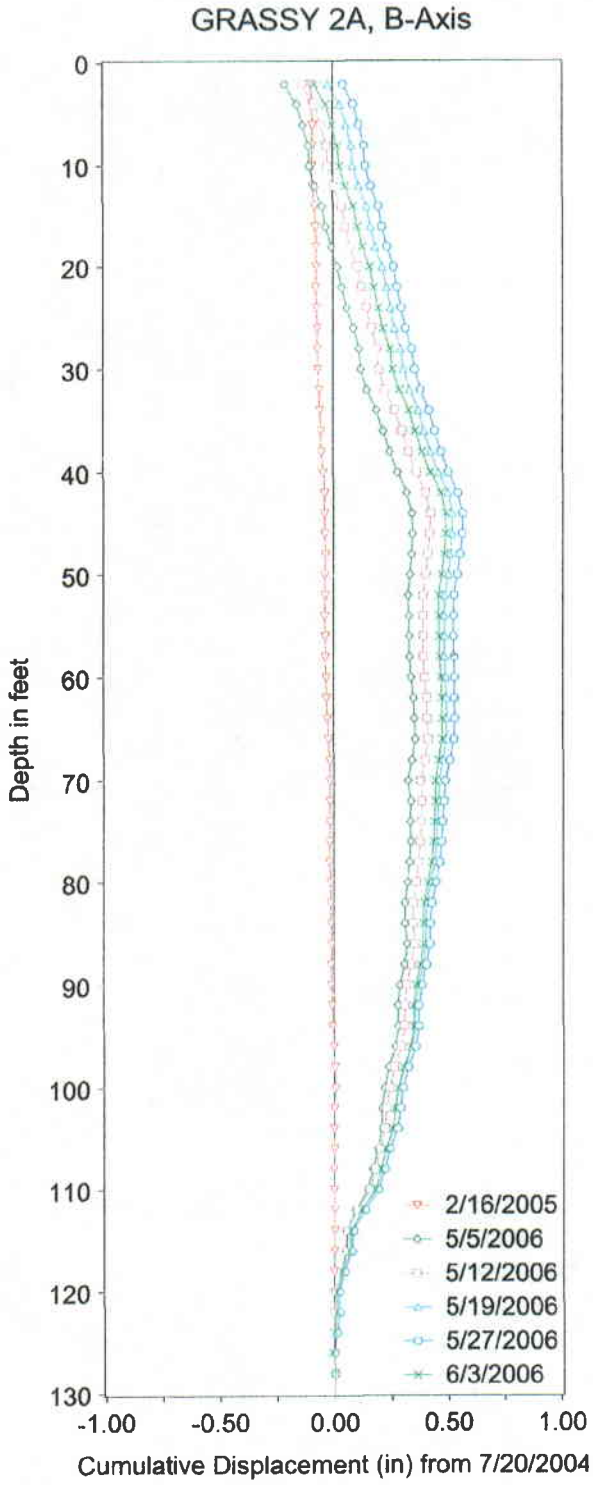
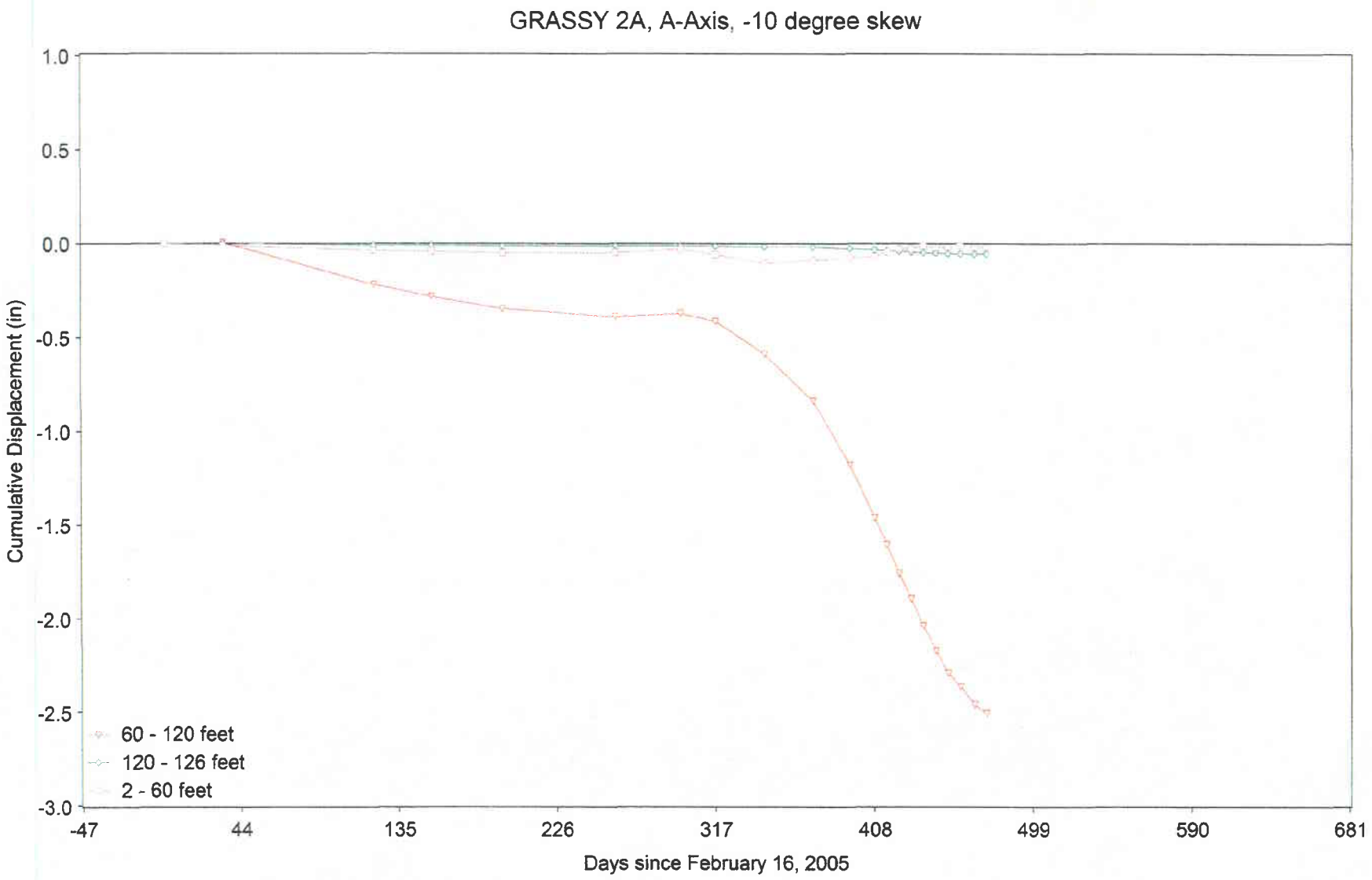
5/18/06
5/25/06
6/1/06

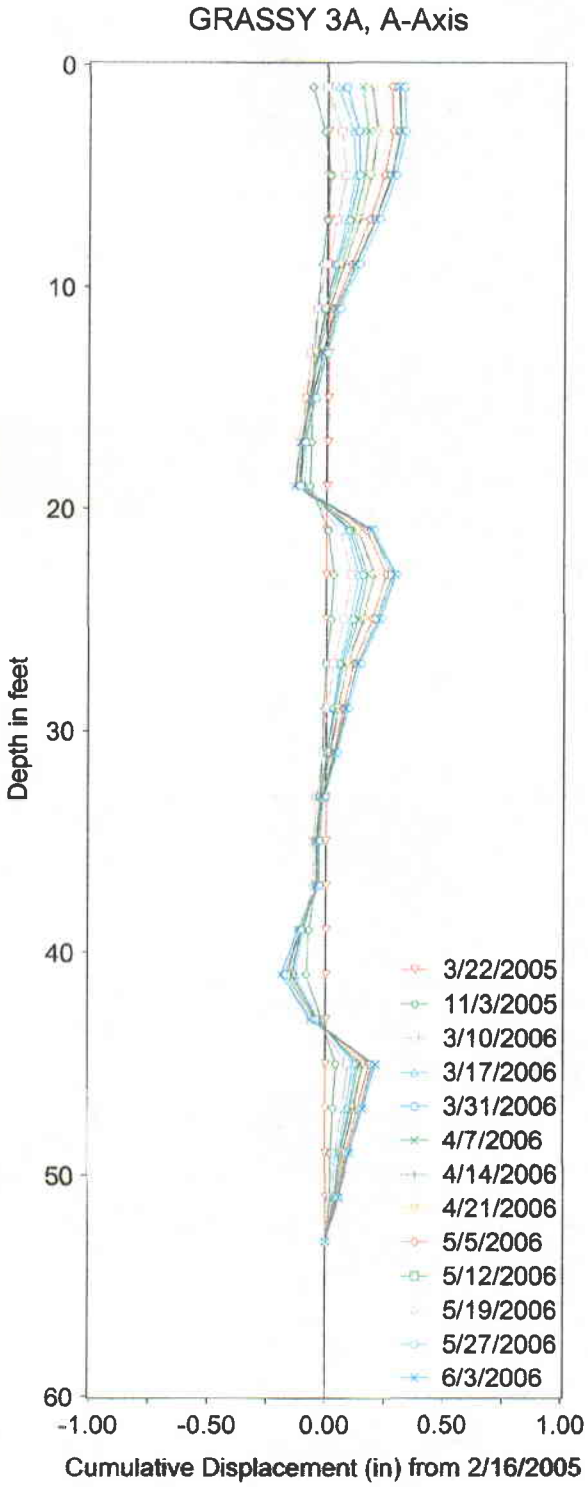

GRASSY 1A, A-Axis
Depth in feet
0
10
20
30
40
50
60
70
80
90
100
110
-1.00
-0.50
0.00
0.50
1.00
Cumulative Displacement (in) from 12/9/2005
12/30/2005
1/27/2006
2/24/2006
3/17/2006
5/5/2006
6/3/2006

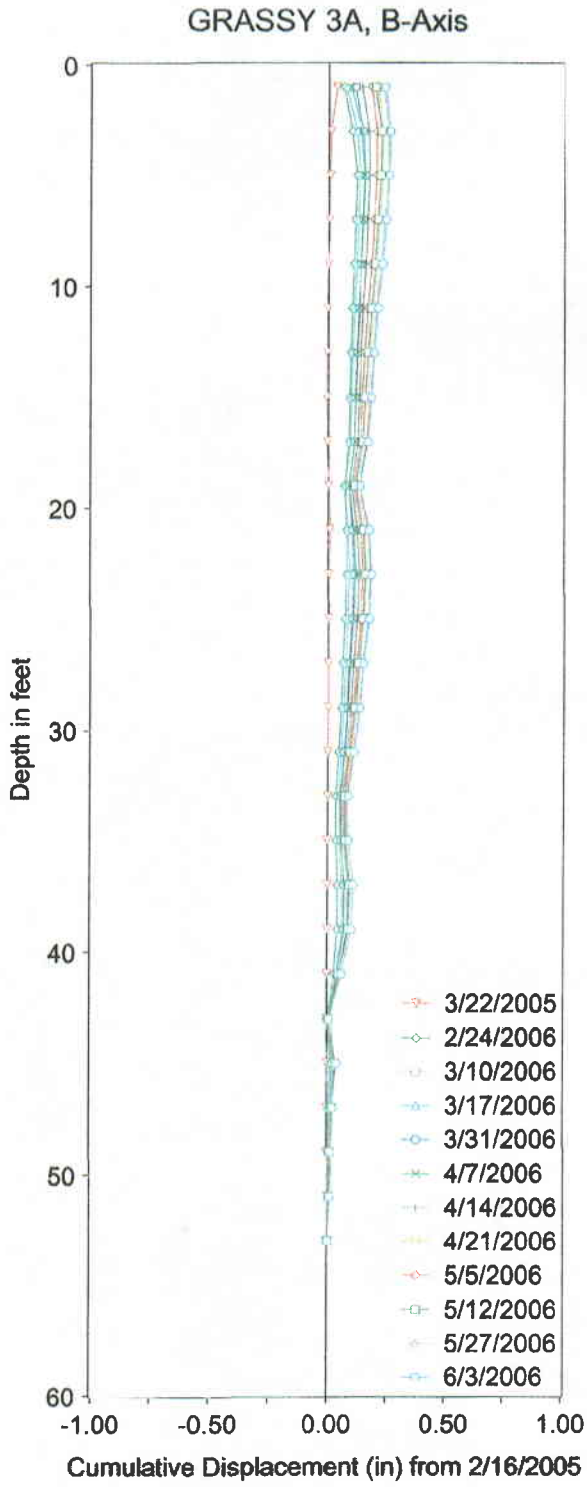

GRASSY 1A, B-Axis
Depth in feet
0
10
20
30
40
50
60
70
80
90
100
110
-1.00
-0.50
0.00
0.50
1.00
Cumulative Displacement (in) from 12/9/2005
12/30/2005
1/27/2006
2/24/2006
3/17/2006
5/5/2006
6/3/2006


GRASSY 2A, A-Axis
Depth in feet
0
10
20
30
40
50
60
70
80
90
100
110
120
130
-2.75
-2.00
-1.25
-0.50
Cumulative Displacement (in) from 7/20/2004
12/8/2004
3/22/2005
7/20/2005
12/30/2005
3/17/2006
4/7/2006
4/14/2006
4/21/2006
4/28/2006
5/5/2006
5/12/2006
5/19/2006
5/27/2006
6/3/2006

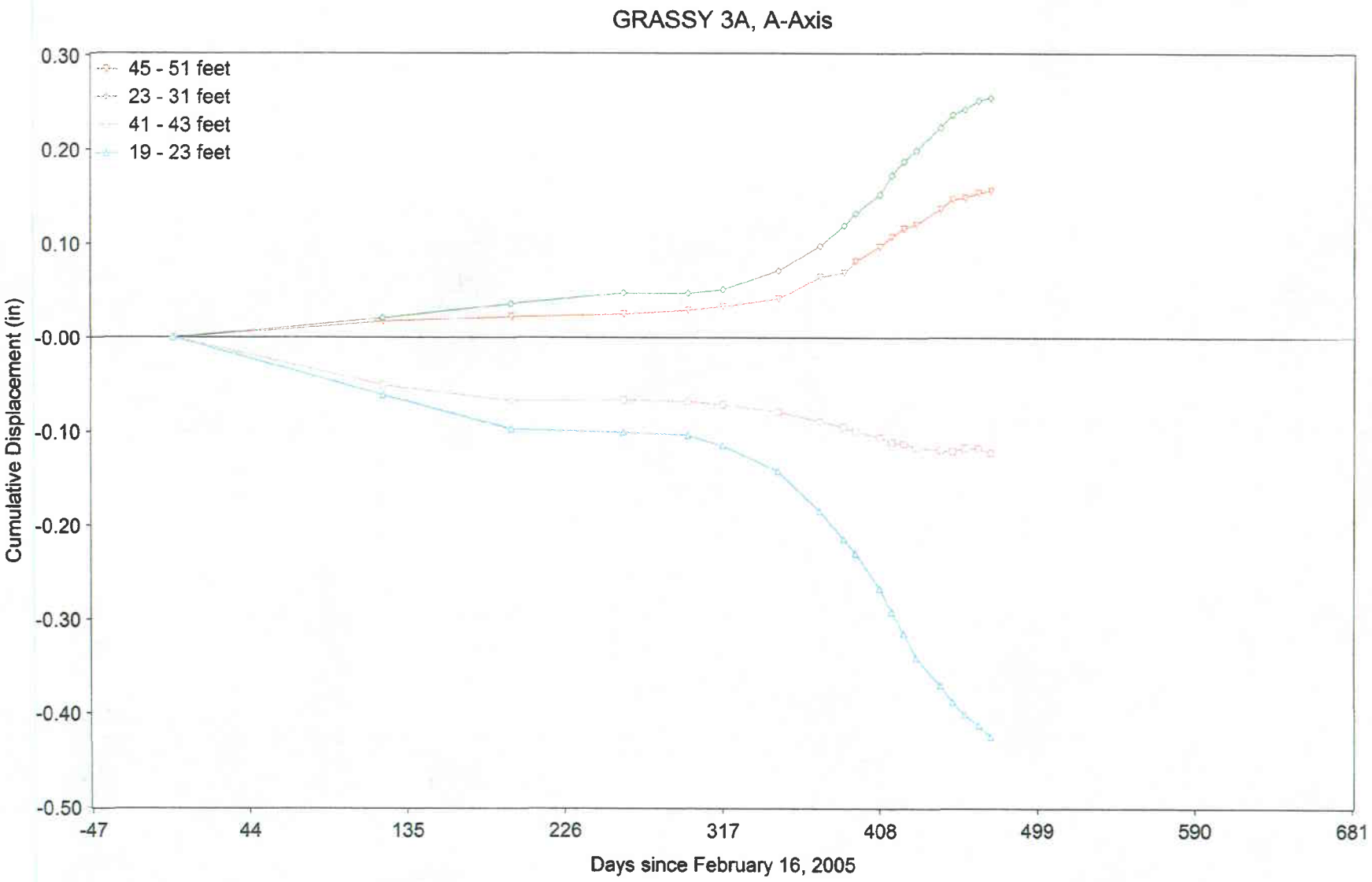

GRASSY 2A, B-Axis
Depth in feet
0
10
20
30
40
50
60
70
80
90
100
110
120
130
-1.00
-0.50
0.00
0.50
1.00
Cumulative Displacement (in) from 7/20/2004
2/16/2005
5/5/2006
5/12/2006
5/19/2006
5/27/2006
6/3/2006

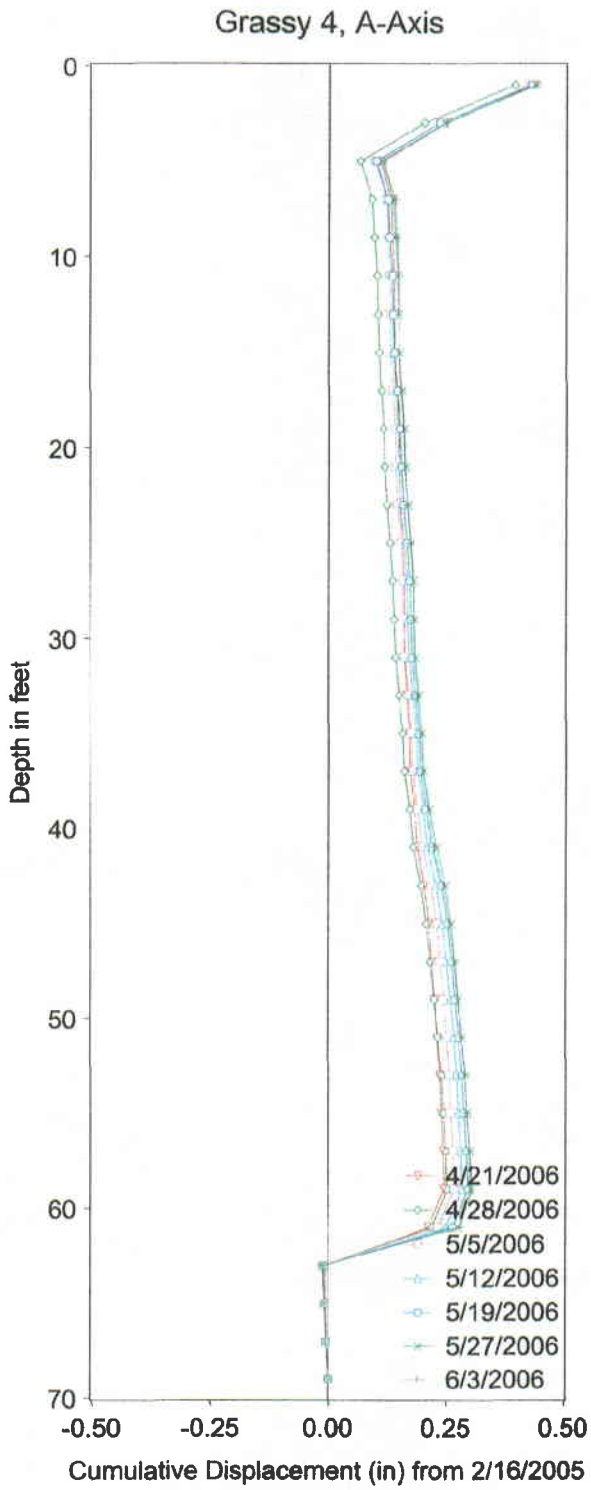

GRASSY 2A, A-Axis, -10 degree skew
Cumulative Displacement (in)
1.0
0.5
0.0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-47
44
135
226
317
408
499
590
681
Days since February 16, 2005
60 - 120 feet
120 - 126 feet
2 - 60 feet

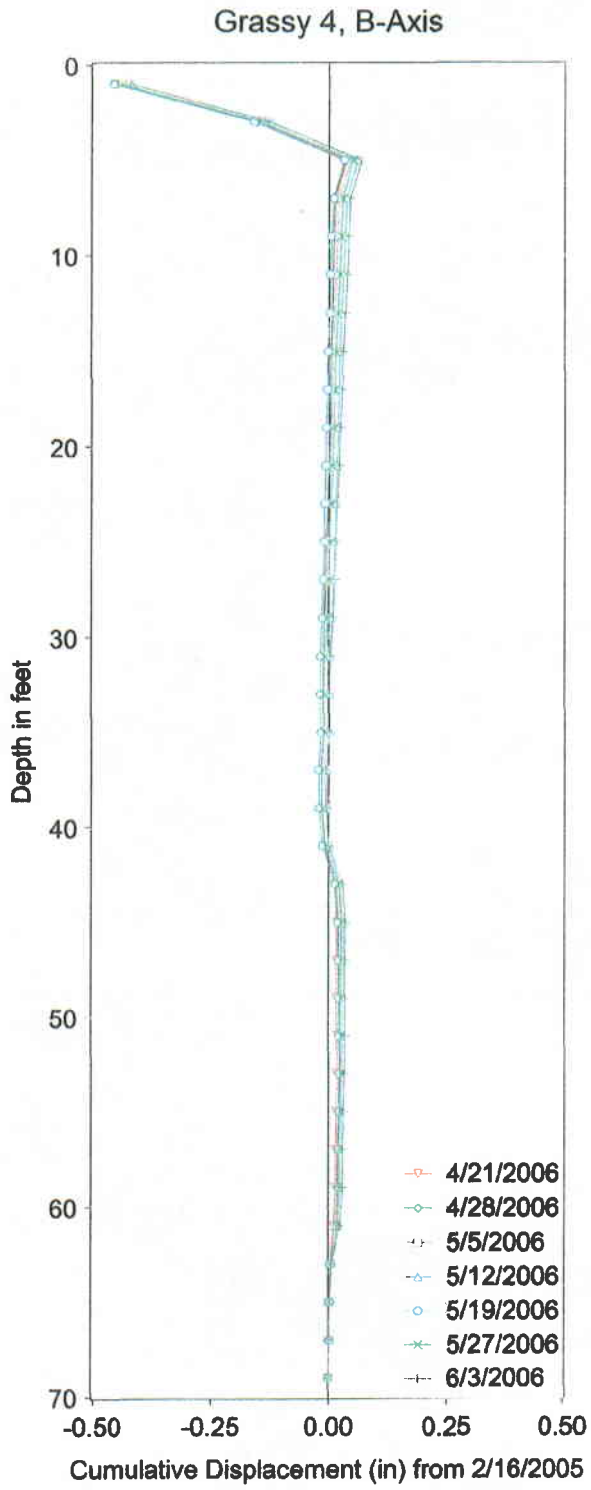


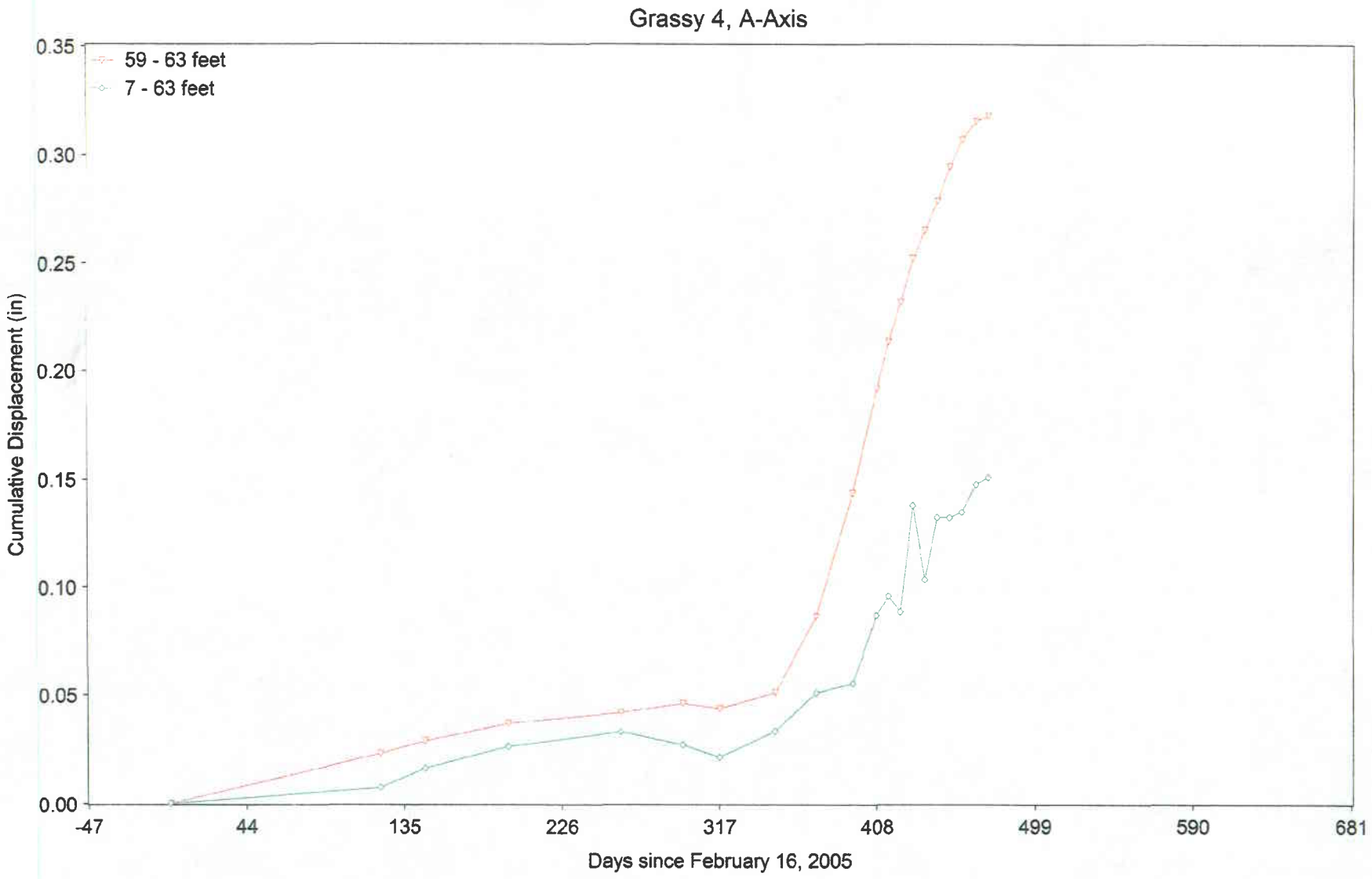


-30 degree skew


GRASSY 3A, A-Axis
45 - 51 feet
23 - 31 feet
41 - 43 feet
19 - 23 feet
0.30
0.20
0.10
-0.00
-0.10
-0.20
-0.30
-0.40
-0.50
Cumulative Displacement (in)
-47
44
135
226
317
408
499
590
681
Days since February 16, 2005


Grassy 4, A-Axis
Depth in feet
0
10
20
30
40
50
60
70
-0.50
-0.25
0.00
0.25
0.50
Cumulative Displacement (in) from 2/16/2005
4/21/2006
4/28/2006
5/5/2006
5/12/2006
5/19/2006
5/27/2006
6/3/2006


Grassy 4, B-Axis
Depth in feet
0
10
20
30
40
50
60
70
-0.50
-0.25
0.00
0.25
0.50
Cumulative Displacement (in) from 2/16/2005
4/21/2006
4/28/2006
5/5/2006
5/12/2006
5/19/2006
5/27/2006
6/3/2006


Grassy 4, A-Axis
59 - 63 feet
7 - 63 feet
Cumulative Displacement (in)
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
-47
44
135
226
317
408
499
590
681
Days since February 16, 2005