0046

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>, <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: 5/15/2006 9:26:09 AM
Subject: Grassy trail update May12

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 May 12, 2006

For the one-week period between May 5 and May 12, 2006 the number of MIS (Mining Induced Seismicity) micro earthquakes recorded near the site by the UUSS decreased from 23 to **10**. These MIS earthquakes ranged in magnitude from 1.3 to a high of 2.1. It should be noted that at the time of this report the last reported earthquake by the UUSS was on the morning of May 10th. The number of earthquake may increase went the website is updated.

The number of events recorded on the Hillside seismic unit decreased during the past week from 53 to **48** seismic events with no PGA values of 0.1g or greater. MIS events on the Dam unit decreased from 50 to **37** events with no PGA values greater than 0.1g. There were also 6 events recorded on the dam which were generated by people or other movement directly on the dam.

During the week the highest Peak Ground Acceleration (PGA) value recorded on the Hillside increased from last weeks high of 0.0232g to **0.0646g**. Highest PGA value on the Dam increased from 0.0232g to **0.0663g**. These PGA values occurred during a 1.5 magnitude earthquake on May 5. It should be noted that while this event generated the highest PGA values it was one of the lower magnitude earthquakes. The highest magnitude earthquake (2.1) only generated PGA values of 0.0199g and 0.0182g. These variations are likely due to earthquakes occurring at varying distances from the dam, with some rockbursts occurring further away in the newly mined areas, and other lag time events still occurring nearer to the dam.

Inclinometers 2, 3, and 4 continue to show similar movement.

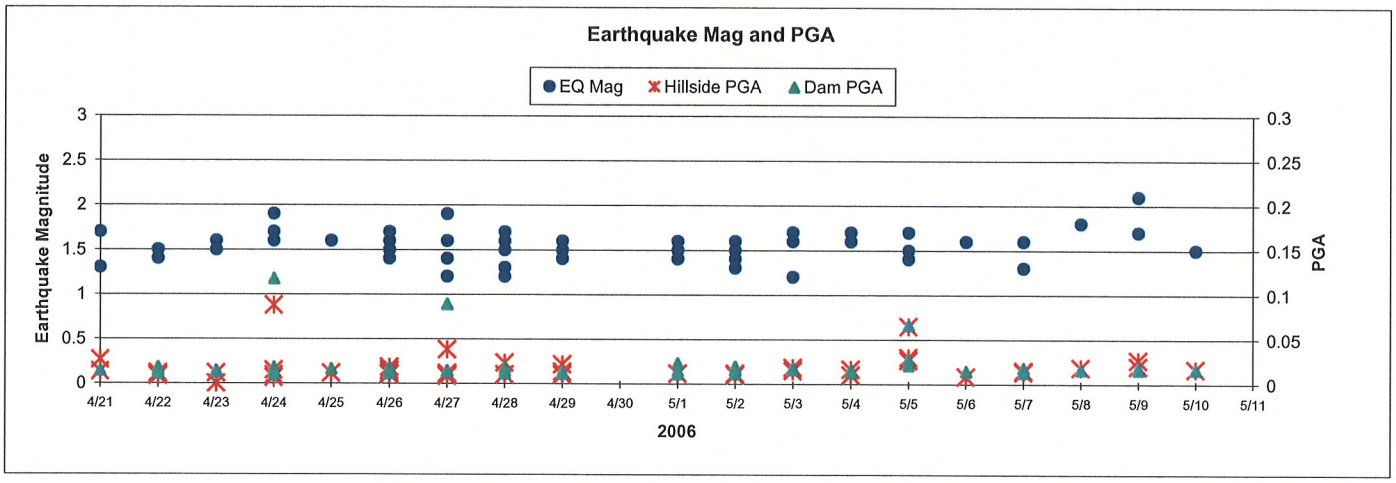
No cracks or signs of movement were noted on the dam or abutments above the dam.

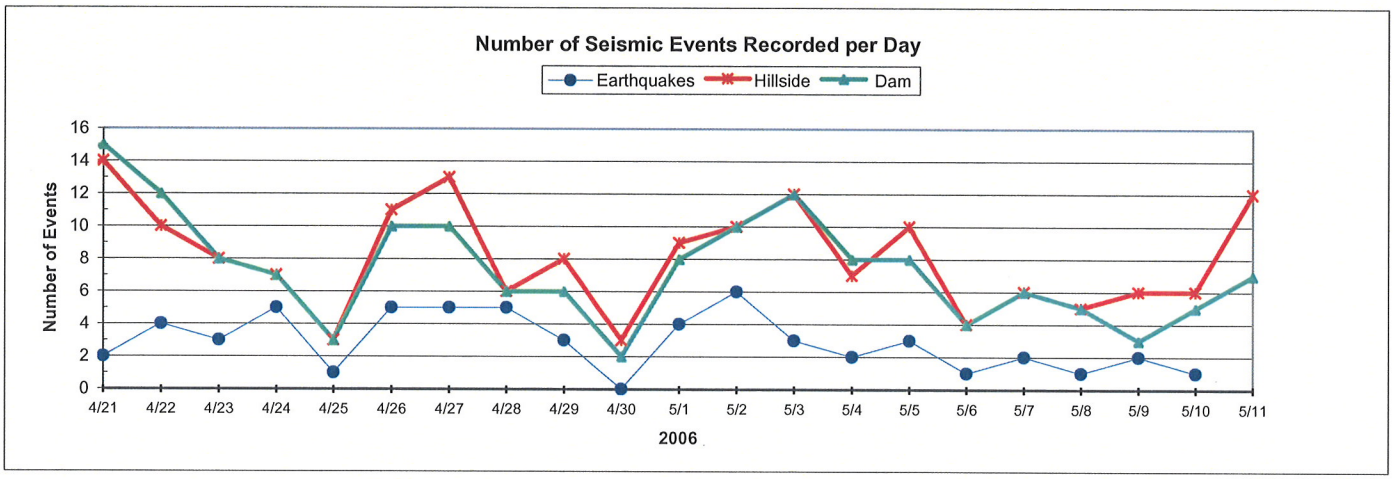
Michael Hansen
RB&G ENGINEERING

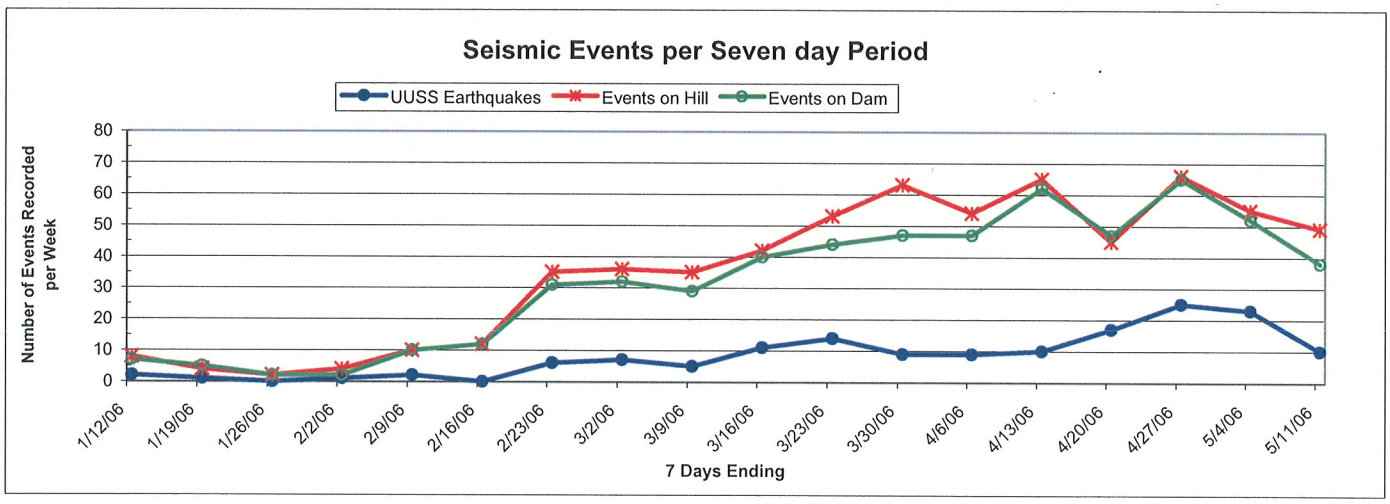
Grassy Trail Dam Carbon County, Utah

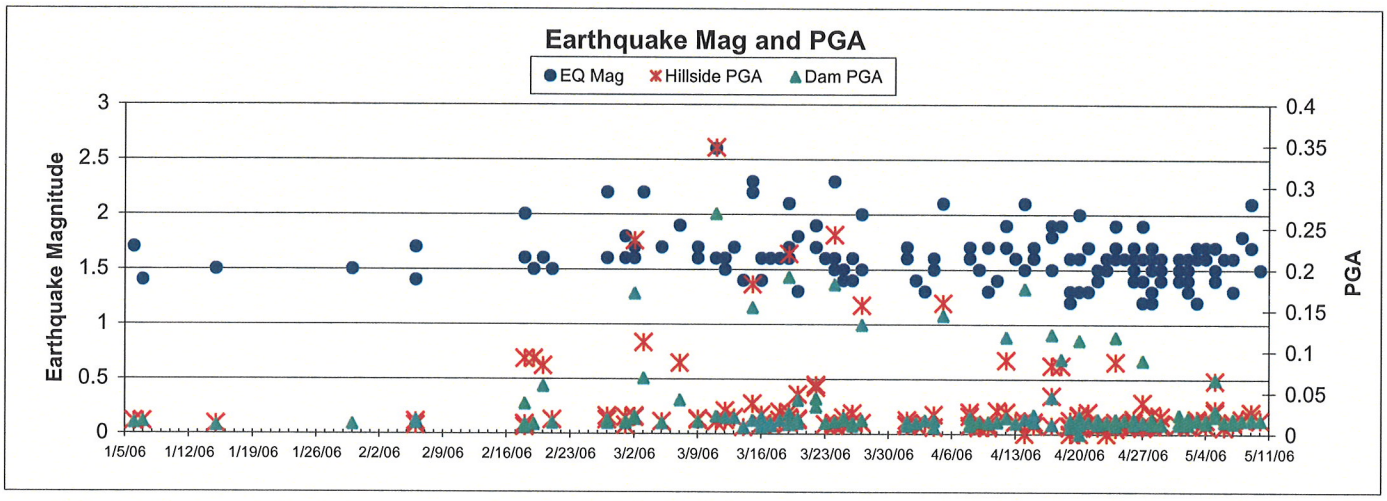
Type	Serial No.	Date	Time	Tran Peak (mm/s)	Vert Peak (mm/s)	Long Peak (mm/s)	PVS1 (mm/s)	Trigger	Tran Accel (g)	Vert Accel (g)	Long Accel (g)	Description	Event Note
LOG	BE9689	5/5/06	11:03:27	***	***	***	***	***	***	***	***	Start Monitoring	Monitoring
W	BE9689	5/5/06	11:19:55	0.968	0.492	0.873	1.15	Long	0.00829	0.00663	0.0133	Grassy Tr. Dam	
LOG	BE9690	5/5/06	11:27:52	***	***	***	***	***	***	***	***	Start Monitoring	Monitoring
W	BE9690	5/5/06	12:45:29	0.54	0.444	0.683	0.825	Long	0.00663	0.00663	0.00829	Hillside	
W	BE9689	5/5/06	13:09:08	1.32	1.76	0.683	1.82	Vert	0.101	0.136	0.058	Grassy Tr. Dam	Man Made
W	BE9689	5/5/06	14:09:37	1.6	0.81	1.48	1.86	Vert	0.0116	0.00829	0.0166	Grassy Tr. Dam	
W	BE9690	5/5/06	14:09:37	1.25	0.762	1.43	1.65	Vert	0.00994	0.00829	0.0133	Hillside	
W	BE9689	5/5/06	14:36:51	0.651	0.556	1.05	1.18	Long	0.0447	0.0398	0.0945	Grassy Tr. Dam	Man Made
W	BE9689	5/5/06	17:07:08	3.32	1.25	1.97	3.45	Vert	0.0282	0.0133	0.0166	Grassy Tr. Dam	EQ Mag 1.7
W	BE9690	5/5/06	17:07:08	2.54	0.81	1.79	2.61	Vert	0.0298	0.0116	0.0116	Hillside	EQ Mag 1.7
W	BE9689	5/5/06	17:07:41	7.75	3.92	3.35	7.77	Vert	0.0663	0.0348	0.0315	Grassy Tr. Dam	EQ Mag 1.5
W	BE9690	5/5/06	17:07:41	5.94	1.78	6.25	8.72	Vert	0.0613	0.0265	0.0646	Hillside	EQ Mag 1.5
W	BE9689	5/5/06	19:46:35	3.57	1.97	3.27	4.24	Vert	0.0215	0.0133	0.0182	Grassy Tr. Dam	EQ Mag 1.4
W	BE9690	5/5/06	19:46:36	2.46	1	4.16	4.64	Vert	0.0182	0.0116	0.0265	Hillside	EQ Mag 1.4
W	BE9690	5/5/06	19:46:50	0.444	0.333	0.651	0.681	Long	0.00663	0.00497	0.00663	Hillside	
W	BE9690	5/5/06	20:55:53	0.444	0.365	0.603	0.692	Long	0.00497	0.00663	0.00663	Hillside	
W	BE9689	5/5/06	21:29:16	1.08	0.524	0.794	1.09	Long	0.00994	0.00663	0.0182	Grassy Tr. Dam	
W	BE9690	5/5/06	21:29:17	0.746	0.444	0.73	0.89	Tran	0.00663	0.00663	0.00829	Hillside	
W	BE9689	5/5/06	23:02:14	2.03	1.08	1.78	2.18	Vert	0.0149	0.00994	0.0149	Grassy Tr. Dam	
W	BE9690	5/5/06	23:02:15	2.06	0.873	2.24	2.99	Vert	0.0133	0.0116	0.0149	Hillside	
W	BE9689	5/6/06	0:27:44	0.476	0.349	0.635	0.745	Long	0.00663	0.00663	0.0133	Grassy Tr. Dam	
W	BE9689	5/6/06	8:00:30	0.651	0.381	0.857	0.916	Long	0.00829	0.00663	0.0149	Grassy Tr. Dam	EQ Mag 1.6
W	BE9690	5/6/06	8:00:30	0.762	0.587	1.03	1.17	Long	0.00829	0.00829	0.00829	Hillside	EQ Mag 1.6
W	BE9689	5/6/06	8:12:09	0.651	0.302	0.476	0.673	Tran	0.00663	0.00663	0.0166	Grassy Tr. Dam	
W	BE9690	5/6/06	9:31:53	0.476	0.365	0.635	0.746	Long	0.00663	0.00663	0.00829	Hillside	
W	BE9689	5/6/06	9:35:37	0.905	0.571	0.921	1.08	Long	0.00829	0.00663	0.0133	Grassy Tr. Dam	
W	BE9690	5/6/06	9:35:37	0.762	0.603	0.762	0.909	Vert	0.00829	0.00829	0.00829	Hillside	
W	BE9690	5/6/06	19:31:22	0.381	0.365	0.667	0.722	Long	0.00663	0.00663	0.00829	Hillside	
W	BE9689	5/7/06	0:05:05	0.222	0.254	0.635	0.651	Long	0.00663	0.00497	0.0149	Grassy Tr. Dam	
W	BE9689	5/7/06	1:04:08	1.08	0.651	0.905	1.38	Vert	0.0116	0.00829	0.0133	Grassy Tr. Dam	
W	BE9690	5/7/06	1:04:08	0.841	0.651	1.06	1.24	Vert	0.00829	0.00994	0.0133	Hillside	
W	BE9690	5/7/06	13:17:36	0.508	0.349	0.619	0.777	Long	0.00663	0.00663	0.00829	Hillside	
W	BE9689	5/7/06	14:55:14	1.37	1.06	1.44	1.58	Vert	0.0116	0.00663	0.0133	Grassy Tr. Dam	EQ Mag 1.6
W	BE9690	5/7/06	14:55:14	1.37	0.968	1.83	2.13	Vert	0.0116	0.0116	0.0133	Hillside	EQ Mag 1.6
W	BE9690	5/7/06	17:19:42	1.02	1.08	3.08	3.28	Vert	0.0133	0.0116	0.0215	Hillside	
W	BE9689	5/7/06	17:19:43	0.714	0.571	1.03	1.11	Long	0.00829	0.00829	0.0166	Grassy Tr. Dam	
W	BE9689	5/7/06	22:33:56	0.778	0.413	0.54	0.798	Tran	0.00994	0.00663	0.0166	Grassy Tr. Dam	
W	BE9690	5/7/06	22:33:56	0.651	0.444	0.778	0.972	Tran	0.00663	0.00663	0.00829	Hillside	
W	BE9689	5/7/06	22:38:38	1.17	0.714	0.952	1.23	Vert	0.00994	0.00663	0.0182	Grassy Tr. Dam	EQ Mag 1.3
W	BE9690	5/7/06	22:38:38	1.3	0.857	1.68	1.85	Vert	0.00994	0.00994	0.0149	Hillside	EQ Mag 1.3
W	BE9689	5/8/06	9:52:17	0.683	0.333	0.476	0.777	Tran	0.00829	0.00663	0.0149	Grassy Tr. Dam	
W	BE9690	5/8/06	9:52:17	0.46	0.444	0.73	0.765	Long	0.00663	0.00829	0.00829	Hillside	
W	BE9689	5/8/06	11:57:00	1.7	1.1	2.24	2.31	Vert	0.0133	0.00829	0.0166	Grassy Tr. Dam	EQ Mag 1.8
W	BE9690	5/8/06	11:57:00	1.57	0.937	2.27	2.47	Vert	0.0116	0.00994	0.0182	Hillside	EQ Mag 1.8
W	BE9689	5/8/06	16:32:20	0.635	0.413	0.667	0.832	Tran	0.00829	0.00663	0.0166	Grassy Tr. Dam	
W	BE9690	5/8/06	16:32:20	0.714	0.524	0.968	1.08	Long	0.00829	0.00663	0.00994	Hillside	
W	BE9690	5/8/06	17:39:07	0.524	0.46	0.81	0.912	Long	0.00829	0.00829	0.00829	Hillside	
W	BE9689	5/8/06	17:42:24	0.603	0.286	0.54	0.669	Tran	0.00663	0.00829	0.0166	Grassy Tr. Dam	
W	BE9690	5/8/06	21:46:34	0.635	0.635	1.32	1.38	Vert	0.00994	0.00829	0.0116	Hillside	
W	BE9689	5/8/06	21:46:35	0.952	0.492	0.698	1.06	Tran	0.0116	0.00663	0.0149	Grassy Tr. Dam	
W	BE9690	5/9/06	6:39:29	0.524	0.317	0.619	0.801	Long	0.00663	0.00663	0.00829	Hillside	
W	BE9690	5/9/06	10:35:17	0.698	0.413	0.508	0.757	Tran	0.00994	0.00829	0.00829	Hillside	
W	BE9690	5/9/06	11:30:43	2.81	1.08	2.94	3.53	Vert	0.0265	0.0133	0.0232	Hillside	EQ Mag 1.7
W	BE9689	5/9/06	11:30:44	1.84	0.984	1.57	2.24	Long	0.0166	0.0116	0.0149	Grassy Tr. Dam	EQ Mag 1.7
W	BE9690	5/9/06	14:11:09	1.46	1.56	2.98	3.14	Vert	0.0199	0.0182	0.0149	Hillside	EQ Mag 2.1
W	BE9689	5/9/06	14:11:10	2.83	1.1	2.89	3.05	Vert	0.0133	0.0116	0.0182	Grassy Tr. Dam	EQ Mag 2.1
W	BE9690	5/9/06	19:07:05	0.381	0.413	0.635	0.709	Long	0.00663	0.00663	0.00829	Hillside	
W	BE9690	5/9/06	23:55:51	0.571	0.603	1.32	1.36	Vert	0.00829	0.00829	0.0116	Hillside	
W	BE9689	5/9/06	23:55:52	0.825	0.46	0.651	0.91	Tran	0.0116	0.00663	0.0166	Grassy Tr. Dam	
W	BE9690	5/10/06	6:29:24	0.667	0.46	0.857	0.918	Long	0.00663	0.00829	0.00829	Hillside	
W	BE9689	5/10/06	6:29:25	0.635	0.365	0.683	0.744	Tran	0.00829	0.00663	0.0149	Grassy Tr. Dam	
W	BE9690	5/10/06	10:49:50	1.75	0.952	2.6	2.7	Vert	0.0133	0.0133	0.0166	Hillside	EQ Mag 1.5
W	BE9689	5/10/06	10:49:52	1.41	0.889	1.56	1.92	Long	0.0133	0.00829	0.0166	Grassy Tr. Dam	EQ Mag 1.5

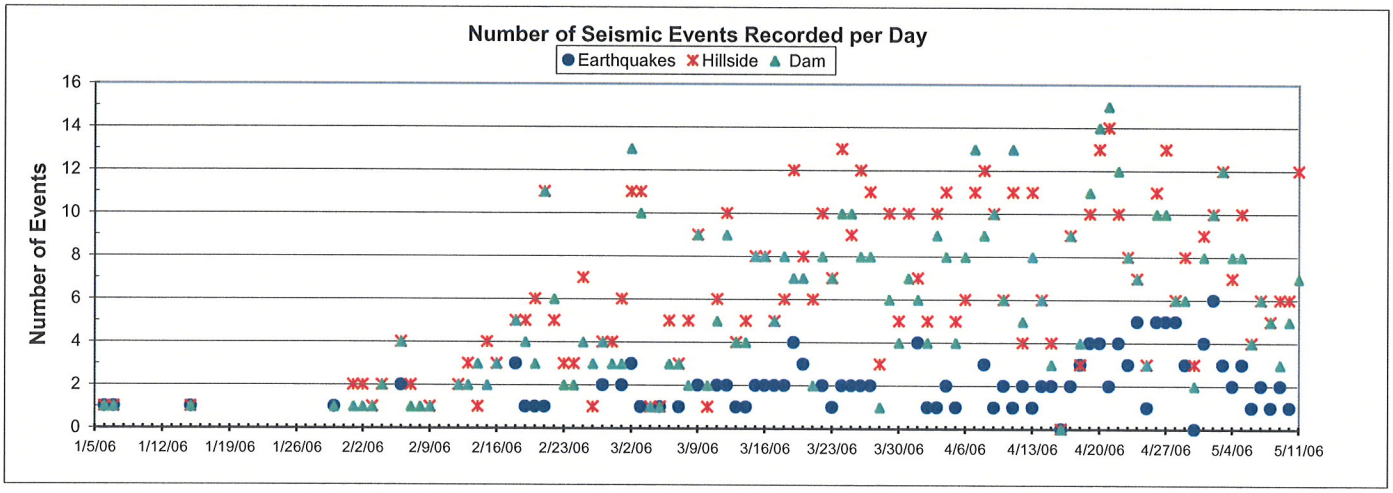
W	BE9689	5/10/06	14:07:17	0.206	0.746	0.381	0.754	Vert	0.00663	0.0249	0.0149	Grassy Tr. Dam	Man Made
W	BE9690	5/10/06	14:17:42	0.444	0.238	0.667	0.679	Long	0.00829	0.00663	0.00829	Hillside	
W	BE9689	5/10/06	14:40:40	0.206	0.921	0.492	0.938	Vert	0.00994	0.0298	0.0166	Grassy Tr. Dam	Man Made
W	BE9690	5/10/06	16:18:36	0.635	0.476	0.968	1.11	Long	0.00994	0.00663	0.00829	Hillside	
W	BE9689	5/10/06	16:18:37	0.714	0.508	0.698	0.907	Tran	0.00663	0.00663	0.0149	Grassy Tr. Dam	
W	BE9690	5/10/06	19:40:37	0.937	0.667	1.24	1.26	Vert	0.00994	0.00829	0.00994	Hillside	
W	BE9689	5/10/06	19:40:39	0.921	0.524	0.778	0.936	Long	0.0116	0.00663	0.0149	Grassy Tr. Dam	
W	BE9690	5/10/06	21:14:11	0.746	0.349	0.571	0.842	Tran	0.00829	0.00497	0.00829	Hillside	
W	BE9689	5/10/06	21:14:12	0.635	0.333	0.635	0.661	Long	0.00829	0.00663	0.0166	Grassy Tr. Dam	
W	BE9690	5/11/06	2:32:39	0.413	0.444	1.02	1.1	Long	0.00663	0.00663	0.00663	Hillside	
W	BE9690	5/11/06	2:50:06	0.365	0.333	0.683	0.713	Long	0.00663	0.00663	0.00829	Hillside	
W	BE9690	5/11/06	6:00:12	0.635	0.587	0.365	0.663	Tran	0.00663	0.00829	0.00663	Hillside	
W	BE9689	5/11/06	6:00:13	0.27	0.381	0.714	0.744	Long	0.00663	0.00663	0.0149	Grassy Tr. Dam	
W	BE9690	5/11/06	9:31:42	0.968	0.444	0.873	1.05	Tran	0.00829	0.00663	0.00663	Hillside	
W	BE9689	5/11/06	9:31:44	1	0.492	0.571	1.02	Tran	0.00829	0.00663	0.0116	Grassy Tr. Dam	
W	BE9690	5/11/06	10:57:36	0.524	0.444	0.984	1.02	Long	0.00663	0.00663	0.00994	Hillside	
W	BE9690	5/11/06	13:52:00	0.317	0.317	0.651	0.667	Long	0.00663	0.00829	0.00994	Hillside	
W	BE9689	5/11/06	13:59:48	0.254	0.667	0.556	0.697	Vert	0.0199	0.0365	0.0348	Grassy Tr. Dam	Man Made
W	BE9689	5/11/06	14:01:39	0.175	0.603	0.286	0.69	Vert	0.0133	0.0348	0.0232	Grassy Tr. Dam	Man Made
W	BE9690	5/11/06	14:21:33	0.873	0.603	1.16	1.22	Long	0.00829	0.00829	0.0116	Hillside	
W	BE9689	5/11/06	14:21:34	0.683	0.492	0.73	0.836	Long	0.00829	0.00663	0.0182	Grassy Tr. Dam	
W	BE9690	5/11/06	16:53:34	0.587	0.397	0.746	0.796	Long	0.00663	0.00663	0.00829	Hillside	
W	BE9689	5/11/06	16:53:35	0.603	0.349	0.397	0.696	Tran	0.00663	0.00663	0.0166	Grassy Tr. Dam	
W	BE9690	5/11/06	18:25:23	1.56	0.698	1.02	1.61	Vert	0.0116	0.00829	0.00829	Hillside	
W	BE9689	5/11/06	18:25:25	1.6	0.841	1.16	1.61	Vert	0.0133	0.00829	0.0182	Grassy Tr. Dam	
W	BE9690	5/11/06	19:03:21	0.365	0.333	0.714	0.74	Long	0.00663	0.00497	0.00829	Hillside	
W	BE9690	5/11/06	19:28:35	2.05	1.16	2	2.55	Vert	0.0182	0.0116	0.0166	Hillside	
W	BE9689	5/11/06	19:28:36	2.1	1.24	1.57	2.23	Long	0.0249	0.00994	0.0149	Grassy Tr. Dam	
W	BE9690	5/11/06	20:43:40	0.603	0.333	0.698	0.718	Tran	0.00994	0.00994	0.00829	Hillside	
W	BE9689	5/11/06	20:43:42	0.317	0.429	0.667	0.712	Long	0.00829	0.00663	0.0149	Grassy Tr. Dam	
LOG	BE9689	5/12/06	11:20:46	***	***	***	***	***	***	***	***	Keyboard Stop	
LOG	BE9690	5/12/06	12:02:33	***	***	***	***	***	***	***	***	Keyboard Stop	

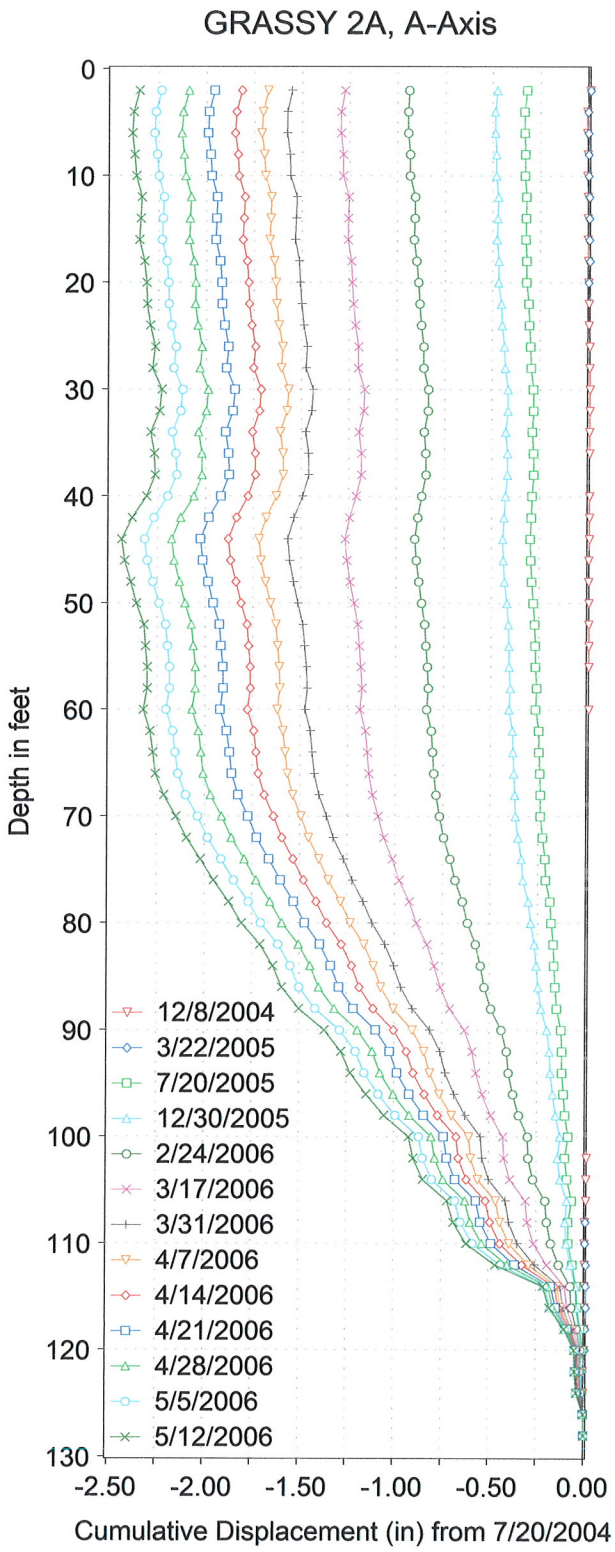

Earthquake Mag and PGA
EQ Mag
Hillside PGA
Dam PGA
Earthquake Magnitude
PGA
2006

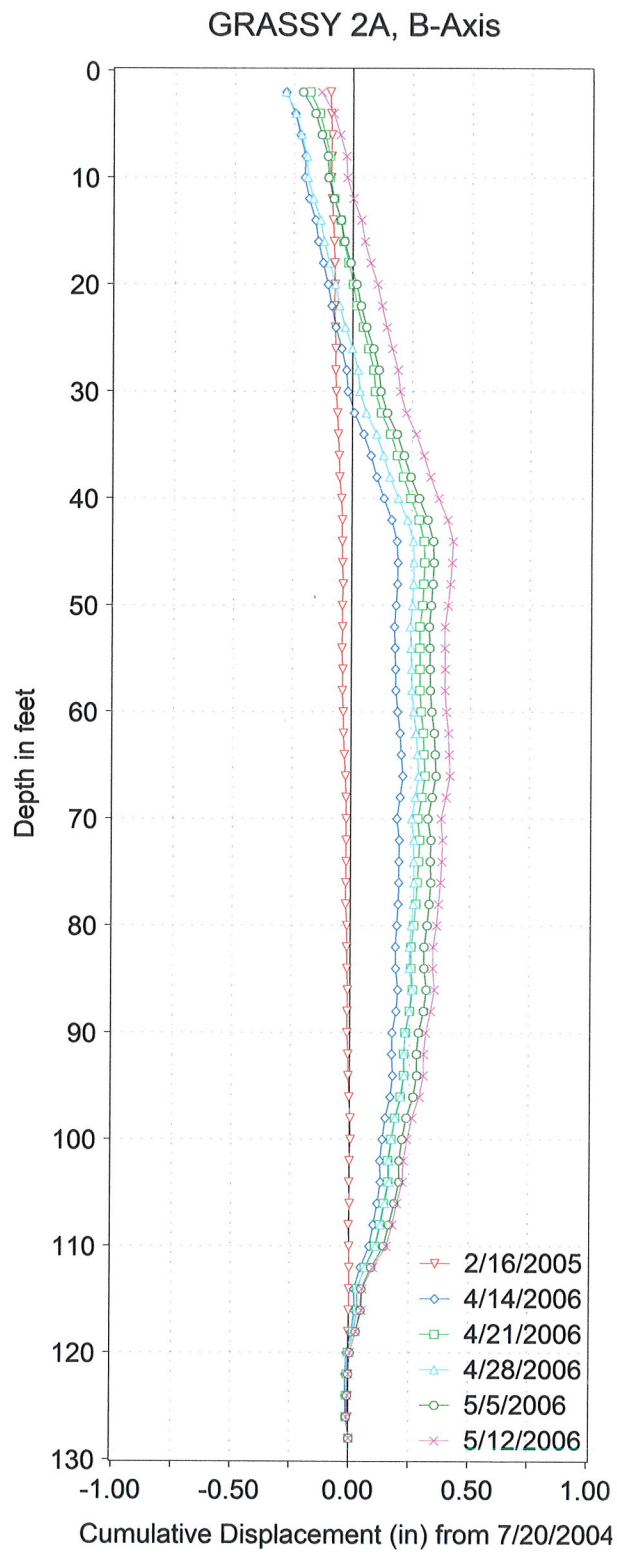

Number of Seismic Events Recorded per Day
Earthquakes
Hillside
Dam
Number of Events
2006

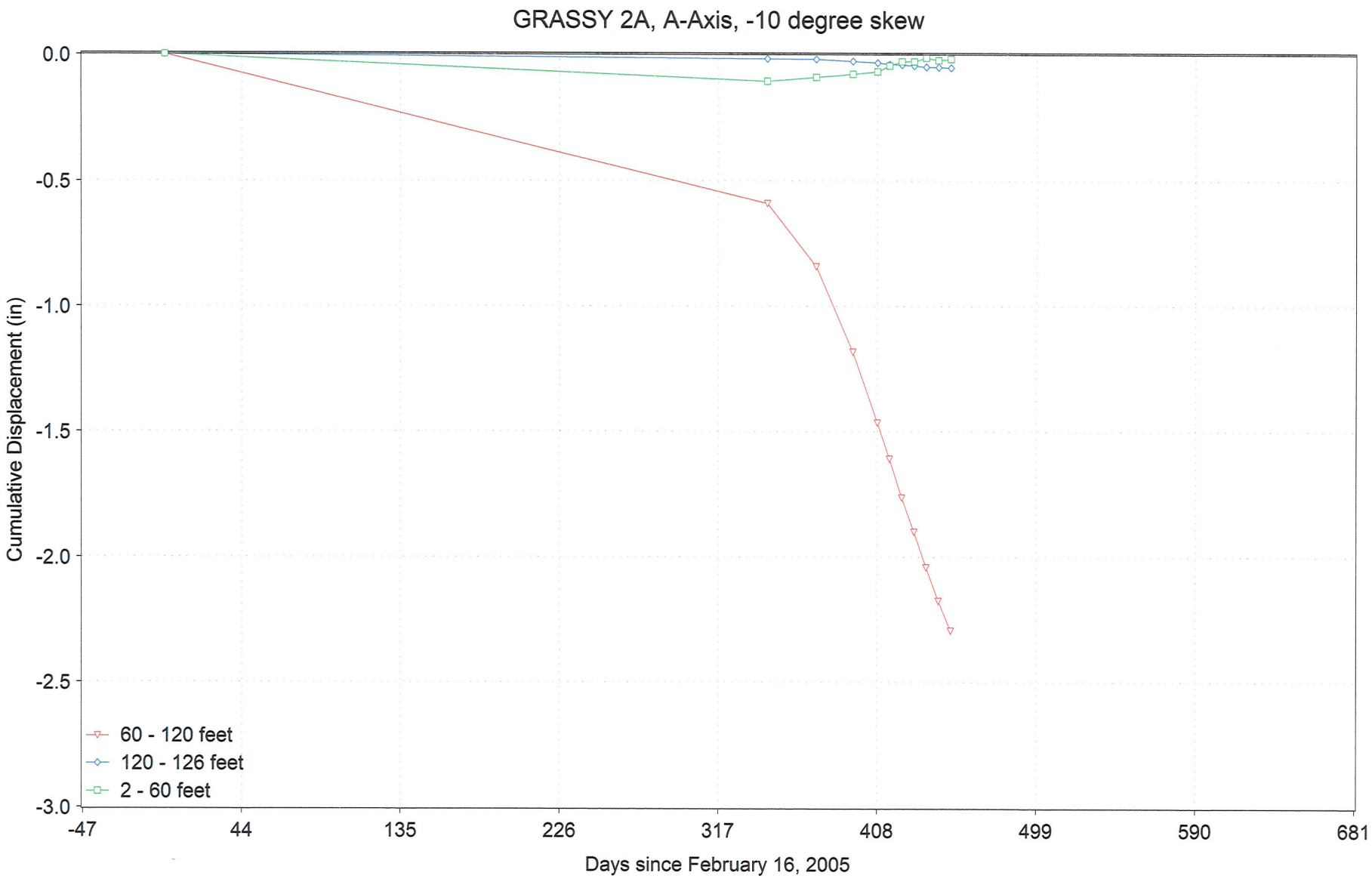

Seismic Events per Seven day Period
UUSS Earthquakes
Events on Hill
Events on Dam
Number of Events Recorded per Week
7 Days Ending

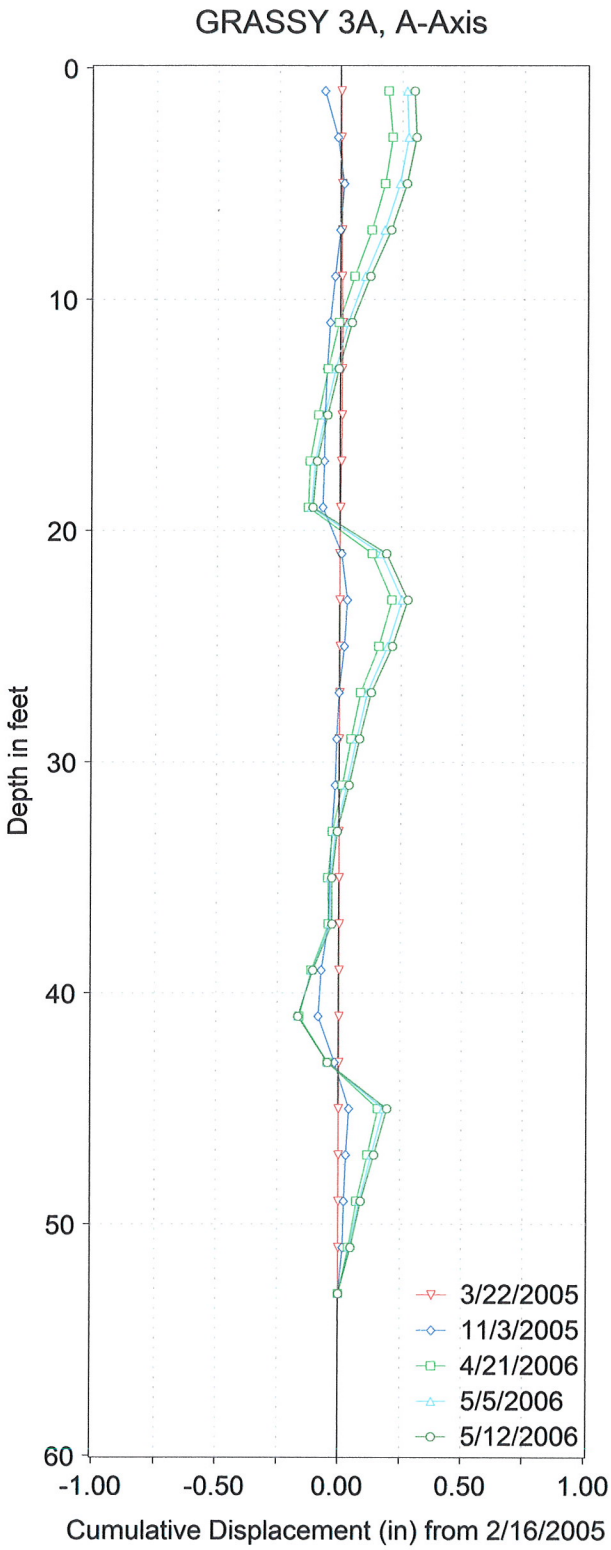

Earthquake Mag and PGA
EQ Mag
Hillside PGA
Dam PGA
Earthquake Magnitude
PGA
3
2.5
2
1.5
1
0.5
0
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
1/5/06
1/12/06
1/19/06
1/26/06
2/2/06
2/9/06
2/16/06
2/23/06
3/2/06
3/9/06
3/16/06
3/23/06
3/30/06
4/6/06
4/13/06
4/20/06
4/27/06
5/4/06
5/11/06

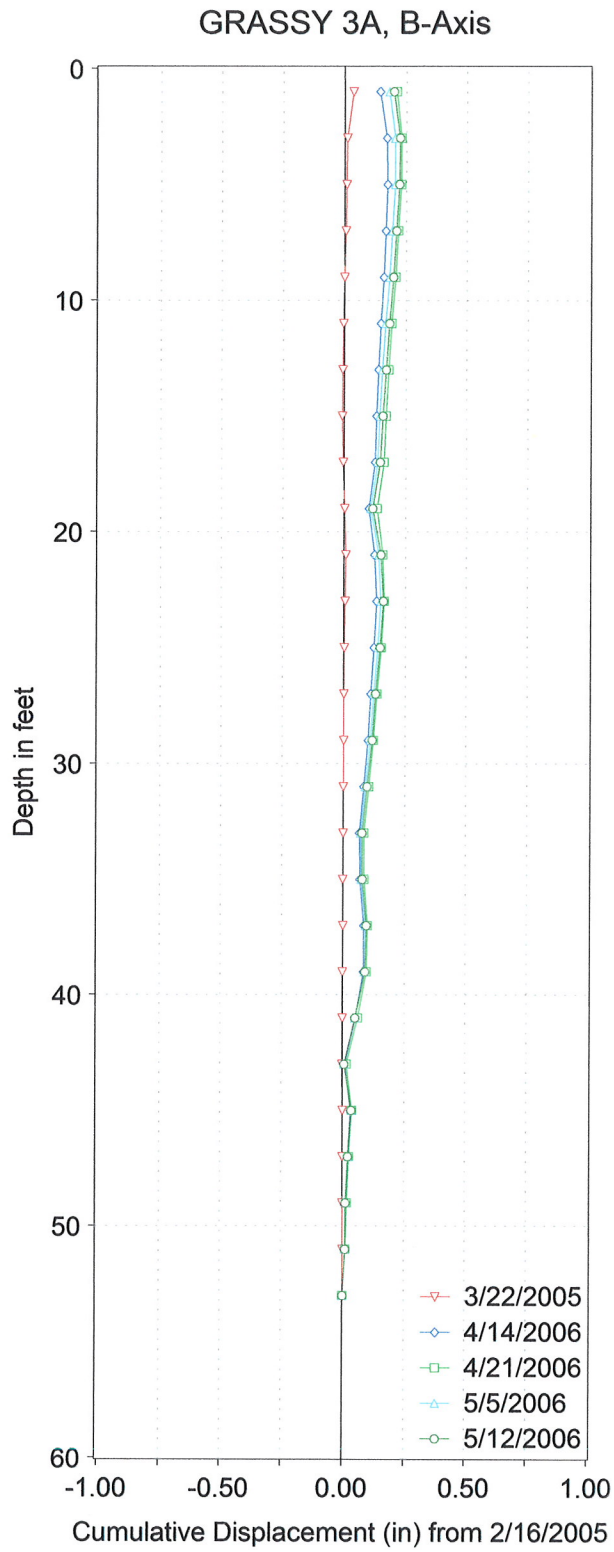

Number of Seismic Events Recorded per Day
Earthquakes
Hillside
Dam
Number of Events
16
14
12
10
8
6
4
2
0
1/5/06
1/12/06
1/19/06
1/26/06
2/2/06
2/9/06
2/16/06
2/23/06
3/2/06
3/9/06
3/16/06
3/23/06
3/30/06
4/6/06
4/13/06
4/20/06
4/27/06
5/4/06
5/11/06


GRASSY 2A, A-Axis
Depth in feet
Cumulative Displacement (in) from 7/20/2004
12/8/2004
3/22/2005
7/20/2005
12/30/2005
2/24/2006
3/17/2006
3/31/2006
4/7/2006
4/14/2006
4/21/2006
4/28/2006
5/5/2006
5/12/2006

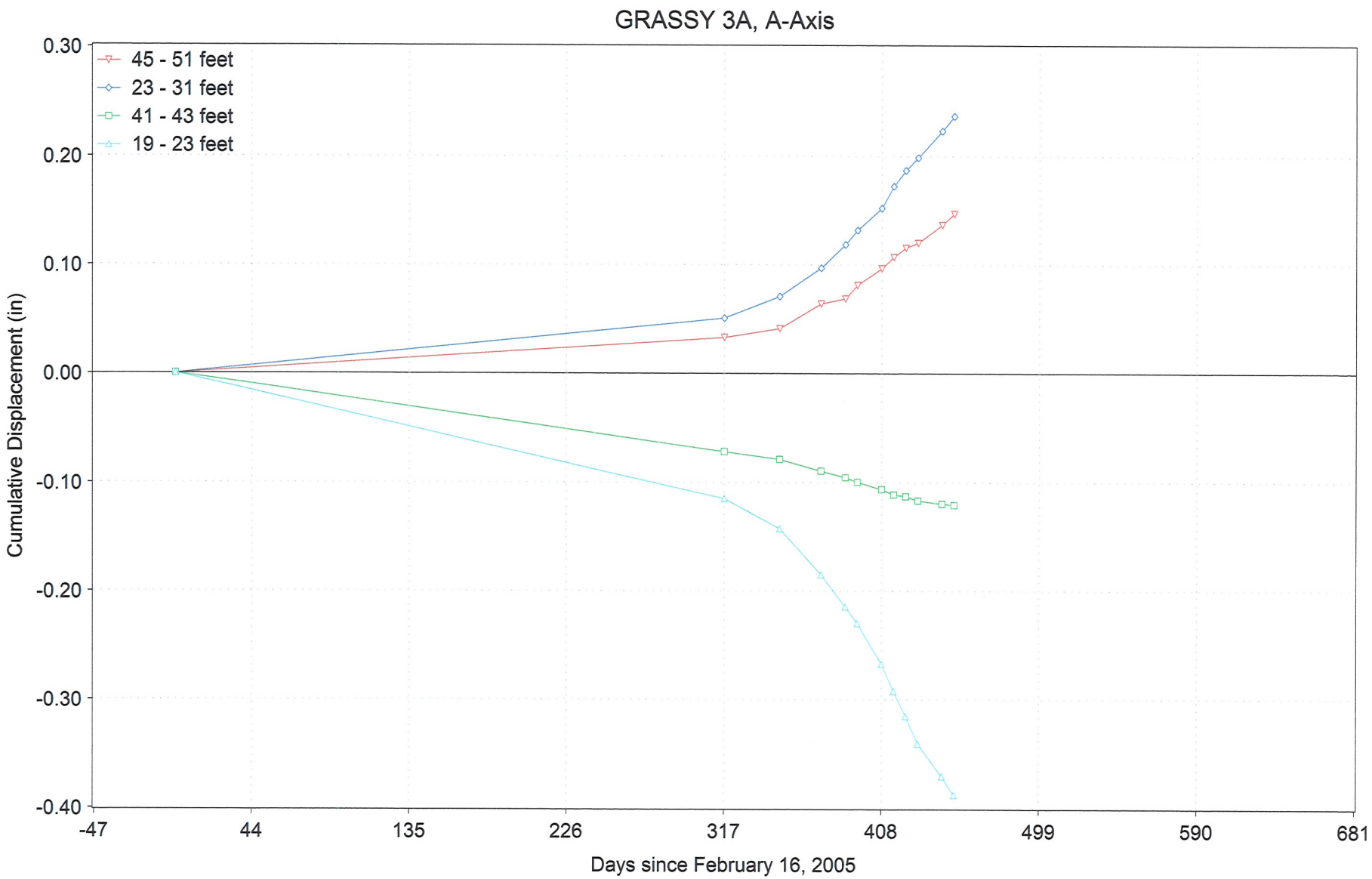

GRASSY 2A, B-Axis
Depth in feet
Cumulative Displacement (in) from 7/20/2004
2/16/2005
4/14/2006
4/21/2006
4/28/2006
5/5/2006
5/12/2006

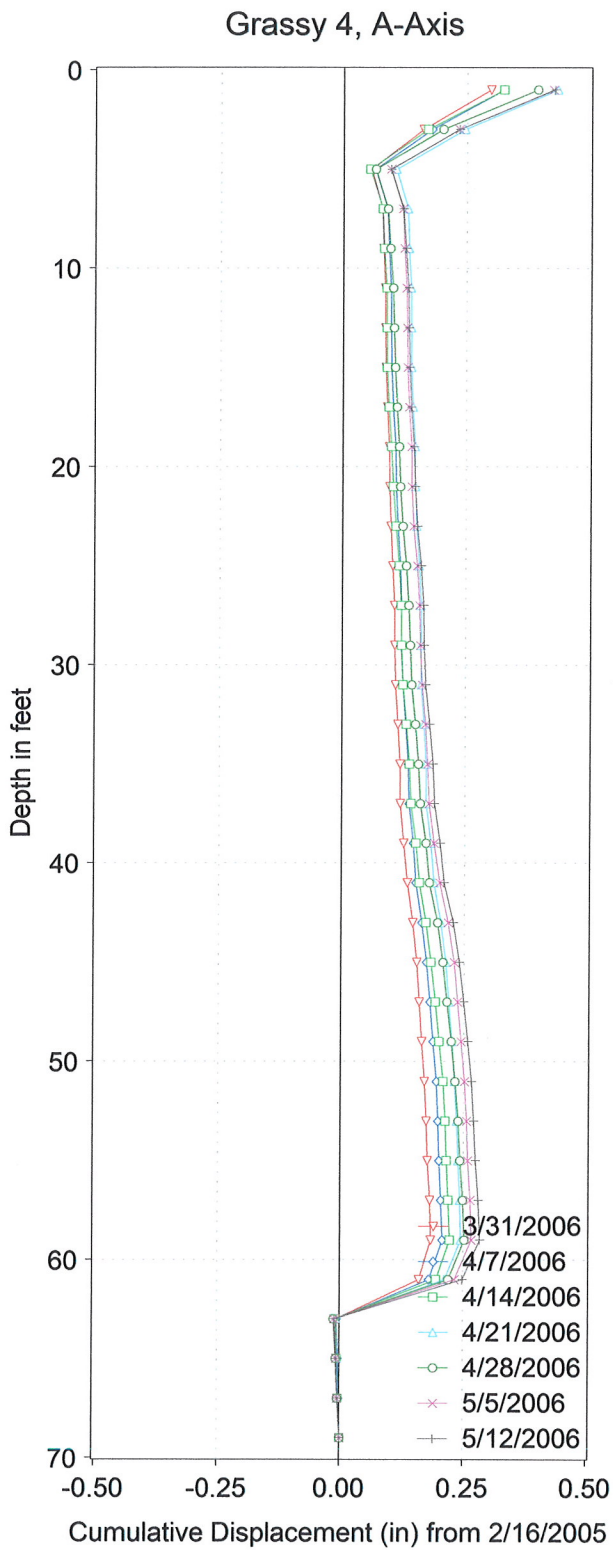

GRASSY 2A, A-Axis, -10 degree skew
Cumulative Displacement (in)
0.0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-47
44
135
226
317
408
499
590
681
Days since February 16, 2005
60 - 120 feet
120 - 126 feet
2 - 60 feet

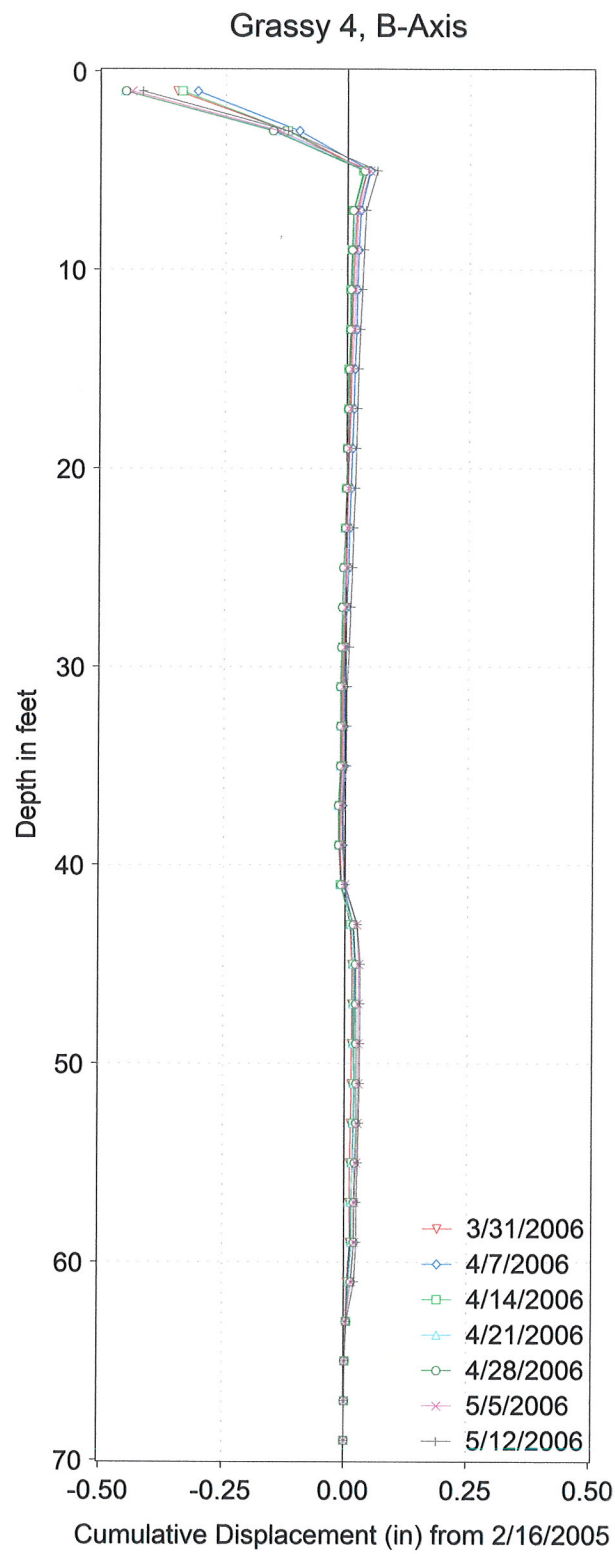


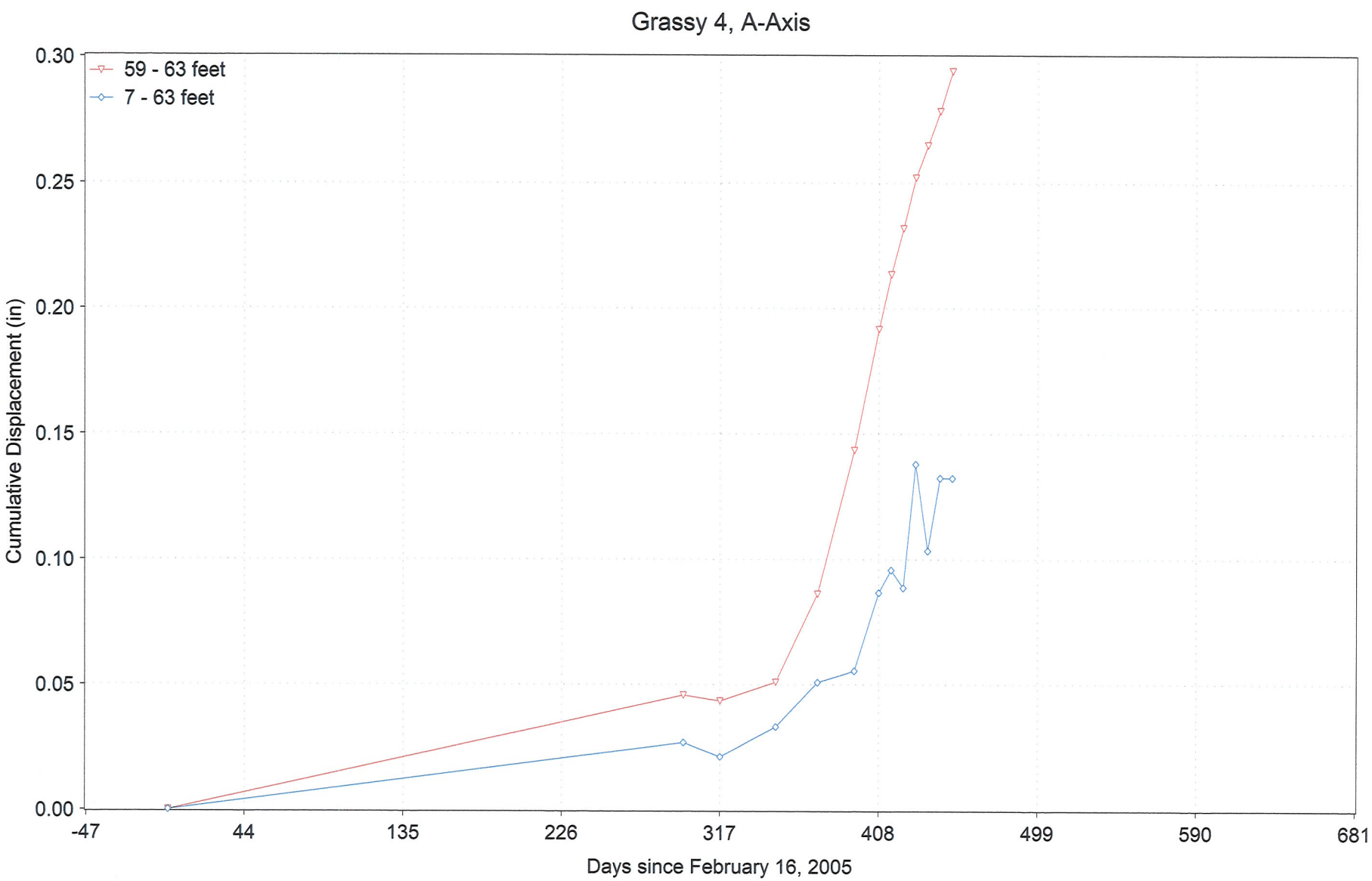


-30 degree skew


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
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
3/31/2006
4/7/2006
4/14/2006
4/21/2006
4/28/2006
5/5/2006
5/12/2006


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
3/31/2006
4/7/2006
4/14/2006
4/21/2006
4/28/2006
5/5/2006
5/12/2006


Grassy 4, A-Axis
59 - 63 feet
7 - 63 feet
Cumulative Displacement (in)
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