

548227


**Routine Calculations Report
In Support of Task 6 of AP-114**


**Potentiometric Surface, Adjusted to Equivalent Freshwater Heads, of
the Culebra Dolomite Member of the Rustler Formation near the WIPP
Site, May 2007**

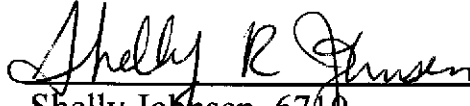
**(AP-114: Analysis Plan for Evaluation and Recalibration of Culebra
Transmissivity Fields, Revision 1, ERMS 548162)**

WBS 1.4.2.3

Report Date: February 26, 2008

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QA Review:  2-26-08
Shelly Jensen, 6710 Date
Carlsbad Programs Group

WIPP:1.4.2.3:TD:QA-L:RECERT:541153

Information Only

Title of Calculation:

Potentiometric Surface, Adjusted to Equivalent Freshwater Heads, of the Culebra Dolomite Member of the Rustler Formation near the WIPP Site, May 2007 in support of Task 6 of AP-114.

1. Planning Document:

AP-114 (ERMS 548162): Analysis Plan for Evaluation and Recalibration of Culebra Transmissivity Fields, Revision 1, Task 6, Calculation of Freshwater Heads and Compilation of Transient Heads to be Used in T-Field Calibration.

Note: A slight deviation from the task 6 specifications in AP-114 is more recent data (2007) were used to calculate freshwater heads in the Culebra than was specified in AP-114 (late 2004 or early 2005) so that more current head data could be used.

2. Description of Calculation Process:

A. The available freshwater head data for WIPP wells completed in the Culebra Dolomite Member of the Rustler Formation to be used in the MODFLOW model of the Culebra Dolomite at the WIPP for May 2007 were calculated in *2007_FreshH2OHead_data.xls* file created in Excel, on the *2007 FreshH2O Head Data* spreadsheet. The spreadsheet includes the supporting data and calculations utilized in the development of freshwater heads to create the 2007 Culebra potentiometric surface map. Attempts were made to use May 2007 water level elevation data for the potentiometric surface map; however, because of lack of data availability, other time periods were used when necessary. The *2007 FreshH2O Head Formula* spreadsheet includes the formulas contained in the data spreadsheet cells. The spreadsheet entries were verified by Shelly Johnsen, Organization 6710. Each column in the spreadsheet and its contents are described below:

- A – Well ID – Well name
- B – RTK - UTM NAD27 Y – RTK survey UTM location coordinate
- C – RTK - UTM NAD27 X – RTK survey UTM location coordinate
- D – RTK - Ground Surface Elevation (ft AMSL)
- E – RTK - Top of Casing Elevation (ft AMSL)
- F – Depth of H2O Below TOC (ft) w TOC adjust – Depth to water measurement including any applicable top of casing adjustment
- G – Source of Water Level – Organization that collected the depth to water level measurement, and date noted when not May 2007
- H – Water-Level Elevation (ft AMSL) – (Formula = Column E - Column F)
- I – Water Level Elevation (m AMSL) – (Formula = Column H*.3048)
- J – Depth to Middle/Center of Culebra (ft)
- K – Center of Culebra Elevation (ft AMSL) – monument/ground surface elevation minus the depth to Culebra (Column D – Column J)
- L – Head (ft) – water level elevation minus center of Culebra elevation (Column H – Column K)
- M – Density Result (g/cm³) – density value used to calculate the freshwater head in grams per centimeter cubed

- N – Freshwater Head (ft AMSL) – head multiplied by the density value plus the center of Culebra elevation ((Column L*Column M)+Column K)
- O – Freshwater Head (m AMSL) – feet AMSL freshwater head converted to meters AMSL freshwater head (Column N*0.3048)

Following the spreadsheets are hydrographs of the water level data for each well from April 2001 through February 2008. The hydrographs illustrate that the water level data used to calculate the freshwater head equivalents are representative for each well.

Note:

- There were no water level data available in 2007 for WIPP-25 Culebra; therefore, the water level elevation was calculated using levelTroll pressure data. The following method was used to calculate the water level elevation at WIPP-25 on 5/9/2007 at 12:00, where the Troll depth was 355 feet BTOC:

Feet of Water above Troll = (psi-baro psi)*2.3067

Feet of Water above Troll = (105.395-13.052)*2.3067

Feet of Water above Troll = 213.008

Depth to Water (BTOC) = depth of Troll-feet of water

Depth to Water (BTOC) = 355 – 213.008

Depth to Water (BTOC) = 141.992 (rounded to 141.99)

- B.** A potentiometric surface map depicting the freshwater heads (ft AMSL) was prepared utilizing the data spreadsheet referenced in item A. The potentiometric surface map contours were developed using the software program Surfer, version 8.0. The parameters used in the Surfer program are as follows:

- Gridding method – Kriging
- Smoothing contours – High
- Contour interval – 5 meters

Notes:

- The potentiometric surface map is for illustration purposes only – it is not used for MODFLOW modeling.
- For contouring purposes, the freshwater head value used for SNL-6 and SNL-15 was 1000 m AMSL. The groundwater in these two wells has not fully recovered since the wells were drilled; therefore, the estimated freshwater head value of 1000 m AMSL was used to simulate anticipated future conditions. The estimated value caused a “bullseye” effect at SNL-15.

3. Identification/Listing of Input, Input sources, and Output:

- Excel spreadsheet including the data – 2007_FreshH2OHead_data.xls
 - Worksheet 1 – 2007 FreshH2O Head Data (printed copy attached and electronic copy provided on attached CD)
 - Worksheet 2 – 2007 FreshH2O Head Formula (printed copy attached and electronic copy provided on attached CD)

- Excel spreadsheet including the water level data (April 2001 to February 2008) – Hydrographs.xls
 - Worksheet 1 – C-2737
 - Worksheet 2 – ERDA-9
 - Worksheet 3 – H-2b2
 - Worksheet 4 – H-3b2
 - Worksheet 5 – H-4b
 - Worksheet 6 – H-5b
 - Worksheet 7 – H-6b
 - Worksheet 8 – H-7b1
 - Worksheet 9 – H-9c
 - Worksheet 10 – H-10c
 - Worksheet 11 – H-11b4
 - Worksheet 12 – H-12
 - Worksheet 13 – H-15
 - Worksheet 14 – H-17
 - Worksheet 15 – H-19b0
 - Worksheet 16 – IMC-461
 - Worksheet 17 – SNL-1
 - Worksheet 18 – SNL-2
 - Worksheet 19 – SNL-3
 - Worksheet 20 – SNL-5
 - Worksheet 21 – SNL-6
 - Worksheet 22 – SNL-8
 - Worksheet 23 – SNL-9
 - Worksheet 24 – SNL-10
 - Worksheet 25 – SNL-12
 - Worksheet 26 – SNL-13
 - Worksheet 27 – SNL-14
 - Worksheet 28 – SNL-15
 - Worksheet 29 – SNL-16
 - Worksheet 30 – SNL-17
 - Worksheet 31 – SNL-18
 - Worksheet 32 – SNL-19
 - Worksheet 33 – USGS-4
 - Worksheet 34 – WIPP-11
 - Worksheet 35 – WIPP-13
 - Worksheet 36 – WIPP-19
 - Worksheet 37 – WIPP-25
 - Worksheet 38 – WIPP-30
 - Worksheet 39 – WQSP-1
 - Worksheet 40 – WQSP-2
 - Worksheet 41 – WQSP-3
 - Worksheet 42 – WQSP-4
 - Worksheet 43 – WQSP-5
 - Worksheet 44 – WQSP-6

- Contour map – 2007_FreshH20Head_plot.srf (printed copy attached and electronic copy provided on attached CD)
- Supporting Surfer files – 2007_FreshH20Head_data.grd (electronic copy provided on attached CD)

4. Data Qualification for Compliance Decision Analysis:

Data sources provided in Section 7.0, References

5. Software Used:

Microsoft Office Excel 2003 and Surfer 8.0 run on Dell Precision GX390, Intel Core 2 processor under Microsoft Windows XP Professional

6. Reviews:

Technical: Richard L. Beauheim, 6712

QA: Shelly Johnsen, 6710

7. References:

2007 Calculated Densities for Use in Deriving Equivalent Freshwater Heads of the Culebra Dolomite Member of the Rustler Formation near the WIPP Site, May 2007 (ERMS 548127).

Culebra Center Depths for Use in Calculating Equivalent Freshwater Heads of the Culebra Dolomite Member of the Rustler Formation near the WIPP Site, May 2007, Revision 1.0 (ERMS 548032).

SNL water level data from the following logbooks:

Long-Term Monitoring Notebook (LTM) 3 (ERMS 546179)

Long-Term Monitoring Notebook (LTM) 4 (ERMS 547753)

Long-Term Monitoring Notebook (LTM) 5 (ERMS 547072)

Long-Term Monitoring Notebook (LTM) 6 (ERMS 548068)

WIPP Site Well Testing (WSWT) 9 (ERMS 545596)

WIPP Site Well Testing (WSWT) 11 (ERMS 548076)

WRES Water Level Data submitted to SNL in monthly memoranda (package ERMS 546636)

WIPP Well Survey Data (package ERMS 547684).

8. List of Attachments:

Printout of Excel file 2007_FreshH20Head_Data.xls:

○ Worksheet 1 – 2007 FreshH20Head Data

○ Worksheet 2 – 2007 FreshH20Head Formula

Printout of Excel file Hydrographs.xls:

○ Worksheet 1 – C-2737

○ Worksheet 2 – ERDA-9

- Worksheet 3 – H-2b2
- Worksheet 4 – H-3b2
- Worksheet 5 – H-4b
- Worksheet 6 – H-5b
- Worksheet 7 – H-6b
- Worksheet 8 – H-7b1
- Worksheet 9 – H-9c
- Worksheet 10 – H-10c
- Worksheet 11 – H-11b4
- Worksheet 12 – H-12
- Worksheet 13 – H-15
- Worksheet 14 – H-17
- Worksheet 15 – H-19b0
- Worksheet 16 – IMC-461
- Worksheet 17 – SNL-1
- Worksheet 18 – SNL-2
- Worksheet 19 – SNL-3
- Worksheet 20 – SNL-5
- Worksheet 21 – SNL-6
- Worksheet 22 – SNL-8
- Worksheet 23 – SNL-9
- Worksheet 24 – SNL-10
- Worksheet 25 – SNL-12
- Worksheet 26 – SNL-13
- Worksheet 27 – SNL-14
- Worksheet 28 – SNL-15
- Worksheet 29 – SNL-16
- Worksheet 30 – SNL-17
- Worksheet 31 – SNL-18
- Worksheet 32 – SNL-19
- Worksheet 33 – USGS-4
- Worksheet 34 – WIPP-11
- Worksheet 35 – WIPP-13
- Worksheet 36 – WIPP-19
- Worksheet 37 – WIPP-25
- Worksheet 38 – WIPP-30
- Worksheet 39 – WQSP-1
- Worksheet 40 – WQSP-2
- Worksheet 41 – WQSP-3
- Worksheet 42 – WQSP-4
- Worksheet 43 – WQSP-5
- Worksheet 44 – WQSP-6

Printout of 2007_FreshH20Head_Plot.srf (potentiometric surface – Surfer file)
CD including the Excel file, Surfer files, and documentation of calculation file

2007 FreshH2O Head Data

A Well ID	B RTK - UTM NAD27 Y (m)	C RTK - UTM NAD27 X (m)	D RTK - Ground Surface Elevation NGVD29 (ft AMSL)	E RTK - Top of Casing Elevation NGVD29 (ft AMSL)	F May 2007 Depth to Water Data				J Depth to Middle/ Center of Culebra (ft) (ERMS 548032)	K Center of Culebra Elevation (ft AMSL)	L Head (ft)	M Density (g/cm ³) (ERMS 548127)	N Freshwater Head (ft AMSL)	O Freshwater Head (m AMSL)
					Depth of H2O Below TOC (ft) w TOC adjust	Source of Water Level	Water-Level Elevation (ft AMSL)	Water-Level Elevation (m AMSL)						
C-2737	3581400.9	613598.0	3396.2	3400.8	381.55	WRES	3019.21	920.26	686.5	2709.71	309.50	1.010	3022.41	921.23
ERDA-9	3581944.3	613696.1	3408.9	3410.2	397.31	WRES	3012.86	918.32	715.9	2692.96	319.90	1.047	3027.94	922.92
H-2b2	3581639.7	612662.5	3376.8	3378.0	332.64	WRES	3045.33	928.22	634.0	2742.82	302.51	1.014	3049.55	929.50
H-3b2	3580899.6	613693.6	3388.7	3389.6	388.54	WRES	3001.11	914.74	686.5	2702.18	298.92	1.042	3013.77	918.60
H-4b	3578478.5	612376.0	3332.5	3333.6	329.81	WRES	3003.77	915.55	503.0	2829.47	174.30	1.015	3006.35	916.34
H-5b	3584807.0	616866.0	3505.0	3506.8	467.64	WRES	3039.14	926.33	908.5	2596.50	442.63	1.091	3079.33	938.58
H-6b	3584986.9	610598.6	3346.9	3347.7	288.48	WRES	3059.21	932.45	615.5	2731.41	327.81	1.034	3070.24	935.81
H-7b1	3574646.4	608122.8	3162.3	3163.7	163.35	WRES	3000.37	914.51	268.5	2893.80	106.57	1.002	3000.60	914.58
H-9c	3568237.2	613971.1	3405.5	3407.0	412.63	WRES	2994.42	912.70	662.0	2743.54	250.88	1.001	2994.77	912.80
H-10c	3572444.3	622976.3	3687.5	3688.4	663.97	WRES	3024.43	921.85	1371.2	2316.33	708.10	1.008	3030.18	923.60
H-11b4	3579123.5	615297.3	3409.2	3409.9	423.93	WRES	2985.94	910.11	734.7	2674.57	311.36	1.070	3007.83	916.79
H-12	3575460.5	617022.0	3425.2	3426.9	457.30	WRES	2969.65	905.15	836.4	2588.90	380.75	1.097	3006.58	916.41
H-15	3581855.2	615310.0	3479.8	3480.9	482.25	WRES	2998.64	913.99	870.8	2609.02	389.63	1.053	3019.41	920.32
H-17	3577507.8	615717.0	3383.4	3384.0	419.13	WRES	2964.88	903.70	718.6	2664.80	300.08	1.133	3004.65	915.82
H-19b0	3580715.8	614515.0	3416.6	3418.6	426.11	WRES	2992.52	912.12	752.3	2664.36	328.15	1.068	3014.89	918.94
IMC-461	3582246.4	606182.6	3281.1	3284.8	236.58	WRES	3048.21	929.10	374.0	2907.11	141.10	1.005	3048.94	929.32
SNL-1	3594299.0	613781.4	3510.0	3513.7	428.84	WRES	3084.89	940.27	610.0	2899.97	184.92	1.033	3091.01	942.14
SNL-2	3586529.1	609113.1	3320.8	3323.8	249.39	WRES	3074.37	937.07	468.5	2852.32	222.05	1.012	3076.99	937.87
SNL-3	3589046.9	616103.0	3487.9	3489.1	415.19	WRES	3073.88	936.92	764.1	2723.83	350.05	1.023	3082.06	939.41
SNL-5	3587284.7	611970.2	3377.4	3380.3	304.05	WRES	3076.29	937.65	646.4	2731.01	345.28	1.010	3079.74	938.70
SNL-6 ¹	3595390.0	621244.6	3643.1	3646.9	936.43	WRES	2710.48	826.15	1335.3	2307.87	402.61	1.246	2809.37	856.30
SNL-8	3583783.3	618522.8	3552.0	3556.0	527.51	WRES	3028.47	923.08	966.0	2586.03	442.44	1.103	3073.87	936.91
SNL-9	3582237.7	608704.8	3358.2	3361.4	309.33	WRES	3052.08	930.27	564.4	2793.76	258.32	1.024	3058.36	932.19
SNL-10	3581764.8	611229.3	3374.1	3378.0	324.43	WRES	3053.57	930.73	610.0	2764.13	289.44	1.011	3056.63	931.66
SNL-12	3572727.4	613223.4	3337.1	3340.0	337.88	WRES	3002.15	915.05	568.5	2768.61	233.54	1.005	3003.31	915.41
SNL-13	3577599.8	610394.3	3291.1	3294.6	284.90	WRES	3009.75	917.37	398.0	2893.06	116.69	1.027	3012.86	918.32
SNL-14	3577652.0	614989.7	3365.0	3368.9	376.05	SNL - 11/07	2992.83	912.21	666.2	2698.90	293.93	1.048	3006.82	916.48
SNL-15 ¹	3580336.4	618353.2	3477.3	3480.8	692.36	WRES	2788.42	849.91	920.2	2557.10	231.32	1.228	2841.09	865.97
SNL-16	3578999.7	605191.8	3131.7	3135.1	121.50	WRES - 9/07	3013.62	918.55	205.0	2926.74	86.88	1.010	3014.53	918.83
SNL-17	3576016.1	609863.2	3235.5	3238.5	230.98	WRES	3007.56	916.70	347.0	2888.50	119.06	1.006	3008.28	916.92
SNL-18	3591528.6	613605.8	3371.7	3375.9	298.83	WRES	3077.02	937.88	547.5	2824.25	252.77	1.028	3083.98	940.00
SNL-19	3588947.4	607813.5	3219.1	3222.9	147.23	WRES	3075.68	937.47	351.5	2867.57	208.11	1.003	3076.32	937.66
USGS-4 ^{2,4}	3569887.0	605841.0	3413.5	3415.9	426.72	SNL - 4/07	2989.19	911.11	495.5	2917.98	71.21	1.000	2989.19	911.11
WIPP-11	3586474.0	613788.2	3425.5	3427.8	360.54	WRES	3067.24	934.89	855.5	2569.99	497.24	1.038	3086.13	940.65
WIPP-13	3584241.7	612645.0	3404.8	3405.7	342.00	WRES	3063.67	933.81	714.5	2690.35	373.32	1.053	3083.27	939.78
WIPP-19	3582773.5	613738.8	3432.4	3434.0	388.60	WRES	3045.43	928.25	767.4	2664.96	380.47	1.044	3062.06	933.32
WIPP-25 ³	3584022.8	606385.7	3211.8	3214.2	141.99	Troll - 5/9/07 12:00	3072.25	936.42	459.5	2752.32	320.16	1.011	3076.00	937.57
WIPP-30 ⁵	3589705.4	613716.5	3426.7	3430.2	347.32	WRES	3082.90	939.67	642.0	2784.67	298.23	1.000	3082.90	939.67
WQSP-1 ⁶	3583430.3	612559.4	3416.1	3419.2	356.95	WRES	3062.30	933.39	710.5	2705.55	356.75	1.0450	3078.35	938.28
WQSP-2 ⁶	3583972.2	613770.4	3460.8	3463.9	396.38	WRES	3067.49	934.97	822.0	2638.85	428.64	1.0375	3083.56	939.87
WQSP-3 ⁶	3583506.8	614685.5	3477.5	3480.1	464.25	WRES	3015.89	919.24	857.2	2620.27	395.62	1.1425	3072.27	936.43
WQSP-4 ⁶	3580762.8	614724.5	3430.4	3433.1	443.35	WRES	2989.74	911.27	778.2	2652.19	337.55	1.0800	3016.74	919.50
WQSP-5 ⁶	3580353.6	613666.5	3381.7	3384.4	378.98	WRES	3005.40	916.05	656.0	2725.67	279.73	1.0250	3012.39	918.18
WQSP-6 ⁶	3580737.9	612602.3	3361.6	3364.7	343.73	WRES	3020.99	920.80	594.0	2767.61	253.38	1.0150	3024.79	921.96

Notes:

1. Heads are many years away from stabilizing; values of 1000m were used for modeling.
2. USGS-4 coordinates are from Gonzales (1989, SAND88-1065)
3. WIPP-25 water level calculated using psi, therefore H2O above Troll not corrected for density, H2O below Troll corrected for density
4. The calculated density for USGS-4 was 0.97; a value of 1.0 was used for freshwater head calculation
5. The calculated density for WIPP-30 was 0.994; a value of 1.0 was used for freshwater head calculation
6. The densities for WQSP-1 through WQSP-6 are averages of Round 22 (sample and duplicate) and Round 23 (sample and duplicate)

Information Only

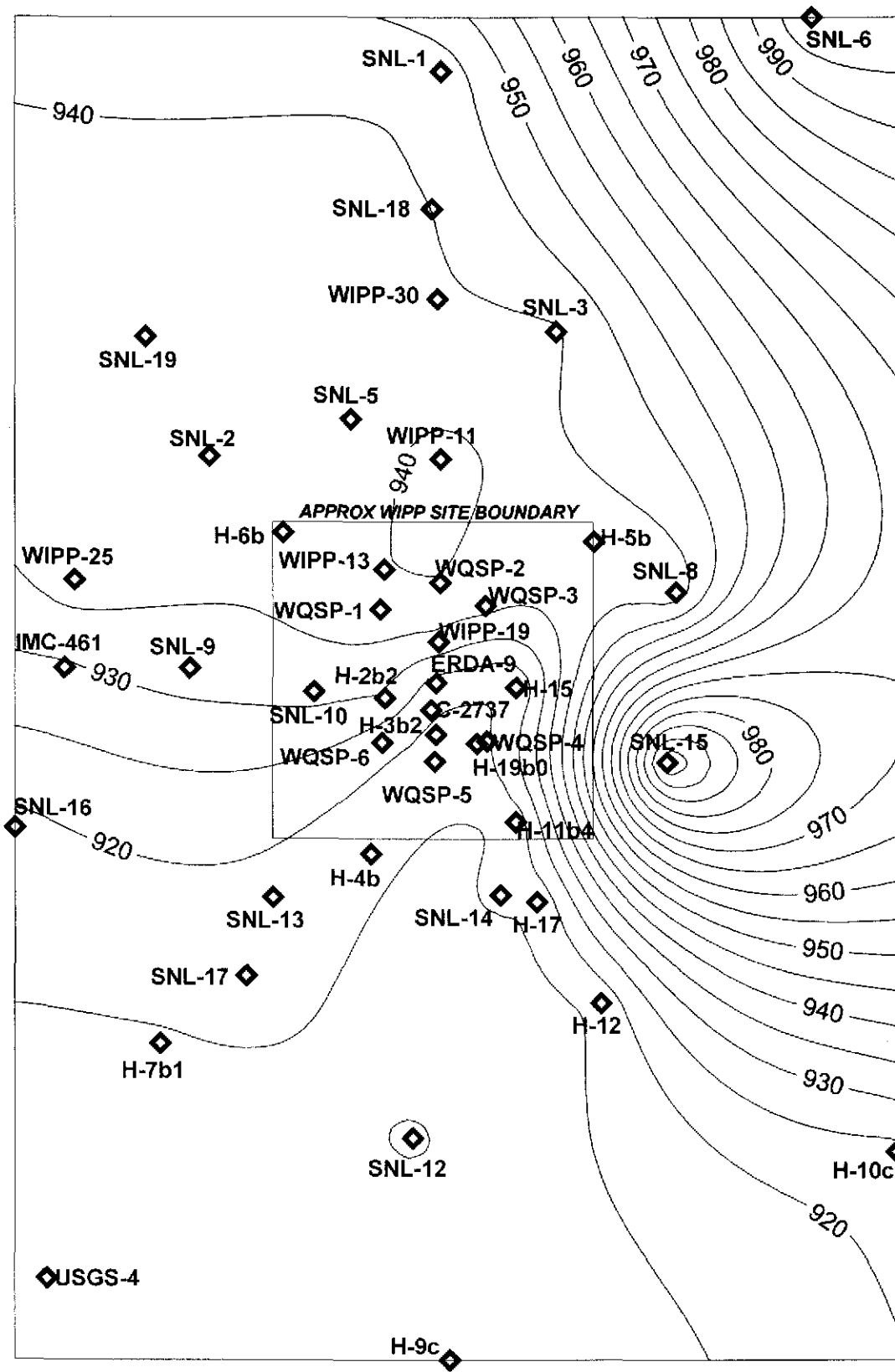
2007 FreshH2O Head Formula

A	B	C	D	E	F				J	K	L	M	N	O
					May 2007 Depth to Water Data									
Well ID	RTK - UTM NAD27 Y (m)	RTK - UTM NAD27 X (m)	RTK - Ground Surface Elevation NGVD29 (ft AMSL)	RTK - Top of Casing Elevation NGVD29 (ft AMSL)	Depth of H2O Below TOC (ft) w TOC adjust	Source of Water Level	Water-Level Elevation (ft AMSL)	Water-Level Elevation (m AMSL)	Depth to Middle/Center of Culebra (ft) (ERMS 548032)	Center of Culebra Elevation (ft AMSL)	Head (ft)	Density (g/cm ³) (ERMS 548127)	Freshwater Head (ft AMSL)	Freshwater Head (m AMSL)
C-2737	3581400.946	613598.024	3398.214	3400.764	381.55	WRES	=E4-F4	=H4*0.3048	686.5	=D4-J4	=H4-K4	1.01032370894648	=(L4*M4)+K4	=N4*0.3048
ERDA-9	3581944.327	613696.117	3408.855	3410.167	397.31	WRES	=E5-F5	=H5*0.3048	715.9	=D5-J5	=H5-K5	1.04715034025086	=(L5*M5)+K5	=N5*0.3048
H-2b2	3581639.889	612662.545	3378.824	3377.972	332.84	WRES	=E6-F6	=H6*0.3048	634	=D6-J6	=H6-K6	1.01393932342182	=(L6*M6)+K6	=N6*0.3048
H-3b2	3580899.628	613693.599	3388.681	3389.645	388.54	WRES	=E7-F7	=H7*0.3048	686.5	=D7-J7	=H7-K7	1.0423684502679	=(L7*M7)+K7	=N7*0.3048
H-4b	3578478.454	612376.001	3332.474	3333.58	329.81	WRES	=E8-F8	=H8*0.3048	503	=D8-J8	=H8-K8	1.01480625364005	=(L8*M8)+K8	=N8*0.3048
H-5b	3584607.018	616865.971	3505.003	3508.775	467.64	WRES	=E9-F9	=H9*0.3048	908.5	=D9-J9	=H9-K9	1.09081606134476	=(L9*M9)+K9	=N9*0.3048
H-6b	3584986.9	610598.633	3346.906	3347.693	288.48	WRES	=E10-F10	=H10*0.3048	615.5	=D10-J10	=H10-K10	1.03363269653144	=(L10*M10)+K10	=N10*0.3048
H-7b1	3574646.432	608122.842	3162.3	3163.718	163.35	WRES	=E11-F11	=H11*0.3048	268.5	=D11-J11	=H11-K11	1.00213541450331	=(L11*M11)+K11	=N11*0.3048
H-9c	3588237.166	613971.126	3405.541	3407.047	412.63	WRES	=E12-F12	=H12*0.3048	662	=D12-J12	=H12-K12	1.00139018209671	=(L12*M12)+K12	=N12*0.3048
H-10c	3572444.276	622976.305	3687.532	3688.402	663.97	WRES	=E13-F13	=H13*0.3048	1371.2	=D13-J13	=H13-K13	1.00811813675813	=(L13*M13)+K13	=N13*0.3048
H-11b4	3579123.478	615297.262	3409.222	3409.865	423.93	WRES	=E14-F14	=H14*0.3048	734.65	=D14-J14	=H14-K14	1.07030972653042	=(L14*M14)+K14	=N14*0.3048
H-12	3575460.481	617021.991	3425.249	3426.945	457.3	WRES	=E15-F15	=H15*0.3048	836.35	=D15-J15	=H15-K15	1.09700563550649	=(L15*M15)+K15	=N15*0.3048
H-15	3581855.208	615310.008	3479.787	3480.892	482.25	WRES	=E16-F16	=H16*0.3048	870.75	=D16-J16	=H16-K16	1.05330355214437	=(L16*M16)+K16	=N16*0.3048
H-17	3577507.764	615716.992	3383.402	3384.012	419.13	WRES	=E17-F17	=H17*0.3048	718.6	=D17-J17	=H17-K17	1.13252326624573	=(L17*M17)+K17	=N17*0.3048
H-19b0	3580715.82	614514.98	3416.614	3418.628	426.11	WRES	=E18-F18	=H18*0.3048	752.25	=D18-J18	=H18-K18	1.068171401485	=(L18*M18)+K18	=N18*0.3048
IMC-461	3582246.353	606182.613	3281.112	3284.794	236.58	WRES	=E19-F19	=H19*0.3048	374	=D19-J19	=H19-K19	1.00512170612952	=(L19*M19)+K19	=N19*0.3048
SNL-1	3594299.049	613781.437	3509.967	3513.73	428.84	WRES	=E20-F20	=H20*0.3048	610	=D20-J20	=H20-K20	1.03308869357414	=(L20*M20)+K20	=N20*0.3048
SNL-2	3586529.054	609113.097	3320.823	3323.763	249.39	WRES	=E21-F21	=H21*0.3048	468.5	=D21-J21	=H21-K21	1.0118	=(L21*M21)+K21	=N21*0.3048
SNL-3	3589046.909	616102.976	3487.933	3489.071	415.19	WRES	=E22-F22	=H22*0.3048	764.1	=D22-J22	=H22-K22	1.0233758999635	=(L22*M22)+K22	=N22*0.3048
SNL-5	3587284.734	611970.224	3377.359	3380.338	304.05	WRES	=E23-F23	=H23*0.3048	646.35	=D23-J23	=H23-K23	1.01	=(L23*M23)+K23	=N23*0.3048
SNL-6 ¹	3595389.988	621244.584	3643.116	3646.905	936.43	WRES	=E24-F24	=H24*0.3048	1335.25	=D24-J24	=H24-K24	1.24563194170761	=(L24*M24)+K24	=N24*0.3048
SNL-8	3583783.348	618522.817	3552.034	3555.981	527.51	WRES	=E25-F25	=H25*0.3048	866	=D25-J25	=H25-K25	1.1026	=(L25*M25)+K25	=N25*0.3048
SNL-9	3582237.698	608704.77	3358.159	3361.408	309.33	WRES	=E26-F26	=H26*0.3048	564.4	=D26-J26	=H26-K26	1.0243	=(L26*M26)+K26	=N26*0.3048
SNL-10	3581764.844	611229.253	3374.127	3377.995	324.43	WRES	=E27-F27	=H27*0.3048	610	=D27-J27	=H27-K27	1.0106	=(L27*M27)+K27	=N27*0.3048
SNL-12	3572727.366	613223.418	3337.057	3340.026	337.88	WRES	=E28-F28	=H28*0.3048	568.45	=D28-J28	=H28-K28	1.005	=(L28*M28)+K28	=N28*0.3048
SNL-13	3577599.768	610394.291	3291.056	3294.649	284.9	WRES	=E29-F29	=H29*0.3048	398	=D29-J29	=H29-K29	1.0267	=(L29*M29)+K29	=N29*0.3048
SNL-14	3577651.971	614989.677	3365.049	3368.877	376.05	SNL - 11/07	=E30-F30	=H30*0.3048	666.15	=D30-J30	=H30-K30	1.0476	=(L30*M30)+K30	=N30*0.3048
SNL-16 ¹	3580336.378	618353.19	3477.25	3480.784	692.36	WRES	=E31-F31	=H31*0.3048	920.15	=D31-J31	=H31-K31	1.22768363580929	=(L31*M31)+K31	=N31*0.3048
SNL-16	3578999.704	605191.791	3131.742	3135.122	121.5	WRES - 9/07	=E32-F32	=H32*0.3048	205	=D32-J32	=H32-K32	1.0104	=(L32*M32)+K32	=N32*0.3048
SNL-17	3576016.07	609863.173	3235.499	3238.54	230.96	WRES	=E33-F33	=H33*0.3048	347	=D33-J33	=H33-K33	1.00606911413893	=(L33*M33)+K33	=N33*0.3048
SNL-18	3591528.616	613605.781	3371.749	3375.853	298.83	WRES	=E34-F34	=H34*0.3048	547.5	=D34-J34	=H34-K34	1.02750489464846	=(L34*M34)+K34	=N34*0.3048
SNL-19	3588847.363	607813.465	3219.072	3222.913	147.23	WRES	=E35-F35	=H35*0.3048	351.5	=D35-J35	=H35-K35	1.00304806603624	=(L35*M35)+K35	=N35*0.3048
USGS-4 ^{2,4}	3569887	605841	3413.4642519688	3415.91207349081	428.72	SNL - 4/07	=E36-F36	=H36*0.3048	495.5	=D36-J36	=H36-K36	1	=(L36*M36)+K36	=N36*0.3048
WIPP-11	3586474.001	613788.155	3425.492	3427.776	360.54	WRES	=E37-F37	=H37*0.3048	855.5	=D37-J37	=H37-K37	1.038007458099	=(L37*M37)+K37	=N37*0.3048
WIPP-13	3584241.7	612644.996	3404.849	3405.666	342	WRES	=E38-F38	=H38*0.3048	714.5	=D38-J38	=H38-K38	1.0525	=(L38*M38)+K38	=N38*0.3048
WIPP-19	3582773.51	613738.77	3432.355	3434.029	368.6	WRES	=E39-F39	=H39*0.3048	767.4	=D39-J39	=H39-K39	1.0437050104413	=(L39*M39)+K39	=N39*0.3048
WIPP-25 ³	3584022.801	606385.697	3211.821	3214.239	141.99	Troll - 5/9/07 12:00	=E40-F40	=H40*0.3048	459.5	=D40-J40	320.16	1.011	=(L40*M40)+K40	=N40*0.3048
WIPP-30 ⁵	3589705.437	613716.478	3426.673	3430.219	347.32	WRES	=E41-F41	=H41*0.3048	642	=D41-J41	=H41-K41	1	=(L41*M41)+K41	=N41*0.3048
WQSP-1 ⁶	3583430.263	612559.447	3416.053	3419.248	358.95	WRES	=E42-F42	=H42*0.3048	710.5	=D42-J42	=H42-K42	=(1.05+1.04+1.04+1.05)/4	=(L42*M42)+K42	=N42*0.3048
WQSP-2 ⁶	3583972.186	613770.382	3460.846	3463.865	396.38	WRES	=E43-F43	=H43*0.3048	822	=D43-J43	=H43-K43	=(1.03+1.03+1.04+1.05)/4	=(L43*M43)+K43	=N43*0.3048
WQSP-3 ⁶	3583508.813	614685.46	3477.47	3480.144	464.25	WRES	=E44-F44	=H44*0.3048	857.2	=D44-J44	=H44-K44	=(1.15+1.14+1.14+1.14)/4	=(L44*M44)+K44	=N44*0.3048
WQSP-4 ⁶	3580762.78	614724.483	3430.393	3433.09	443.35	WRES	=E45-F45	=H45*0.3048	778.2	=D45-J45	=H45-K45	=(1.09+1.09+1.07+1.07)/4	=(L45*M45)+K45	=N45*0.3048
WQSP-5 ⁶	3580353.565	613666.505	3381.666	3384.38	378.98	WRES	=E46-F46	=H46*0.3048	856	=D46-J46	=H46-K46	=(1.03+1.02+1.03+1.02)/4	=(L46*M46)+K46	=N46*0.3048
WQSP-6 ⁶	3580737.907	612602.297	3381.607	3384.721	343.73	WRES	=E47-F47	=H47*0.3048	594	=D47-J47	=H47-K47	=(1.01+1.02+1.02+1.01)/4	=(L47*M47)+K47	=N47*0.3048

Notes:

1. Heads are many years away from stabilizing; values of 1000m were used for modeling.
2. USGS-4 coordinates are from Gonzales (1989, SAND88-1065)
3. WIPP-25 water level calculated using psi, therefore H2O above Troll not corrected for density, H2O below Troll corrected for density
4. The calculated density for USGS-4 was 0.97; a value of 1.0 was used for freshwater head calculation
5. The calculated density for WIPP-30 was 0.994; a value of 1.0 was used for freshwater head calculation
6. The densities for WQSP-1 through WQSP-6 are averages of Round 22 (sample and duplicate) and Round 23 (sample and duplicate)

Information Only



Potentiometric Surface, Adjusted to Equivalent Freshwater Heads, of the Culebra Dolomite Member of the Rustler Formation near the WIPP Site, May 2007

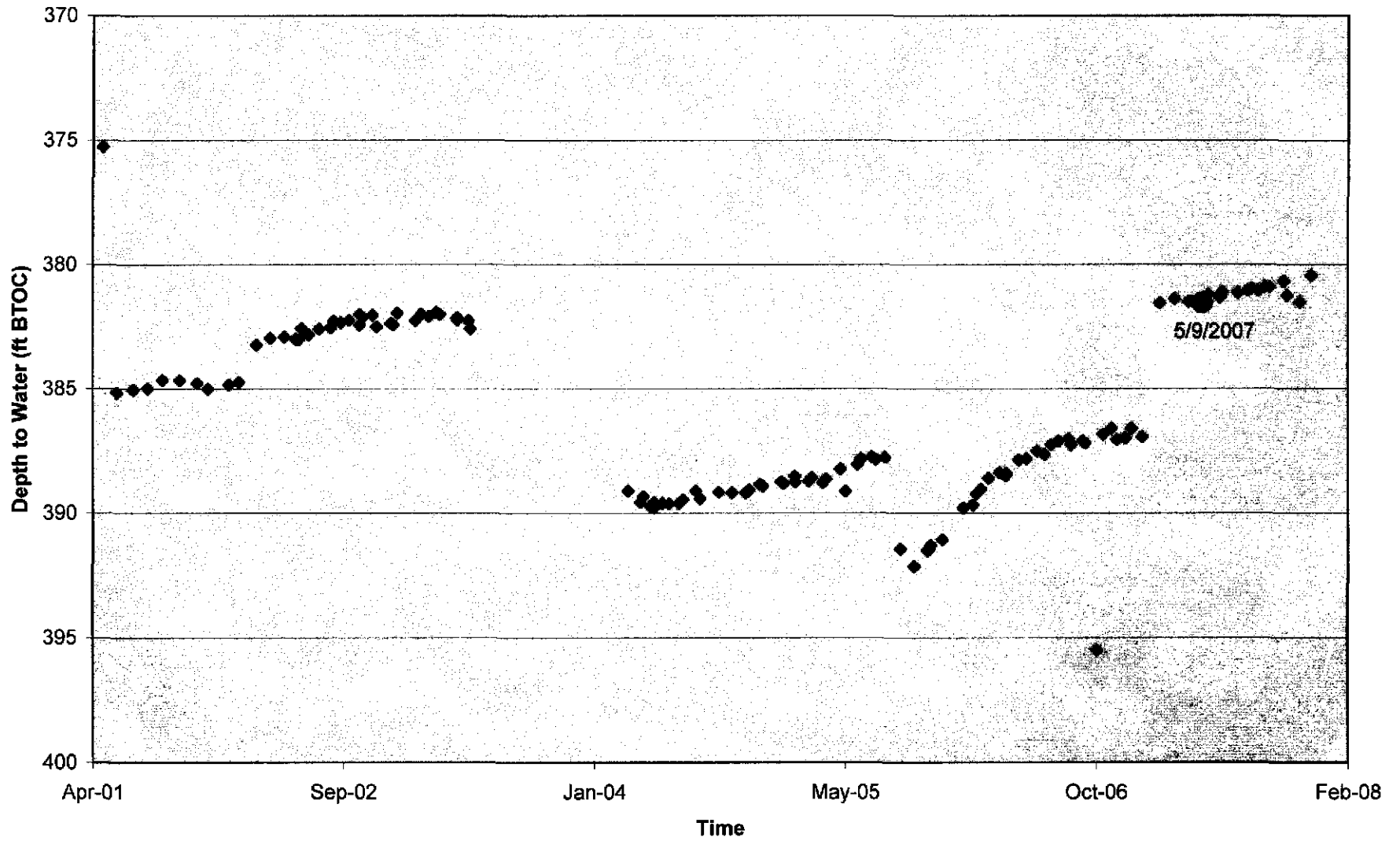


Note: Contour elevations are in meters above mean sea level

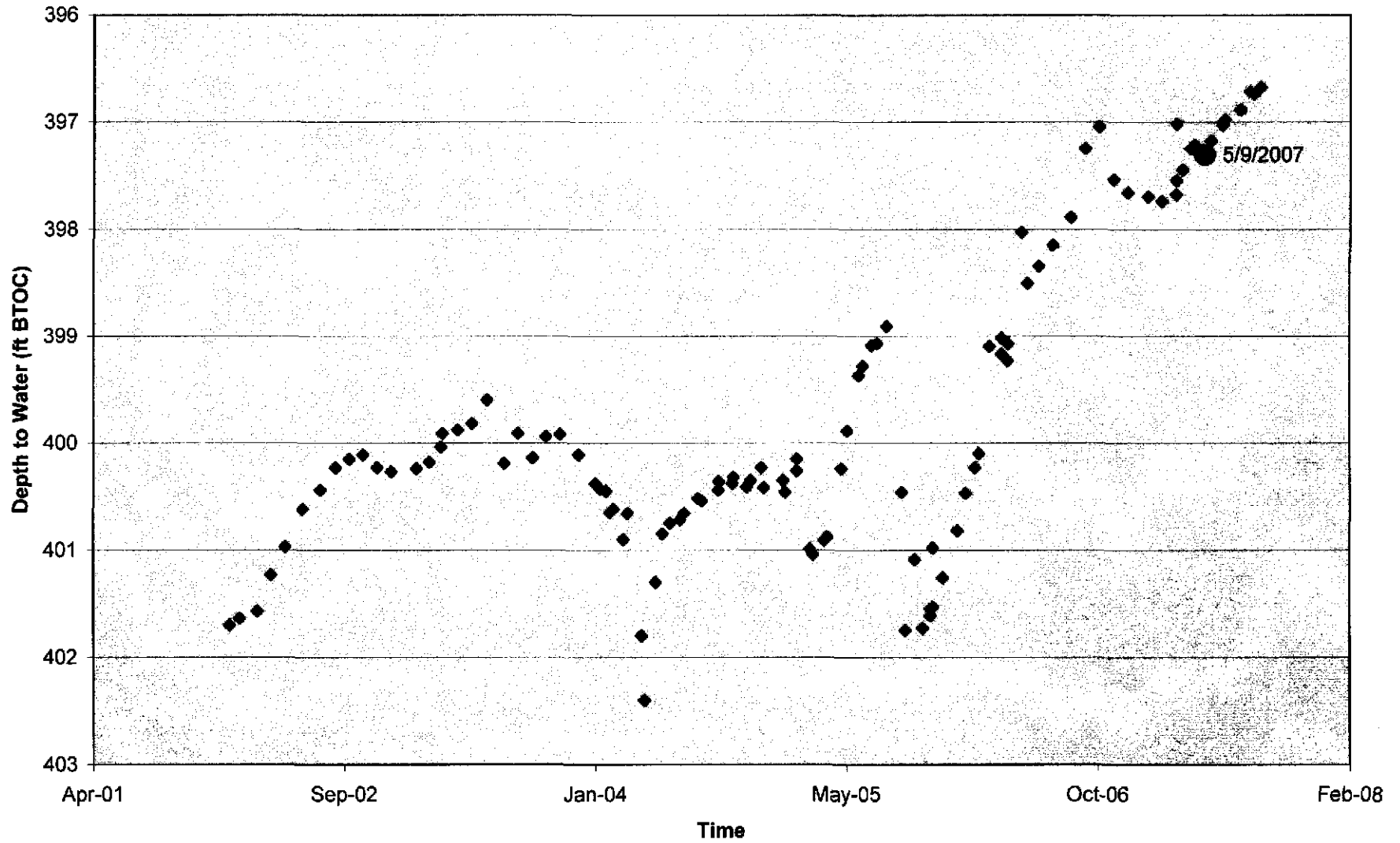


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C-2737

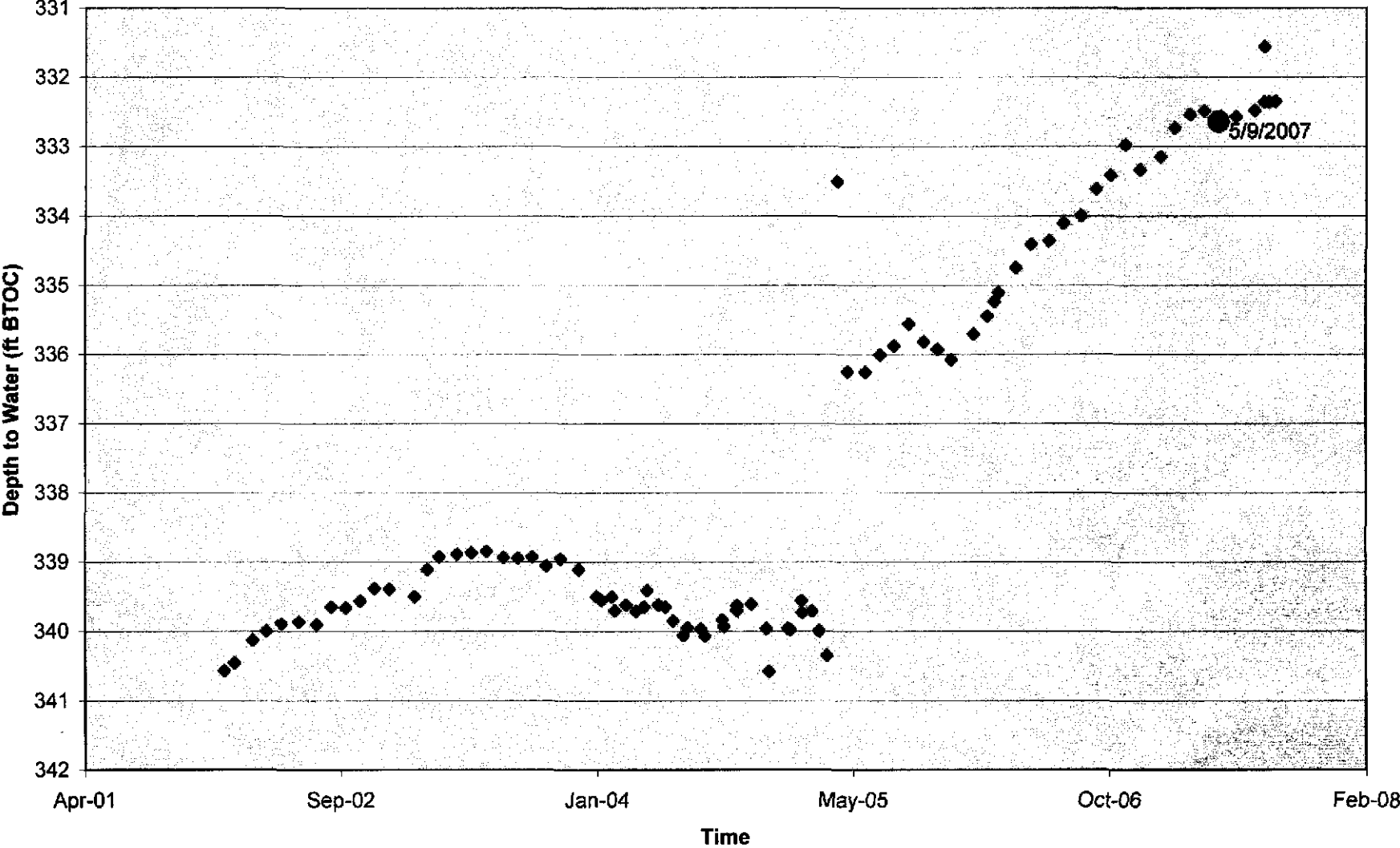


ERDA-9

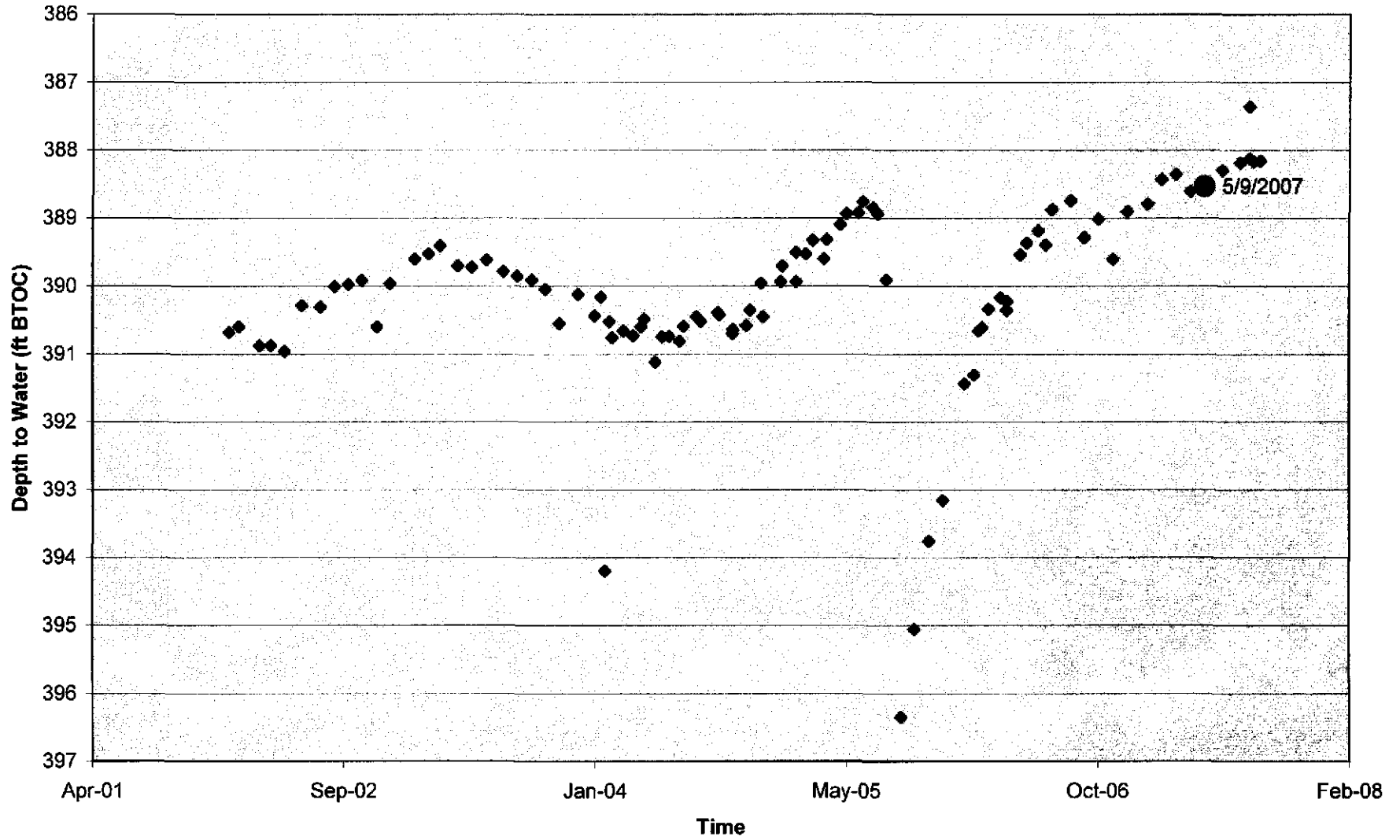


Information Only

H-2b2

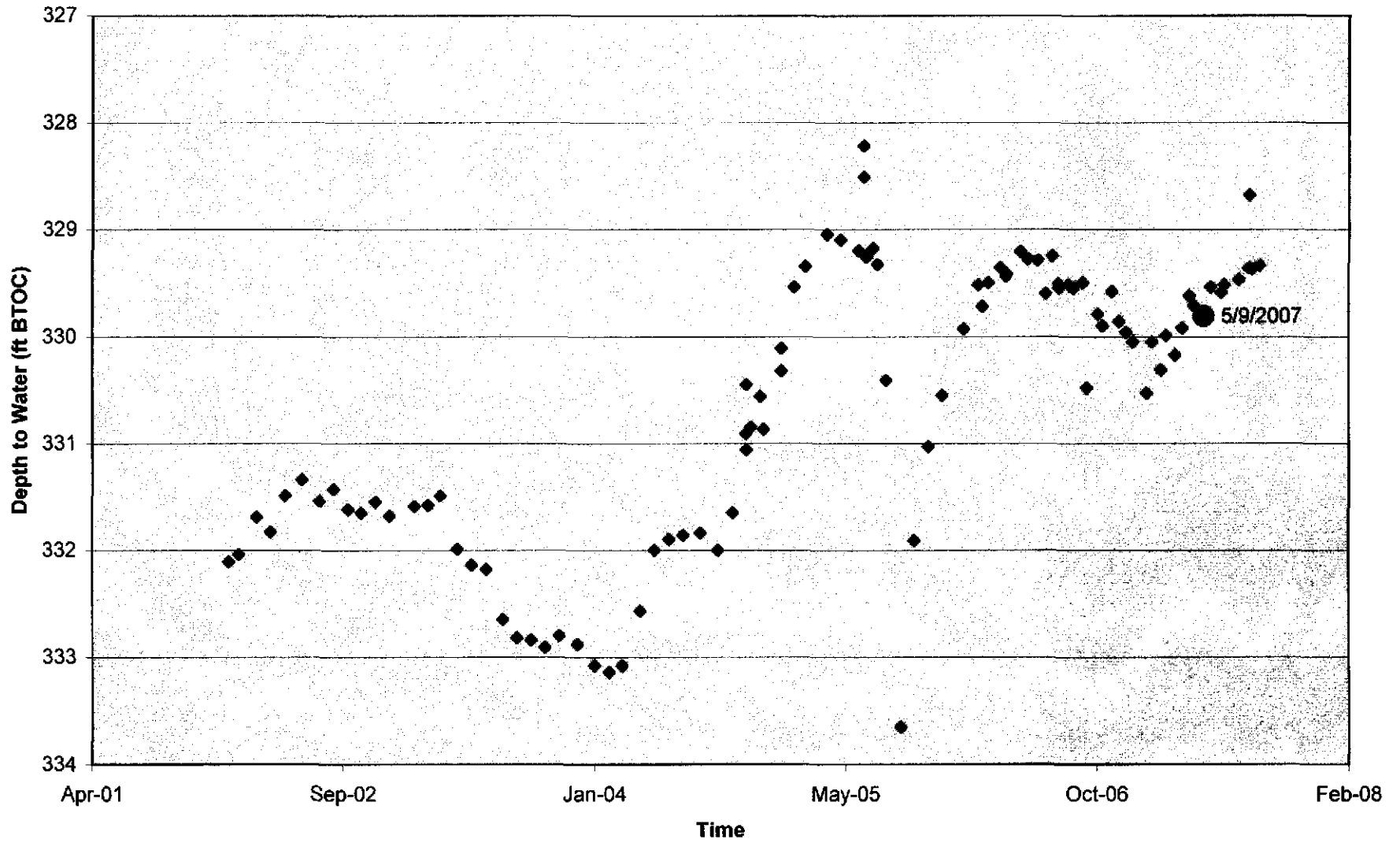


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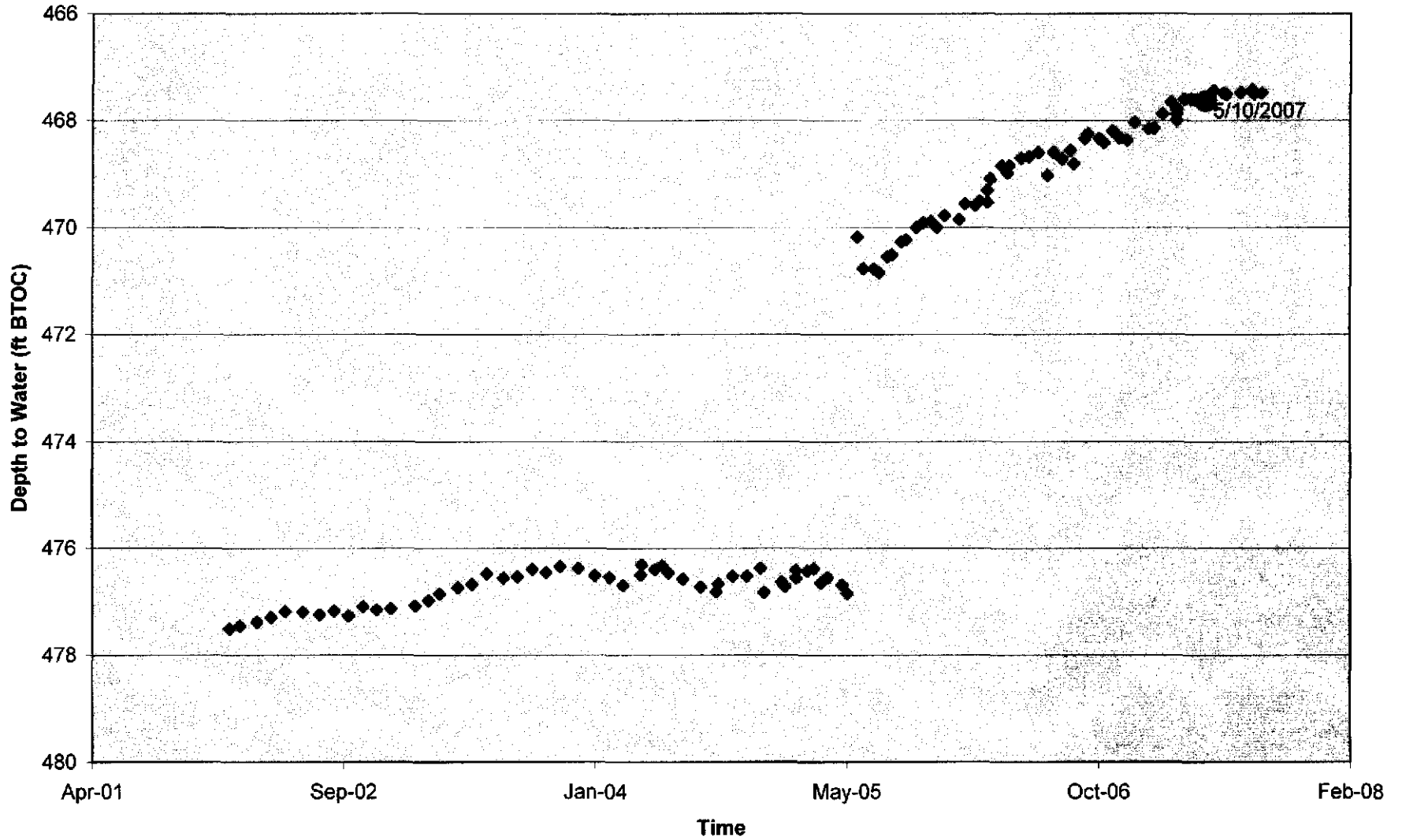
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H-4b



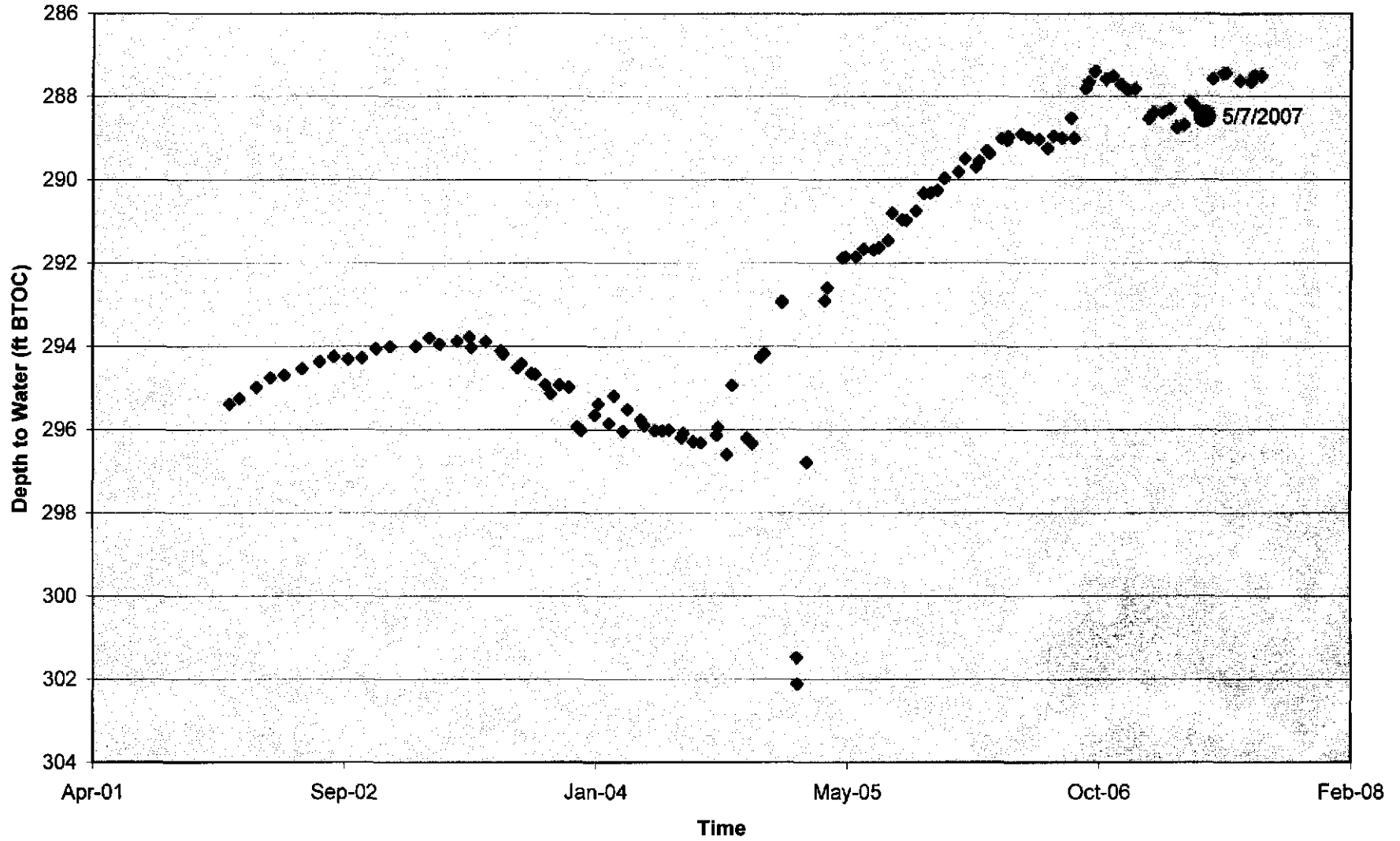
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H-5b



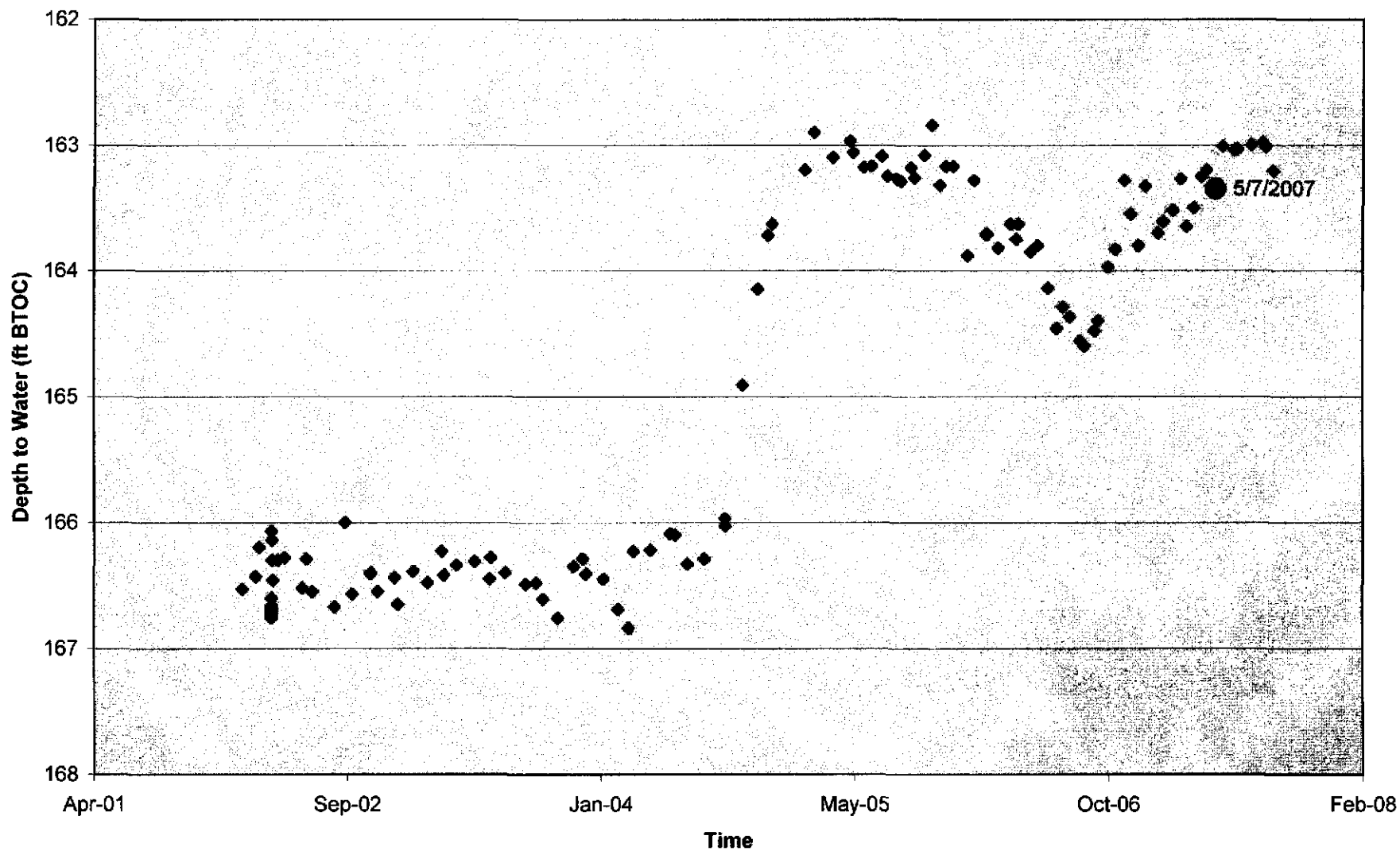
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H-6b



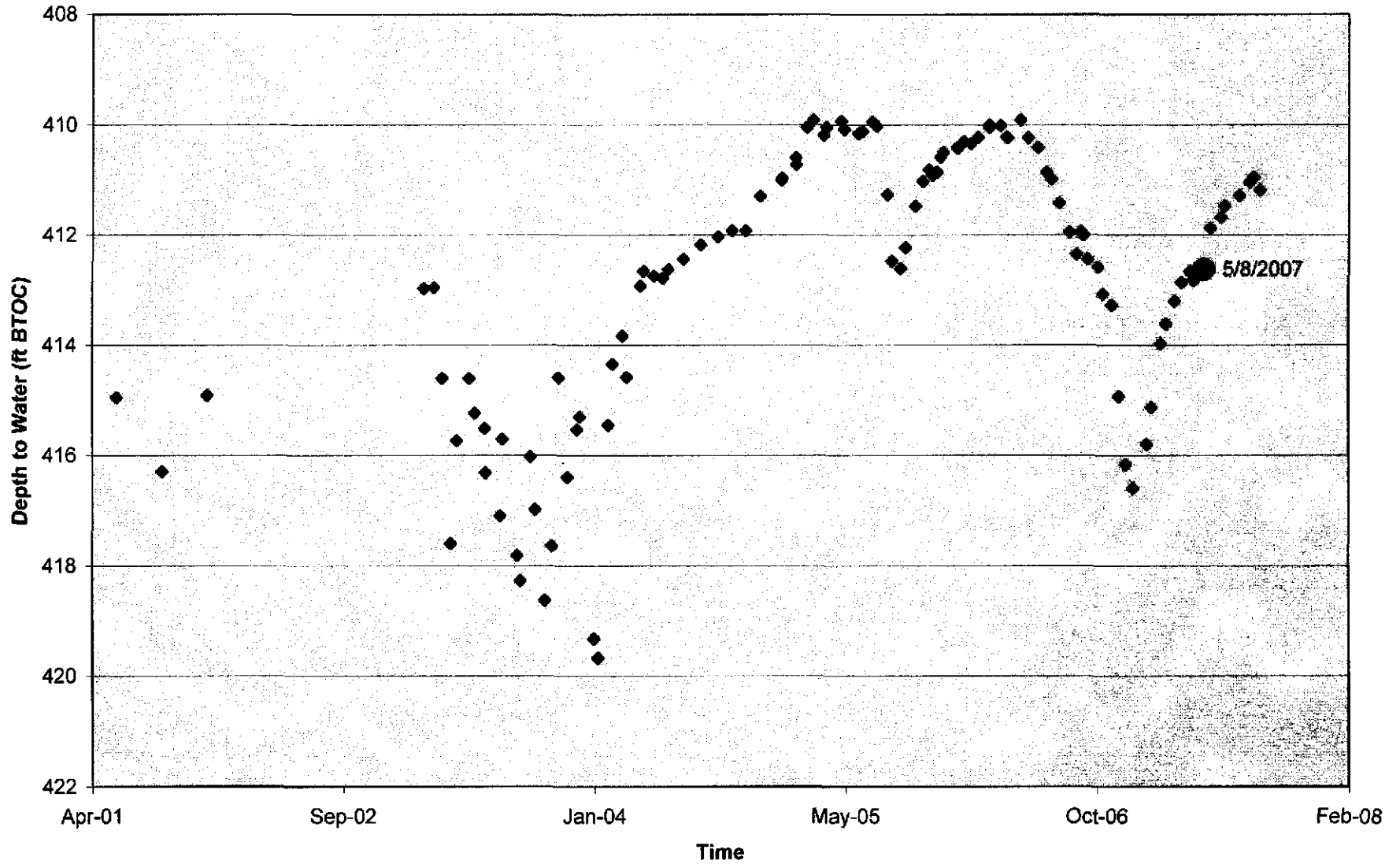
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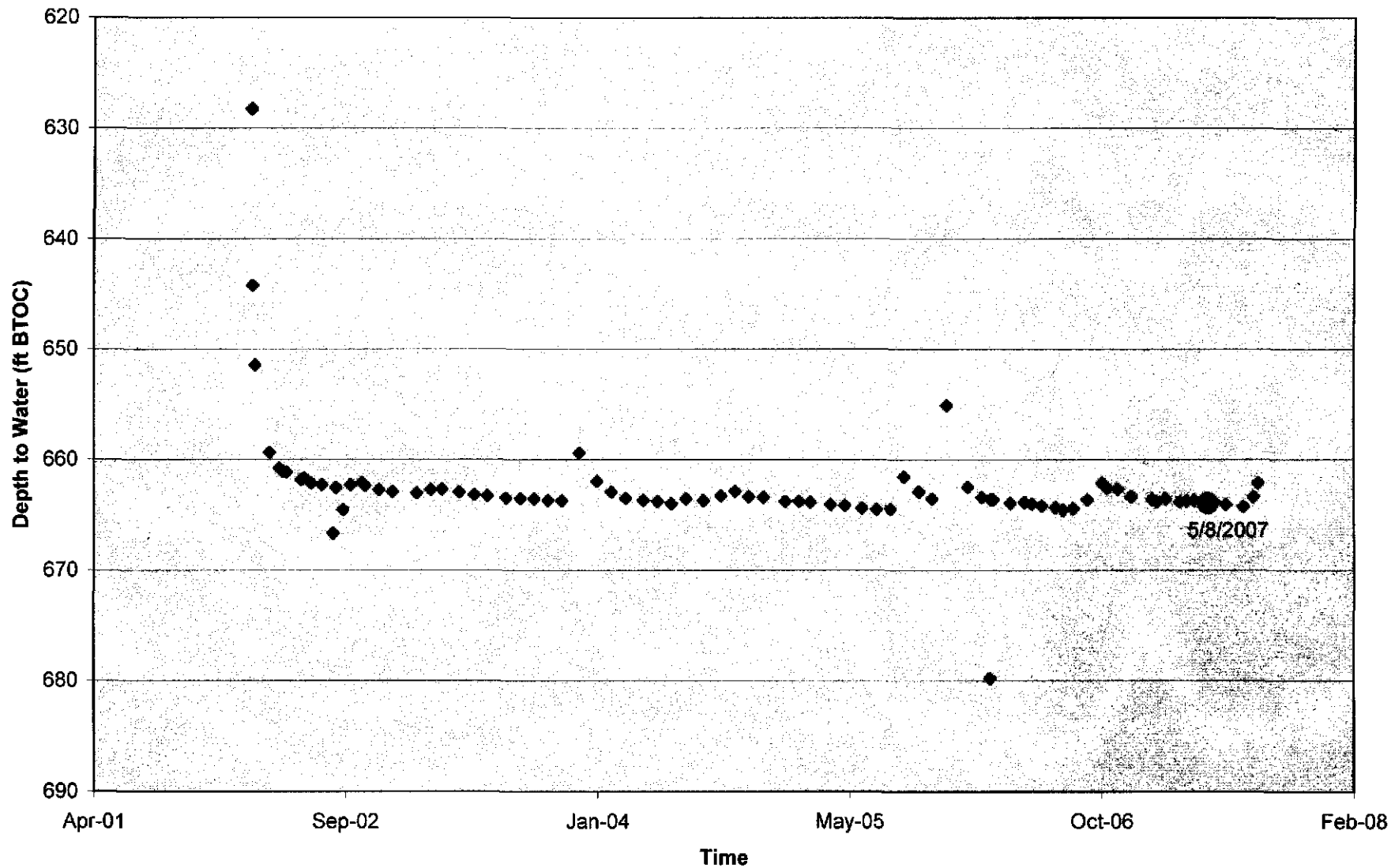
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H-9c



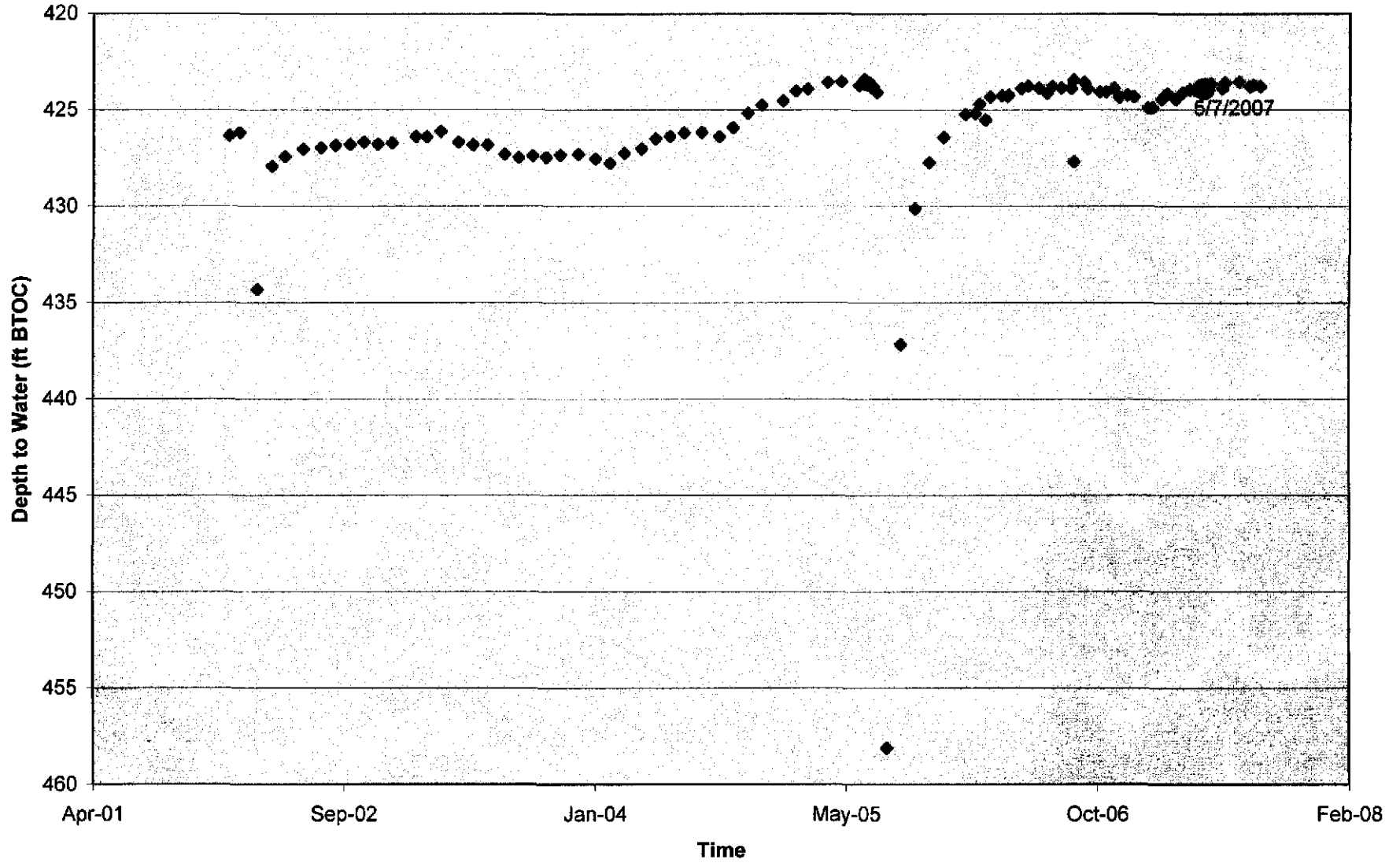
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H-10c



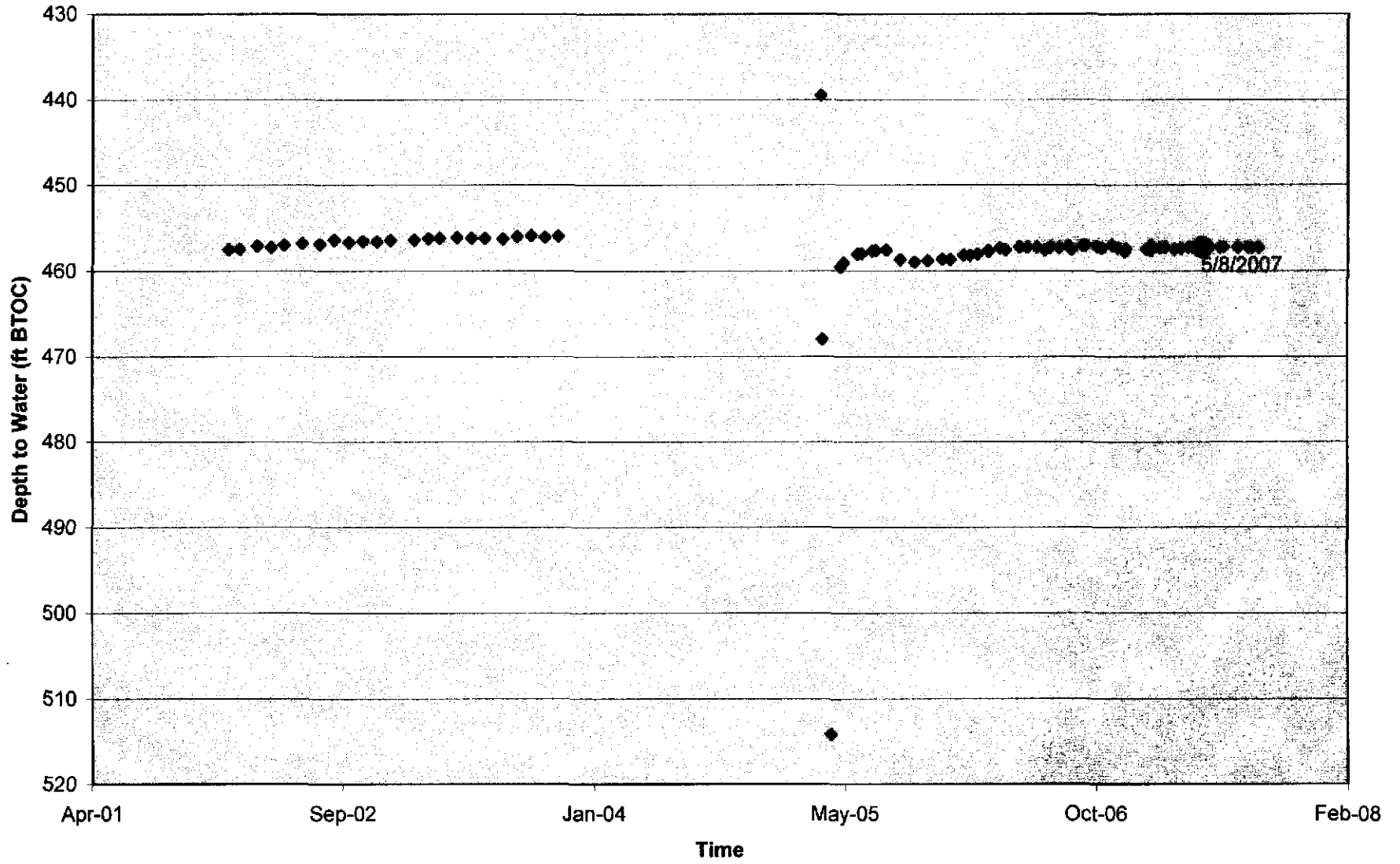
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H-11b4



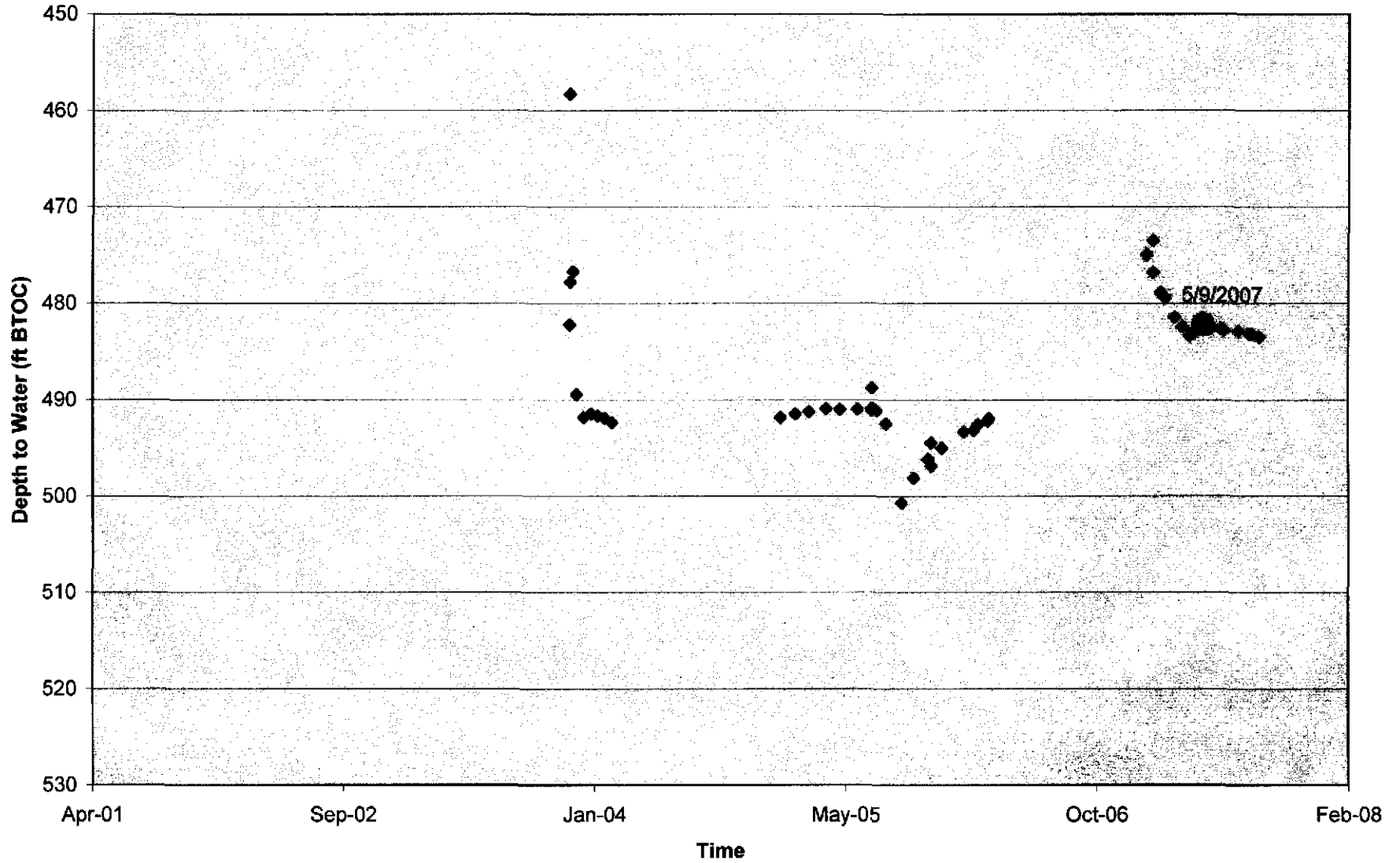
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H-12



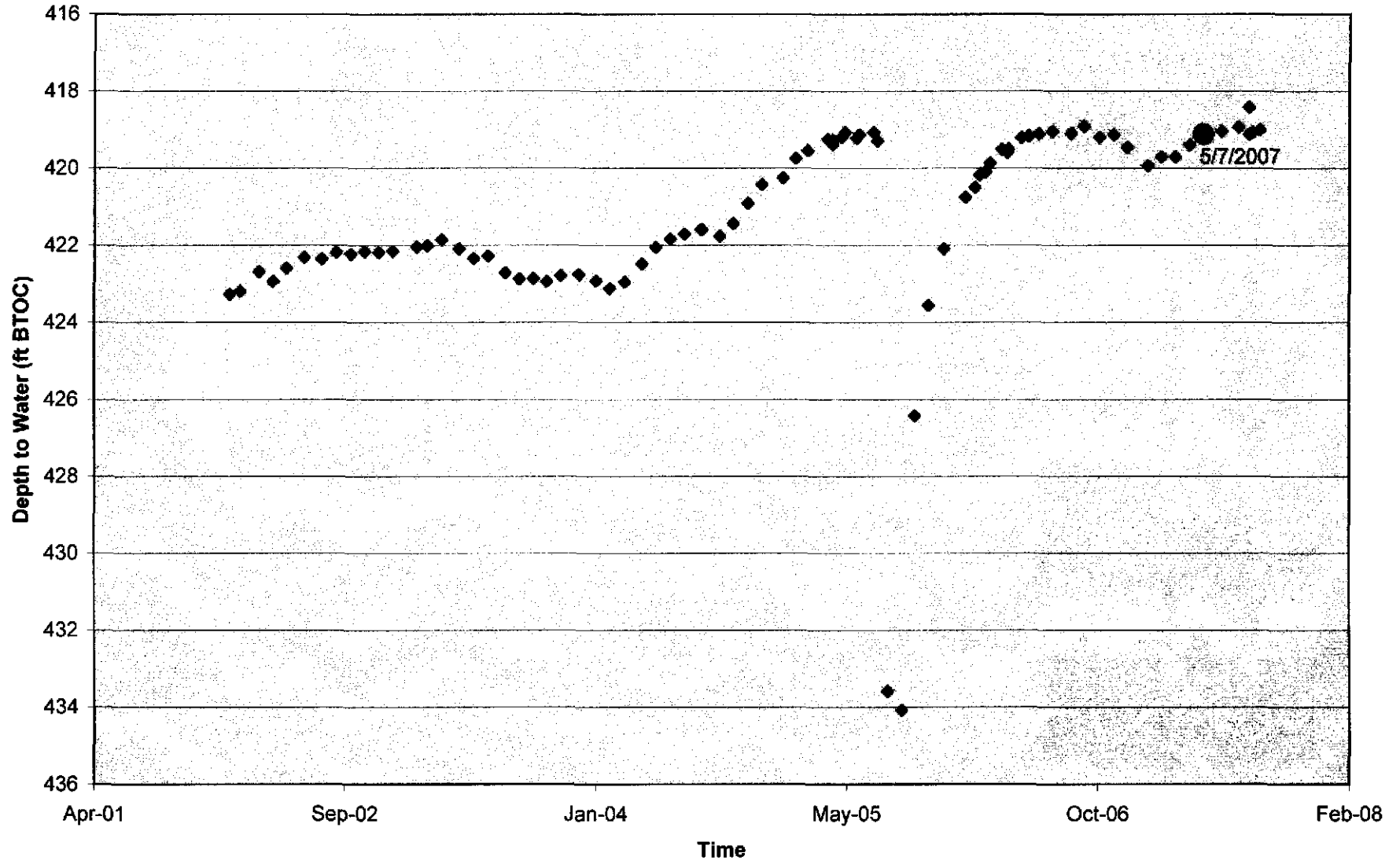
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H-15



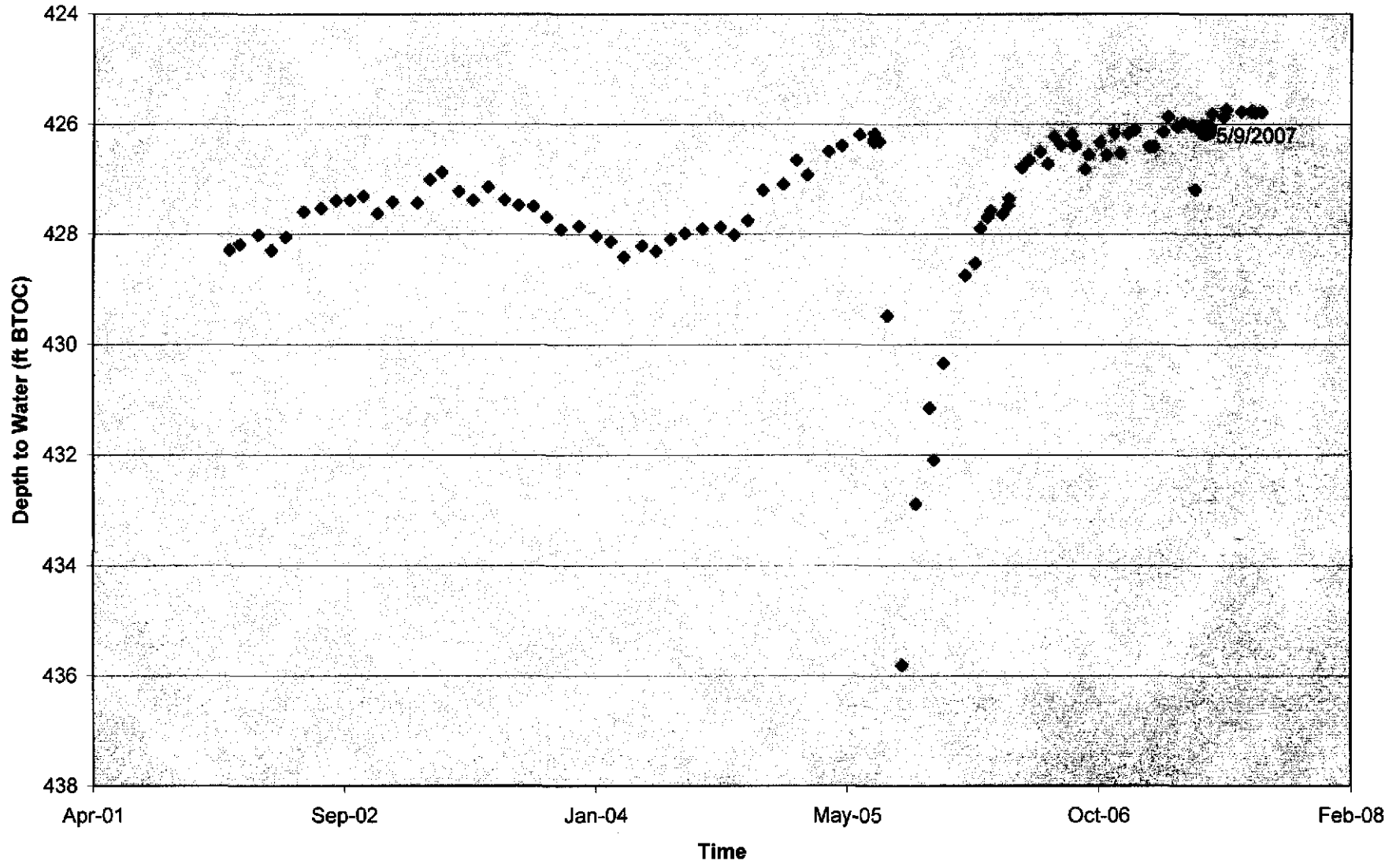
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H-17



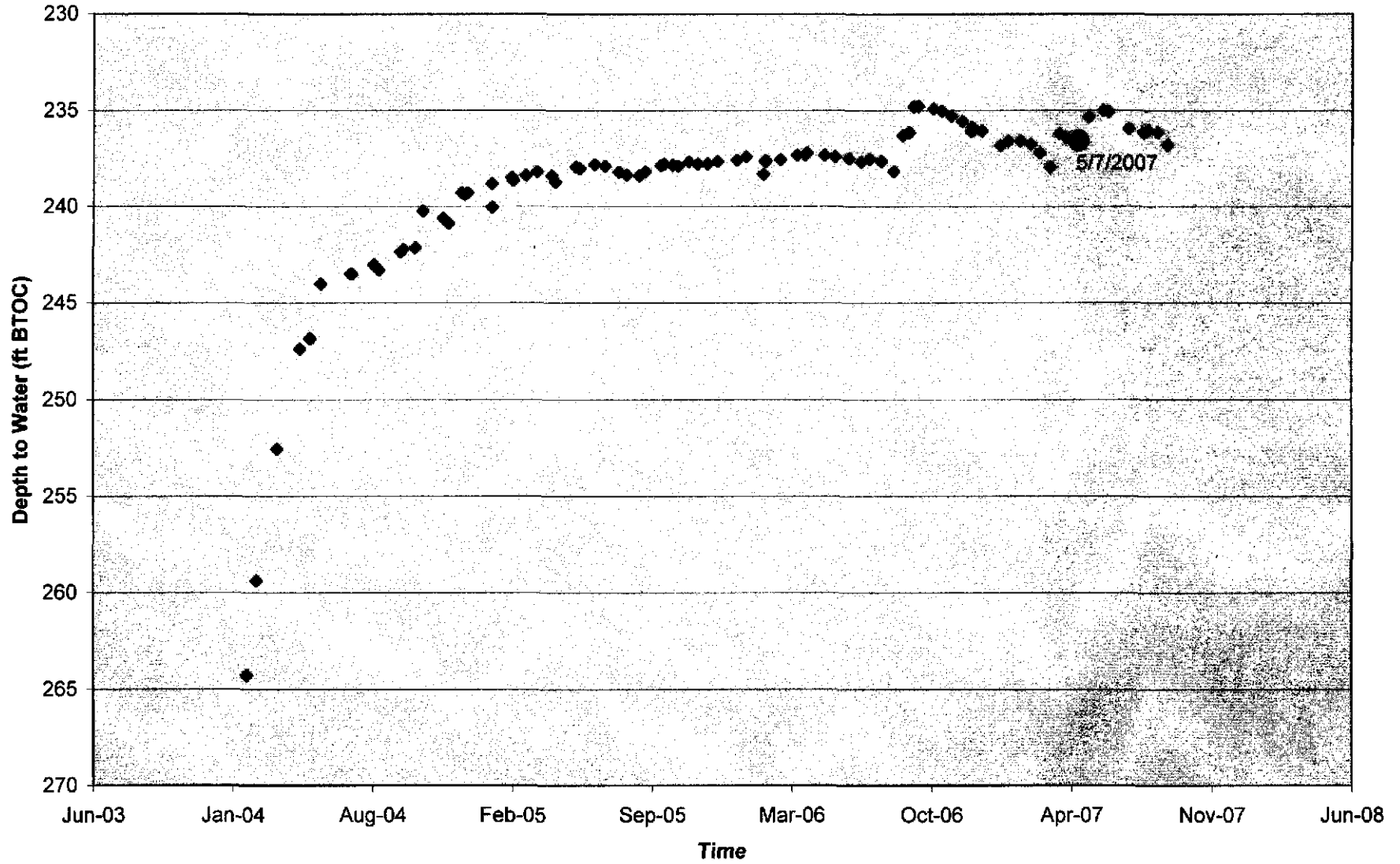
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H-19b0



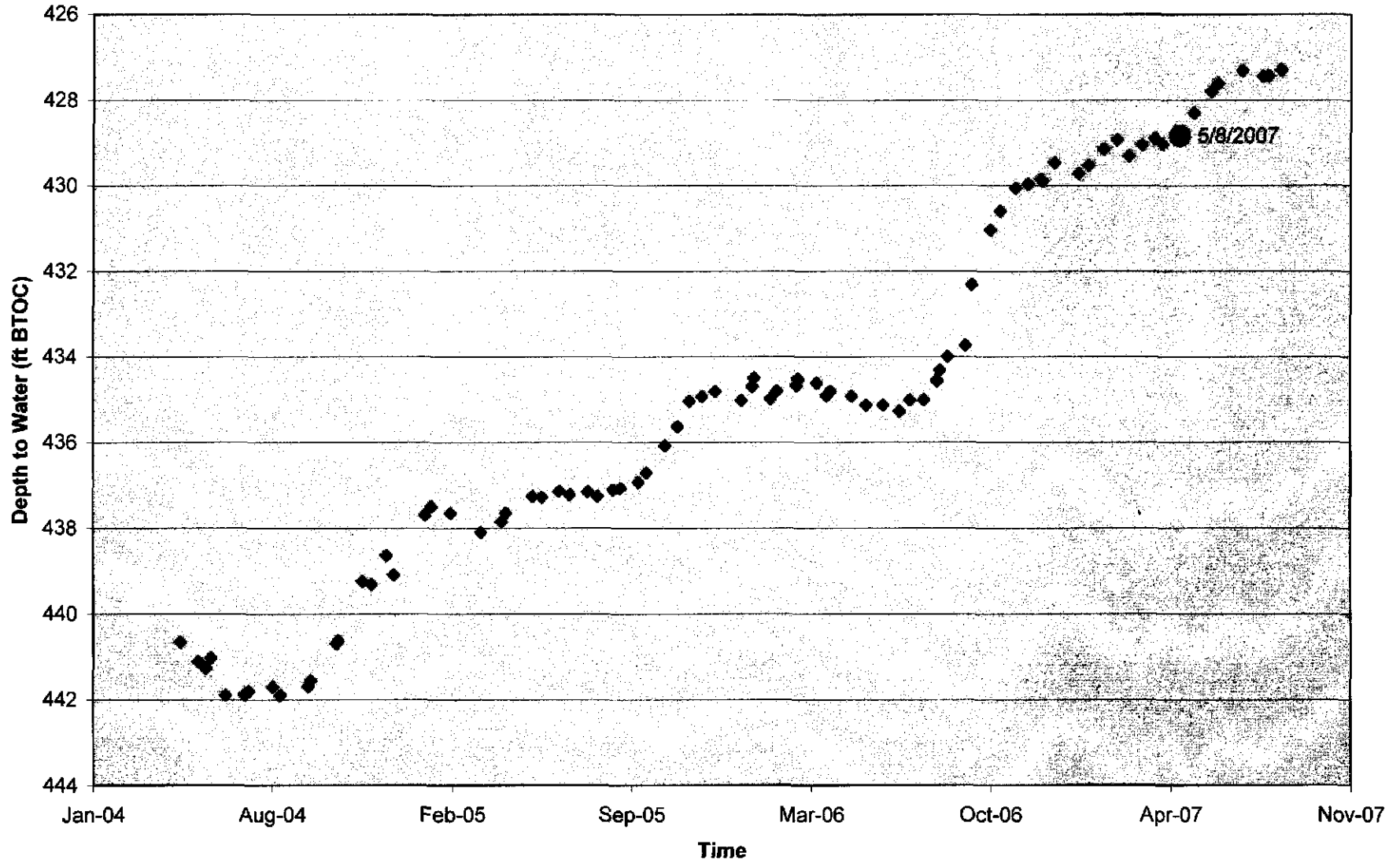
Information Only

IMC-461



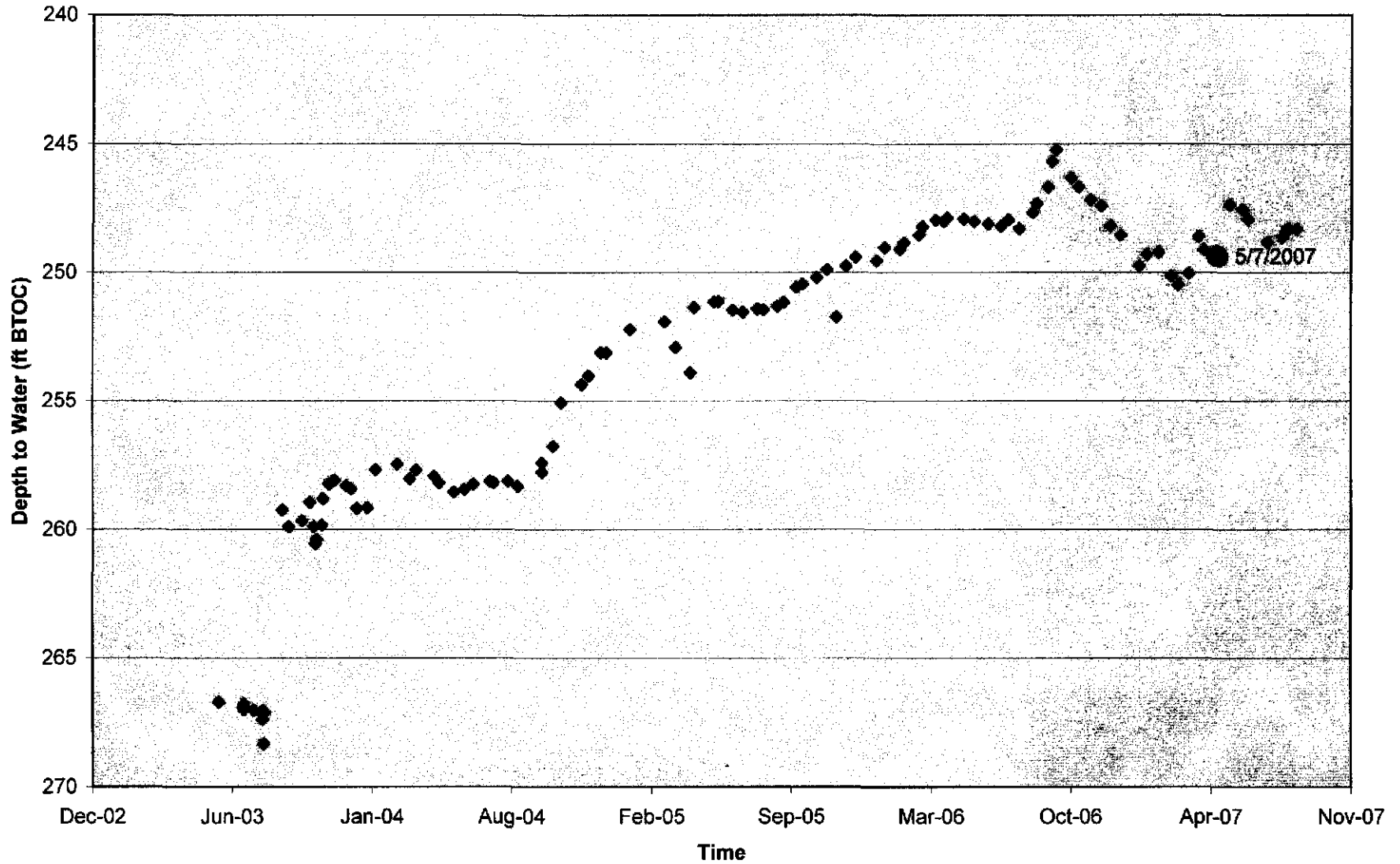
Information Only

SNL-1



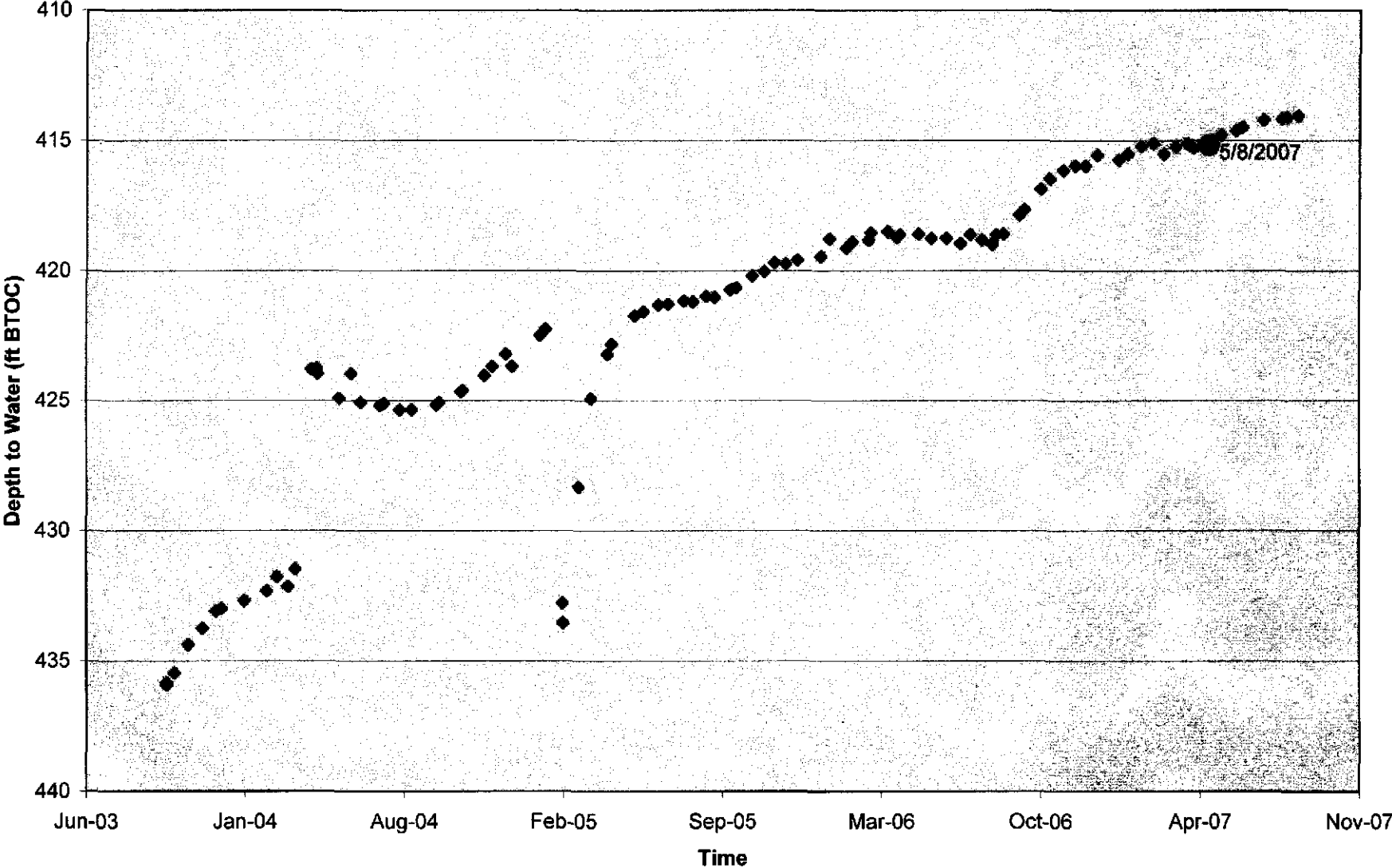
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SNL-2



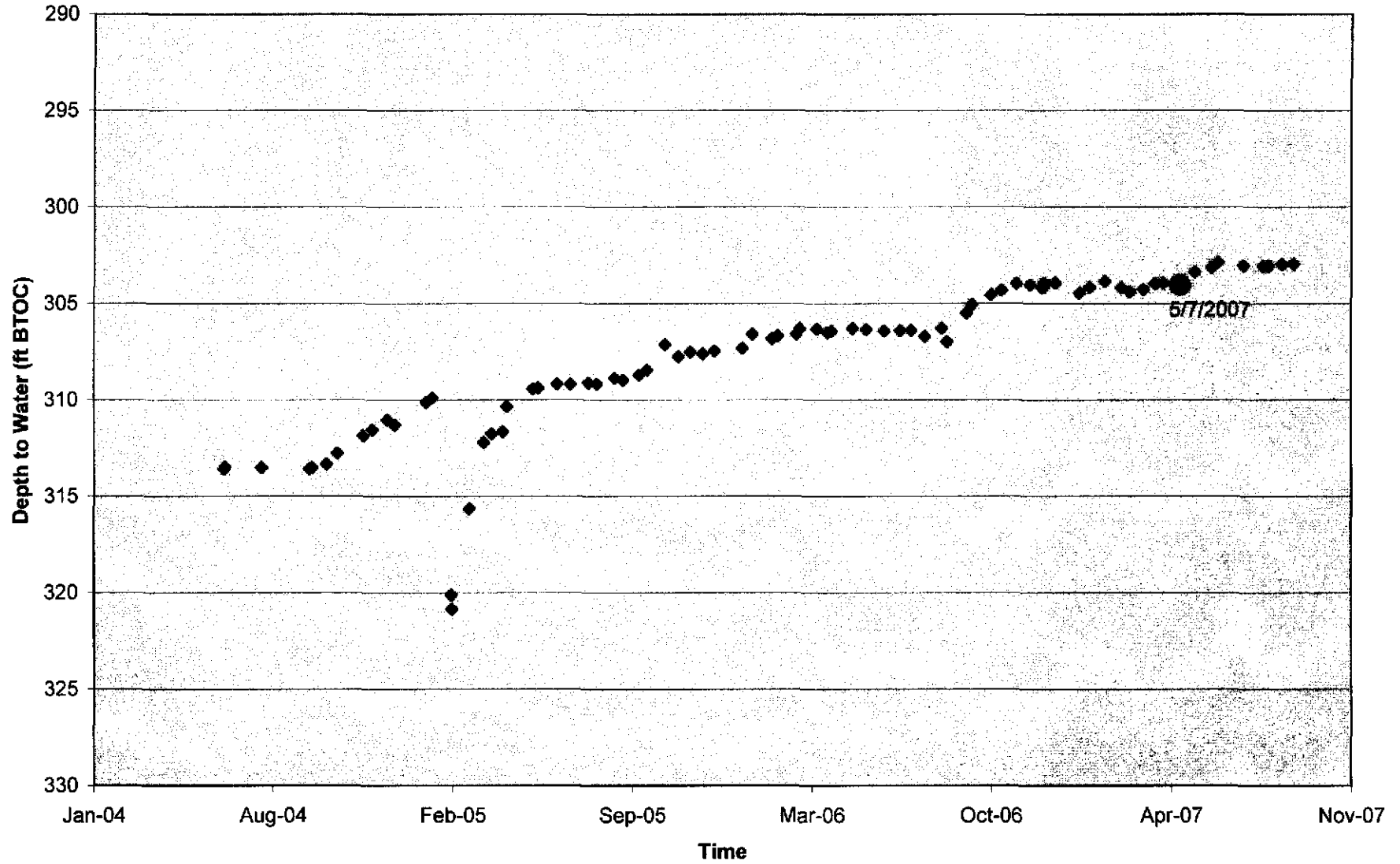
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SNL-3



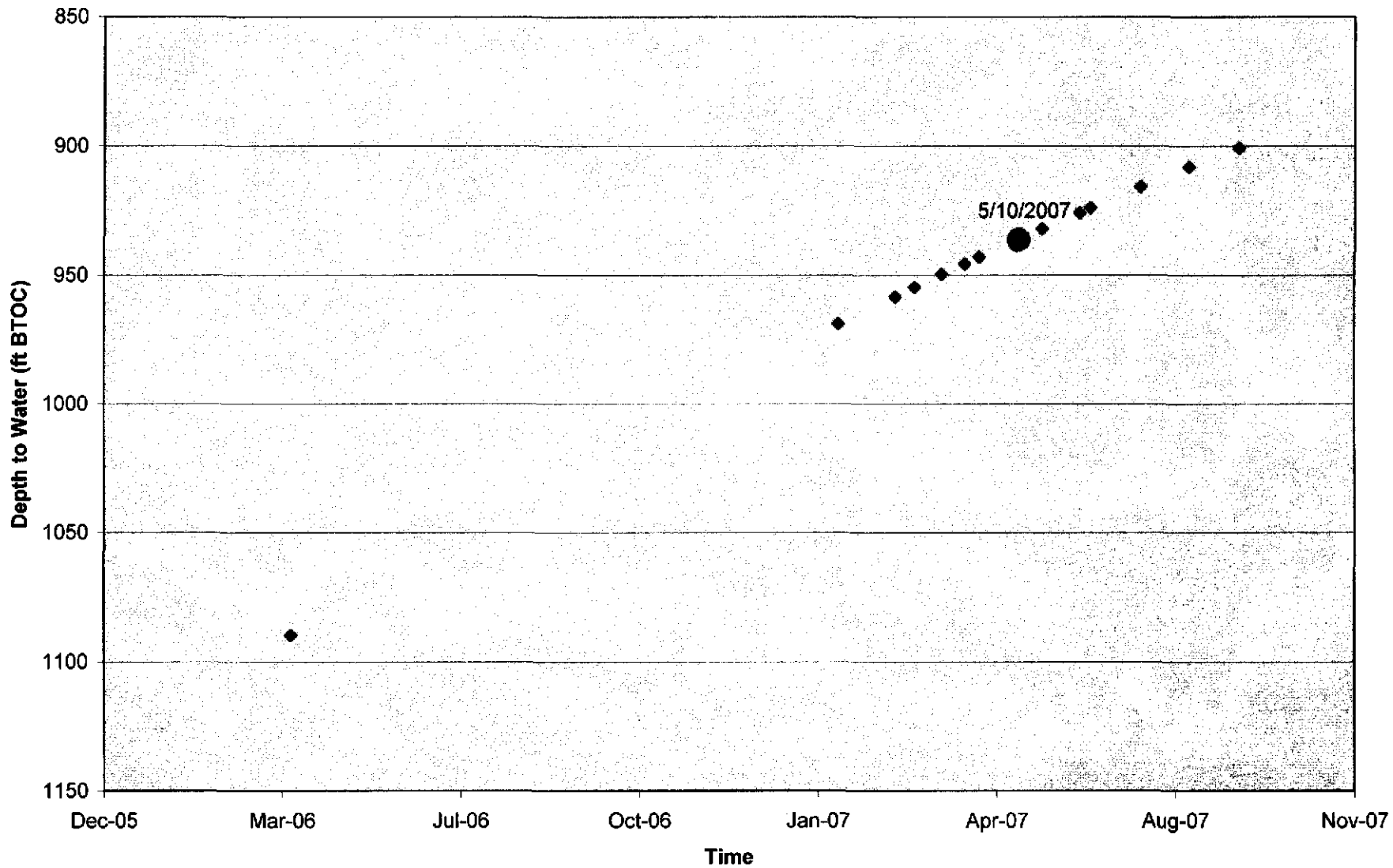
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SNL-5



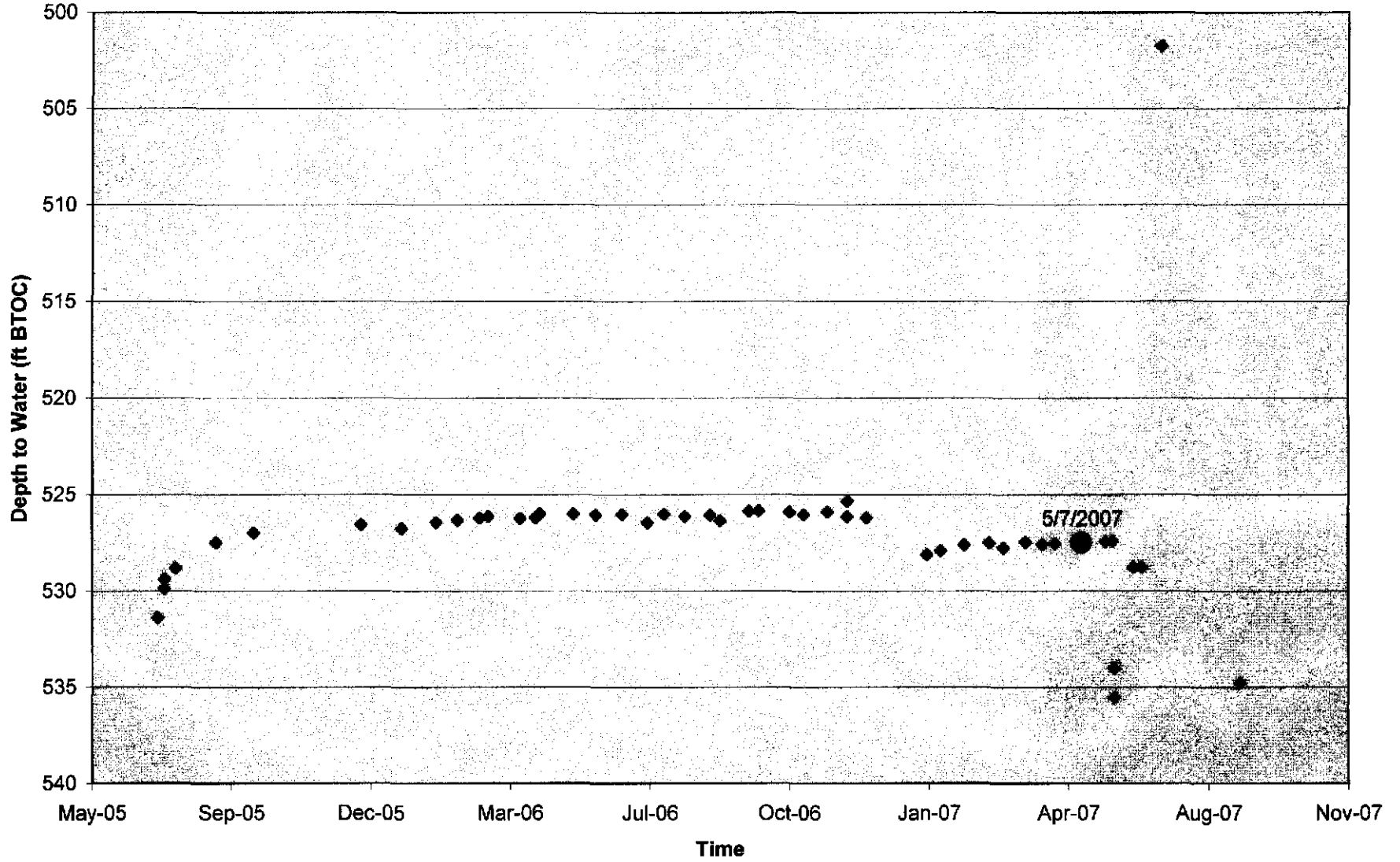
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SNL-6



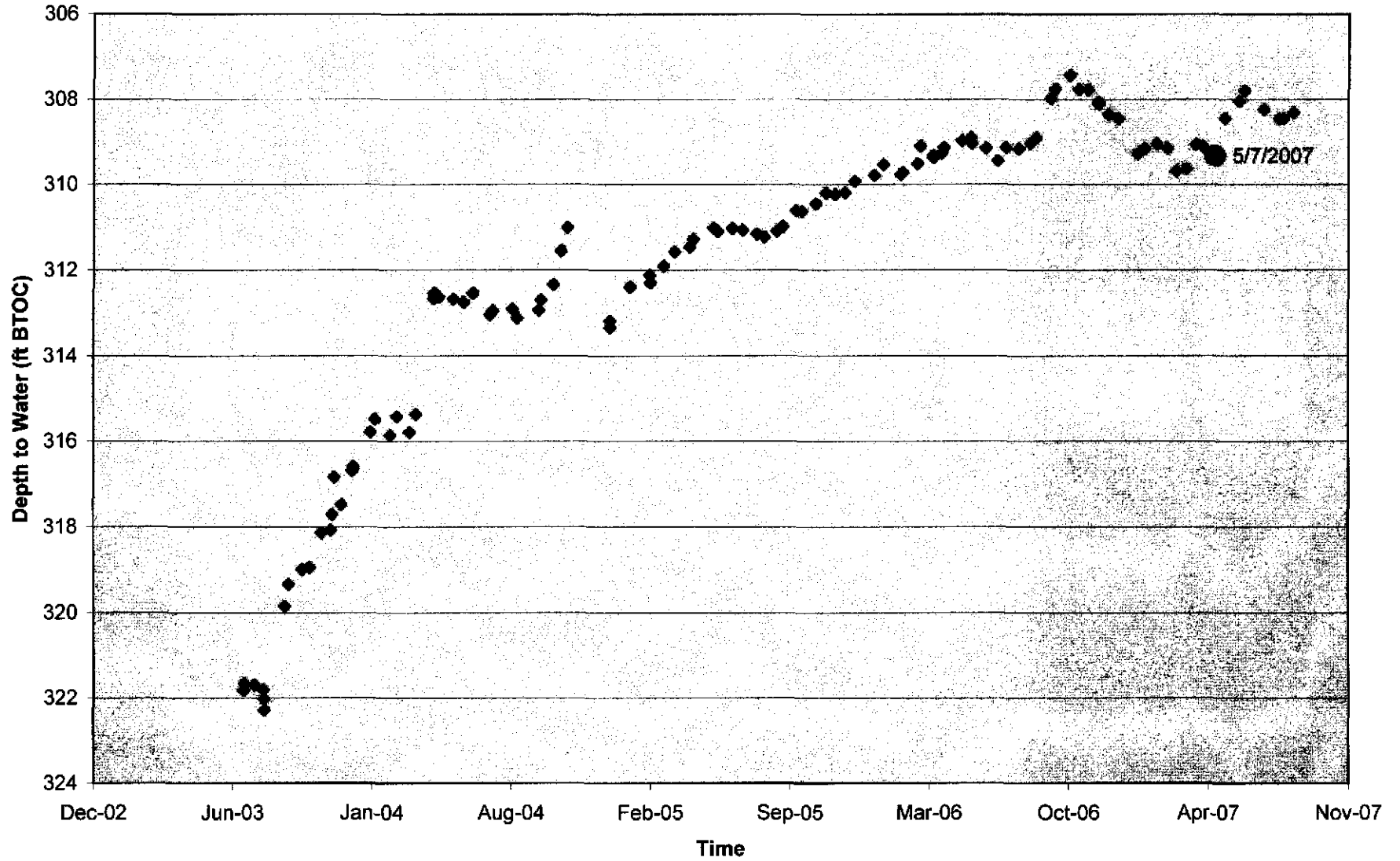
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SNL-8



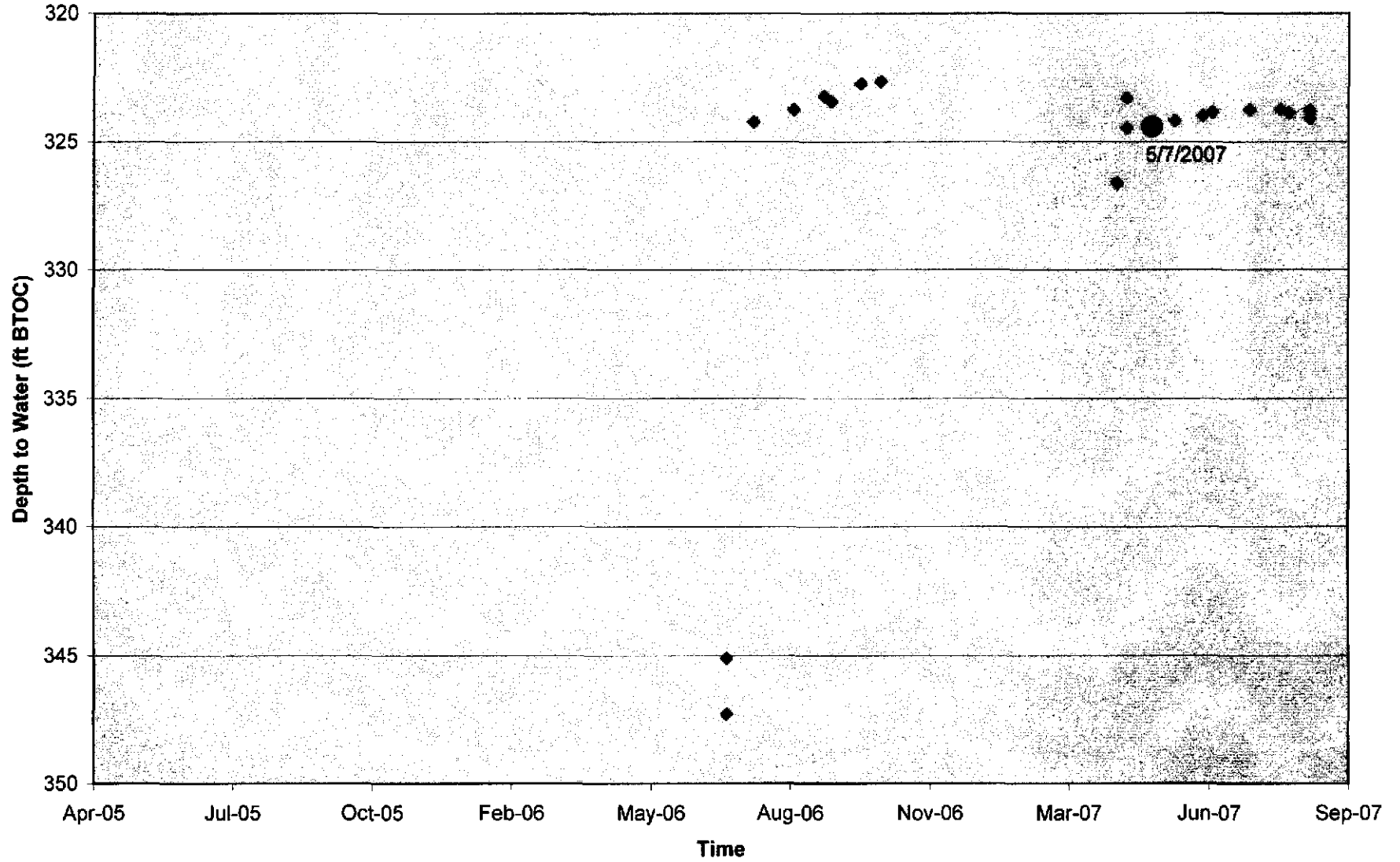
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SNL-9



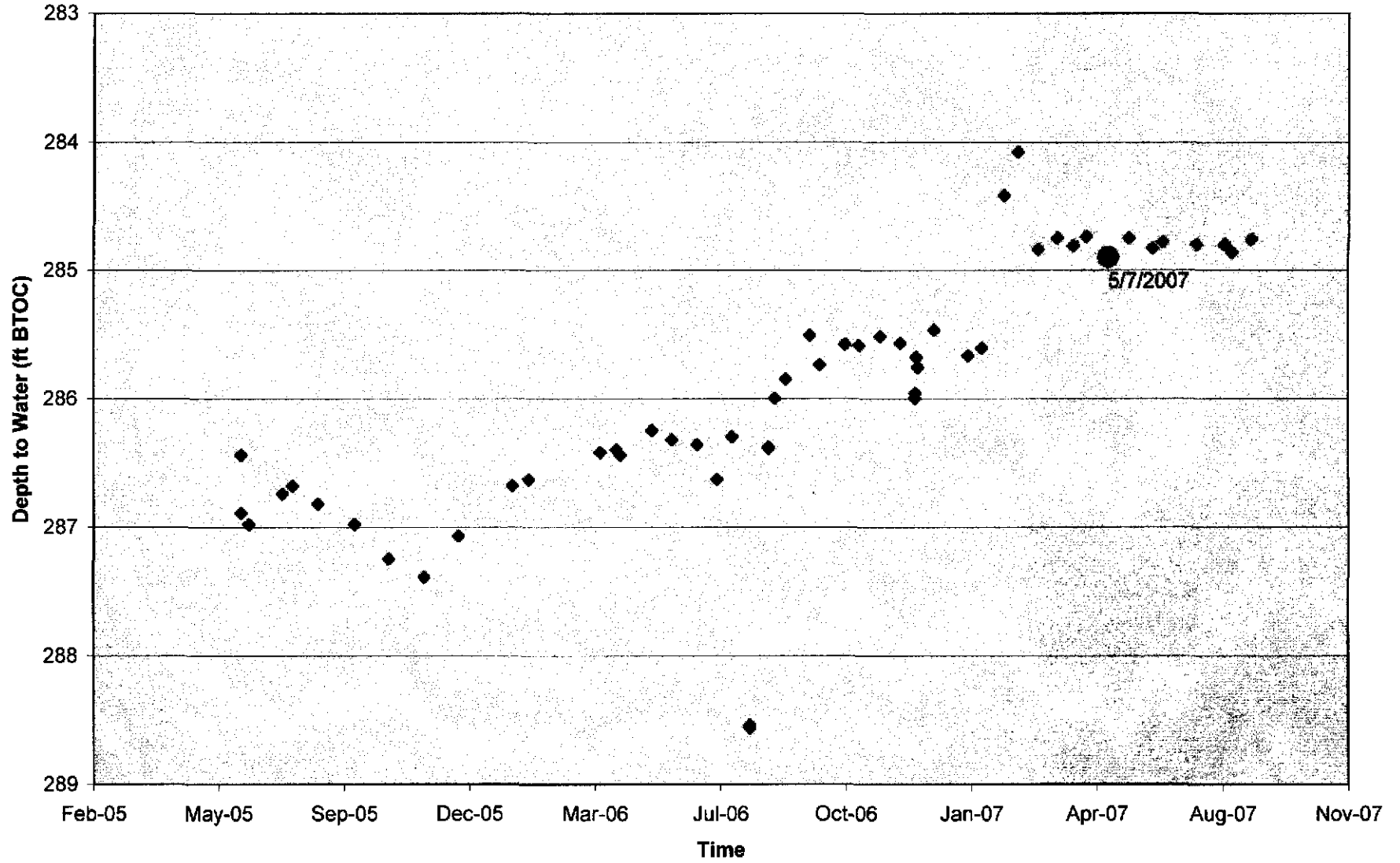
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SNL-10



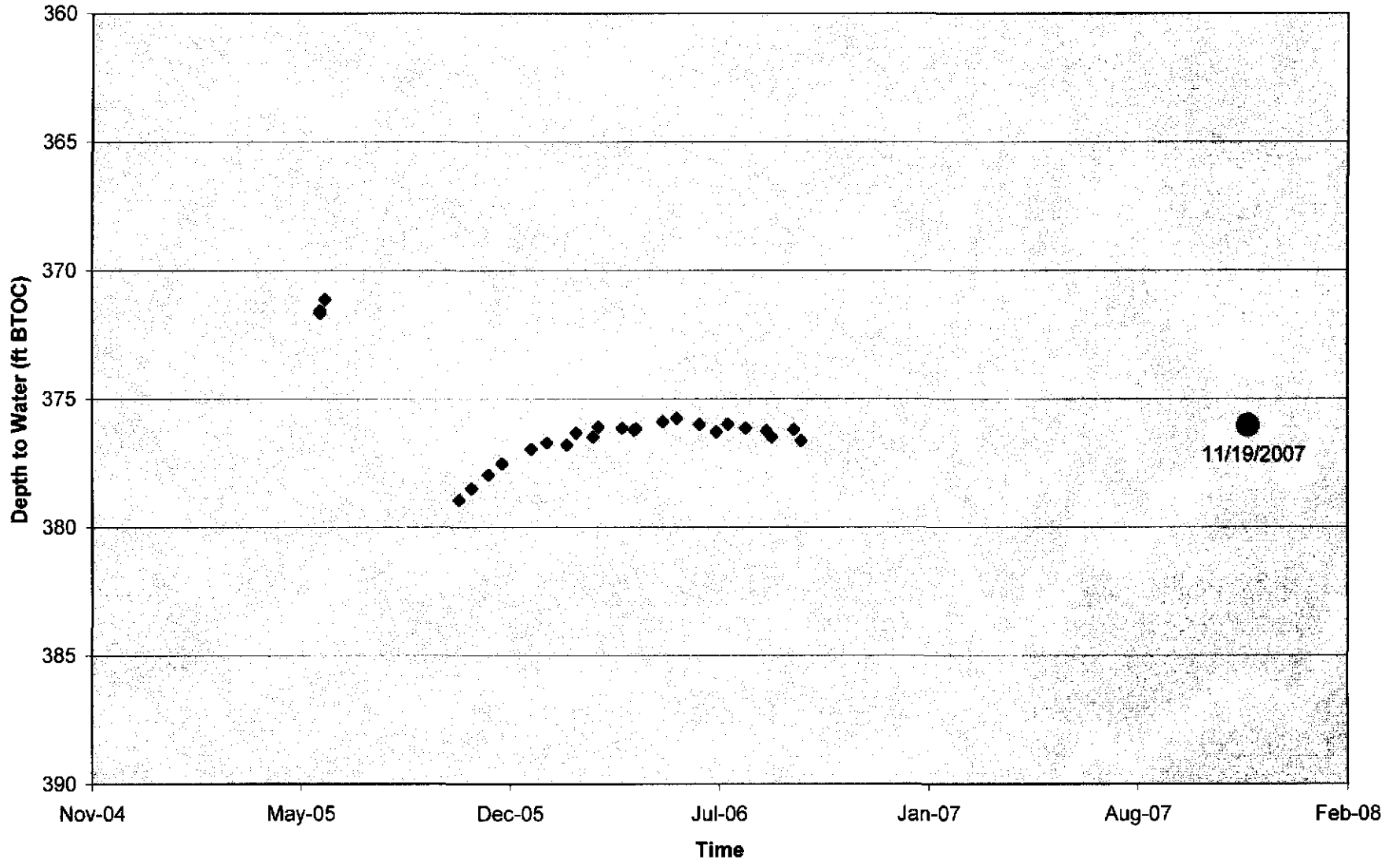
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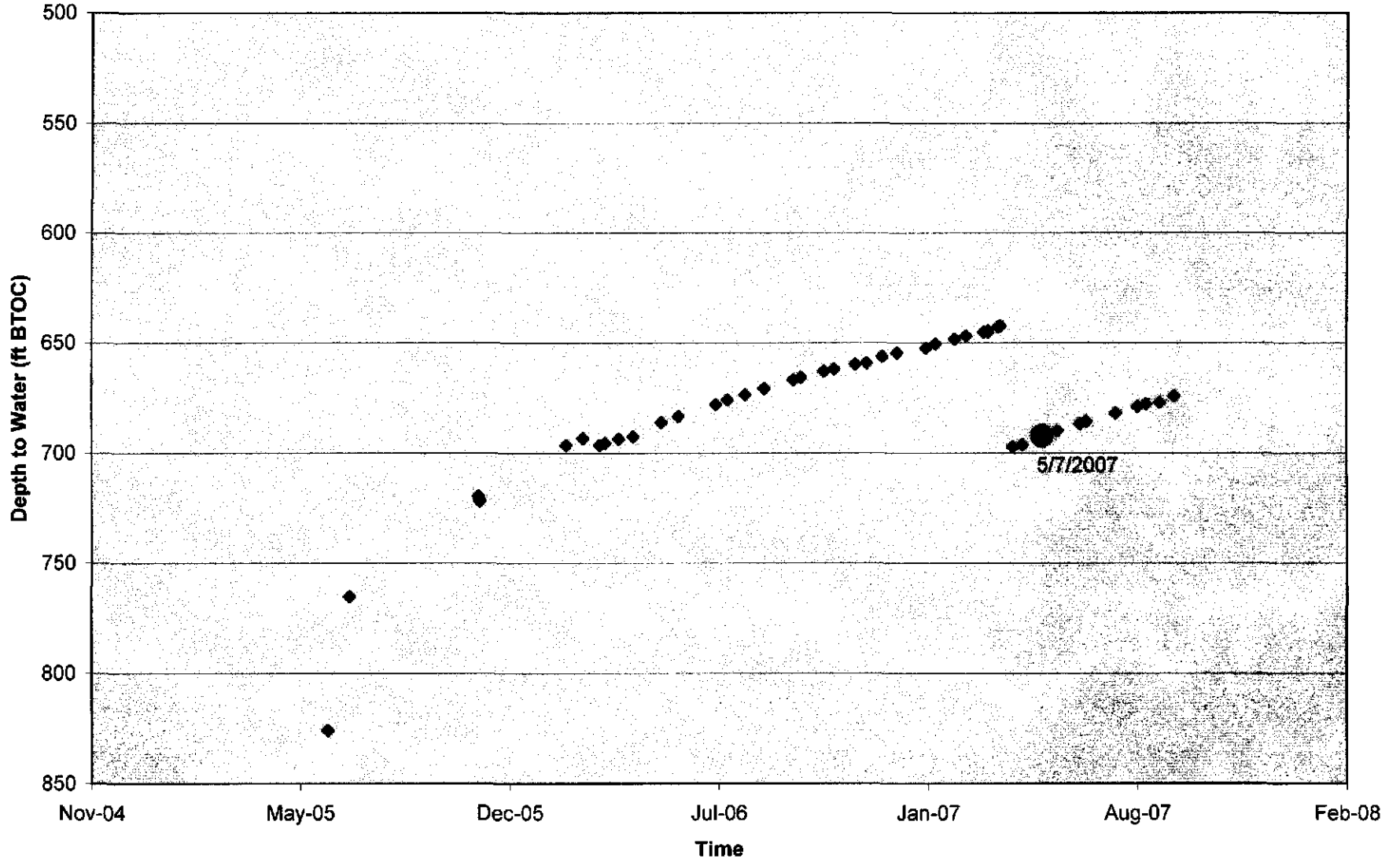
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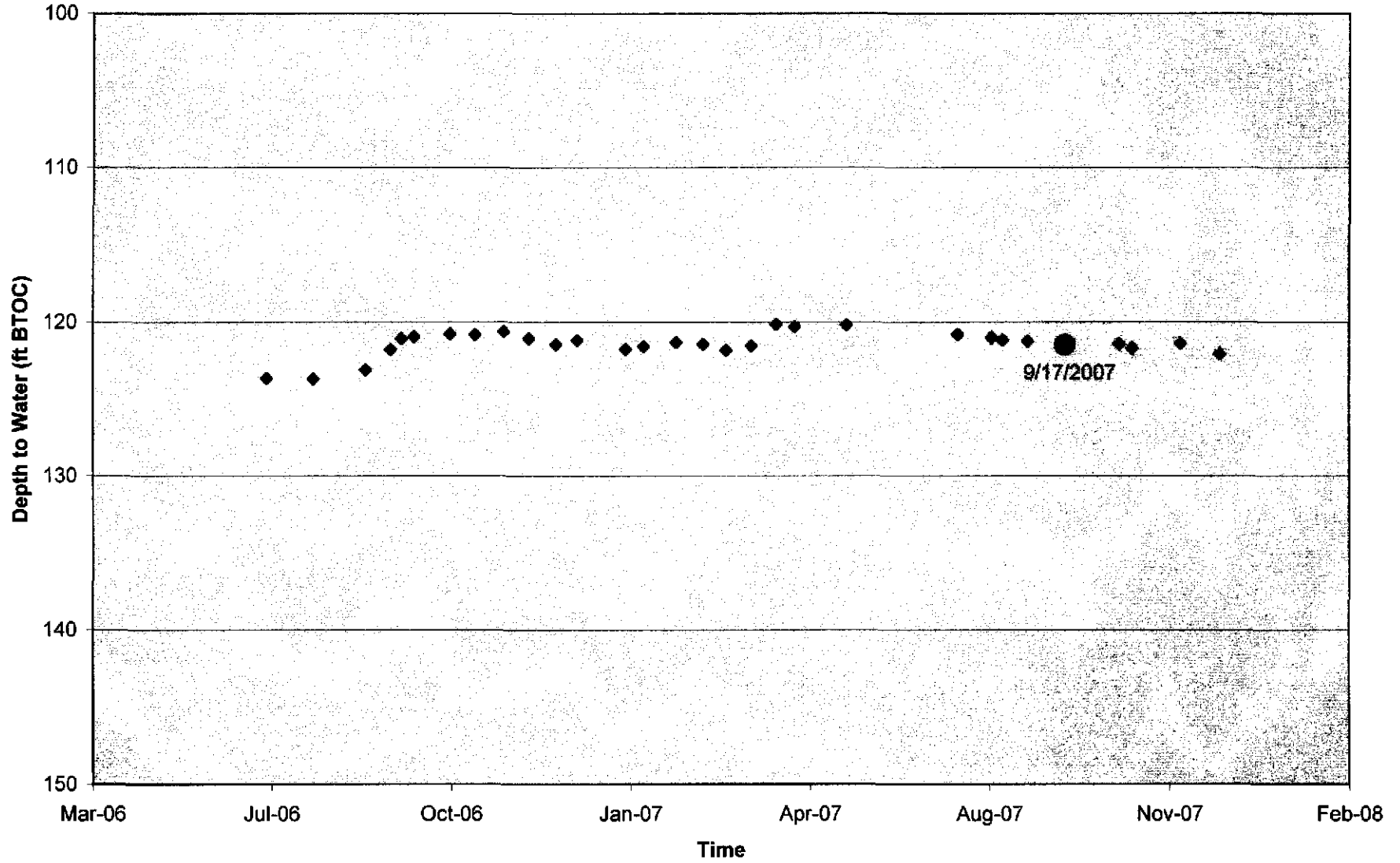
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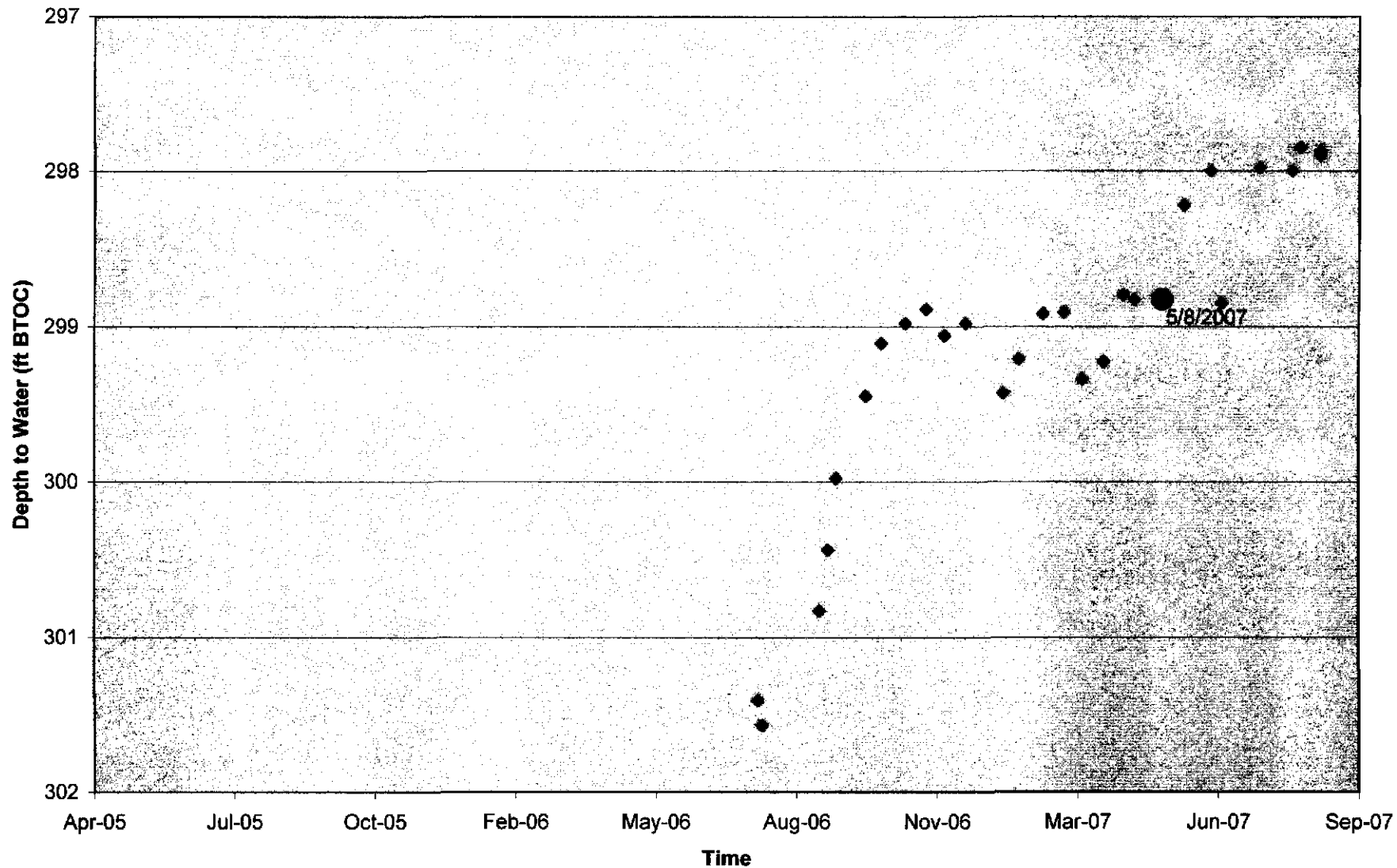
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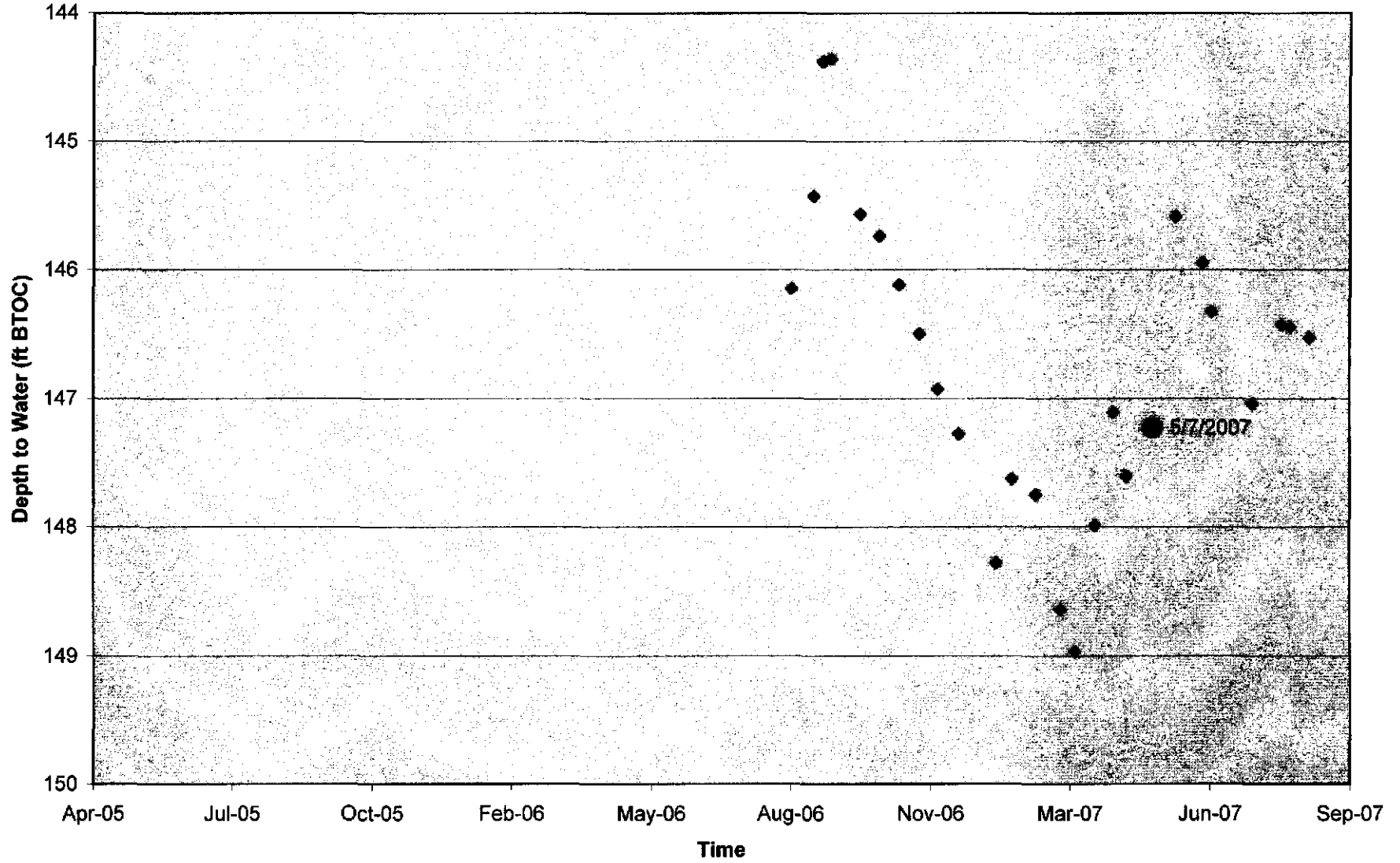
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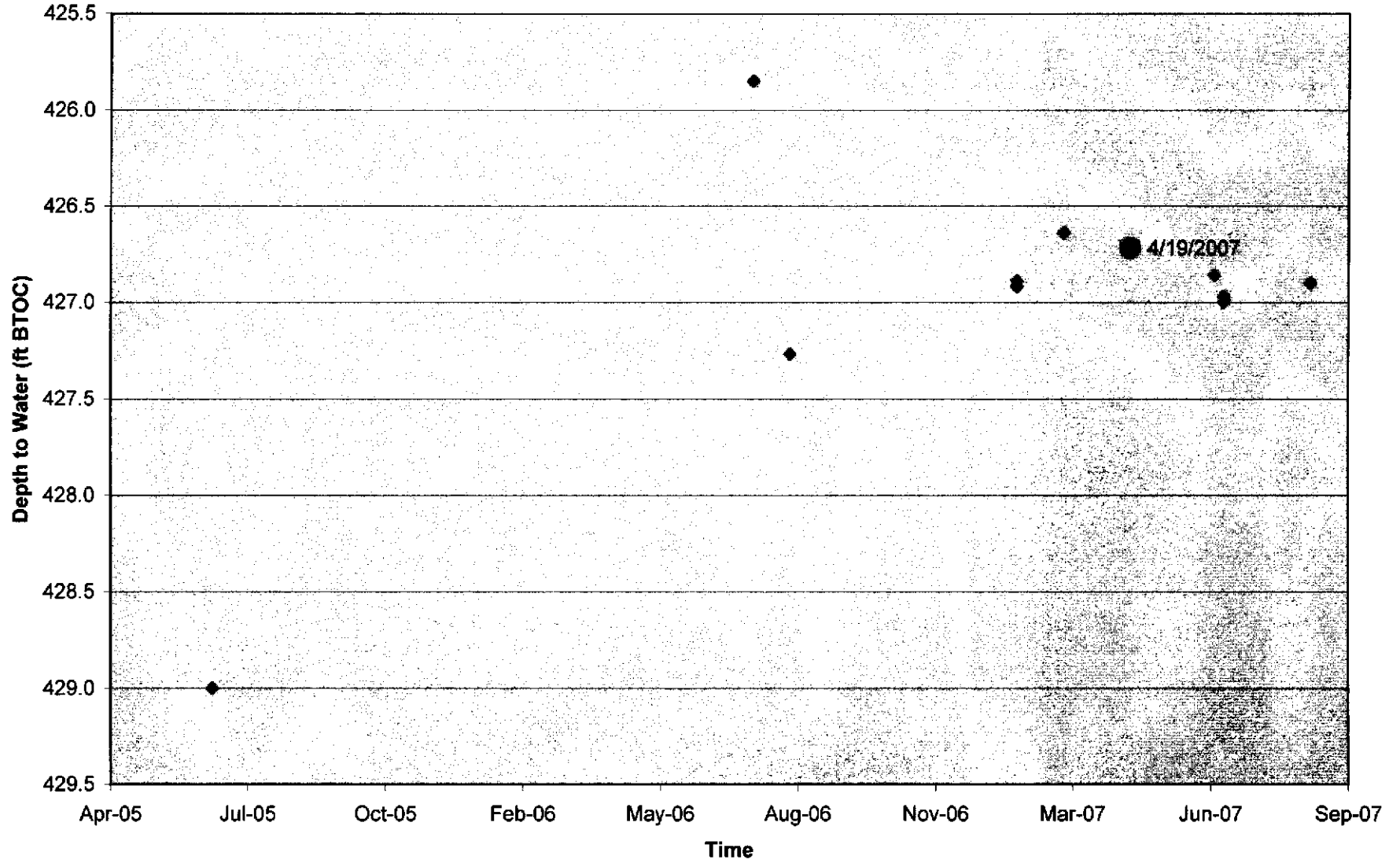
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SNL-19



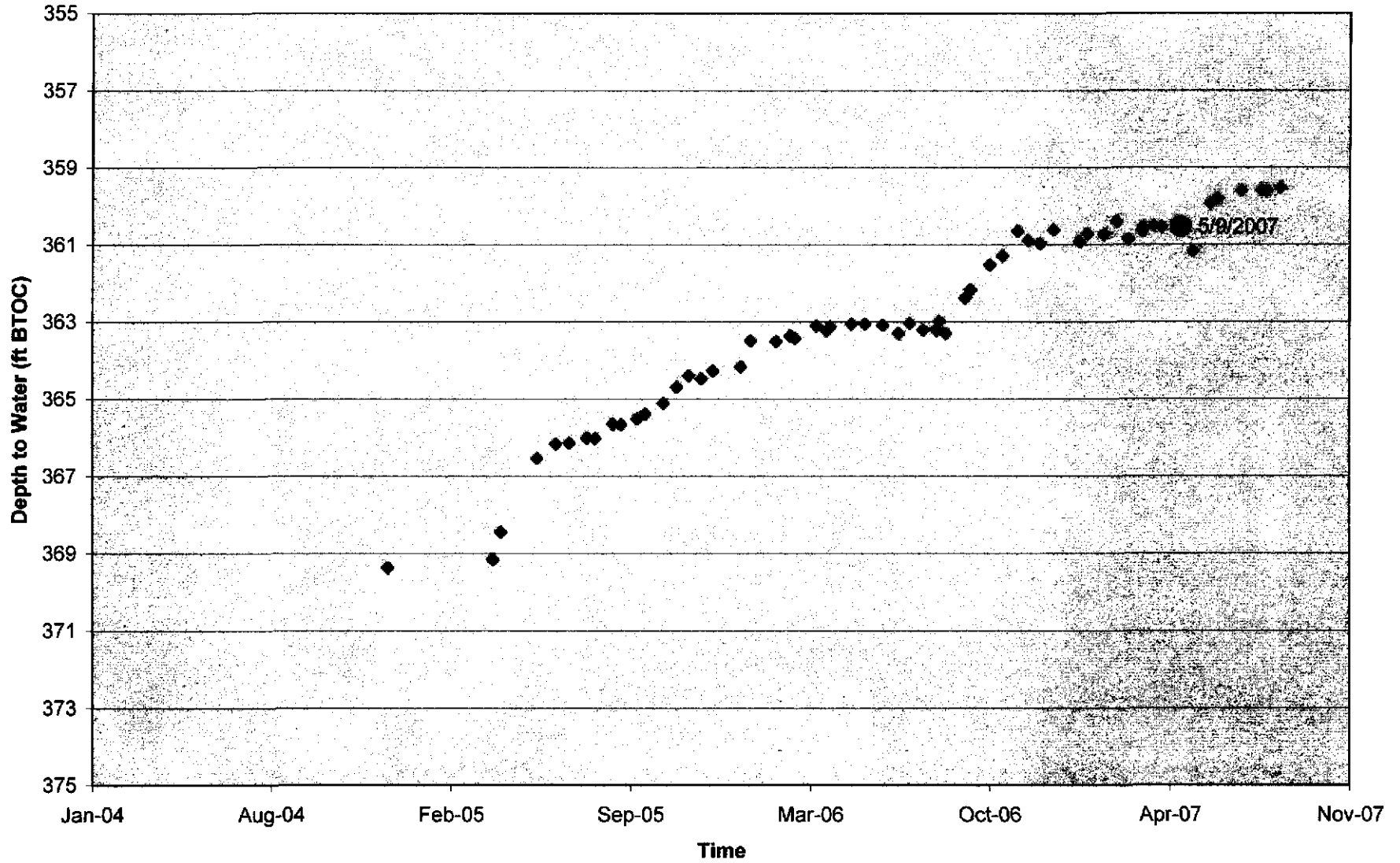
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USGS-4



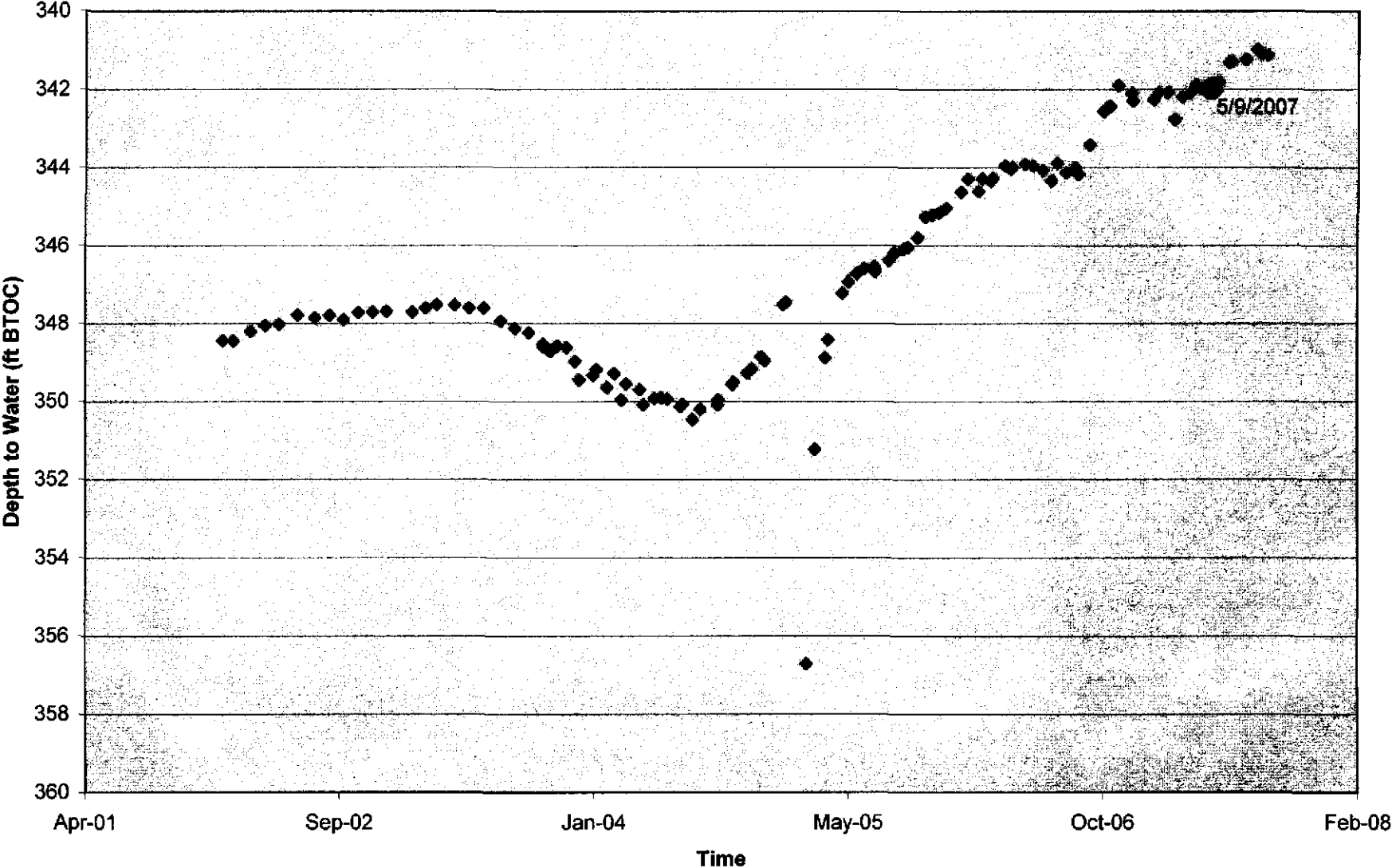
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WIPP-11



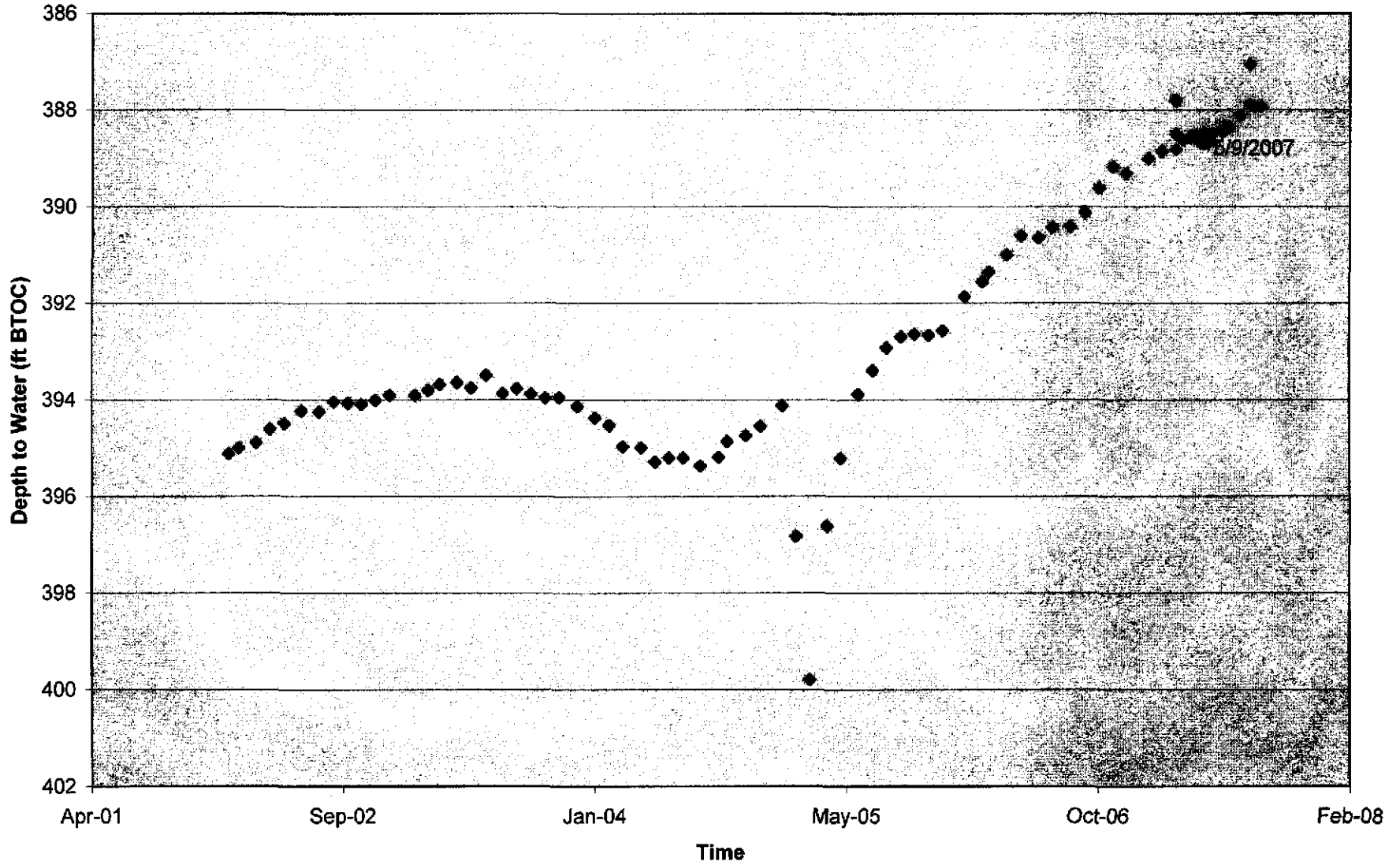
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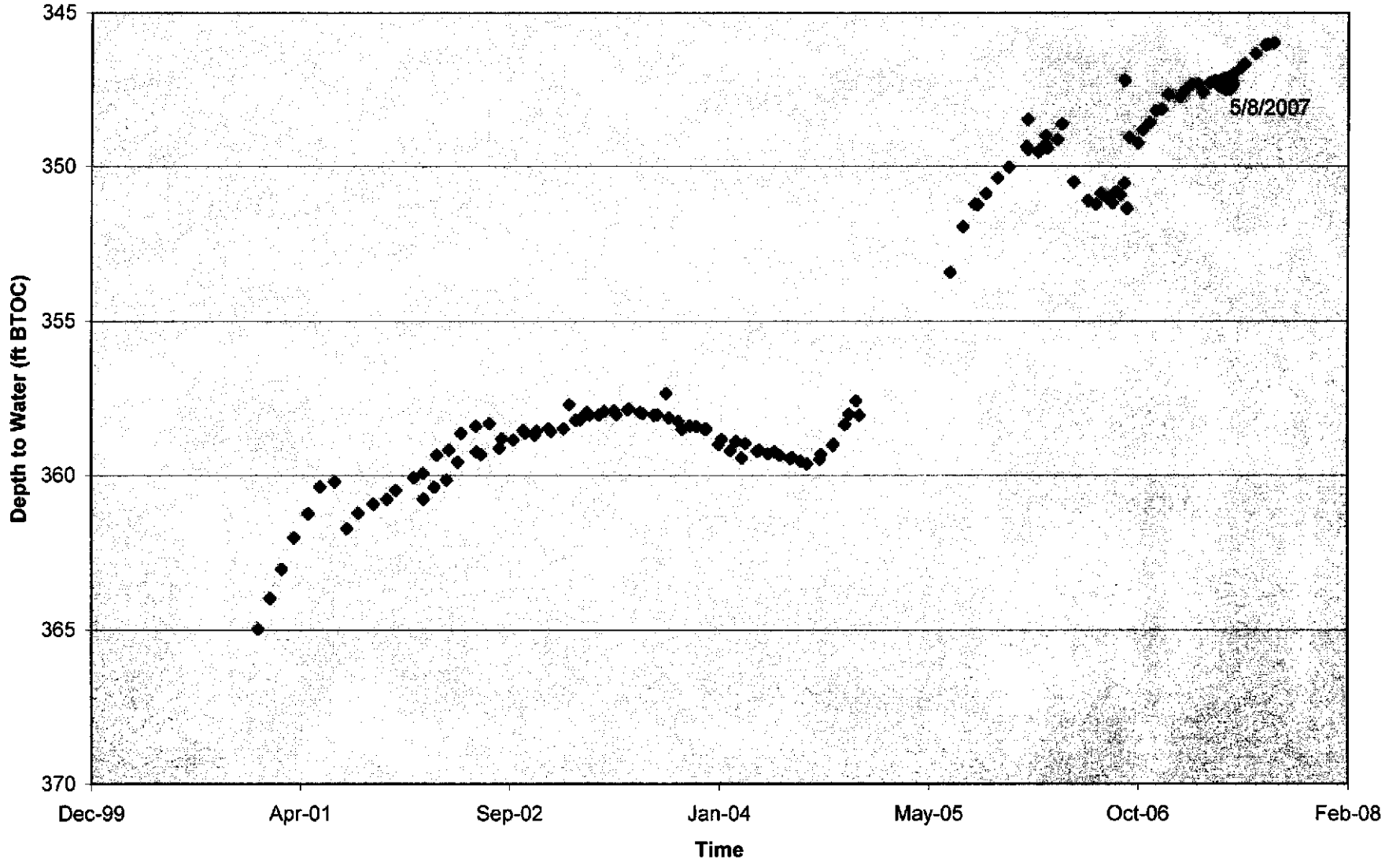
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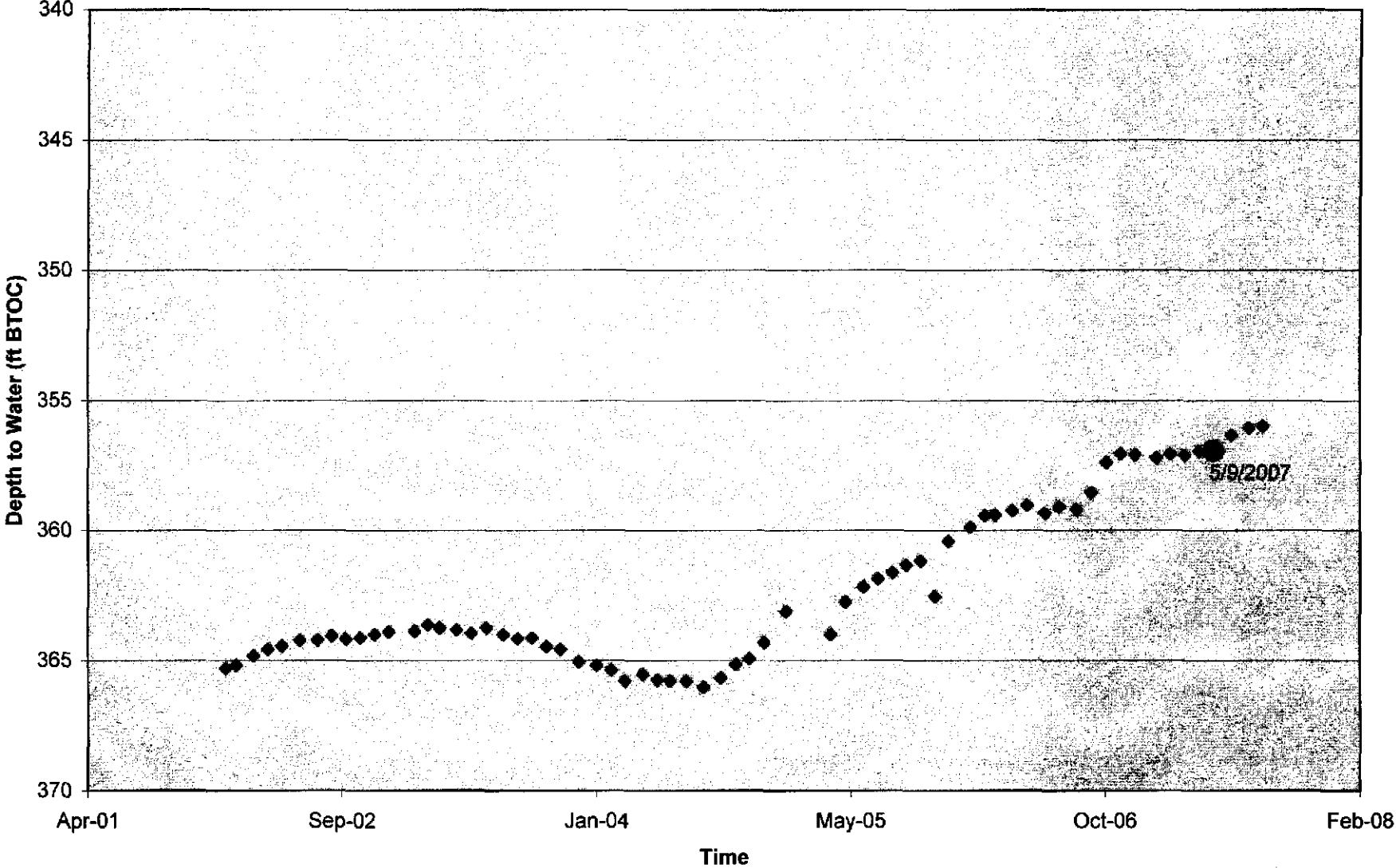
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WIPP-30



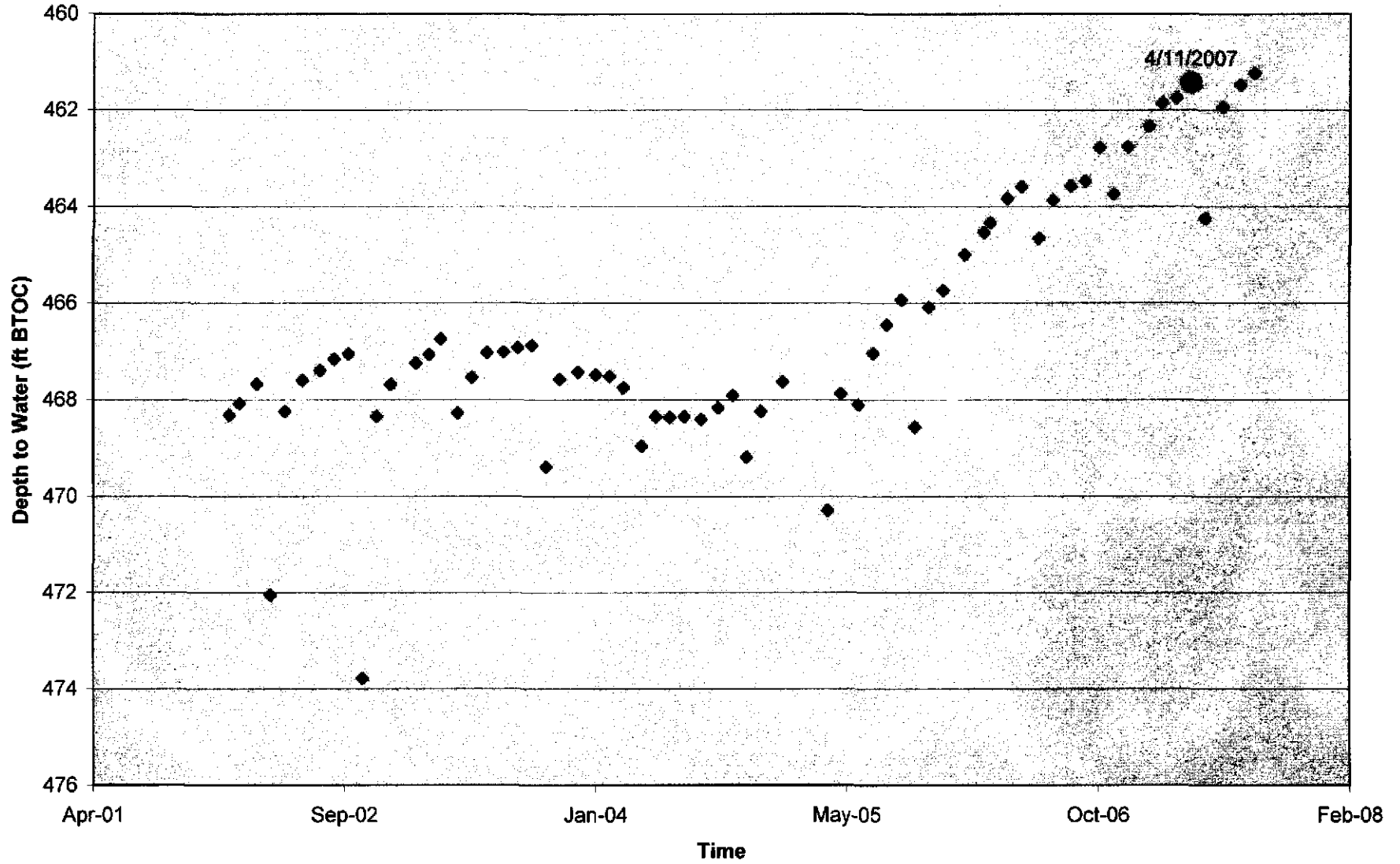
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WQSP-1

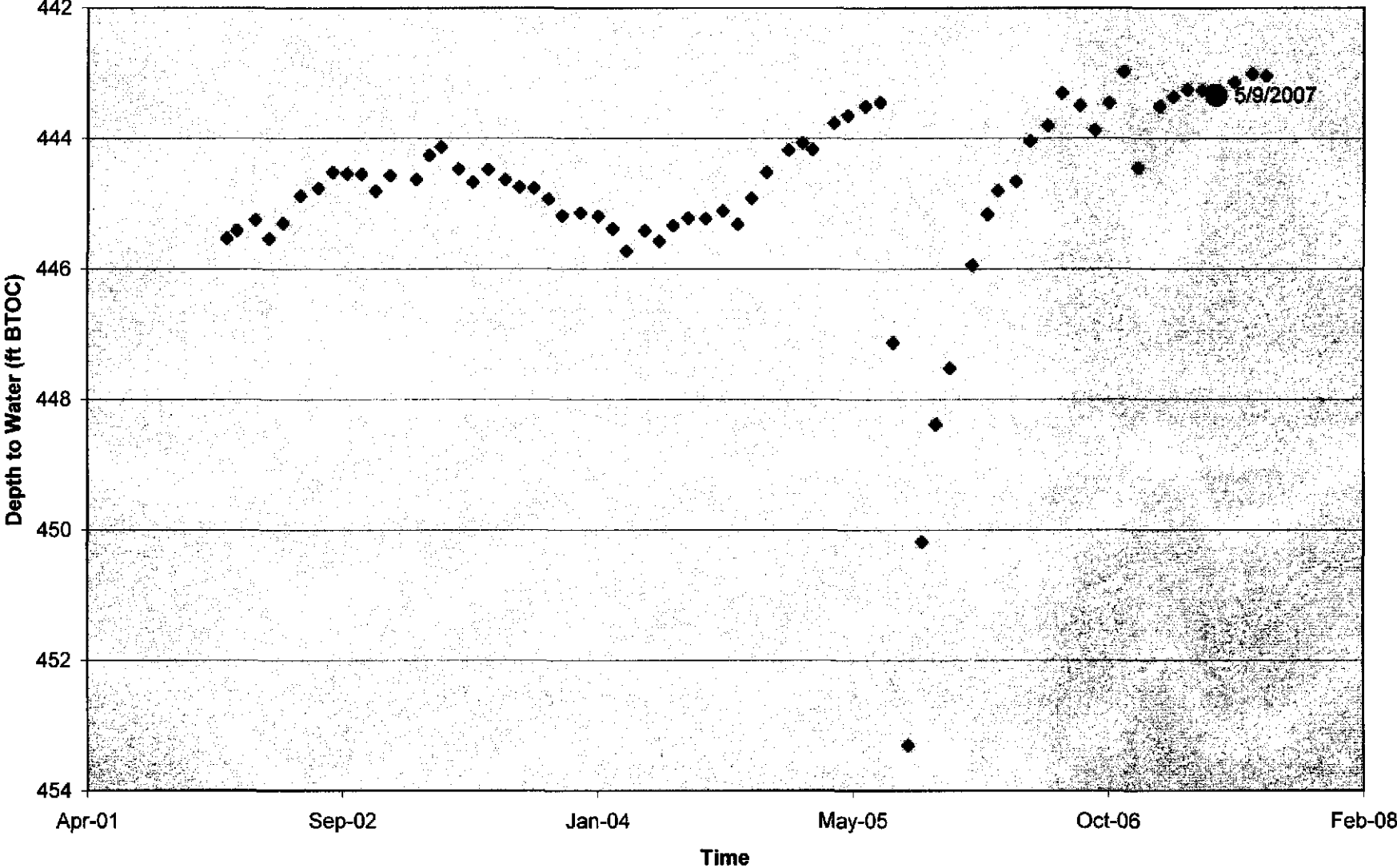


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WQSP-3

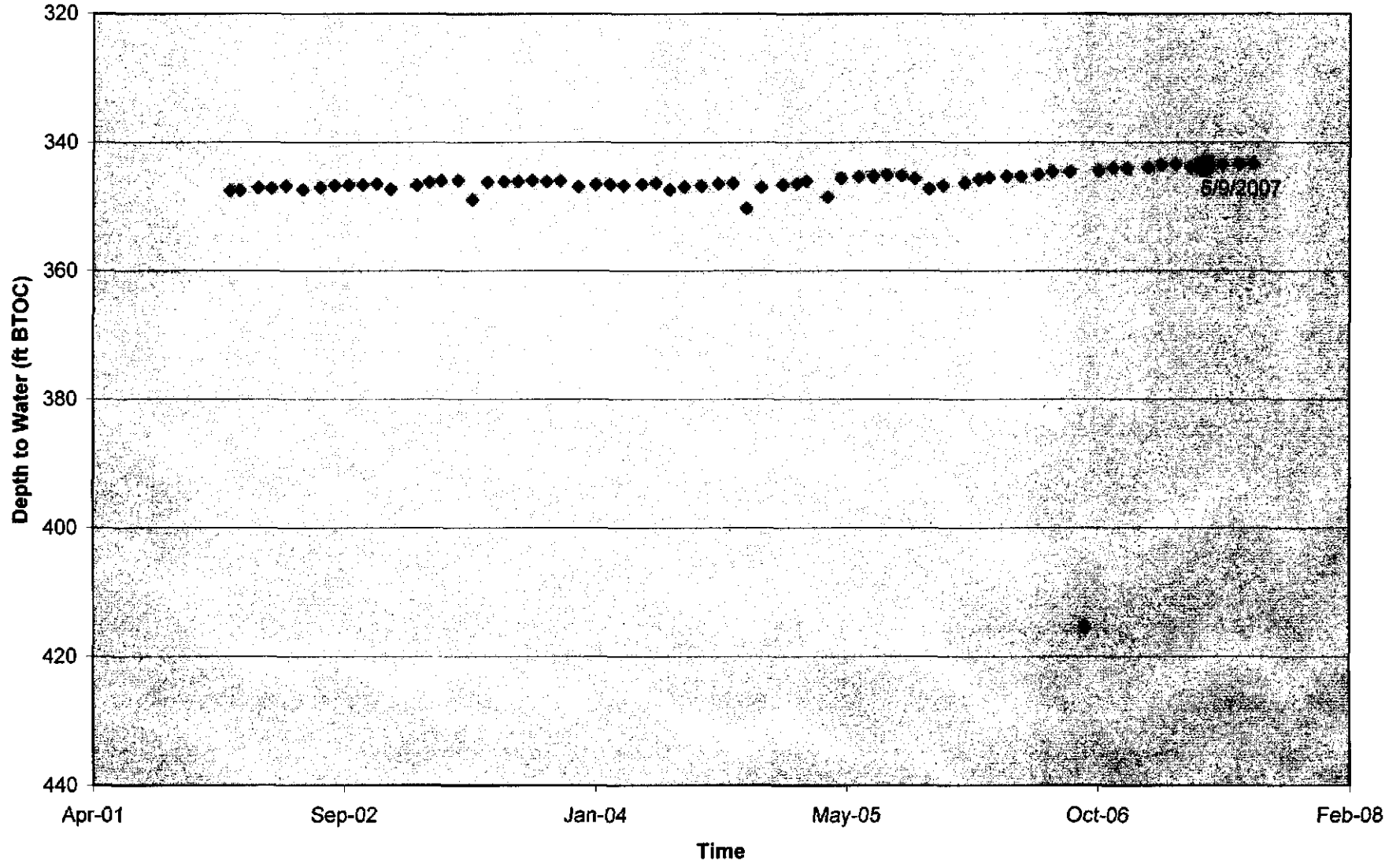


WQSP-4



Information Only

WQSP-6



Information Only