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TECHNICAL MEMORANDUM

DATE:	January 15, 2014	**PROJECT:** 605.413
TO:	Heather Gluski, Resolution Copper Mining LLC	
FROM:	Daniel Weber	
COPY:	Greg Ghidotti, Resolution Copper Mining LLC Todd Keay, Montgomery & Associates	
SUBJECT:	Well HRES-20 - Results of 90-day Aquifer Test, Resolution Copper Mining, Pinal County, Arizona	

Introduction

In accordance with a request from Ms. Heather Gluski, Resolution Copper Mining LLC (RCM), Montgomery & Associates (M&A) has prepared this Technical Memorandum to document results and analysis of a 90-day aquifer test conducted by RCM at well HRES-20 completed in the Apache Leap Tuff (ALT) aquifer.

Summary

A summary of the long-term pumping test operations and results is as follows:

1. The long-term pumping test was conducted at well HRES-20 for 90 days beginning April 2, 2013 and ending July 1, 2013. Recovery was monitored for 90 days after pumping stopped.
2. Pumping rate at HRES-20 averaged 77 gallons per minute (gpm).
3. Water level and/or hydraulic pressure response in the ALT aquifer was monitored at: pumped well HRES-20, fifteen observation wells, and one annular grouted piezometer. Distances from the pumped well range from 72 to 12,935 feet. Discernible water level drawdown due to pumping was evident in wells HRES-15, HRES-14, HRES-16, A-06, HRES-07, MJ-11, and grouted piezometer DHRES-14_1071.

4. After 90 days of pumping, water level drawdown was strongly asymmetric with a north-south orientation; largest drawdown was observed to the north of the pumped well at well HRES-14 and south to well A-06.
5. Analysis of drawdown and recovery data indicates a geometric mean of hydraulic conductivity of 0.079 meters per day (m/d) (0.26 feet per day (ft/d)); using an aquifer thickness equivalent to the depth penetrated at well HRES-15 of 983 feet, transmissivity averages about 24 square meters per day (m^2/d) (258 square feet per day (ft^2/d)).
6. Specific storage is estimated to range from 4.2E-07 to 1.5E-05 1/ft; using an aquifer thickness equivalent to the penetration at well HRES-15 of 983 feet, storativity ranges from about 4.1E-04 to 1.5E-02 (dimensionless). The smaller of these values are obtained at distant observation wells and are indicative of the elastic response of the aquifer; the larger values are obtained near the pumped well and are indicative of specific yield or drainable porosity value of the aquifer.

Background

Well HRES-20 is collared east of Devils Canyon and west of Rawhide Canyon in the Devils Canyon watershed. The well was completed on December 7, 2012. Well HRES-20 is a "partially penetrating" well that is completed in the upper 390 feet of the ALT aquifer, which is approximately 980 feet thick at this location. The locations for pumped well HRES-20, and the surrounding ALT monitor wells and piezometer used as observation wells during the test, are shown on **Figure 1**. The ALT monitor wells referred to as part of the "Test Suite" were designated prior to testing as potential wells that may show discernible water level drawdown during pumping at well HRES-20. These include twelve wells and one annular grouted piezometer, at distances ranging from 72 to 11,590 feet from well HRES-20. These locations were routinely monitored during the test period. Other ALT monitor wells on the map were monitored less frequently during testing given their significant distance from the pumped well (e.g., wells HRES-07, HRES-09, and MJ-11). RCM personnel conducted all field operations for the test; M&A provided technical input prior to and during the test, as well as data processing of water levels and analytical modeling of results.

Well construction details for the pumped well and observation wells are summarized in **Table 1**. For purposes of analytical modeling of aquifer test data, the saturated thickness of the ALT aquifer was assumed to be 983 feet, equivalent to the ALT aquifer thickness at well HRES-15 which fully penetrates the ALT aquifer.

Field Methods and Results

The test pump and discharge assembly was installed in hydrologic test well HRES-20 by Boart Longyear, of Peoria, Arizona on February 5, 2013. Well HRES-20 was equipped with a Grundfos Model 150S300-16 pump with a 30-horsepower, 460-volt, three-phase Grundfos Model MS-6000 electric motor. The pump was installed on 3-inch diameter galvanized steel column pipe with galvanized steel couplings; depth to the pump intake was 700 feet below land surface (ft/bls). The well was equipped with a 1-inch Schedule 80 PVC sounder/transducer access tube which extended from the wellhead to the top of the pump. The access tube was capped on the bottom and factory slotted in the lowermost 60 feet.

The discharge assembly included a McCrometer UltraMag digital flowmeter, a pressure gage, gate valves to adjust flow rate, and a hose bib for obtaining water samples. Best management practices were employed to manage discharge of pumped groundwater, and prevent its entry into Devils Canyon. Discharge water was dispersed using more than 2500 feet of flexible dispersion lines and sprinkler sections, resulting in zero discharge into Devils Canyon. Flow rate and water quality parameters were monitored daily in accordance with discharge authorization number AZDGP – 60821 under the Arizona Pollutant Discharge Elimination System General Permit for De Minimus Discharges to Waters of the U.S.

During testing, water levels at HRES-20 were measured and recorded using an In Situ Level TROLL integrated datalogger/pressure transducer. Pumping rate and discharge line pressure were also measured, as well as water quality parameters. Sand content of the water was measured using a 1-liter calibrated Imhoff cone. After the constant-rate test pumping period was complete, water level recovery was measured for a period equal to the pumping period.

At observation wells, water levels during the test were monitored with In Situ Level TROLL integrated datalogger/pressure transducers. At piezometer DHRES-14_1071, hydraulic pressure is measured using a Geokon pressure transducer grouted in the annulus of the well. Water levels were also measured manually using water level sounders on a regular basis at the pumped well and observations wells. Barometric pressure was monitored at several stations during the pumping test in order to correct pressure from non-vented pressure transducers and to distinguish water level stresses due to pumping from stresses caused by changes in atmospheric pressure.

The average pumping rate measurement during the test was 77 gpm. Maximum drawdown at the pumped well was 18.23 feet and occurred near the end the pumping period. Operational parameters for the HRES-20 pumping test are as follows:

Well Identifier	Date and Time Pumping Started	Duration of Pumping Period (days)	Average Pumping Rate (gpm) [a]	Pre-pumping Water Level (ft bmp) [b]	Maximum Water Level Drawdown (ft)	Specific Capacity (gpm/ft) [c]
HRES-20	02-Apr 2013 12:00	90	77	646.82	18.23	4.2

[a] gpm = gallons per minute
[b] ft bmp = feet below measuring point
[c] gpm/ft = gallons per minute per foot of drawdown

A hydrograph of water levels obtained at the pumped well is shown on **Figure 2**. The magnitude of drawdown at other wells in response to pumping are summarized in **Table 1**. Hydrographs of water levels obtained at the pumped well and observation wells during the testing period are provided in **Appendix A**. Long-term hydrographs for wells are provided in **Appendix B**.

The long-term hydrographs were used to assess possible antecedent water level trends which could mask or distort drawdown response in observation wells. The long-term hydrographs were compiled from RCM's AcQuire database for months to years prior to the start of the pumping period. Several hydrographs exhibited a well-defined antecedent water level trend prior to pumping. When judged appropriate, these trends were then used to correct water level data in order to analyze the water level data for discernible water level change due to pumping at well HRES-20. For DHRES-14_1071, a linear water level was used to approximate observed pre-test water level decline. This trend was removed to correct data during the drawdown and recovery periods.

Barometric pressure measurements obtained at various stations is included on the hydrographs. Barometric corrections were computed for a majority of the hydrographs using a Barometric Response Function technique described by Butler and others (2011). Discernible water level response at observation wells due to pumping at well HRES-20 was evident in the following wells: HRES-15, HRES-14, HRES-16, A-06, HRES-07, MJ-11, and grouted piezometer DHRES-14_1071. Drawdown at observation wells at the end of pumping ranged from 0.34 feet at HRES-07 to 8.52 feet at HRES-15 (**Table 1; Figure 2**).

Analytical Methods and Results

A semi-log drawdown and recovery graph for pumped well HRES-20 is shown on **Figure 3**, together with transmissivity estimates using the Cooper-Jacob drawdown method (Cooper and Jacob, 1946) and Theis recovery method (Theis, 1935). Shape of drawdown graph suggests delayed yield or dual-porosity type aquifer (Bourdet, 2002).

Using the analytical modeling program AQTESOLV (HydroSOLVE, 2008), a variety of diagnostic flow plots were examined to help determine a conceptual model of the flow regime at HRES-20. Diagnostic techniques and observations are tabulated below:

Graphical Representation	Diagnostic Observation	Indicated Flow Characteristic
Log s vs. log t	Derivative plateau	Infinite-acting radial flow
Log s vs. log t	Early-time unit slope in drawdown plot	Wellbore storage
Log s vs. log t	Concave upward in derivative plot during mid-time	Delayed drainage or dual-porosity
Log s vs. log $t^{1/2}$	Early-time unit slope	Infinite conductive fracture
Log s vs. log $t^{1/2}$	Late-time unit slope	Channel or strip aquifer (aquifer between two parallel no-flow boundaries)
Log s vs. log $t^{1/4}$	Early-time unit slope	Bilinear flow (finite conductive fracture in infinite slab reservoir)
Log s vs. log $t^{1/4}$	Late-time unit slope	Bilinear flow (channel or strip aquifer with leakage from boundaries)
s vs. log t	Constant slope at late time	Infinite-acting radial flow (Cooper-Jacob)

s = drawdown
t = time elapsed since start of pumping

Figure 4 shows a diagnostic plot of the logarithmic drawdown (s) and the derivative of drawdown ($\delta s/\delta \log t$) as a function of logarithmic time elapsed since the beginning of the test (t) for pumped well HRES-20. The well response is dominated by wellbore storage for the first several minutes of the pumping period. Between approximately 50 and 500 minutes the drawdown trend flattens and there is a valley in the derivative plot. This behavior is consistent with delayed gravity response of an unconfined aquifer or with dual-porosity response of a fractured rock aquifer containing fracture and matrix permeability (Renard and others, 2008). Appropriate analytical techniques include Neuman (1974) and Moench (1997) delayed response methods, and Moench (1984 and 1988) dual-porosity method. All three of these techniques were compared during preliminary analysis.

Figure 5 shows a similar diagnostic plot for nearby observation well HRES-15. The derivative plateau at intermediate time indicates infinite-acting radial flow; at late-time the drawdown and derivative curves attain 1:2 slope indicative of linear flow in a channel or bounded aquifer. Accurate analysis of flow plots and drawdown derivatives for the other observation wells at much larger distances from the pumped well requires a much longer duration of pumping, but generally the plots follow infinite acting radial flow characteristics.

The Moench (1984) dual-porosity model gave the best fit to the pumped well and nearby observation well response. The analytical method accounts for unsteady flow to a well with wellbore storage and wellbore skin in a fractured-rock aquifer assuming slab or

spherical matrix blocks and fracture skin. It includes partially penetrating wells and anisotropy based on the solution by Dougherty and Babu (1984). The solution also includes delayed response in an observation well based on the work of Moench (1997).

Parameters and units used in the Moench (1984) solution include the following:

- Hydraulic Conductivity of fractures and rock matrix (K and K') in m/d
- Specific Storage of fractures and rockmatrix (Ss and Ss') in $feet^{-1}$
- Aquifer Thickness (b) in feet; set to 983 feet, equivalent to the thickness of the ALT aquifer at well HRES-15
- Thickness of slab blocks or diameter of spherical blocks in feet
- Well radius and casing radius, r(w) and r(c), in feet
- Fitting parameters for wellbore and fracture skin (Sf and Sw); dimensionless
- Fitting parameters for spherical block diameter, in feet; set equivalent to 1 foot

For analysis of HRES-20 aquifer test data, all parameters were held constant for all analyses except for K, K', Ss, and Ss'. Constant parameters were set as follows:

- For pumped well and all observation wells, well radius r(w) was set identical to drilled borehole radius.

- For pumped well HRES-20, well radius r(w) was allowed to vary larger than drilled diameter. This was done to allow better match of early time drawdown and drawdown derivative data, which are strongly influenced by wellbore storage. The improved match using a larger radius for the pumped well is commonly observed in fractured rock aquifers and may indicate the presence of open fractures of limited volume that are in good hydraulic communication with the pumped well. For all observation wells, casing radius r(c) was set identical to installed casing radius.

- For pumped well and all observation wells, the fitting parameter for wellbore and fracture skin was allowed to vary to improve matches to type curves.

Log-log drawdown and recovery graphs for the pumped well and each analyzed observation well and piezometer are shown on **Figures 4 through 11**. Hydraulic parameters derived from the 90-day aquifer test at HRES-20 are summarized in **Table 2**. In addition to showing dual-porosity graphical analysis (Moench, 1984), the graphs and tabulations include semi-log analysis of late time drawdown and recovery for the pumped well (Cooper and Jacob, 1946; Theis, 1935), as well as log-log analysis of drawdown and recovery for distant wells (Theis, 1935).

Conclusions

Maximum drawdown at the pumped well and observation wells is shown on **Figure 1**. Drawdown response is strongly N-S asymmetric following the pattern of faulting along Devils Canyon. The lack of observed response at observation wells E-W indicates the presence of hydraulic boundaries or a change in aquifer parameters. A bounded or channel aquifer response is apparent in the diagnostic flow analysis for nearby observation well HRES-15, which is consistent with the conceptual hydrogeologic model of the area (e.g., a fractured rock aquifer between two parallel no-flow or low permeable boundaries).

Using dual-porosity analytical methods, analysis of water level response at HRES-20 and observation points indicates a geometric average hydraulic conductivity of about 0.079 m/day (0.26 ft/d). Using an aquifer thickness equivalent to the penetration at well HRES-15 of 983 feet, transmissivity averages 24 m^2/d (258 ft^2/d). Using single-porosity, infinite-acting radial flow analytical methods for the distant observation wells, the geometric average of transmissivity is also 24 m^2/d (258 ft^2/d). These estimates are similar to previous testing in the ALT aquifer in the vicinity of HRES-09 (M&A, 2012).

Specific storage is estimated to range from 4.2E-07 to 1.5E-05 1/ft; using an aquifer thickness equivalent to the penetration at well HRES-15 of 983 feet, storativity ranges from about 4.1E-04 to 1.5E-02 (dimensionless). The smaller of these values was obtained at a distant observation wells and is indicative of the elastic response of the aquifer; the larger value was obtained at a nearby observation wells and is indicative of specific yield of the aquifer and long-term drainable porosity value.

During the late time pumping period at the pumped well, approximately t >60,000 minutes or about 40 days, an infinite-acting radial flow period dominates the time-drawdown data and the computed transmissivity using conventional single-porosity analytical methods is similar to the transmissivity computed using dual-porosity methods **(Figures 3 and 4)**. The transition period prior to this time occurs when groundwater begins to flow from the matrix to the fractures but has not yet reached a state of equilibrium.

At wells north and south from pumped well, and at distances equivalent to or greater than the distance from HRES-14 (i.e., 5,987 feet), aquifer parameters derived analytical methods based on a dual-porosity or single-porosity model are similar. This suggests that water level changes in the ALT aquifer, at these distances and during the time period and rate of pumping at HRES-20, follow an equivalent porous medium response rather than a fractured medium response to reach a state of equilibrium. Furthermore, it is likely in the north-south orientation, an integrated and fairly extensive fracture system associated with Devils Canyon faulting exists in the ALT aquifer.

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Tables

TABLE 1. WELL CONSTRUCTION DATA AND HYDRAULIC PARAMETERS FOR 90-DAY AQUIFER TEST AT HRES-20

WELL OR PIEZOMETER IDENTIFIER	EASTING (AZSPC, ft)[a]	NORTHING (AZSPC, ft)	MEASURING POINT ELEVATION (ft, amsl)[b]	DISTANCE FROM HRES-20 (ft)	AZIMUTH FROM HRES-20 (degrees)[c]	..... PRE-PUMPING		..... BOREHOLE		..... CASING			..... WATER LEVEL CHANGE ..... DURING 180-DAY TEST PERIOD[f]		COMMENTS
						DEPTH TO WATER (ft, bmp)[d]	WATER LEVEL ELEVATION (ft, amsl)	DIAMETER (inches)	DEPTH (ft, bls)[e]	DIAMETER (inches)	DEPTH (ft, bls)	PERFORATED or OPEN INTERVAL DEPTH (ft, bls)	AT END OF 90- DAY PUMPING PERIOD[g] (ft)	AT END OF 90- DAY RECOVERY PERIOD[h] (ft)	
PUMPED WELL															
HRES-20	971988.00	842286.02	4318.06	----PUMPED WELL----		646.82	3671.24	20 15	0 - 39.0 39.0 - 1,057.1	16 8	0 - 39.0 0 - 1,057.1	597.4 - 1,035.8	18.23	3.77	analyze for aquifer parameters
APACHE LEAP TUFF AQUIFER MONITOR WELL - TEST SUITE															
HRES-3S	967959.75	841033.16	4077.53	4218.58	252.72	293.68	3783.85	17-1/2 9 8-3/4	0 - 19 19.0 - 1,537.1 1,537.1 - 2,116.1	12 1	0 - 19.0 0 - 398.0	338.6 - 398.0	0.50	1.12	antecedent trend; no discernible drawdown
HRES-3D	967959.75	841033.16	4078.16	4218.58	252.72	287.66	3790.50	17-1/2 9 8-3/4	0 - 19 19.0 - 1,537.1 1,537.1 - 2,116.1	12 4	0 - 19.0 0 - 1,500	1456.4 - 1,500.0	1.52	8.44	transducer malfunction; no discernible drawdown based on manual measurements
Oak Flat	967933.92	841129.21	4079.28	4215.90	254.07	295.37	3783.91	19 12-1/4 9-1/2	0 - 20.0 20.0 - 1,107.9 1,107.9 - 1,712.9	14 10-3/4 9-1/2	0 - 20.0 0 - 1,107.9	400.9 - 432.1	0.53	1.11	antecedent trend; no discernible drawdown
HRES-04	964531.56	835383.25	4075.80	10161.04	227.21	401.29	3674.51	17-1/2 9	0 - 19.0 19.0 - 1,747.0	12 4	0 - 19.0 0 - 1,440.0	584.3 - 624.3 724.4 - 764.4 1,284.1 - 1,304.1 1,419.3 - 1,440.0	-0.02	0.23	no discernible drawdown
HRES-06	977111.80	852681.67	4434.16	11589.77	386.24	392.43	4041.73	17-1/2 9	0 - 18.0 18.0 - 1,500.0	12 4	0 - 18.0 0 - 799.9	339.9 - 799.9	0.62	1.70	antecedent trend; no discernible drawdown
HRES-12	963794.06	847210.32	4170.95	9559.78	301.00	77.30	4093.65	17-1/2 10	0 - 80.1 80.1 - 2,140.1	12 4-1/2	0 - 80.1 0 - 1,988.5	1,767.4 - 1,967.2	-1.61	0.98	antecedent trend; no discernible drawdown
HRES-14	972011.01	848272.50	4217.28	5986.52	0.22	534.62	3682.66	17 10 9-7/8	0 - 40.0 40.0 - 1,310.0 1,310.0 - 1,643.0	12-1/4 4-1/2	0 - 40.0 0 - 1,460.3	961.6 - 1,440.3	6.07	3.45	analyze for aquifer parameters
HRES-15	971983.41	842357.32	4317.15	71.54	356.35	646.31	3670.84	17-1/2 10 9-7/8	0 - 60.0 60.0 - 1,095.1 1,095.1 - 2,018.0	12-1/4 4-1/2	0 - 60.0 0 - 1,976.7	678.8 - 1,529.9 1,750.0 - 1,957.7	8.52	3.58	analyze for aquifer parameters
HRES-16	973982.78	832538.41	3992.27	9949.63	168.43	374.08	3618.19	20-1/2 14-3/4 12-1/2 12-1/4	0 - 64.0 64.0 - 165.0 165.0 - 674.9 674.9 - 1,174.9	16 8-5/8	0 - 64.0 0 - 1,160.1	360.9 - 885.8 949.1 - 1,139.1	0.50	1.14	analyze for aquifer parameters
HRES-17	976950.80	840709.58	4394.68	5207.17	107.62	744.74	3649.94	17-1/4 10	0 - 40.0 40.0 - 1,455.1	12-1/4 4-1/2	0 - 40.0 0 - 1,345.1	725.4 - 1,329.7	-0.31	-0.11	no discernible drawdown
HRES-18	976321.47	834909.70	4093.18	8555.06	149.57	693.96	3399.22	17-1/4 10	0 - 40.0 40.0 - 1,065.9	12-1/4 4-1/2	0 - 40.0 0 - 960.0	461.9 - 940.0	0.14	0.74	no discernible drawdown
A-06	971257.98	834171.54	4169.38	8147.25	185.14	523.33	3646.05	NA 8	NA 0 - 1,160.1	8 open	0 - 9.8 9.8 - 1,160.1	9.8 - 1,160.1	2.15	2.73	analyze for aquifer parameters
APACHE LEAP TUFF AQUIFER MONITOR WELL															
HRES-07	969606.45	829960.08	4018.53	12553.91	190.94	384.27	3634.26	14-3/4 8-3/4	0 - 19.7 19.7 - 1,067.9	10 4	0 - 19.7 0 - 1,041.0	335.0 - 749.0 812.0 - 1,019.0	0.34	0.57	analyze for aquifer parameters
HRES-09	965770.23	831902.98	3925.23	12102.40	210.91	252.65	3672.58	20-1/2 14-3/4	0 - 22.6 22.6 - 1,125.0	16 8-5/8	0 - 22.6 0 - 1,121.4	271 - 1,077.8	0.18	0.34	antecedent trend; no discernible drawdown
MJ-11	973629.34	829455.91	3920.13	12934.68	172.71	303.47	3616.66	NA 6	NA 785.1	6 open	0 - 10.2 10.2 - 785.1	10.2 - 785.1	0.62	1.37	analyze for aquifer parameters
GROUTED PIEZOMETER															
DHRES-14_ 1071	974466.98	840819.30	4684.71	2880.18	120.61	1,031.54[i]	3653.17	19 12-1/2 12-1/4 6-3/4	0 - 29.9 29.9 - 985.9 985.9 - 2,141.1 2,141.1 - 3,279.9	14 7-5/8 4-1/2	0 - 29.9 0 - 2,135.8 2,073.5 - 3,270.1	1,169.2[j]	0.72	1.30	analyze for aquifer parameters

[a] Datum NAD83, Arizona State Plane Coordinates, Zone 0202 - NAVD88 (Geoid12A), in feet. Data from Geodetic Analysis, LLC (August 2013)

[b] ft, amsl = feet above mean sea level

[c] Degrees measured clockwise from North NA = data not available

[d] ft, bmp = feet below measuring point

[e] ft, bls = feet below land surface

[f] Pumping started 02-Apr-2013 @ 12:00

[g] 01-Jul-2013 @ 12:00

[h] 29-Sep-2013 @ 12:00

[i] Depth to water computed from pressure on grouted vibrating-wire transducer

[j] Installed depth of vibrating-wire pressure transducer pressure-grouted in annular space between 7-5/8-inch blank casing and 12-1/4-inch borehole

Additional notes: (1) highlighted rows indicate pumping at HRES-20 attributed to discernable water level change; (2) physical data based on data received from RCM (via AcQuire database and spreadsheets).

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TABLE 2. AQUIFER HYDRAULIC PARAMETERS FOR HRES-20 90-DAY AQUIFER TEST

				LOG-LOG ANALYTICAL METHOD				LOG-LOG ANALYTICAL METHOD		SEMI-LOG ANALYTICAL METHOD	
WELL IDENTIFIER	DISTANCE FROM PUMPED WELL (feet)	DRAWDOWN AT 90 DAYS (feet)	RESIDUAL DRAWDOWN AT t/t'=2[a] (feet)	MOENCH (1984) K[b] (m/day)	MOENCH (1984) S_s[c] (1/ft)	T[d] (m^2/day)	S[e] (dimensionless)	THEIS (1935) METHOD T (m^2/day)	S (dimensionless)	COOPER-JACOB (1946) DRAWDOWN METHOD T (m^2/day)	THEIS (1935) RECOVERY METHOD T (m^2/day)
Pumped Well											
HRES-20	0	18.23	3.77	0.077	1.0E-05	23	9.8E-03	---	---	32	40
Monitor Well											
HRES-15	72	8.52	3.58	0.062	1.5E-05	19	1.5E-02	---	---	---	---
HRES-14	5,987	6.07	3.45	0.098	4.2E-07	29	4.1E-04	33	4.0E-04	---	---
HRES-16	9,950	0.50	1.14	0.071	1.3E-06	21	1.3E-03	16	1.2E-03	---	---
A-06	8,147	2.15	2.73	0.063	7.7E-07	19	7.6E-04	19	7.8E-04	---	---
HRES-07*	12,554	0.34	0.57	0.19	1.9E-06	57	1.9E-03	48	1.7E-03	---	---
MJ-11*	12,935	0.64	1.37	0.066	6.7E-07	20	6.6E-04	18	6.6E-04	---	---
Grouted Piezometer											
DHRES-14_ 1071	2,880	1.11	2.02	0.057	7.2E-06	17	7.1E-03	24	1.4E-02	---	---
			AVERAGE[f,g] =	0.079[f]		24[g]		24[h]			
Monitor Wells (No Discernible Response)											
HRES-3S	4,219										
HRES-3D	4,219										
Oak Flat	4,216										
HRES-17	5,207										
HRES-18	8,555										
HRES-12	9,560										
HRES-04	10,161										
HRES-06	11,590										
HRES-09*	12,102										

[a] t/t' = (time after pumping started/time after pumping stopped)

[b] K= Hydraulic Conductivity in meters per day

[c] S_s= Specific Storage in feet $^{-1}$

[d] T= transmissivity in square meters per day; computed based hydraulic conductivity multiplied by aquifer thickness at HRES-15 equivalent to 983 feet (299.6 meters)

[e] S= storativity computed based computed based Specific Storage multiplied by aquifer thickness at HRES-15 equivalent to 983 feet

[f] geometric average of hydraulic conductivity of the pumped well and all observation boreholes, wells, and grouted piezometer

[g] average transmissivity based on the product of the geometric mean of hydraulic conductivity and aquifer thickness of 983 feet

[h] geometric average of transmissivity excluding the pumped well and observation well HRES-15

* = wells not part of test well suite; water level measurments obtained less frequently

--- = method not appropriate for analyses

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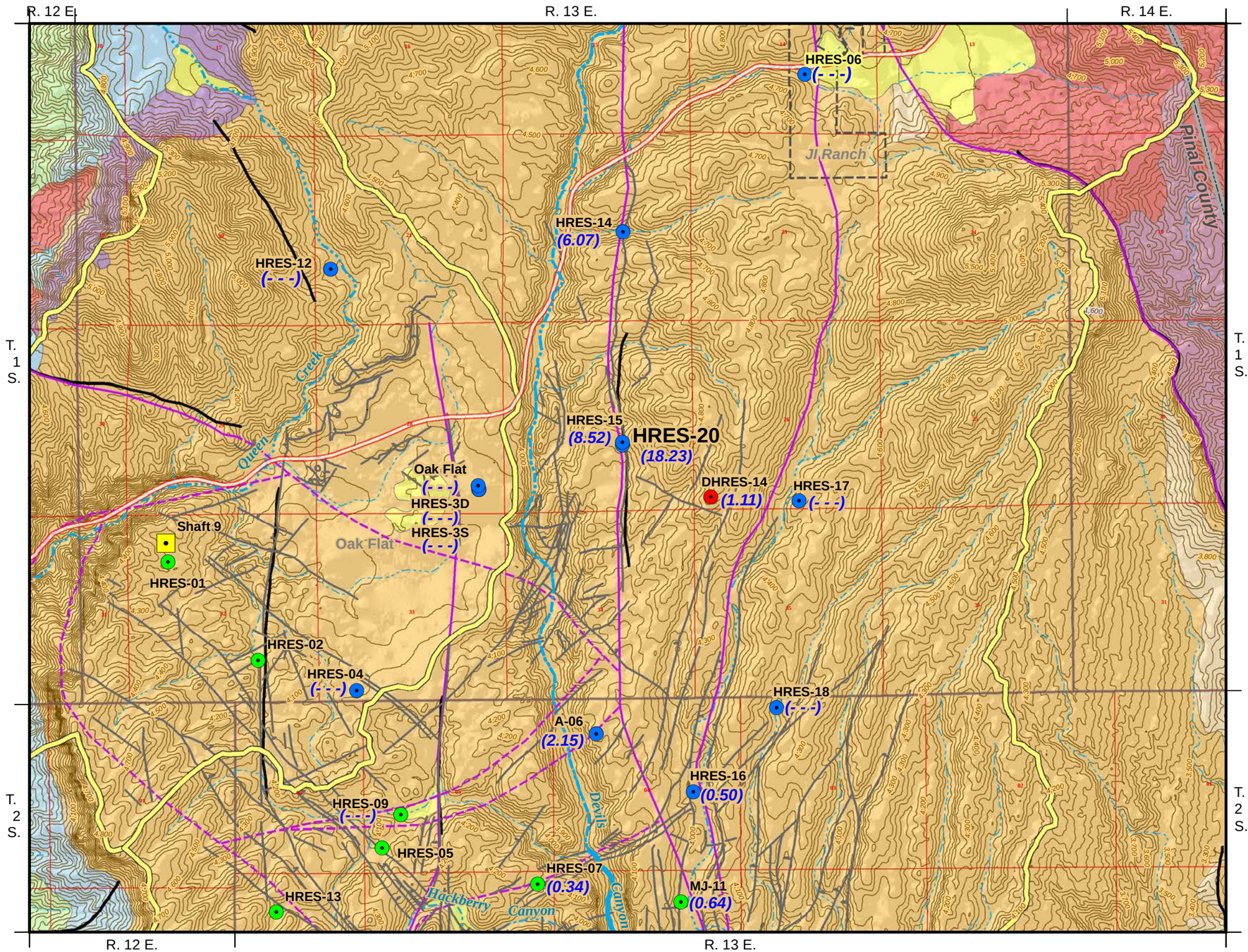
Illustrations



EXPLANATION

- Watershed Boundary
- Perennial Reach
- Fault (Gant & Wilkins, Peterson, RCM)
- *(6.07)* Maximum Drawdown, in feet
- *(- - -)* No Discernible Drawdown Measured

Groundwater Monitoring Sites

- Apache Leap Tuff Aquifer Monitor Well -Test Suite
- Apache Leap Tuff Aquifer Monitor Well
- Deep Groundwater System Monitor Well with Apache Leap Tuff Annular Grouted Piezometer
- Shaft

Geologic Units

- Disturbed Surficial Deposits
- Quaternary Alluvial Deposits
- Quaternary-Tertiary Basin-Fill Deposits
- Tertiary Younger Volcanic Rocks
- Tertiary Apache Leap Tuff
- Tertiary Older Volcanic Rocks
- Tertiary Whitetail Conglomerate
- Cretaceous-Tertiary Intrusives
- Paleozoic Sedimentary Rocks
- Younger Precambrian Sedimentary, Volcanic, and Intrusives Rocks
- Willow Spring Granodiorite
- Older Precambrian Pinal Schist

0 1,000 2,000 3,000 4,000 5,000 6,000
Feet

N

Resolution Copper Mining

LOCATION MAP
HRES-20 AQUIFER TEST

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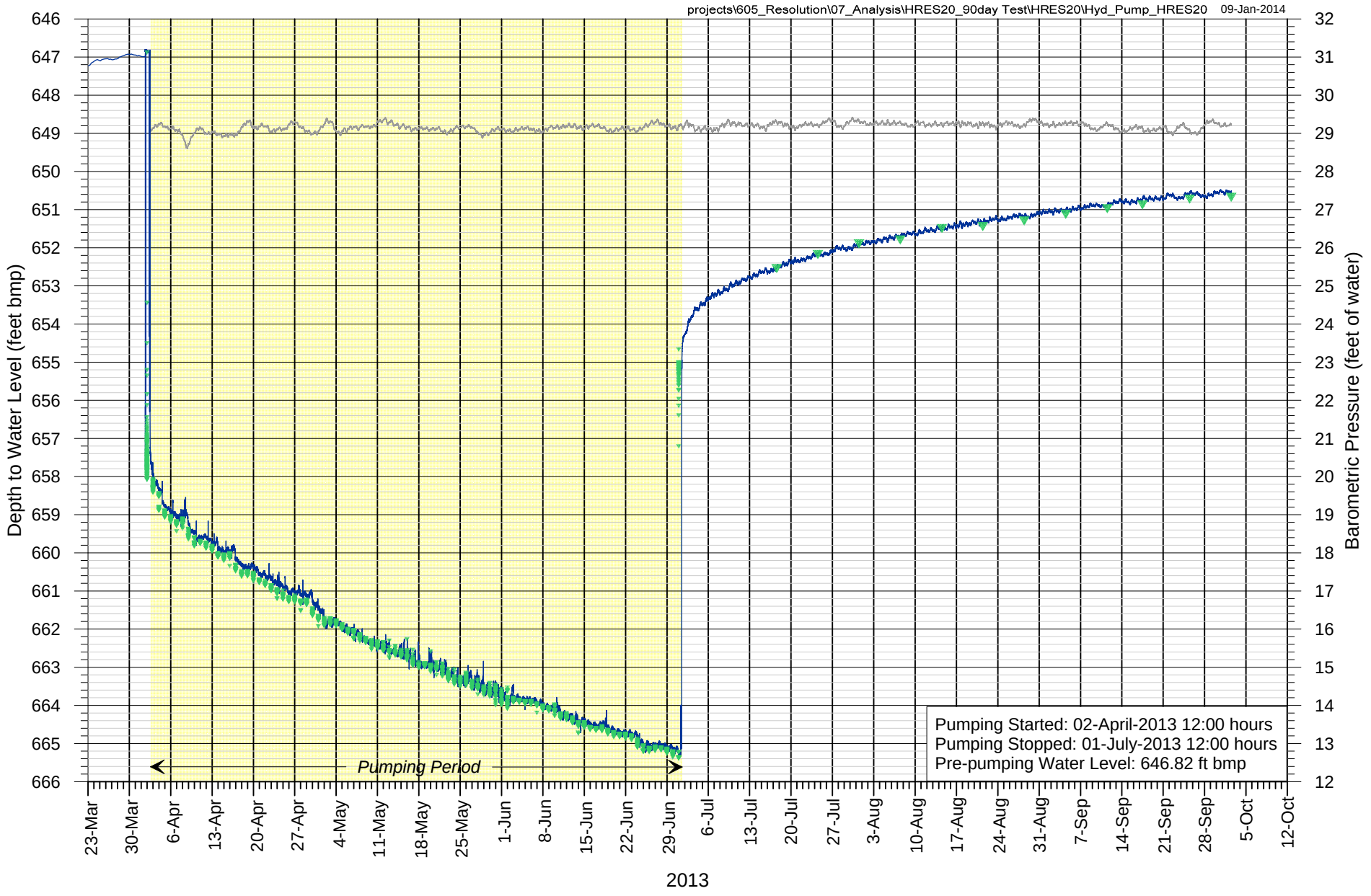
Water Resource Consultants

2014

FIGURE 1

\GIS-Tuc\Projects\605\605.413\HRES20_pumptest.mxd\13Jan2014 StatePlane83USft.



EXPLANATION

- Depth to Water (baro corrected)
- Depth to Water (manual)
- Barometric Pressure (HRES-20 station)

FIGURE 2. HYDROGRAPH FOR PUMPING WELL HRES-20

Client: Resolution Copper Mining LLC
Project: Well HRES-20 90-day Aquifer Test
Location: Pinal County, Arizona

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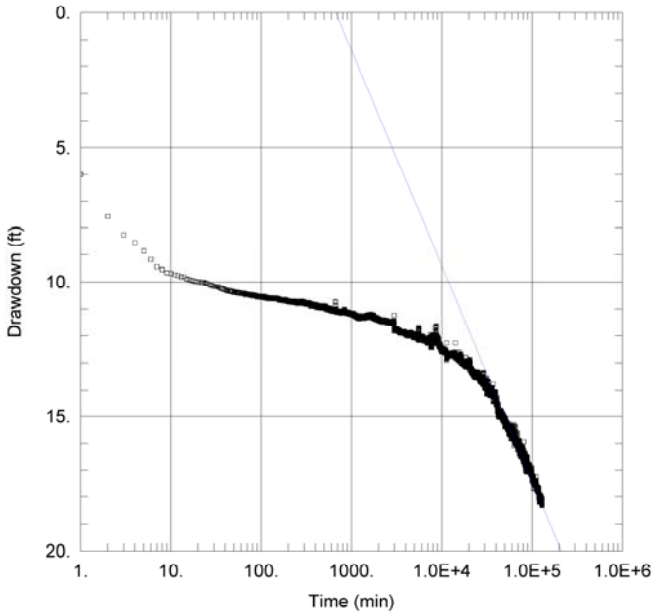


DRAWDOWN GRAPH FOR PUMPED WELL HRES-20

PROJECT INFORMATION

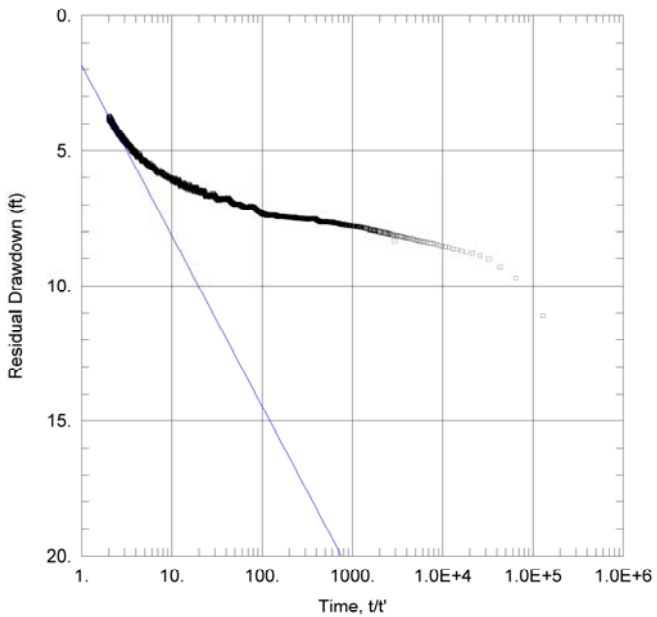
Company: Montgomery & Associates
Client: Resolution Copper Mining LLC
Project: 605.413
Location: Pinal County, Arizona
Test Well: HRES-20
Test Date: 02-April-2013

AQUIFER DATA

Saturated Thickness: 983. ft
Anisotropy Ratio (Kz/Kr): 1.

SOLUTION

Aquifer Model: Unconfined
Solution Method: Cooper-Jacob
T = 31.52 m^2/day
S = 907.1



RECOVERY GRAPH FOR PUMPED WELL HRES-20

PROJECT INFORMATION

Company: Montgomery & Associates
Client: Resolution Copper Mining LLC
Project: 605.413
Location: Pinal County, Arizona
Test Well: HRES-20
Test Date: 02-April-2013

AQUIFER DATA

Saturated Thickness: 983. ft
Anisotropy Ratio (Kz/Kr): 1.

SOLUTION

Aquifer Model: Confined
Solution Method: Theis (Recovery)
T = 40. m^2/day
S/S' = 0.51

EXPLANATION

Pumping Started: 02-April-2013 12:00 hours
Pumping Stopped: 01-July-2013 12:00 hours
Initial Water Level: 646.82 ft bmp
Average Pumping Rate: 77 gpm

FIGURE 3. DRAWDOWN AND RECOVERY GRAPHS FOR PUMPED WELL HRES-20

Client: Resolution Copper Mining LLC
Project: HRES-20 90-day Aquifer Test
Location: Pinal County, Arizona

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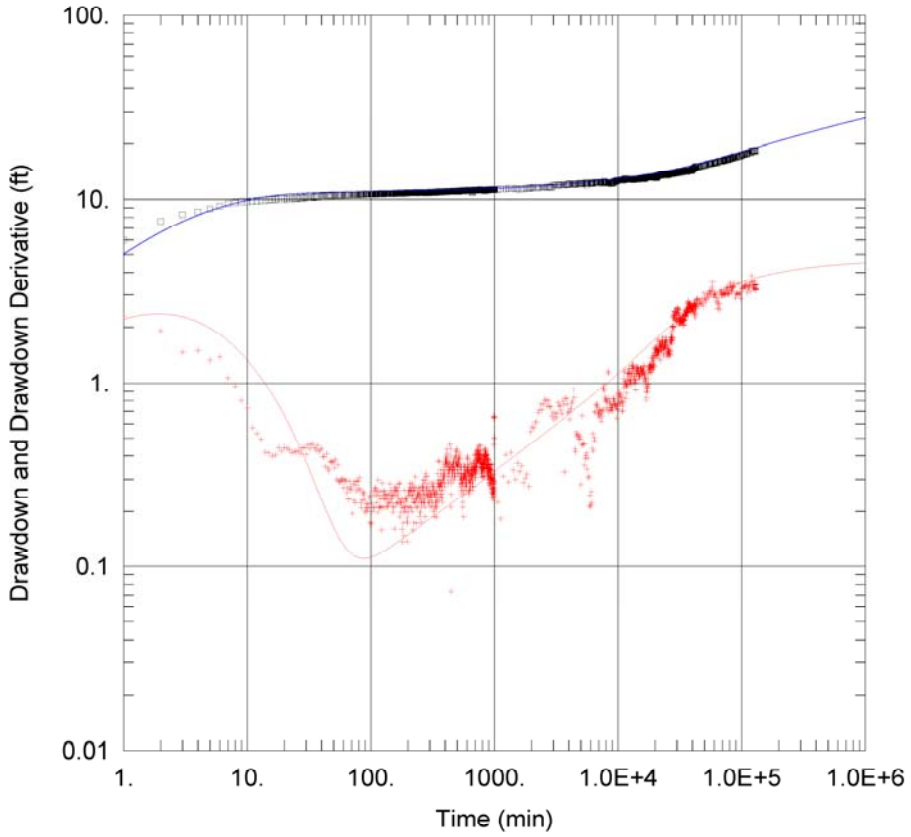


LOG-LOG DRAWDOWN GRAPH FOR PUMPED WELL HRES-20

PROJECT INFORMATION

Company: Montgomery & Associates
Client: Resolution Copper Mining LLC
Project: 605.413
Location: Pinal County, Arizona
Test Well: HRES-20
Test Date: 02-April-2013

AQUIFER DATA

Saturated Thickness: 983. ft
Spherical Block Diameter: 1. ft

SOLUTION

Aquifer Model: Fractured
Solution Method: Moench w/spherical blocks

K = 0.077 m/day
K' = 0.00022 m/day
Sw = -5.
r(w) = 4.05 ft

Ss = 6.95E-9 ft^{-1}
Ss' = 1.0E-5 ft^{-1}
Sf = 0.46
r(c) = 0.33 ft

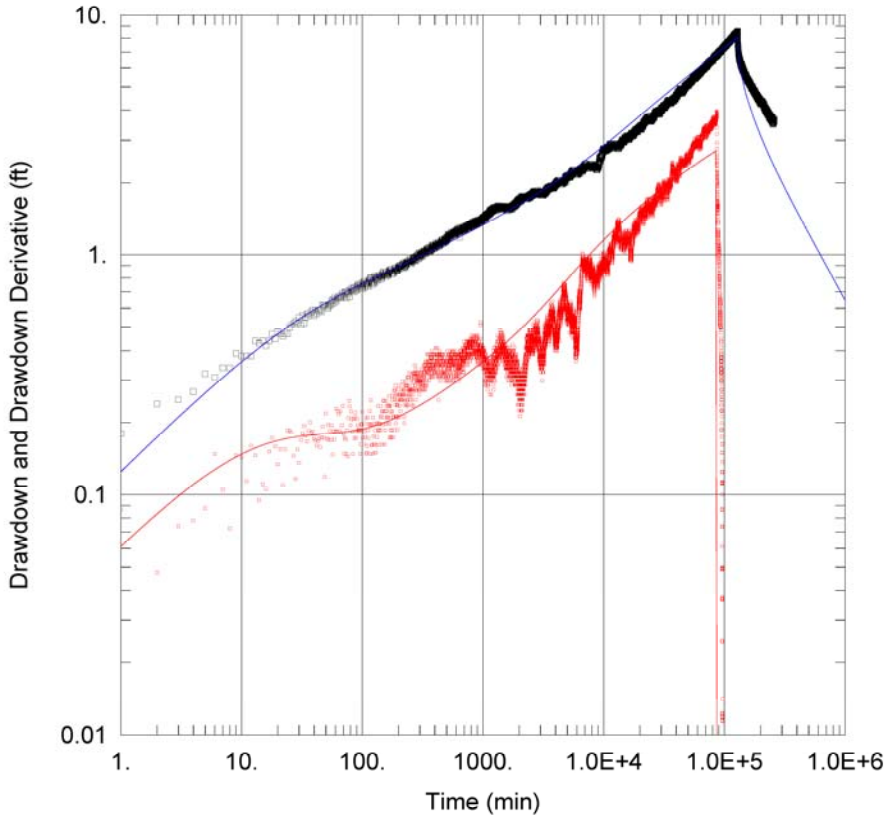
EXPLANATION

Pumping Started: 02-April-2013 12:00 hours
Pumping Stopped: 01-July-2013 12:00 hours
Initial Water Level: 646.82 ft bmp
Average Pumping Rate: 77 gpm

FIGURE 4. PUMPED WELL HRES-20

Client: Resolution Copper Mining LLC
Project: HRES-20 90-day Aquifer Test
Location: Pinal County, Arizona

MONTGOMERY & ASSOCIATES



LOG-LOG DRAWDOWN AND RECOVERY GRAPH FOR OBSERVATION WELL HRES-15

PROJECT INFORMATION

Company: Montgomery & Associates
Client: Resolution Copper Mining LLC
Project: 605.413
Location: Pinal County, Arizona
Test Well: HRES-20
Obs. Well: HRES-15
Test Date: 02-April-2013

AQUIFER DATA

Saturated Thickness: 983. ft
Spherical Block Diameter: 1. ft

SOLUTION

Aquifer Model: Fractured
Solution Method: Moench w/spherical blocks

K = 0.062 m/day
K' = 0.0017 m/day
Sw = -5.1
r(w) = 8.1 ft
Ss = 8.8E-7 ft^{-1}
Ss' = 1.5E-5 ft^{-1}
Sf = 0.05
r(c) = 0.33 ft

EXPLANATION

Pumping Started: 02-April-2013 12:00 hours
Pumping Stopped: 01-July-2013 12:00 hours
Initial Water Level: 646.31 ft bmp
Distance to Pumped Well: 72 ft

FIGURE 5. OBSERVATION WELL HRES-15

Client: Resolution Copper Mining LLC
Project: HRES-20 90-day Aquifer Test
Location: Pinal County, Arizona

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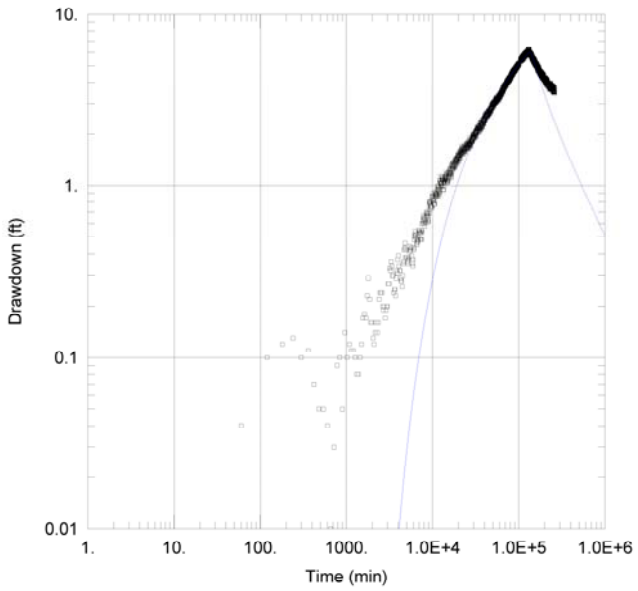


LOG-LOG DRAWDOWN AND RECOVERY GRAPH FOR OBSERVATION WELL HRES-14

PROJECT INFORMATION

Company: Montgomery & Associates
Client: Resolution Copper Mining LLC
Project: 605.413
Location: Pinal County, Arizona
Test Well: HRES-20
Obs. Well: HRES-14
Test Date: 02-April-2013

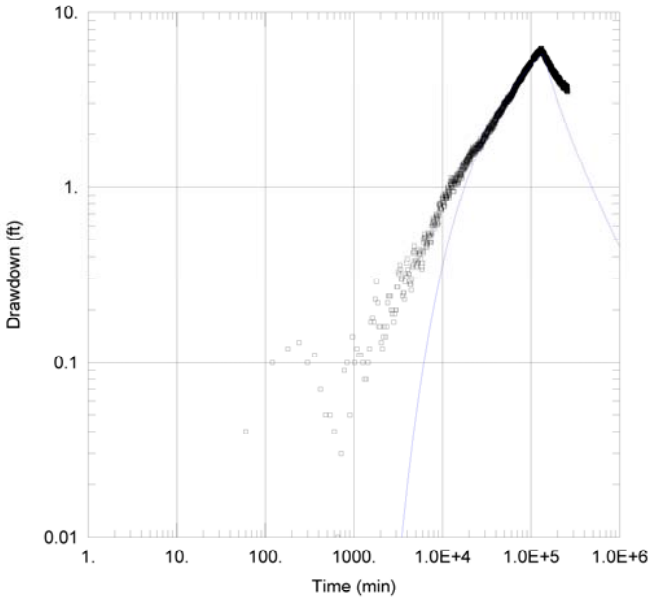
AQUIFER DATA

Saturated Thickness: 983. ft
Spherical Block Diameter: 1. ft

SOLUTION

Aquifer Model: Fractured
Solution Method: Moench w/spherical blocks

K = 0.098 m/day
K' = 4.389E-20 m/day
Sw = 0.
r(w) = 0.625 ft
Ss = 4.2E-7 ft^{-1}
Ss' = 1.0E-10 ft^{-1}
Sf = 10.
r(c) = 0.33 ft



LOG-LOG DRAWDOWN AND RECOVERY GRAPH FOR OBSERVATION WELL HRES-14

PROJECT INFORMATION

Company: Montgomery & Associates
Client: Resolution Copper Mining LLC
Project: 605.413
Location: Pinal County, Arizona
Test Well: HRES-20
Obs. Well: HRES-14
Test Date: 02-April-2013

SOLUTION

Aquifer Model: Confined
Solution Method: Theis

T = 33. m^2/day
Kz/Kr = 1.
S = 0.0004
b = 983. ft

EXPLANATION

Pumping Started: 02-April-2013 12:00 hours
Pumping Stopped: 01-July-2013 12:00 hours
Initial Water Level: 534.62 ft bmp
Distance to Pumped Well: 5987 ft

FIGURE 6. OBSERVATION WELL HRES-14

Client: Resolution Copper Mining LLC
Project: HRES-20 90-day Aquifer Test
Location: Pinal County, Arizona

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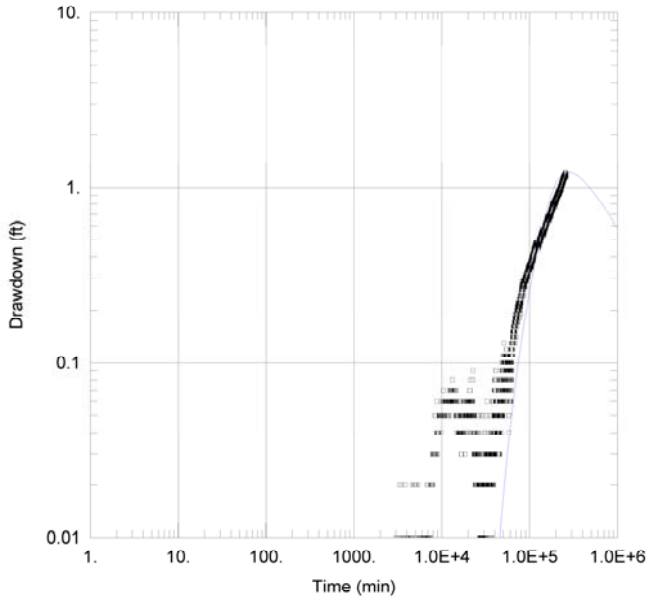


LOG-LOG DRAWDOWN AND RECOVERY GRAPH FOR OBSERVATION WELL HRES-16

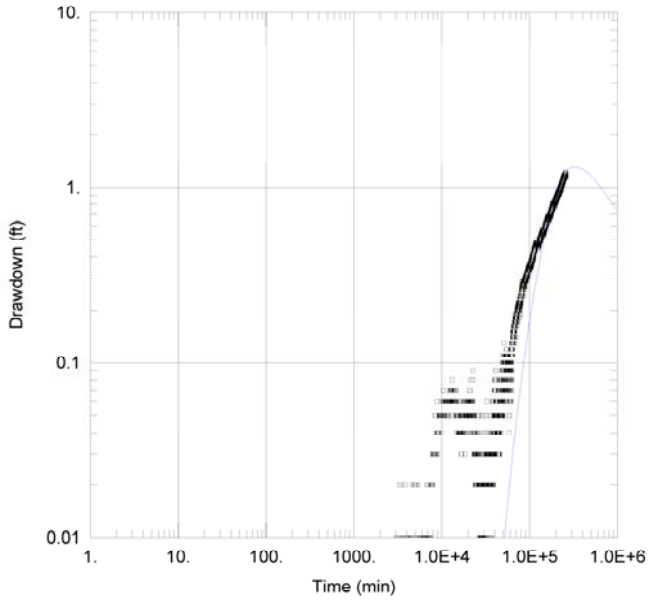
PROJECT INFORMATION

Company: Montgomery & Associates
Client: Resolution Copper Mining LLC
Project: 605.413
Location: Pinal County, Arizona
Test Well: HRES-20
Obs. Well: HRES-16
Test Date: 02-April-2013

SOLUTION

Aquifer Model: Fractured
K = 0.071 m/day
K' = 1.0E-8 m/day
Sw = 0.
r(w) = 0.625 ft

Solution Method: Moench w/spherical blocks
Ss = 1.3E-6 ft^{-1}
Ss' = 1.0E-10 ft^{-1}
Sf = 10.
r(c) = 0.33 ft



LOG-LOG DRAWDOWN AND RECOVERY GRAPH FOR OBSERVATION WELL HRES-16

PROJECT INFORMATION

Company: Montgomery & Associates
Client: Resolution Copper Mining LLC
Project: 605.413
Location: Pinal County, Arizona
Test Well: HRES-20
Obs. Well: HRES-16
Test Date: 02-April-2013

SOLUTION

Aquifer Model: Confined
T = 16. m^2/day
Kz/Kr = 1.

Solution Method: Theis
S = 0.0012
b = 983. ft

EXPLANATION

Pumping Started: 02-April-2013 12:00 hours
Pumping Stopped: 01-July-2013 12:00 hours
Initial Water Level: 374.08 ft bmp
Distance to Pumped Well: 9950 ft

FIGURE 7. OBSERVATION WELL HRES-16

Client: Resolution Copper Mining LLC
Project: HRES-20 90-day Aquifer Test
Location: Pinal County, Arizona

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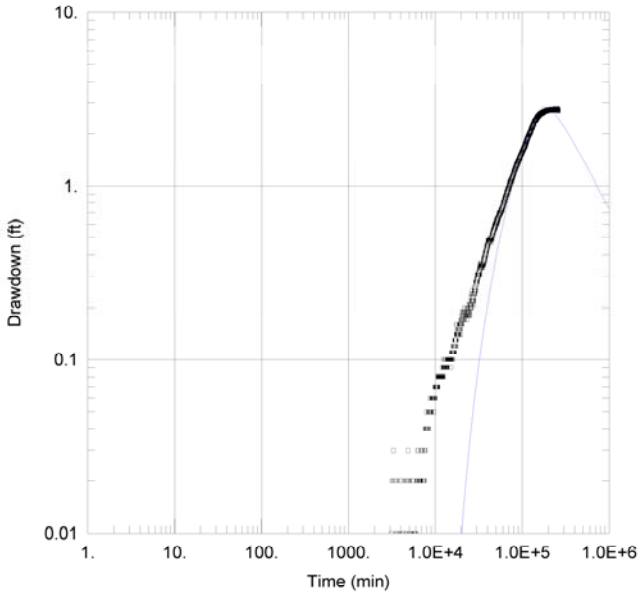


LOG-LOG DRAWDOWN AND RECOVERY GRAPH FOR OBSERVATION WELL A-06

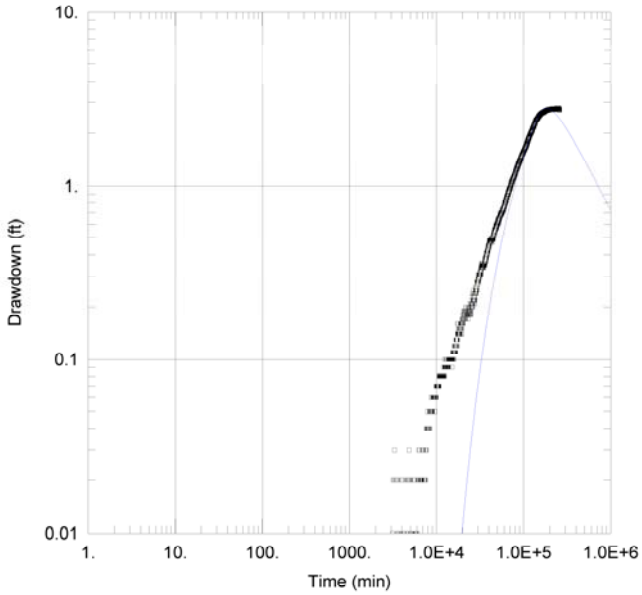
PROJECT INFORMATION

Company: Montgomery & Associates
Client: Resolution Copper Mining LLC
Project: 605.413
Location: Pinal County, Arizona
Test Well: HRES-20
Obs. Well: A-06
Test Date: 02-April-2013

SOLUTION

Aquifer Model: Fractured
K = 0.063 m/day
K' = 8.9E-16 m/day
Sw = 0.
r(w) = 0.33 ft

Solution Method: Moench w/spherical blocks
Ss = 7.7E-7 ft^{-1}
Ss' = 1.0E-13 ft^{-1}
Sf = 0.
r(c) = 0.33 ft



LOG-LOG DRAWDOWN AND RECOVERY GRAPH FOR OBSERVATION WELL A-06

PROJECT INFORMATION

Company: Montgomery & Associates
Client: Resolution Copper Mining LLC
Project: 605.413
Location: Pinal County, Arizona
Test Well: HRES-20
Obs. Well: A-06
Test Date: 02-April-2013

SOLUTION

Aquifer Model: Confined
T = 19. m^2/day
Kz/Kr = 1.

Solution Method: Theis
S = 0.00078
b = 983. ft

EXPLANATION

Pumping Started: 02-April-2013 12:00 hours
Pumping Stopped: 01-July-2013 12:00 hours
Initial Water Level: 523.33 ft bmp
Distance to Pumped Well: 8147 ft

FIGURE 8. OBSERVATION WELL A-06

Client: Resolution Copper Mining LLC
Project: HRES-20 90-day Aquifer Test
Location: Pinal County, Arizona

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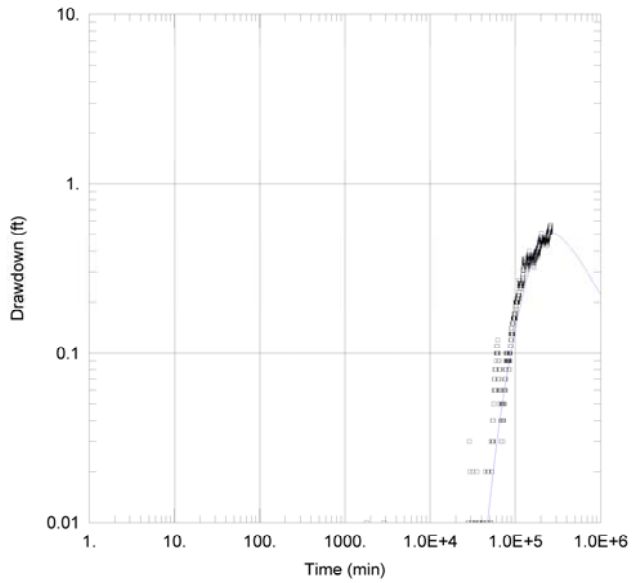


LOG-LOG DRAWDOWN AND RECOVERY GRAPH FOR OBSERVATION WELL HRES-07

PROJECT INFORMATION

Company: Montgomery & Associates
Client: Resolution Copper Mining LLC
Project: 605.413
Location: Pinal County, Arizona
Test Well: HRES-20
Obs. Well: HRES-07
Test Date: 02-April-2013

AQUIFER DATA

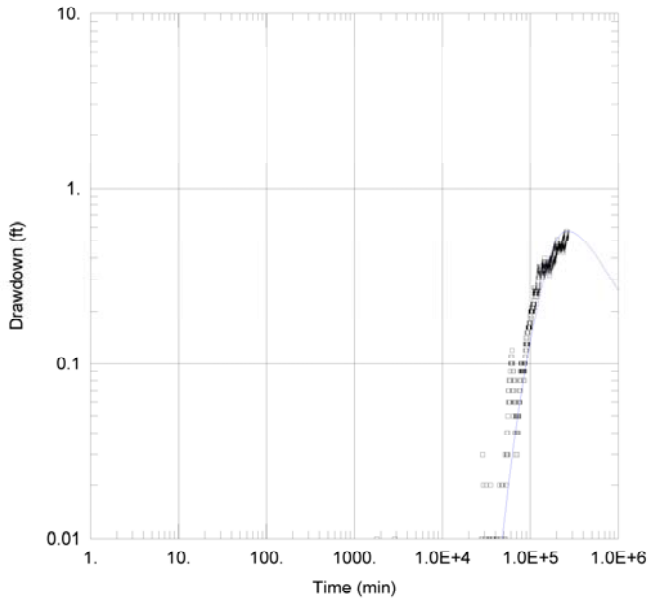
Saturated Thickness: 983. ft
Spherical Block Diameter: 1. ft

SOLUTION

Aquifer Model: Fractured
Solution Method: Moench w/spherical blocks

K = 0.19 m/day
K' = 1.0E-11 m/day
Sw = 0.
r(w) = 0.33 ft

Ss = 1.9E-6 ft^{-1}
Ss' = 1.0E-15 ft^{-1}
Sf = 0.
r(c) = 0.33 ft



LOG-LOG DRAWDOWN AND RECOVERY GRAPH FOR OBSERVATION WELL HRES-07

PROJECT INFORMATION

Company: Montgomery & Associates
Client: Resolution Copper Mining LLC
Project: 605.413
Location: Pinal County, Arizona
Test Well: HRES-20
Obs. Well: HRES-07
Test Date: 02-April-2013

SOLUTION

Aquifer Model: Confined
Solution Method: Theis

T = 48. m^2/day
Kz/Kr = 1.

S = 0.0017
b = 983. ft

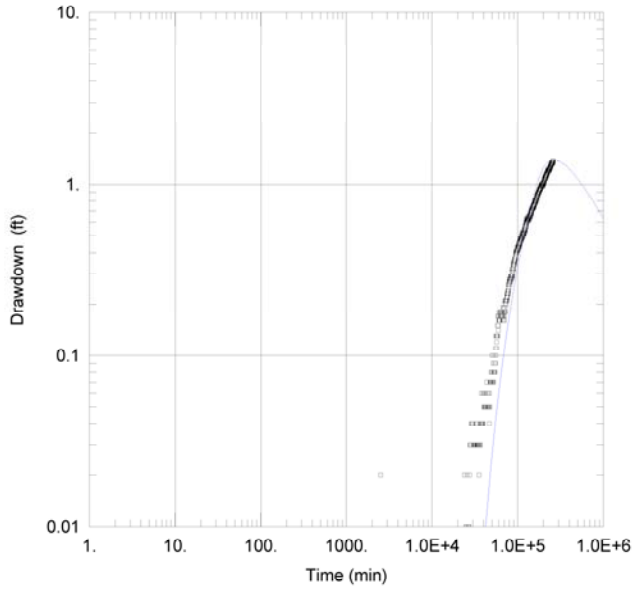
EXPLANATION

Pumping Started: 02-April-2013 12:00 hours
Pumping Stopped: 01-July-2013 12:00 hours
Initial Water Level: 384.27 ft bmp
Distance to Pumped Well: 12554 ft

FIGURE 9. OBSERVATION WELL HRES-07

Client: Resolution Copper Mining LLC
Project: HRES-20 90-day Aquifer Test
Location: Pinal County, Arizona

MONTGOMERY & ASSOCIATES



LOG-LOG DRAWDOWN AND RECOVERY GRAPH FOR OBSERVATION WELL MJ-11

PROJECT INFORMATION

Company: Montgomery & Associates
Client: Resolution Copper Mining LLC
Project: 605.413
Location: Pinal County, Arizona
Test Well: HRES-20
Obs. Well: MJ-11
Test Date: 02-April-2013

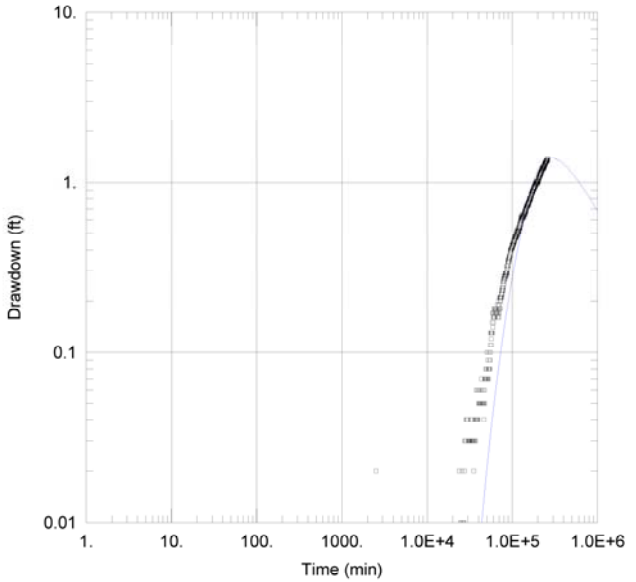
AQUIFER DATA

Saturated Thickness: 983. ft
Spherical Block Diameter: 1. ft

SOLUTION

Aquifer Model: Fractured
Solution Method: Moench w/spherical blocks

K = 0.066 m/day
K' = 7.1E-12 m/day
Sw = -5.
r(w) = 0.25 ft
Ss = 6.7E-7 ft^{-1}
Ss' = 4.2E-10 ft^{-1}
Sf = 10.
r(c) = 0.25 ft



LOG-LOG DRAWDOWN AND RECOVERY GRAPH FOR OBSERVATION WELL MJ-11

PROJECT INFORMATION

Company: Montgomery & Associates
Client: Resolution Copper Mining LLC
Project: 605.413
Location: Pinal County, Arizona
Test Well: HRES-20
Obs. Well: MJ-11
Test Date: 02-April-2013

SOLUTION

Aquifer Model: Confined
Solution Method: Theis

T = 18. m^2/day
Kz/Kr = 1.
S = 0.00066
b = 983. ft

EXPLANATION

Pumping Started: 02-April-2013 12:00 hours
Pumping Stopped: 01-July-2013 12:00 hours
Initial Water Level: 303.47 ft bmp
Distance to Pumped Well: 12935 ft

FIGURE 10. OBSERVATION WELL MJ-11

Client: Resolution Copper Mining LLC
Project: HRES-20 90-day Aquifer Test
Location: Pinal County, Arizona

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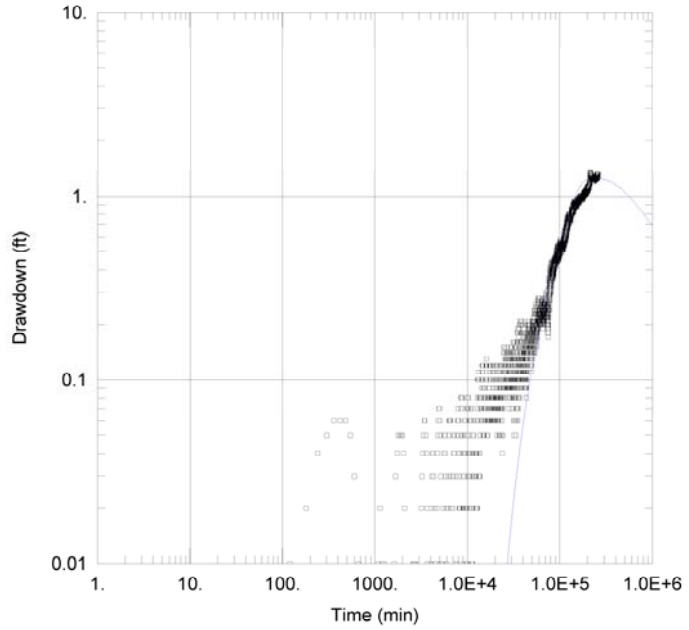


LOG-LOG DRAWDOWN AND RECOVERY GRAPH FOR OBSERVATION WELL DHRES-14_1071

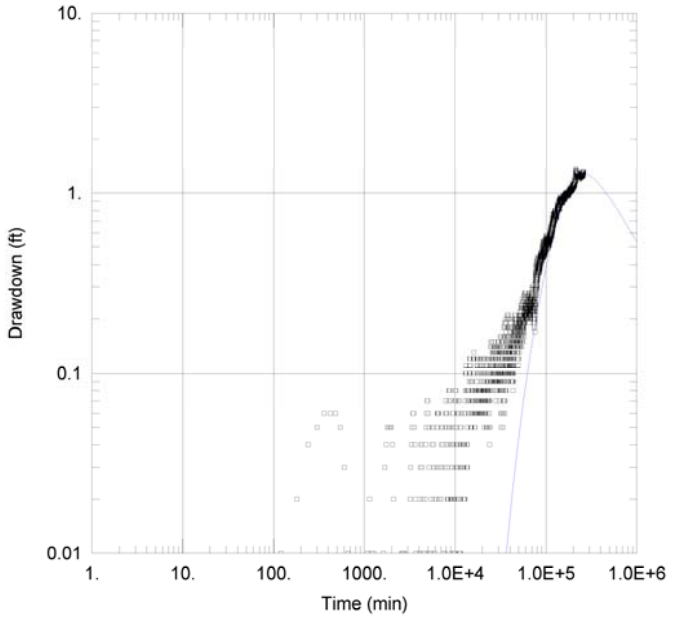
PROJECT INFORMATION

Company: Montgomery & Associates
Client: Resolution Copper Mining LLC
Project: 605.413
Location: Pinal County, Arizona
Test Well: HRES-20
Obs. Well: DHRES-14_1071
Test Date: 02-April-2013

SOLUTION

Aquifer Model: Fractured
Solution Method: Moench w/spherical blocks

K = 0.057 m/day
K' = 1.52E-9 m/day
Sw = 0.
r(w) = 0.625 ft
Ss = 7.2E-6 ft^{-1}
Ss' = 7.0E-6 ft^{-1}
Sf = 0.2036
r(c) = 0.33 ft



LOG-LOG DRAWDOWN AND RECOVERY GRAPH FOR OBSERVATION WELL DHRES-14_1071

PROJECT INFORMATION

Company: Montgomery & Associates
Client: Resolution Copper Mining LLC
Project: 605.413
Location: Pinal County, Arizona
Test Well: HRES-20
Obs. Well: DHRES-14_1071
Test Date: 02-April-2013

SOLUTION

Aquifer Model: Confined
Solution Method: Theis

T = 24. m^2/day
Kz/Kr = 1.
S = 0.014
b = 983. ft

EXPLANATION

Pumping Started: 02-April-2013 12:00 hours
Pumping Stopped: 01-July-2013 12:00 hours
Initial Water Level: 1031.54 ft bmp
Distance to Pumped Well: 2880 ft

FIGURE 11. OBSERVATION WELL DHRES-14_1071

Client: Resolution Copper Mining LLC
Project: HRES-20 90-day Aquifer Test
Location: Pinal County, Arizona

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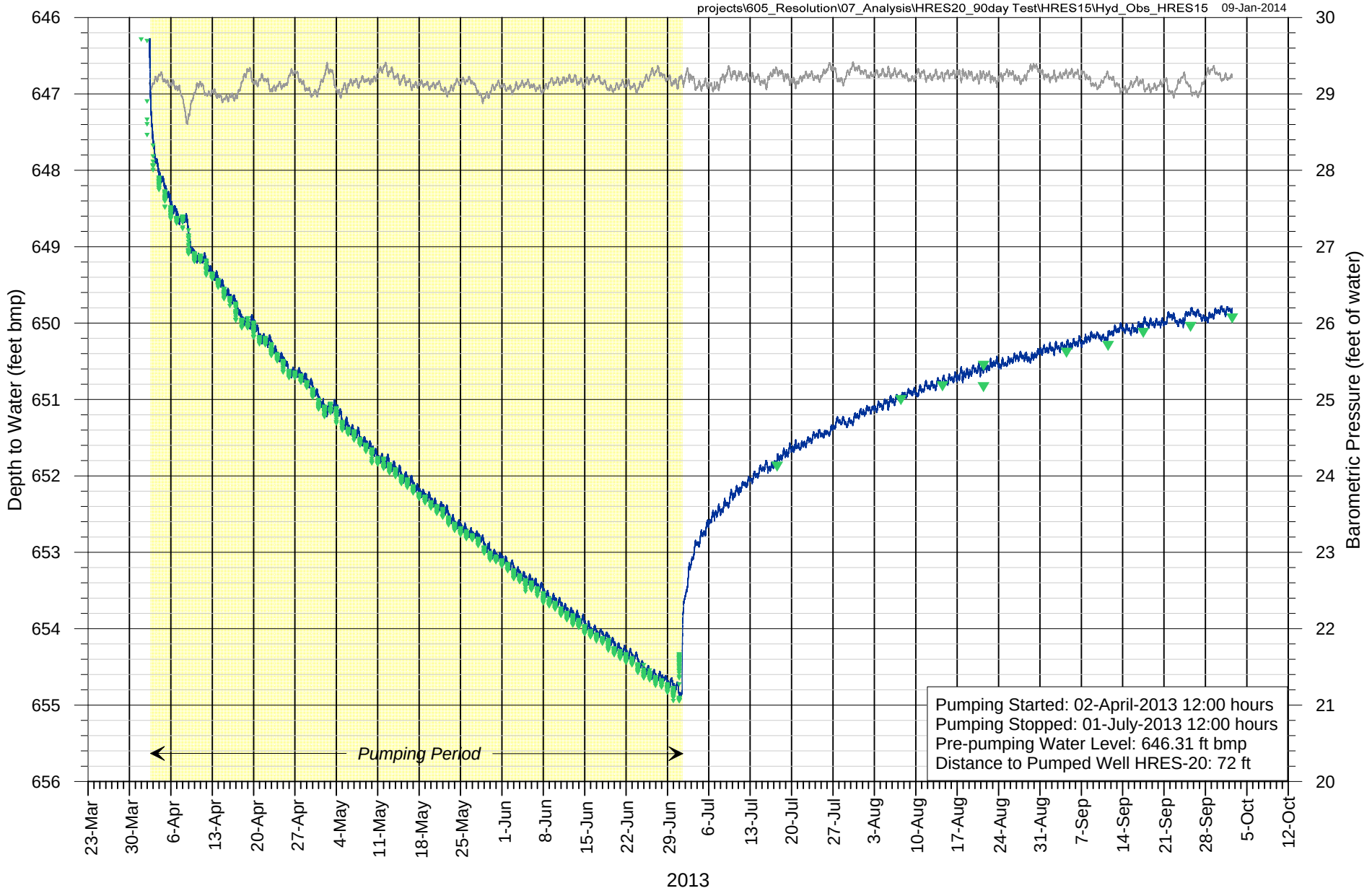
Appendix A

Pumping Test Hydrographs

Well HRES-20 90-day Aquifer Test
Resolution Copper Mining, Pinal County, Arizona



EXPLANATION

- Depth to Water (baro corrected)
- Depth to Water (manual)
- Barometric Pressure (HRES-20 station)

FIGURE A-1. HYDROGRAPH FOR OBSERVATION WELL HRES-15

Client: Resolution Copper Mining LLC
Project: Well HRES-20 90-day Aquifer Test
Location: Pinal County, Arizona

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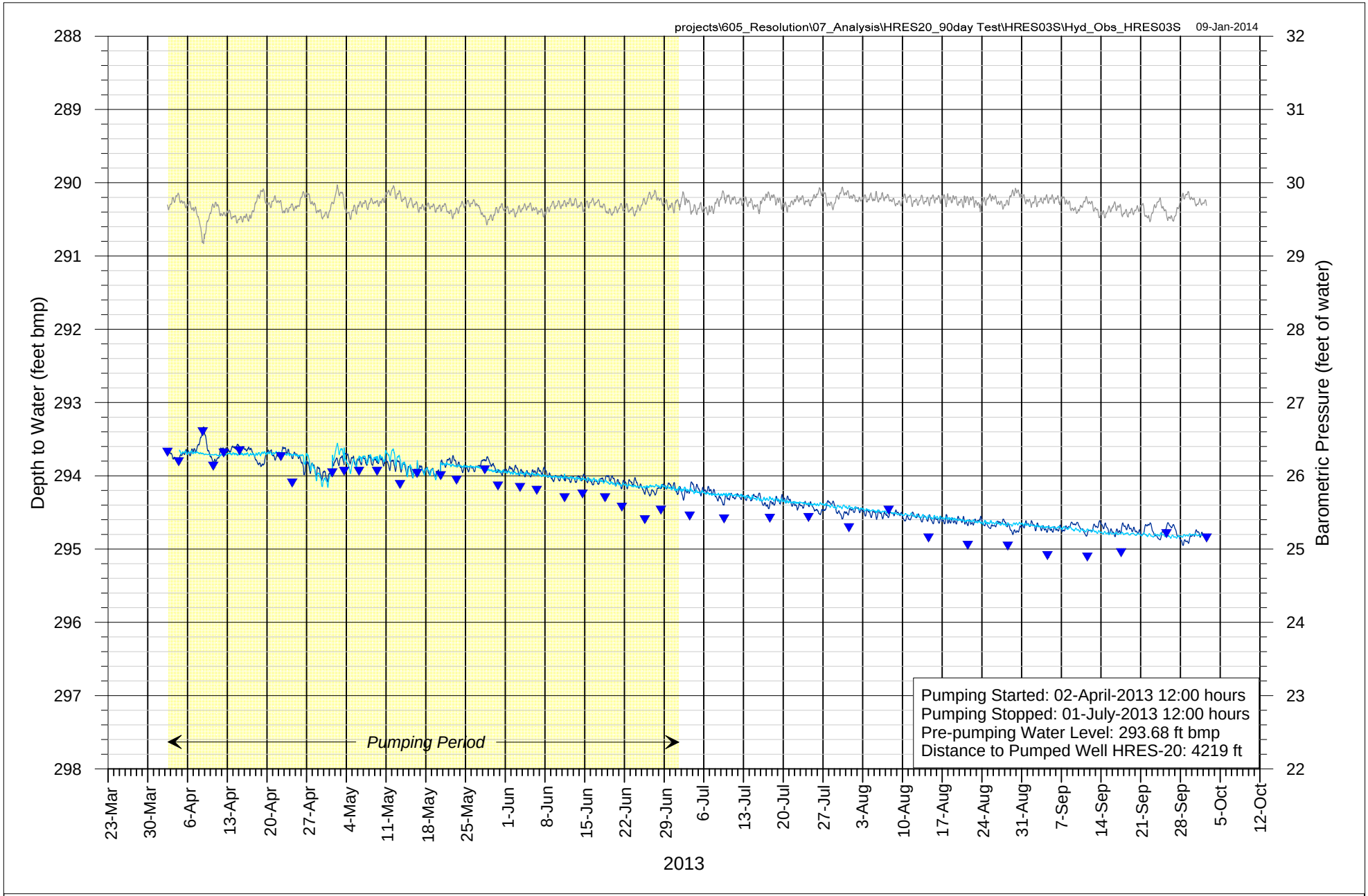

EXPLANATION

- Depth to Water (baro corrected)
- Depth to Water (BRF corrected)
- Depth to Water (manual)
- Barometric Pressure (HRES-04 station)

FIGURE A-2. HYDROGRAPH FOR OBSERVATION WELL HRES-03S

Client: Resolution Copper Mining LLC
Project: Well HRES-20 90-day Aquifer Test
Location: Pinal County, Arizona

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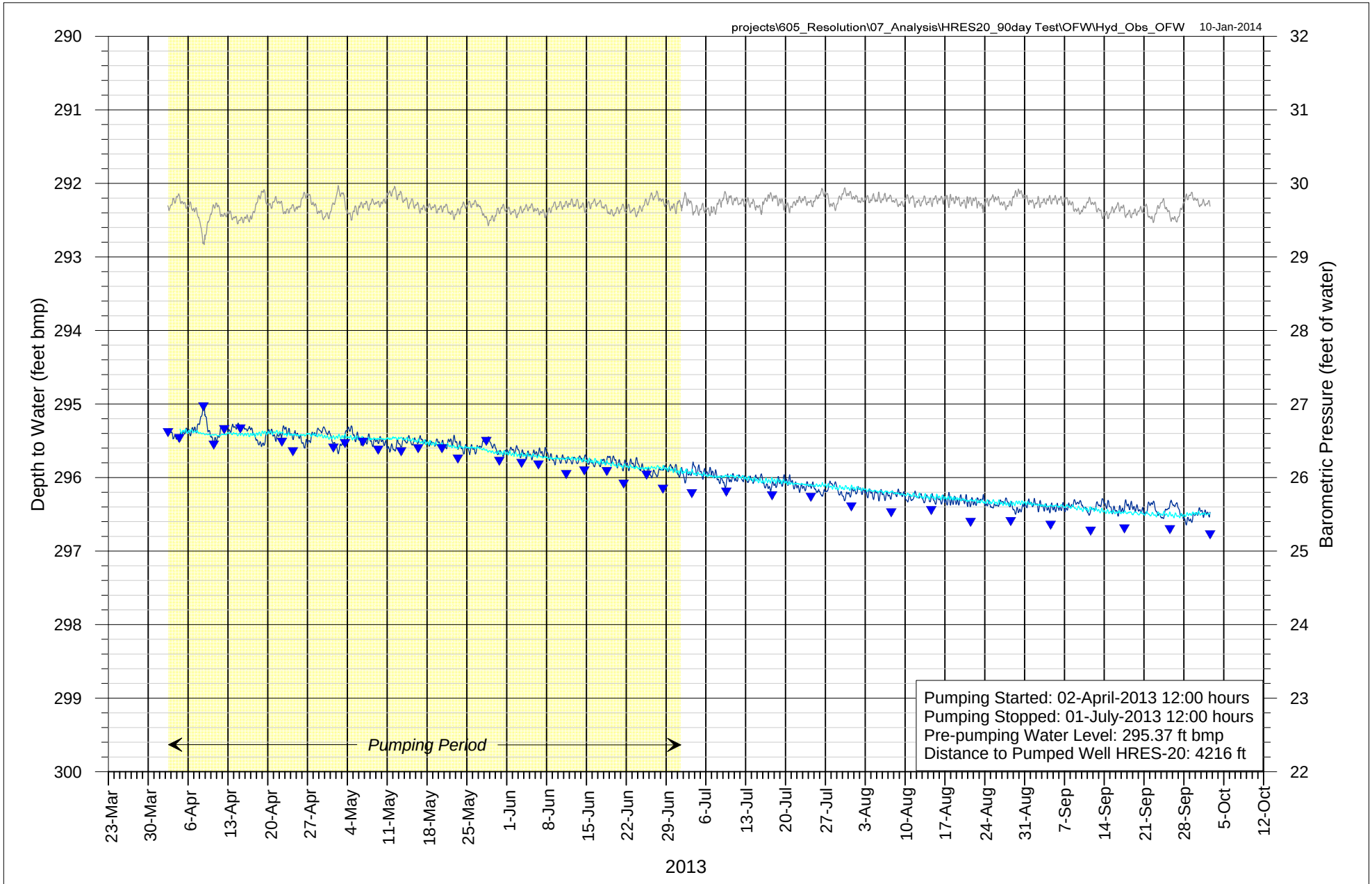


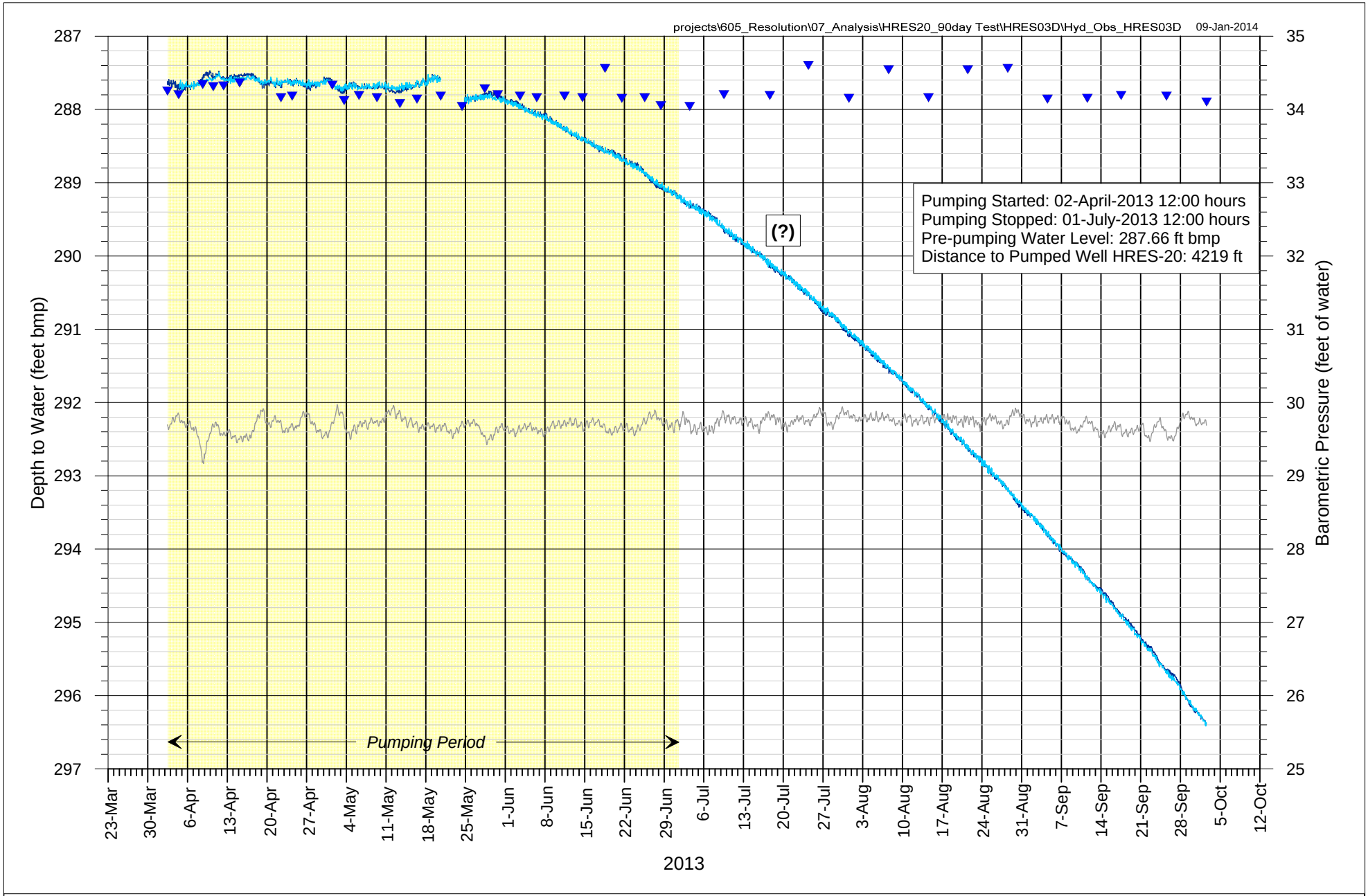
EXPLANATION

- Depth to Water (baro corrected)
- Depth to Water (BRF corrected)
- Depth to Water (manual)
- Barometric Pressure (HRES-04 station)

FIGURE A-3. HYDROGRAPH FOR OBSERVATION WELL OAK FLAT

Client: Resolution Copper Mining LLC
Project: Well HRES-20 90-day Aquifer Test
Location: Pinal County, Arizona

MONTGOMERY & ASSOCIATES



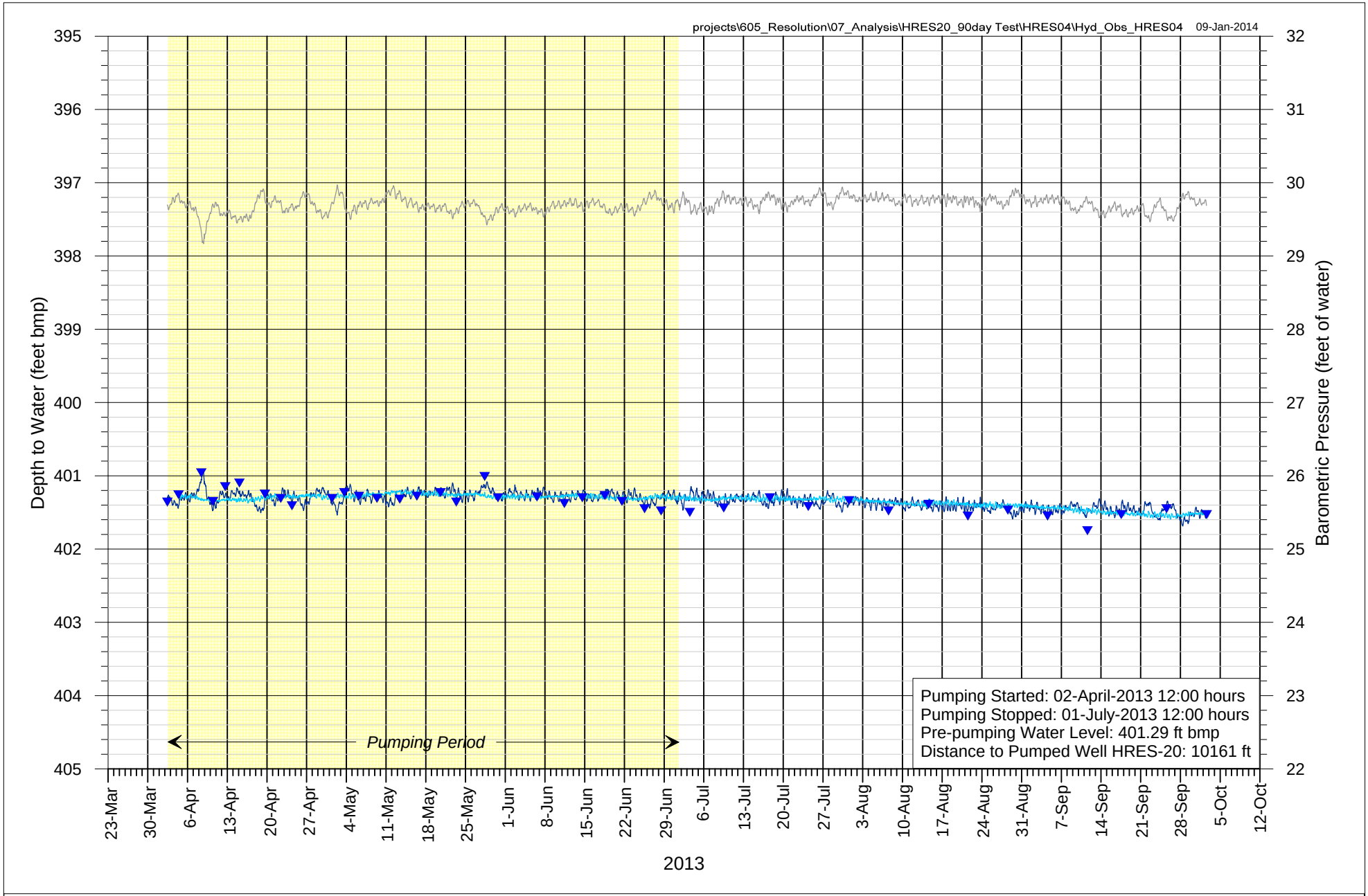
EXPLANATION

- Depth to Water (baro corrected)
- Depth to Water (BRF corrected)
- Depth to Water (manual)
- Barometric Pressure (HRES-04 station)
- (?) Pressure Transducer Malfunction

FIGURE A-4. HYDROGRAPH FOR OBSERVATION WELL HRES-03D

Client: Resolution Copper Mining LLC
Project: Well HRES-20 90-day Aquifer Test
Location: Pinal County, Arizona

MONTGOMERY & ASSOCIATES



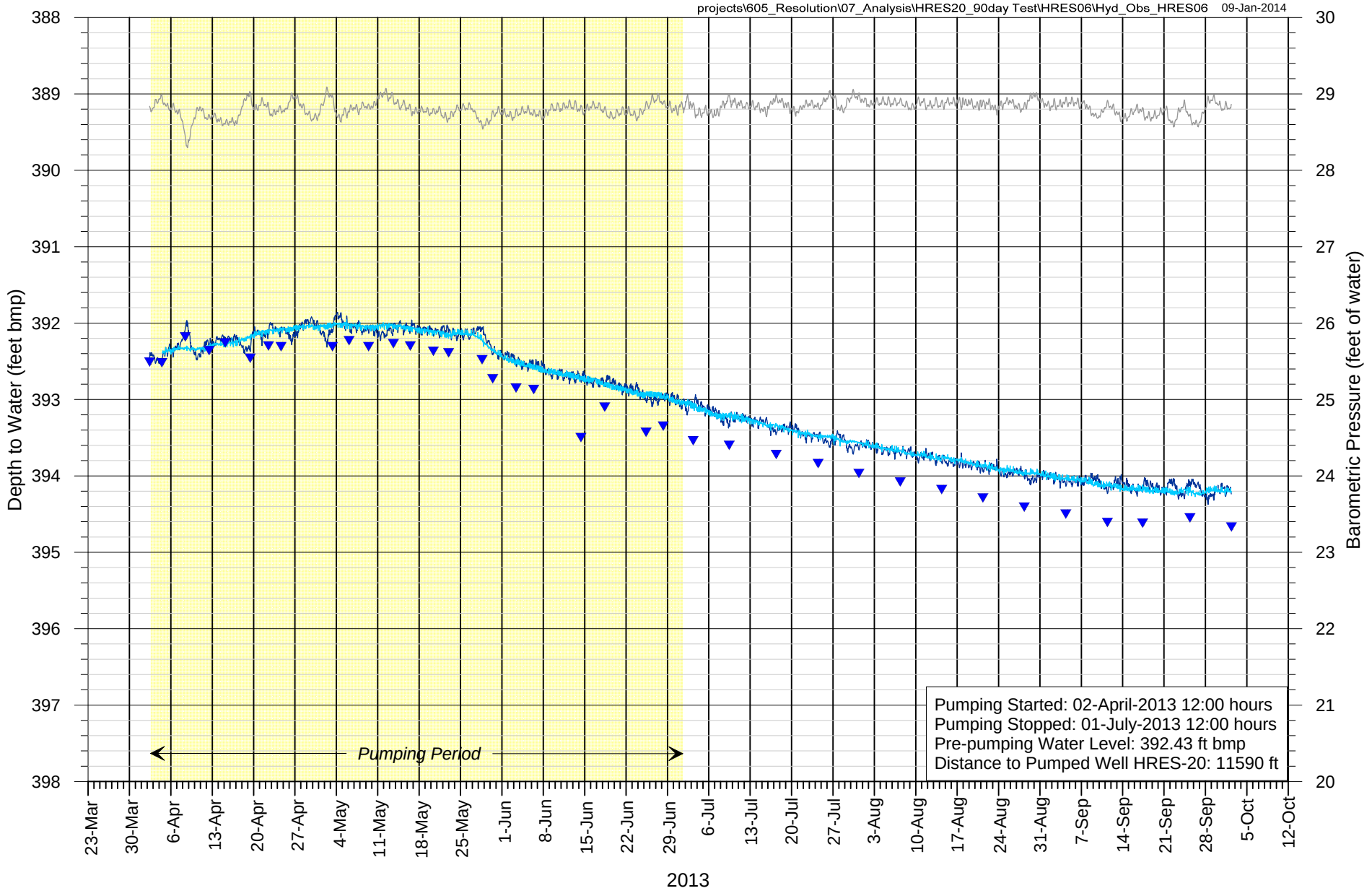
EXPLANATION

- Depth to Water (baro corrected)
- Depth to Water (BRF corrected)
- Depth to Water (manual)
- Barometric Pressure (HRES-04 station)

FIGURE A-5. HYDROGRAPH FOR OBSERVATION WELL HRES-04

Client: Resolution Copper Mining LLC
Project: Well HRES-20 90-day Aquifer Test
Location: Pinal County, Arizona

MONTGOMERY & ASSOCIATES



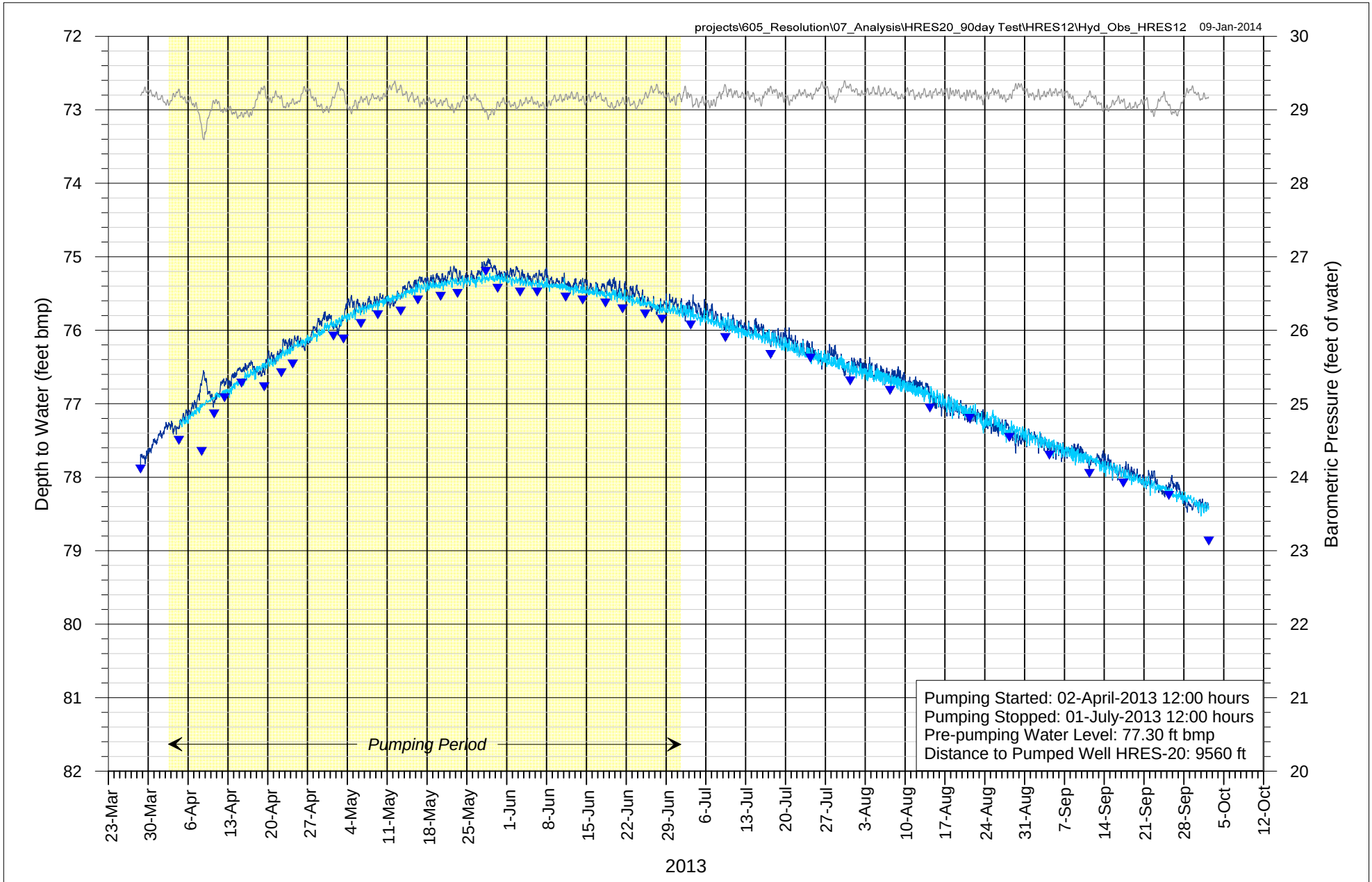
EXPLANATION

- Depth to Water (baro corrected)
- Depth to Water (BRF corrected)
- Depth to Water (manual)
- Barometric Pressure (HRES-06 station)

FIGURE A-6. HYDROGRAPH FOR OBSERVATION WELL HRES-06

Client: Resolution Copper Mining LLC
Project: Well HRES-20 90-day Aquifer Test
Location: Pinal County, Arizona

MONTGOMERY & ASSOCIATES



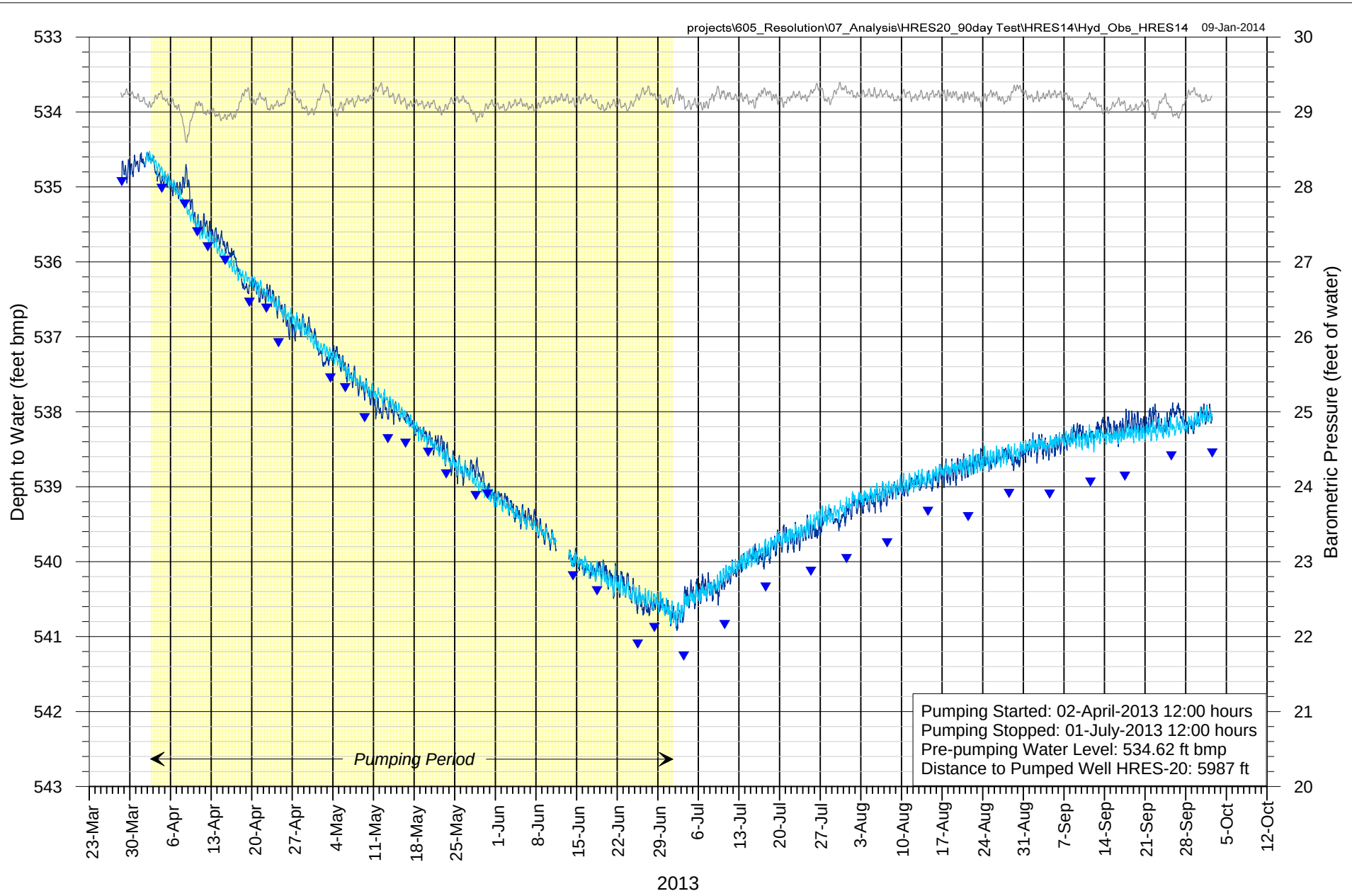
EXPLANATION

- Depth to Water (baro corrected)
- Depth to Water (BRF corrected)
- Depth to Water (manual)
- Barometric Pressure (Met station)

FIGURE A-7. HYDROGRAPH FOR OBSERVATION WELL HRES-12

Client: Resolution Copper Mining LLC
Project: Well HRES-20 90-day Aquifer Test
Location: Pinal County, Arizona

MONTGOMERY & ASSOCIATES



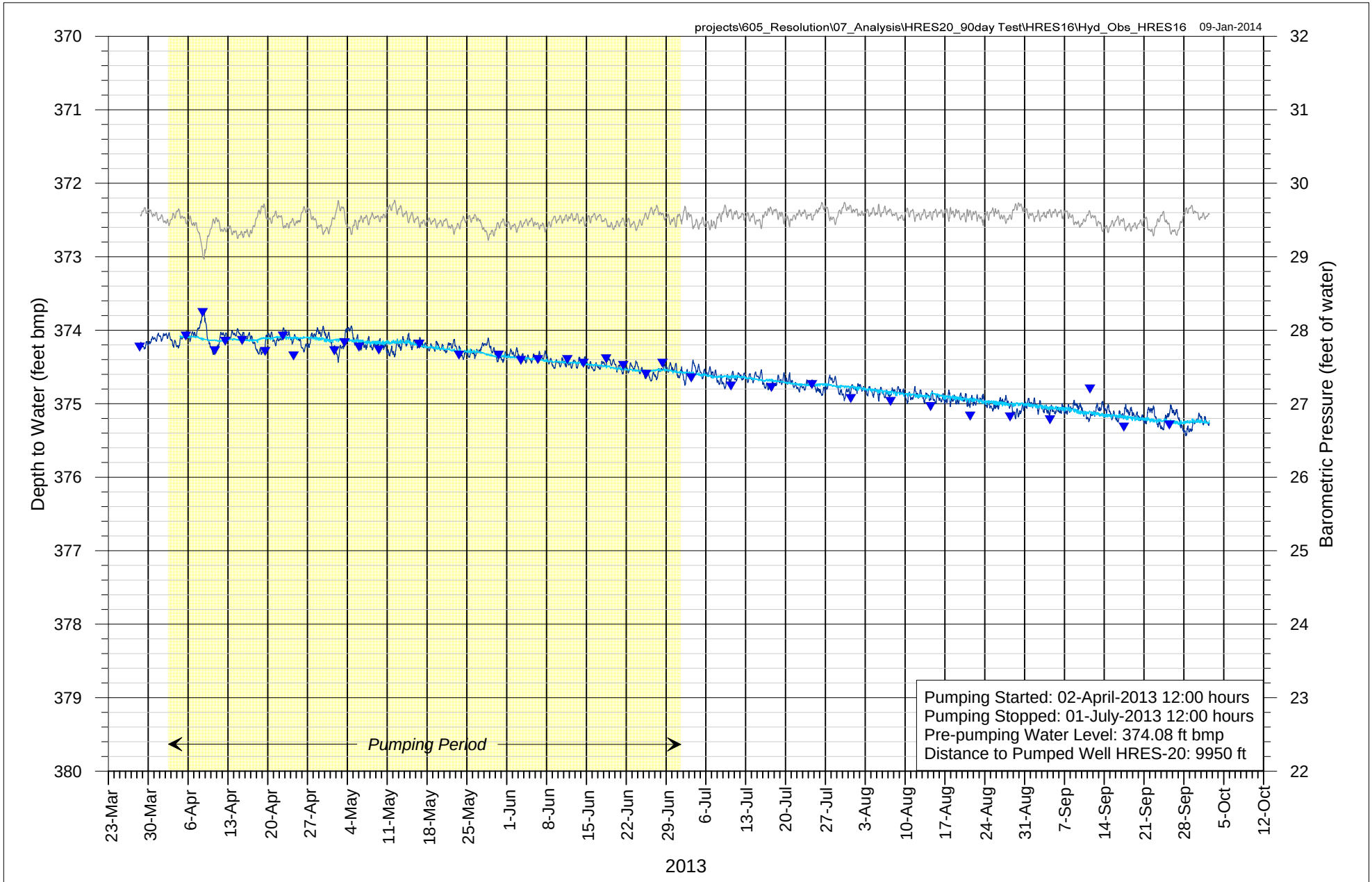
EXPLANATION

- Depth to Water (baro corrected)
- Depth to Water (BRF corrected)
- Depth to Water (manual)
- Barometric Pressure (Met Station)

FIGURE A-8. HYDROGRAPH FOR OBSERVATION WELL HRES-14

Client: Resolution Copper Mining LLC
Project: Well HRES-20 90-day Aquifer Test
Location: Pinal County, Arizona

MONTGOMERY & ASSOCIATES



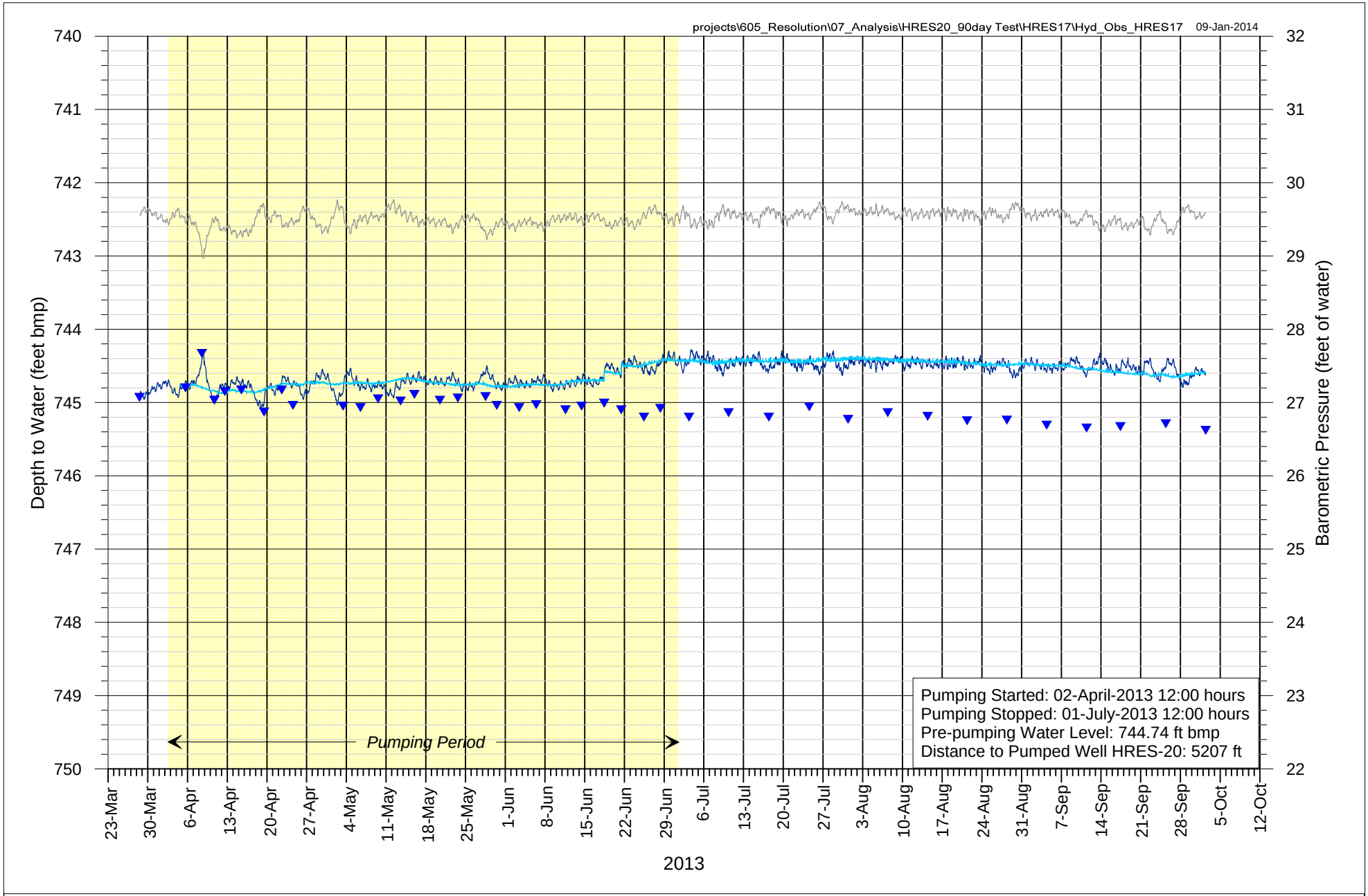
EXPLANATION

- Depth to Water (baro corrected)
- Depth to Water (BRF corrected)
- Depth to Water (manual)
- Barometric Pressure (HRES-16 station)

FIGURE A-9. HYDROGRAPH FOR OBSERVATION WELL HRES-16

Client: Resolution Copper Mining LLC
Project: Well HRES-20 90-day Aquifer Test
Location: Pinal County, Arizona

MONTGOMERY & ASSOCIATES



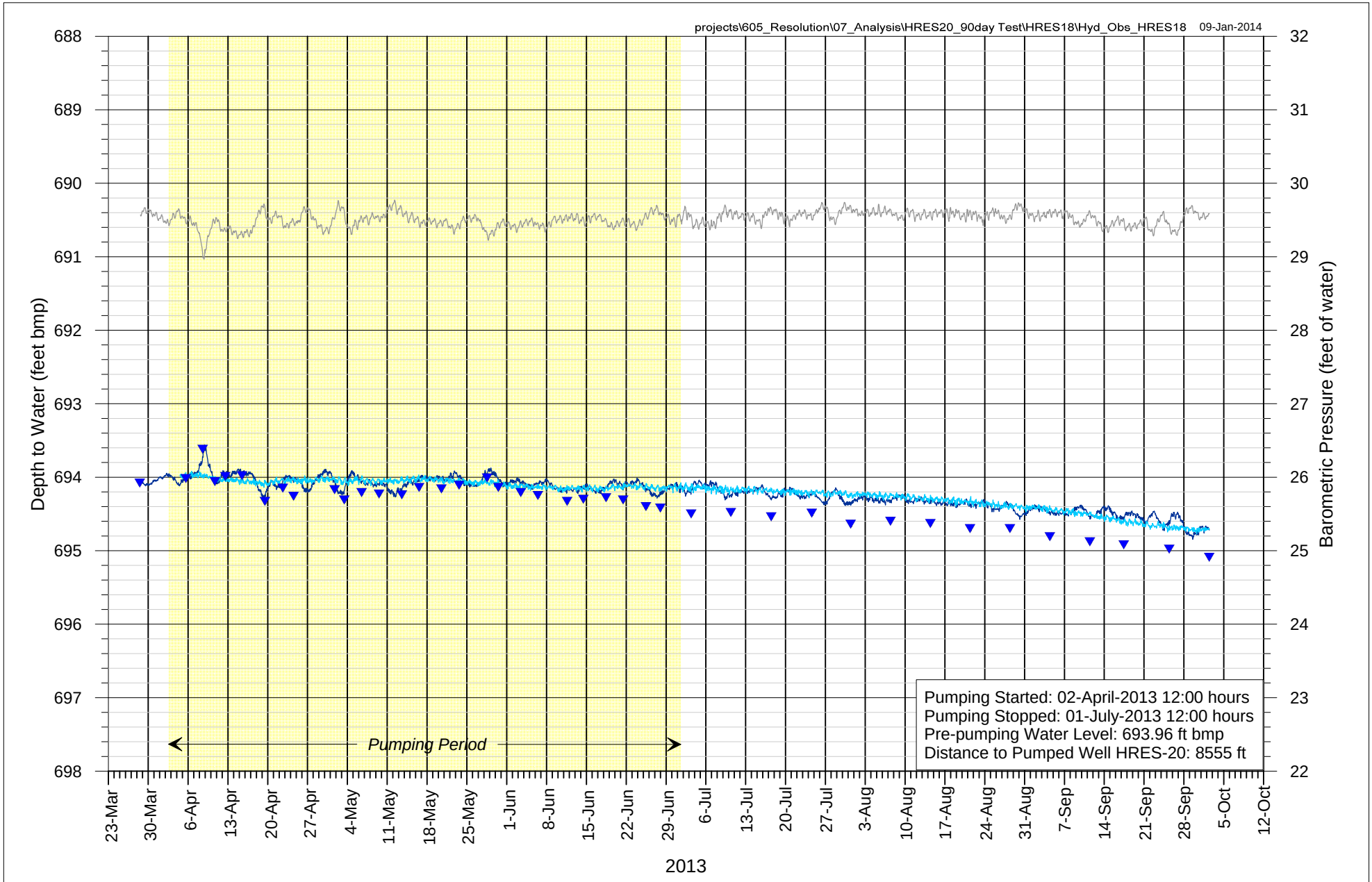
EXPLANATION

- Depth to Water (baro corrected)
- Depth to Water (BRF corrected)
- Depth to Water (manual)
- Barometric Pressure (HRES-16 station)

FIGURE A-10. HYDROGRAPH FOR OBSERVATION WELL HRES-17

Client: Resolution Copper Mining LLC
Project: Well HRES-20 90-day Aquifer Test
Location: Pinal County, Arizona

MONTGOMERY & ASSOCIATES



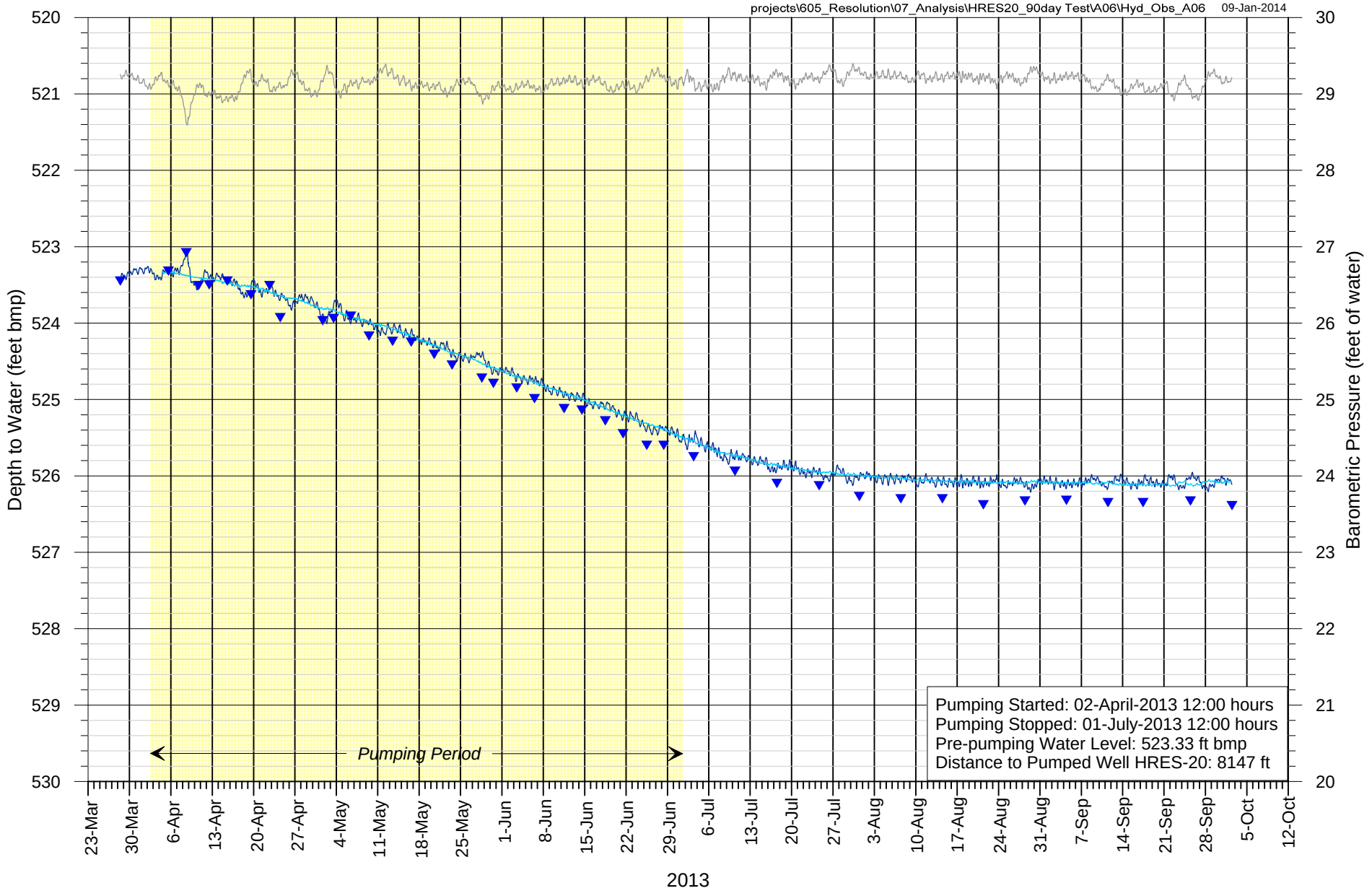
EXPLANATION

- Depth to Water (baro corrected)
- Depth to Water (BRF corrected)
- Depth to Water (manual)
- Barometric Pressure (HRES-16 station)

FIGURE A-11. HYDROGRAPH FOR OBSERVATION WELL HRES-18

Client: Resolution Copper Mining LLC
Project: Well HRES-20 90-day Aquifer Test
Location: Pinal County, Arizona

MONTGOMERY & ASSOCIATES



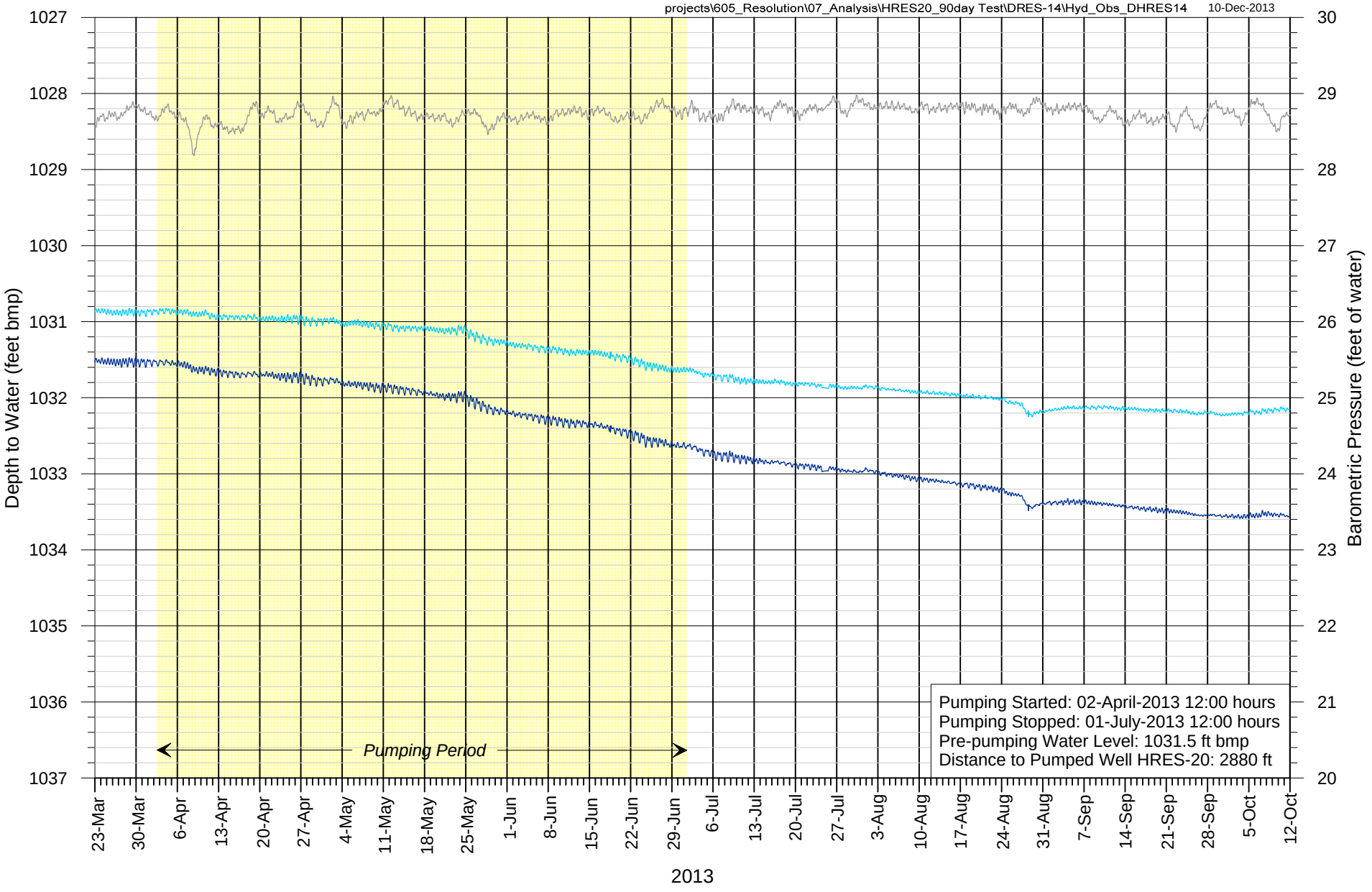
EXPLANATION

- Depth to Water (baro corrected)
- Depth to Water (BRF corrected)
- Depth to Water (manual)
- Barometric Pressure (Met station)

FIGURE A-12. HYDROGRAPH FOR OBSERVATION WELL A-06

Client: Resolution Copper Mining LLC
Project: Well HRES-20 90-day Aquifer Test
Location: Pinal County, Arizona

MONTGOMERY & ASSOCIATES



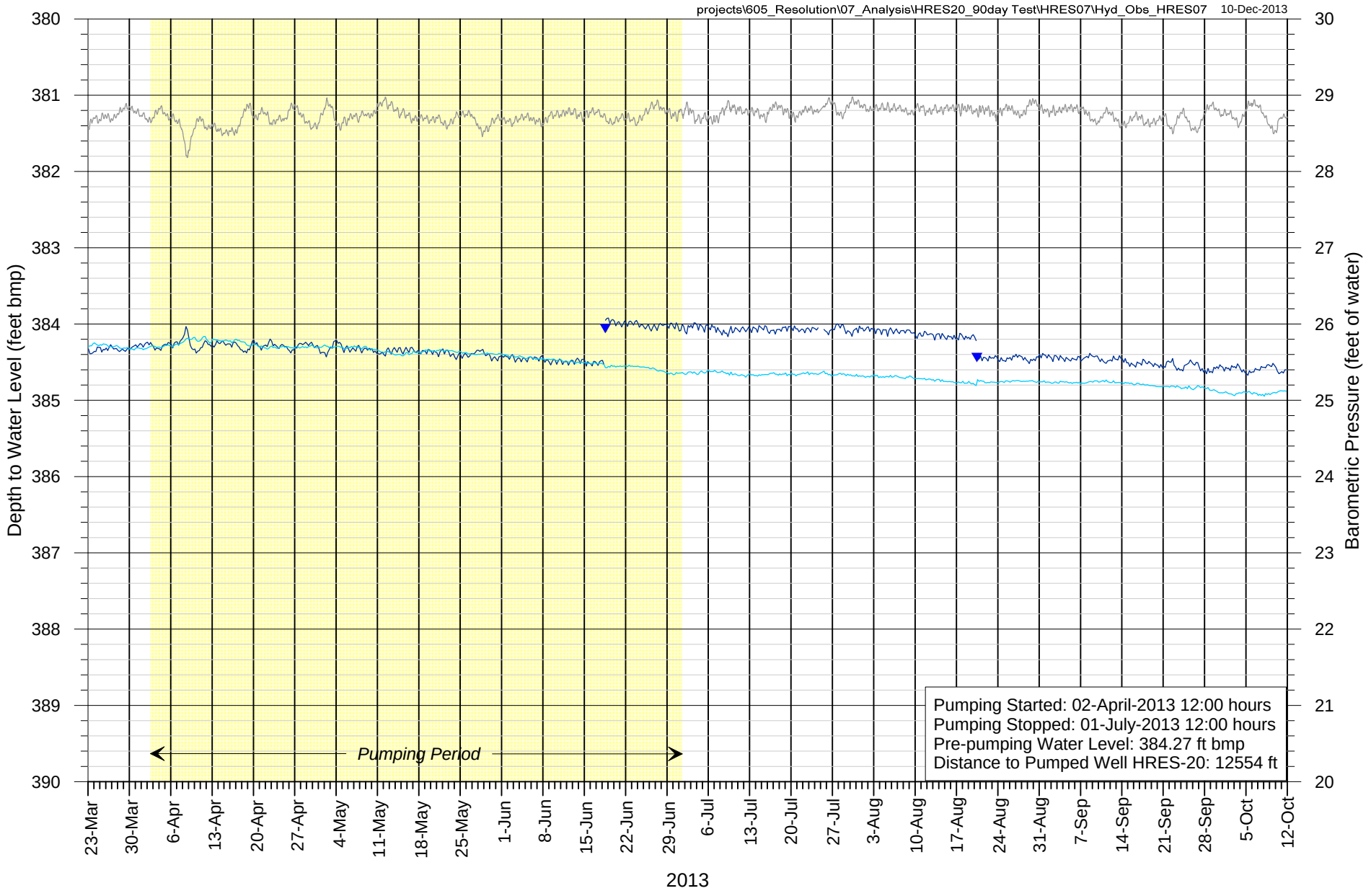
EXPLANATION

- Depth to Water (baro corrected)
- Depth to Water (antecedent trend and BRF corrected)
- Barometric Pressure (DHRES-14)

FIGURE A-13. HYDROGRAPH FOR OBSERVATION WELL DHRES-14

Client: Resolution Copper Mining LLC
Project: Well HRES-20 90-day Aquifer Test
Location: Pinal County, Arizona

MONTGOMERY & ASSOCIATES



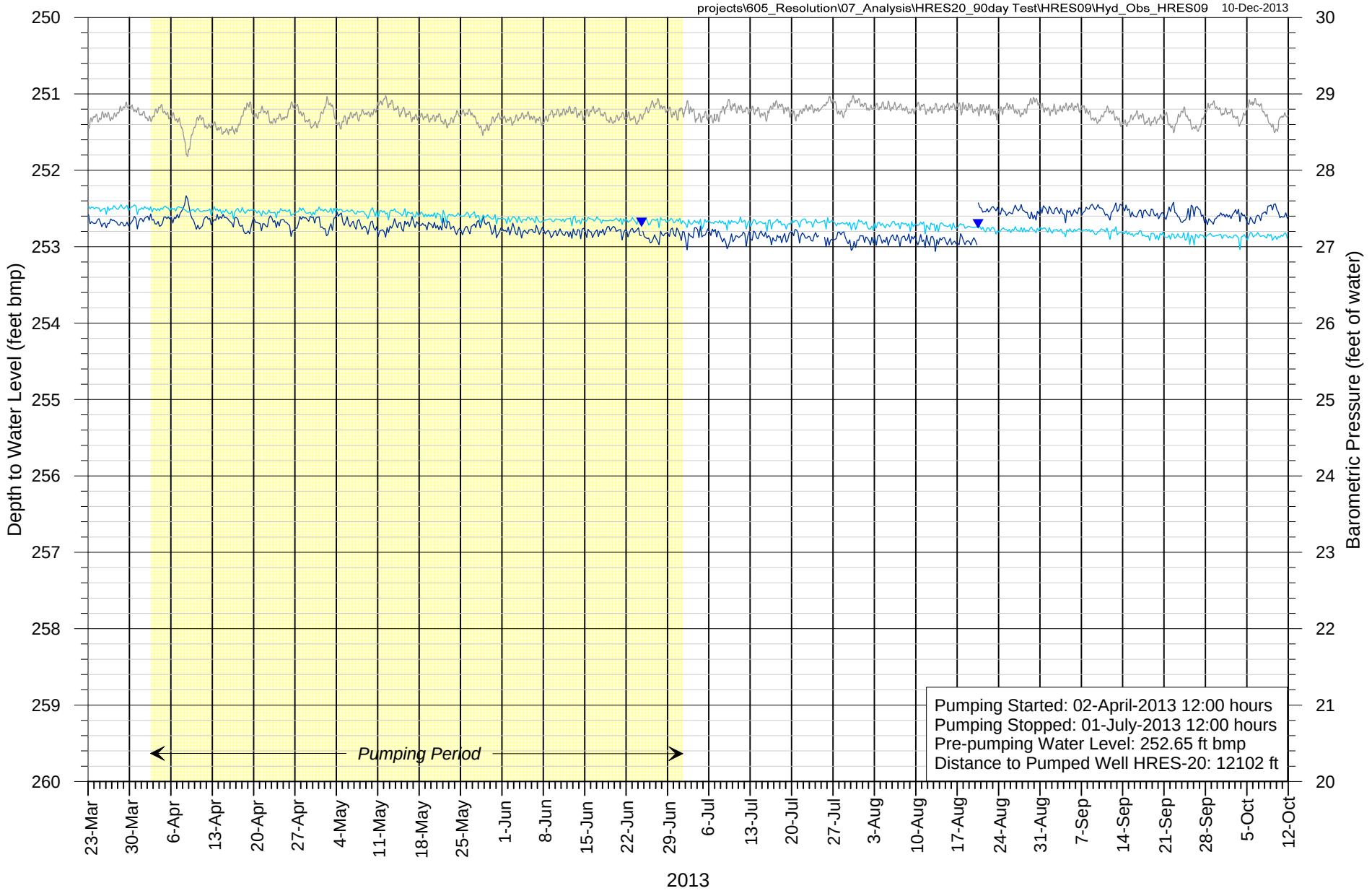
EXPLANATION

- Depth to Water (baro corrected)
- Depth to Water (BRF corrected with meas. point change)
- Depth to Water (manual)
- Barometric Pressure (DHRES-14 station)

FIGURE A-14. HYDROGRAPH FOR OBSERVATION WELL HRES-07

Client: Resolution Copper Mining LLC
Project: Well HRES-20 90-day Aquifer Test
Location: Pinal County, Arizona

MONTGOMERY & ASSOCIATES



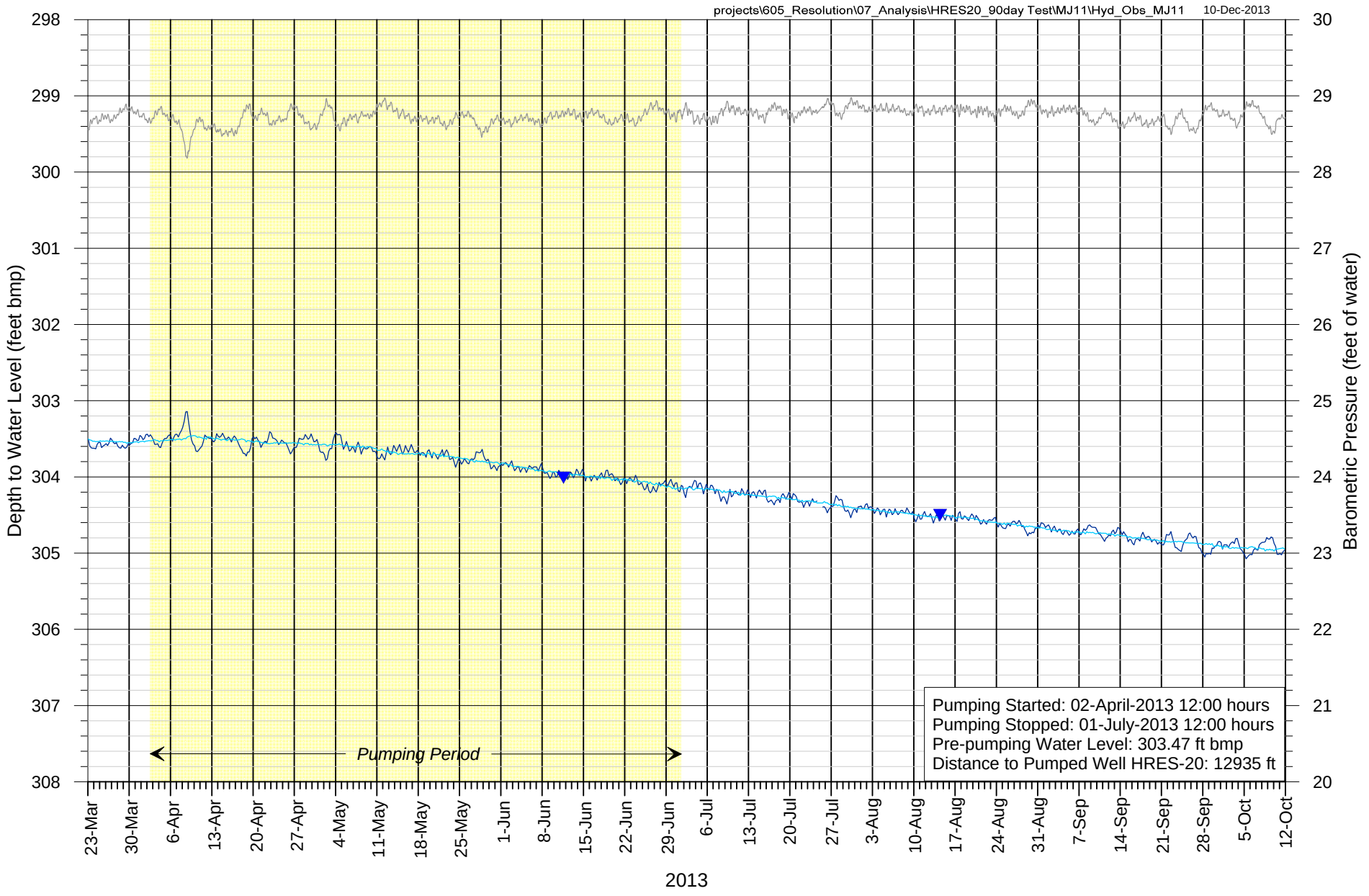
EXPLANATION

- Depth to Water (baro corrected)
- Depth to Water (BRF corrected with meas. point change)
- Depth to Water (manual)
- Barometric Pressure (DHRES-14 station)

FIGURE A-15. HYDROGRAPH FOR OBSERVATION WELL HRES-09

Client: Resolution Copper Mining LLC
Project: Well HRES-20 90-day Aquifer Test
Location: Pinal County, Arizona

MONTGOMERY & ASSOCIATES



EXPLANATION

- Depth to Water (baro corrected)
- Depth to Water (BRF corrected)
- Depth to Water (manual)
- Barometric Pressure (DHRES-14 station)

FIGURE A-16. HYDROGRAPH FOR OBSERVATION WELL MJ-11

Client: Resolution Copper Mining LLC
Project: Well HRES-20 90-day Aquifer Test
Location: Pinal County, Arizona

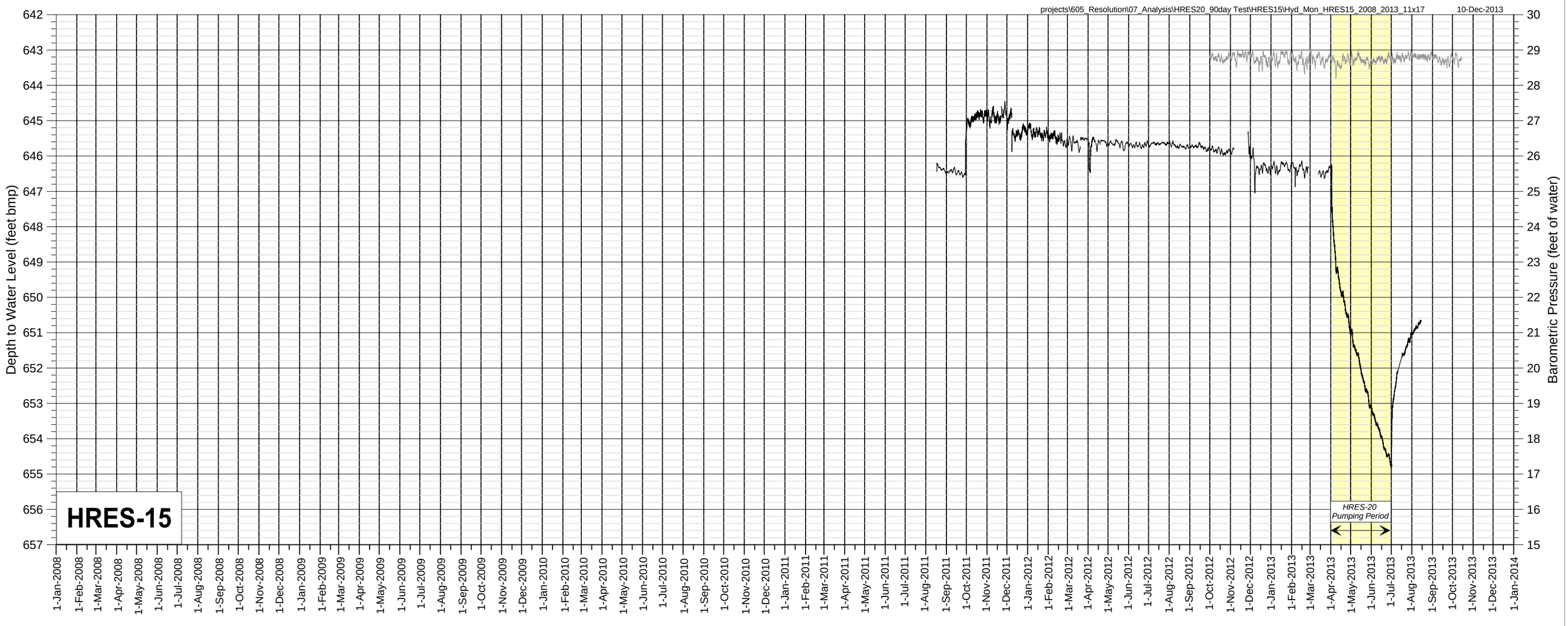
MONTGOMERY & ASSOCIATES

MONTGOMERY & ASSOCIATES

Appendix B

Long-term Hydrographs

Well HRES-20 90-day Aquifer Test
Resolution Copper Mining, Pinal County, Arizona



Note: Water level measurement record started 17-Aug-2011

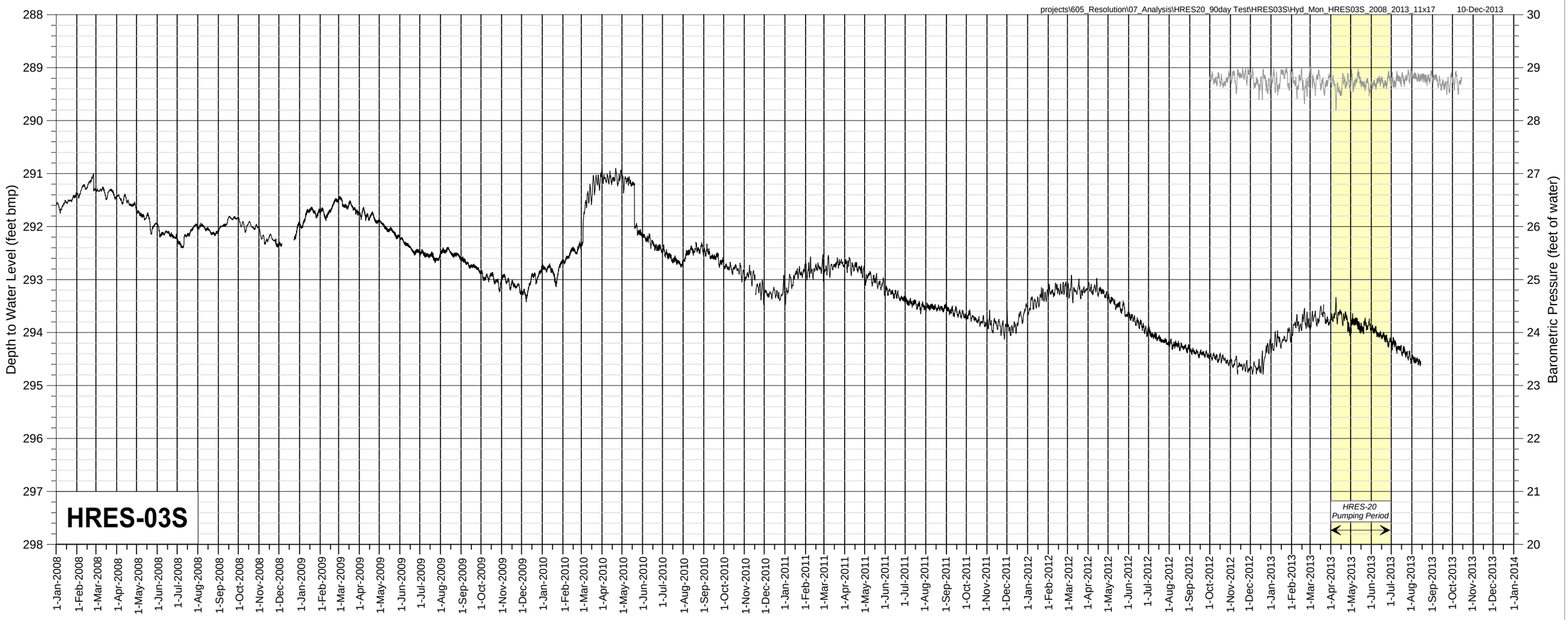
EXPLANATION

- Depth to Water (no correction)
- Barometric Pressure (DHRES-14)

FIGURE B-1. LONG-TERM HYDROGRAPH FOR MONITOR WELL HRES-15

Client: Resolution Copper Mining LLC
Project: Well HRES-20 90-day Aquifer Test
Location: Pinal County, Arizona

MONTGOMERY & ASSOCIATES



Note: Water level measurement record started 4-Jun-2004

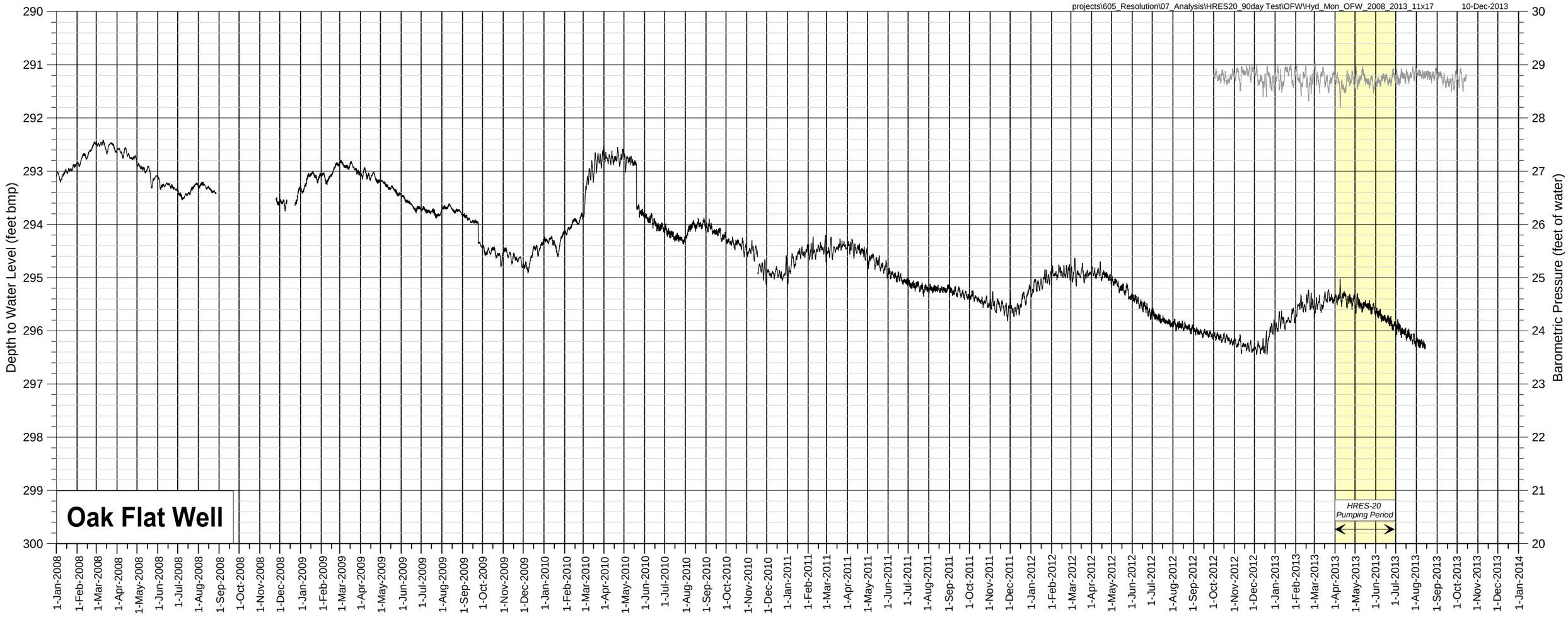
EXPLANATION

- Depth to Water (no correction)
- Barometric Pressure (DHRES-14)

FIGURE B-2. LONG-TERM HYDROGRAPH FOR MONITOR WELL HRES-03S

Client: Resolution Copper Mining LLC
Project: Well HRES-20 90-day Aquifer Test
Location: Pinal County, Arizona

MONTGOMERY & ASSOCIATES



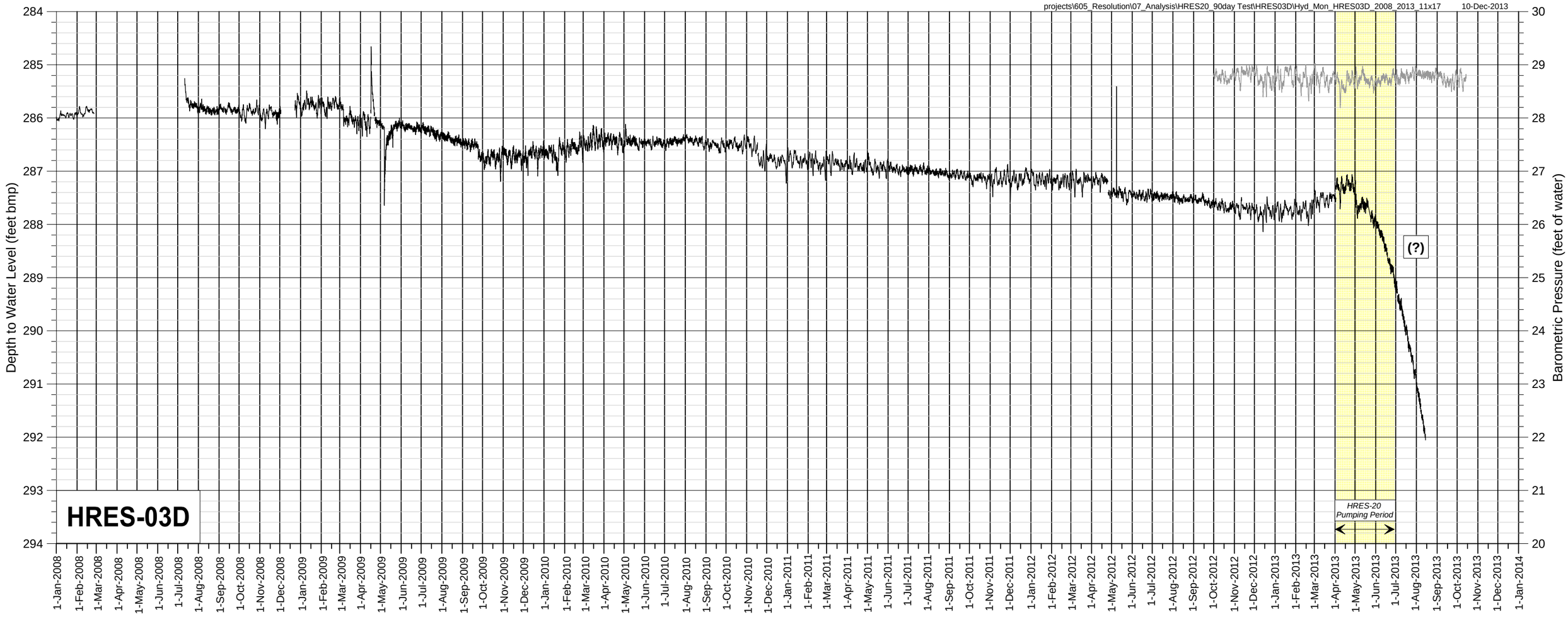
Note: Water level measurement record started 31-Oct-2003

EXPLANATION
- Depth to Water (no correction)
- Barometric Pressure (DHRES-14)

FIGURE B-3. LONG-TERM HYDROGRAPH FOR MONITOR WELL OAK FLAT WELL

Client: Resolution Copper Mining LLC
Project: Well HRES-20 90-day Aquifer Test
Location: Pinal County, Arizona

MONTGOMERY & ASSOCIATES



Note: Water level measurement record started 4-Jun-2004

EXPLANATION

—— Depth to Water (no correction)

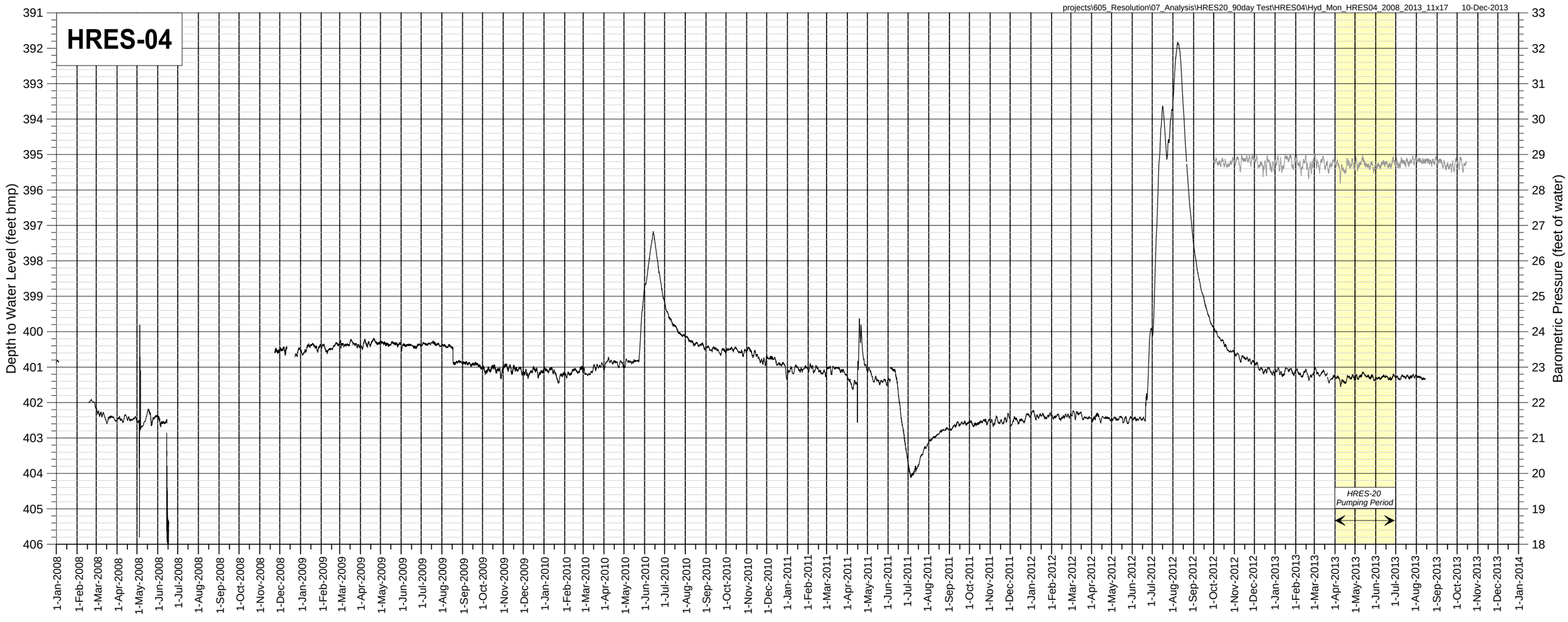
—— Barometric Pressure (DHRES-14)

(?) Pressure Transducer Malfunction

FIGURE B-4. LONG-TERM HYDROGRAPH FOR MONITOR WELL HRES-03D

Client: Resolution Copper Mining LLC
Project: Well HRES-20 90-day Aquifer Test
Location: Pinal County, Arizona

MONTGOMERY & ASSOCIATES



Note: Water level measurement record started 2-Mar-2005

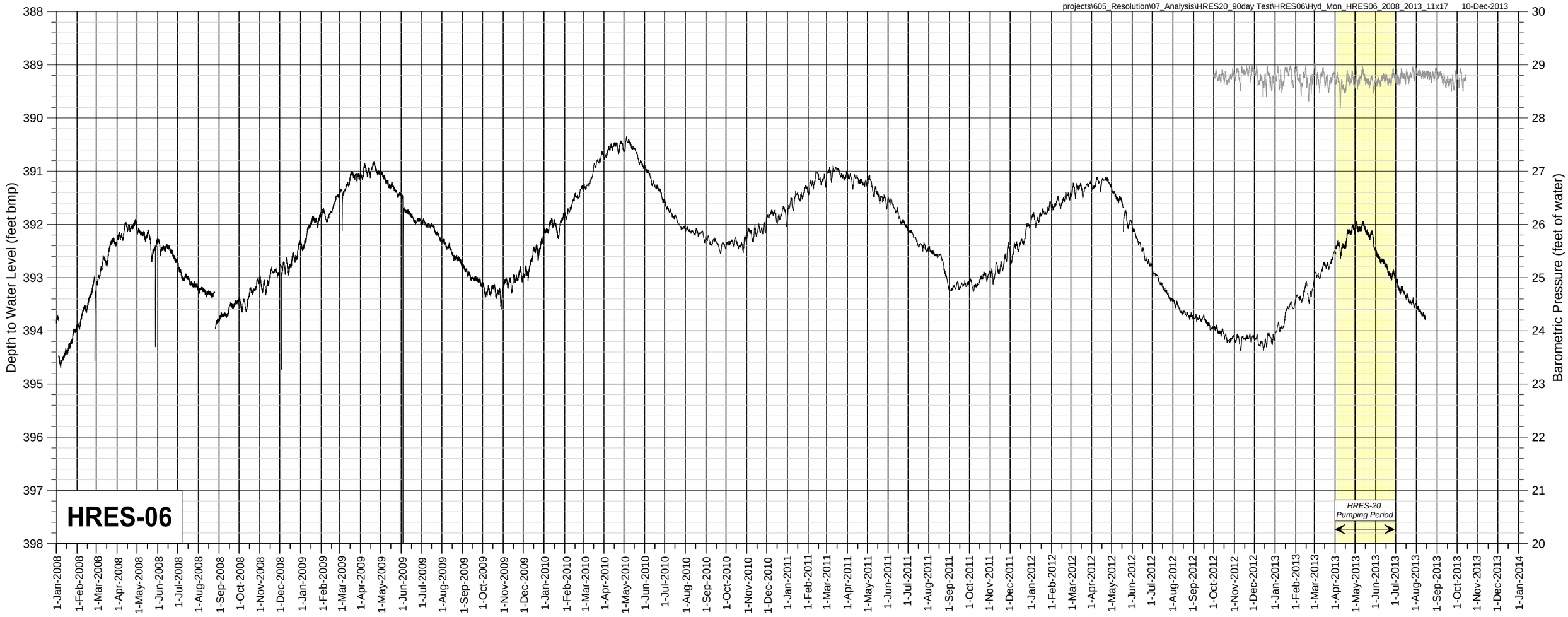
EXPLANATION

- Depth to Water (no correction)
- Barometric Pressure (DHRES-14)

FIGURE B-5. LONG-TERM HYDROGRAPH FOR MONITOR WELL HRES-04

Client: Resolution Copper Mining LLC
Project: Well HRES-20 90-day Aquifer Test
Location: Pinal County, Arizona

MONTGOMERY & ASSOCIATES



Note: Water level measurement record started 13-Jun-2007

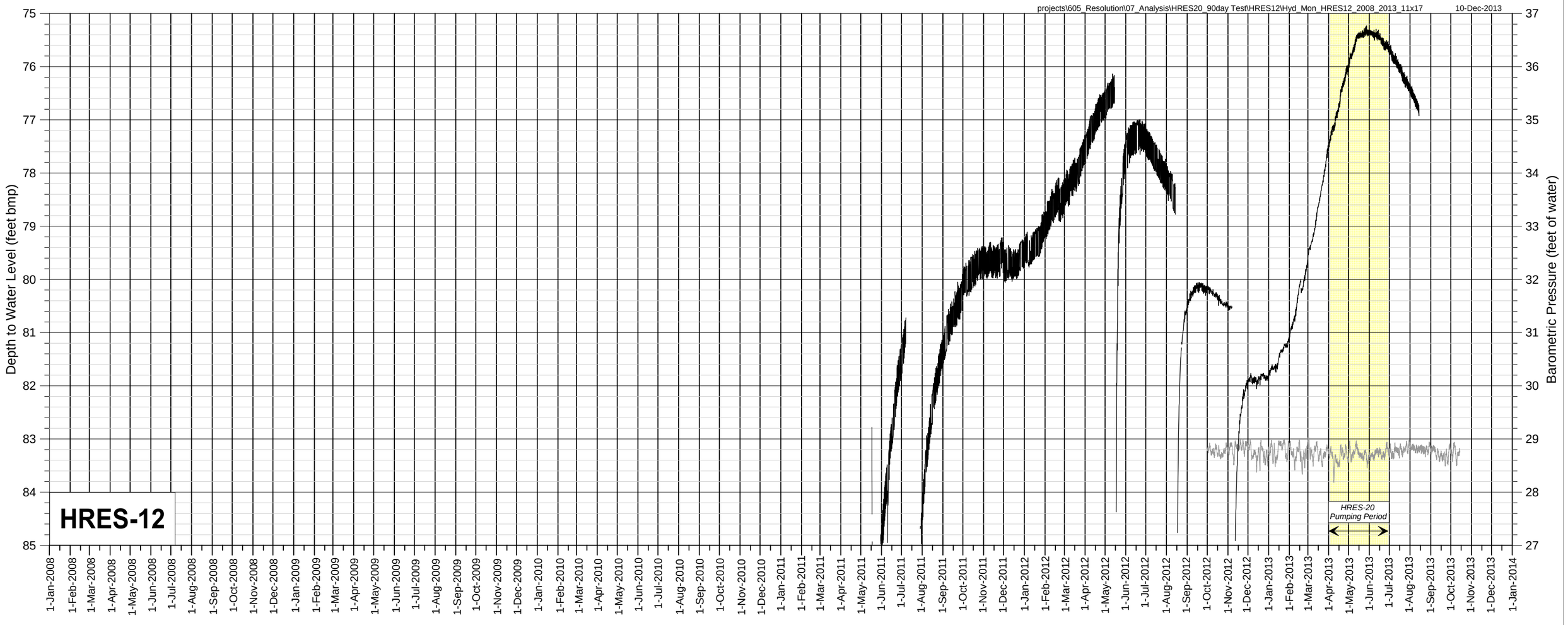
EXPLANATION

- Depth to Water (no correction)
- Barometric Pressure (DHRES-14)

FIGURE B-6. LONG-TERM HYDROGRAPH FOR MONITOR WELL HRES-06

Client: Resolution Copper Mining LLC
Project: Well HRES-20 90-day Aquifer Test
Location: Pinal County, Arizona

MONTGOMERY & ASSOCIATES



Note: Water level measurement record started 4-May-2011

EXPLANATION
- Depth to Water (no correction)
- Barometric Pressure (DHRES-14)

FIGURE B-7. LONG-TERM HYDROGRAPH FOR MONITOR WELL HRES-12

Client: Resolution Copper Mining LLC
Project: Well HRES-20 90-day Aquifer Test
Location: Pinal County, Arizona

MONTGOMERY & ASSOCIATES

projects\605_Resolution\07_Analysis\HRES20_90day Test\HRES14\Hyd_Mon_HRES14_2008_2013_11x17 10-Dec-2013

HRES-20 Pumping Period

Depth to Water Level (feet bmp)

Barometric Pressure (feet of water)

HRES-14

Note: Water level measurement record started 10-May-2011

EXPLANATION

- Depth to Water (no correction)
- Depth to Water (measuring point change)
- Barometric Pressure (DHRES-14)

FIGURE B-8. LONG-TERM HYDROGRAPH FOR MONITOR WELL HRES-14

Client: Resolution Copper Mining LLC
Project: Well HRES-20 90-day Aquifer Test
Location: Pinal County, Arizona

MONTGOMERY & ASSOCIATES

projects\605_Resolution\07_Analysis\HRES20_90day Test\HRES16\Hyd_Mon_HRES16_2008_2013_11x17 10-Dec-2013

Depth to Water Level (feet bmp)

Barometric Pressure (feet of water)

370
371
372
373
374
375
376
377
378
379
380

30
29
28
27
26
25
24
23
22
21
20

HRES-16

HRES-20 Pumping Period

1-Jan-2008 1-Feb-2008 1-Mar-2008 1-Apr-2008 1-May-2008 1-Jun-2008 1-Jul-2008 1-Aug-2008 1-Sep-2008 1-Oct-2008 1-Nov-2008 1-Dec-2008 1-Jan-2009 1-Feb-2009 1-Mar-2009 1-Apr-2009 1-May-2009 1-Jun-2009 1-Jul-2009 1-Aug-2009 1-Sep-2009 1-Oct-2009 1-Nov-2009 1-Dec-2009 1-Jan-2010 1-Feb-2010 1-Mar-2010 1-Apr-2010 1-May-2010 1-Jun-2010 1-Jul-2010 1-Aug-2010 1-Sep-2010 1-Oct-2010 1-Nov-2010 1-Dec-2010 1-Jan-2011 1-Feb-2011 1-Mar-2011 1-Apr-2011 1-May-2011 1-Jun-2011 1-Jul-2011 1-Aug-2011 1-Sep-2011 1-Oct-2011 1-Nov-2011 1-Dec-2011 1-Jan-2012 1-Feb-2012 1-Mar-2012 1-Apr-2012 1-May-2012 1-Jun-2012 1-Jul-2012 1-Aug-2012 1-Sep-2012 1-Oct-2012 1-Nov-2012 1-Dec-2012 1-Jan-2013 1-Feb-2013 1-Mar-2013 1-Apr-2013 1-May-2013 1-Jun-2013 1-Jul-2013 1-Aug-2013 1-Sep-2013 1-Oct-2013 1-Nov-2013 1-Dec-2013 1-Jan-2014

Note: Water level measurement record started 17-Aug-2011

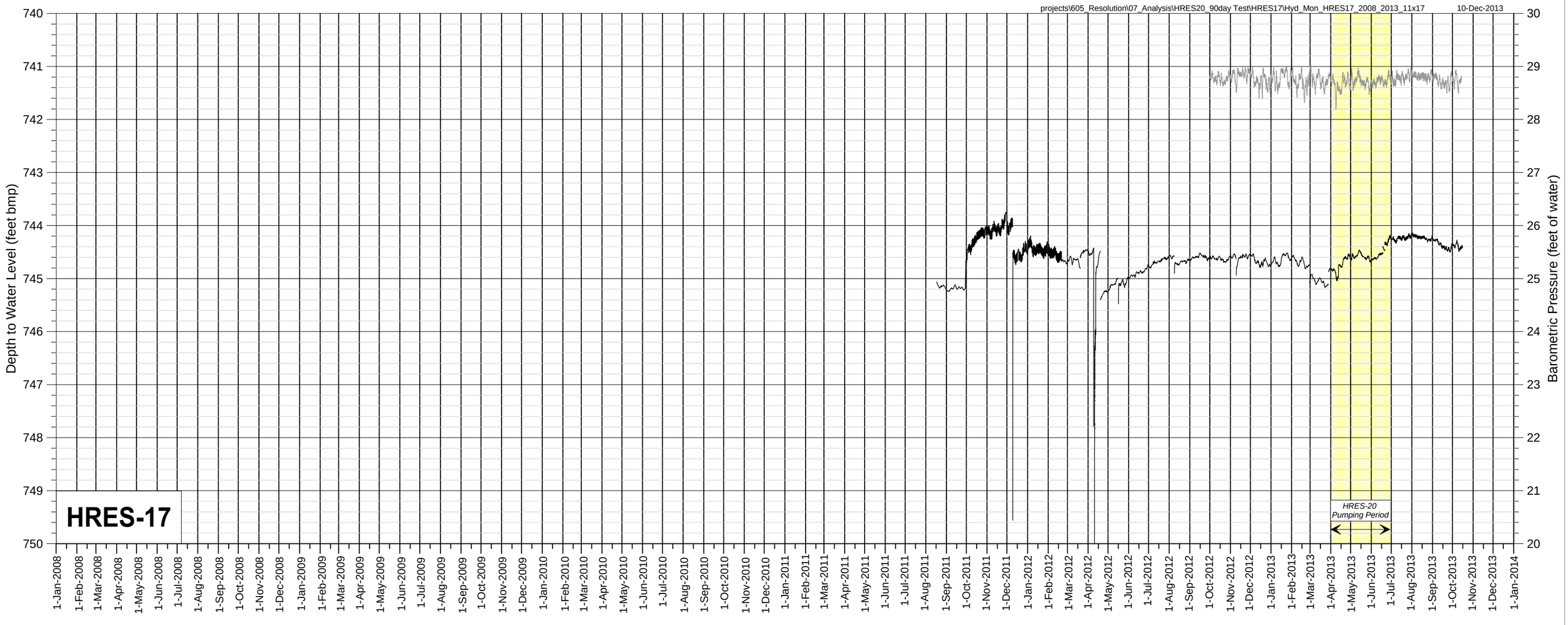
EXPLANATION

- Depth to Water (no correction)
- Depth to Water (measuring point change)
- Barometric Pressure (DHRES-14)

FIGURE B-9. LONG-TERM HYDROGRAPH FOR MONITOR WELL HRES-16

Client: Resolution Copper Mining LLC
Project: Well HRES-20 90-day Aquifer Test
Location: Pinal County, Arizona

MONTGOMERY & ASSOCIATES



Note: Water level measurement record started 17-Aug-2011

EXPLANATION

- Depth to Water (no correction)
- Barometric Pressure (DHRES-14)

FIGURE B-10. LONG-TERM HYDROGRAPH FOR MONITOR WELL HRES-17

Client: Resolution Copper Mining LLC
Project: Well HRES-20 90-day Aquifer Test
Location: Pinal County, Arizona

MONTGOMERY & ASSOCIATES

projects\605_Resolution\07_Analysis\HRES20_90day Test\HRES18\Hyd_Mon_HRES18_2008_2013_11x17 10-Dec-2013

Depth to Water Level (feet bmp)

Barometric Pressure (feet of water)

688
689
690
691
692
693
694
695
696
697
698

30
29
28
27
26
25
24
23
22
21
20

HRES-18

HRES-20 Pumping Period

1-Jan-2008 1-Feb-2008 1-Mar-2008 1-Apr-2008 1-May-2008 1-Jun-2008 1-Jul-2008 1-Aug-2008 1-Sep-2008 1-Oct-2008 1-Nov-2008 1-Dec-2008 1-Jan-2009 1-Feb-2009 1-Mar-2009 1-Apr-2009 1-May-2009 1-Jun-2009 1-Jul-2009 1-Aug-2009 1-Sep-2009 1-Oct-2009 1-Nov-2009 1-Dec-2009 1-Jan-2010 1-Feb-2010 1-Mar-2010 1-Apr-2010 1-May-2010 1-Jun-2010 1-Jul-2010 1-Aug-2010 1-Sep-2010 1-Oct-2010 1-Nov-2010 1-Dec-2010 1-Jan-2011 1-Feb-2011 1-Mar-2011 1-Apr-2011 1-May-2011 1-Jun-2011 1-Jul-2011 1-Aug-2011 1-Sep-2011 1-Oct-2011 1-Nov-2011 1-Dec-2011 1-Jan-2012 1-Feb-2012 1-Mar-2012 1-Apr-2012 1-May-2012 1-Jun-2012 1-Jul-2012 1-Aug-2012 1-Sep-2012 1-Oct-2012 1-Nov-2012 1-Dec-2012 1-Jan-2013 1-Feb-2013 1-Mar-2013 1-Apr-2013 1-May-2013 1-Jun-2013 1-Jul-2013 1-Aug-2013 1-Sep-2013 1-Oct-2013 1-Nov-2013 1-Dec-2013 1-Jan-2014

Note: Water level measurement record started 3-Aug-2011

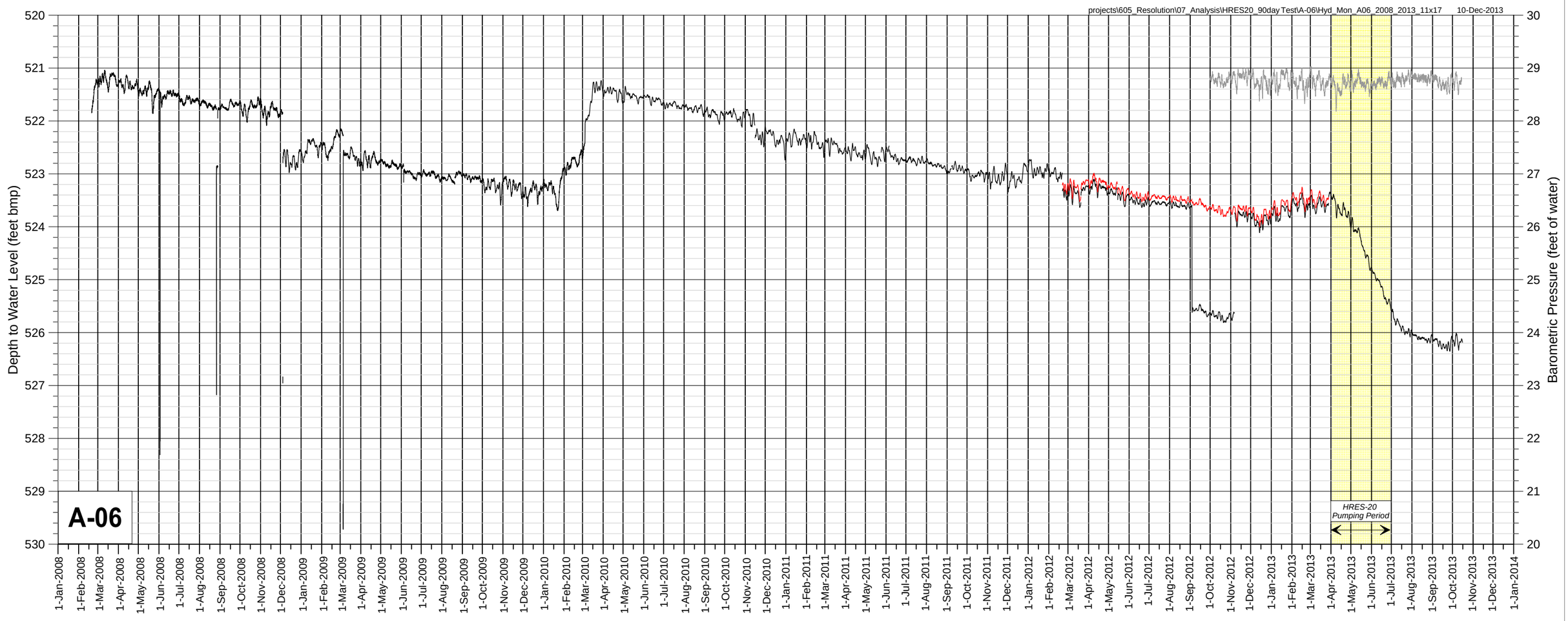
EXPLANATION

- Depth to Water (no correction)
- Depth to Water (measuring point change)
- Barometric Pressure (DHRES-14)

FIGURE B-11. LONG-TERM HYDROGRAPH FOR MONITOR WELL HRES-18

Client: Resolution Copper Mining LLC
Project: Well HRES-20 90-day Aquifer Test
Location: Pinal County, Arizona

MONTGOMERY & ASSOCIATES



Note: Water level measurement record started 29-Sep-2006

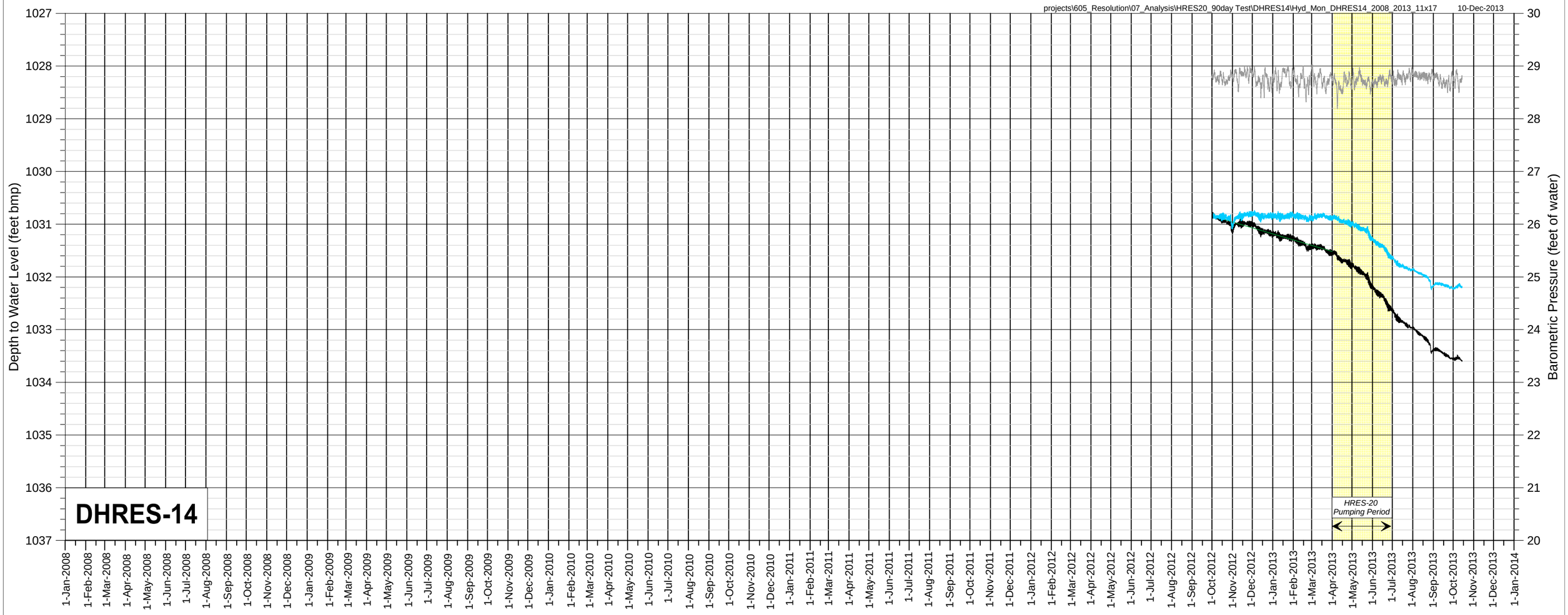
EXPLANATION

- Depth to Water (no correction)
- Depth to Water (measuring point change)
- Barometric Pressure (DHRES-14)

FIGURE B-12. LONG-TERM HYDROGRAPH FOR MONITOR WELL A-06

Client: Resolution Copper Mining LLC
Project: Well HRES-20 90-day Aquifer Test
Location: Pinal County, Arizona

MONTGOMERY & ASSOCIATES



Note: Water level measurement record started October-2011

EXPLANATION

- Depth to Water (no correction)
- Depth to Water (antecedent trend and BRF corrected)
- Antecedent Trend
- Barometric Pressure (DHRES-14)

FIGURE B-13. LONG-TERM HYDROGRAPH FOR MONITOR WELL DHRES-14

Client: Resolution Copper Mining LLC
Project: Well HRES-20 90-day Aquifer Test
Location: Pinal County, Arizona

MONTGOMERY & ASSOCIATES

projects\605_Resolution\07_Analysis\HRES20_90day Test\HRES07\Hyd_Mon_HRES07_2008_2013_11x17 10-Dec-2013

Depth to Water Level (feet bmp)

Barometric Pressure (feet of water)

HRES-07

HRES-20 Pumping Period

Note: Water level measurement record started 14-Apr-2008

EXPLANATION
- Depth to Water (no correction)
- Depth to Water (baro corrected)
- Depth to Water (measuring point change)
- Depth to Water (manual)
- Barometric Pressure (DHRES-14)

FIGURE B-14. LONG-TERM HYDROGRAPH FOR MONITOR WELL HRES-07

Client: Resolution Copper Mining LLC
Project: Well HRES-20 90-day Aquifer Test
Location: Pinal County, Arizona

MONTGOMERY & ASSOCIATES

projects\605_Resolution\07_Analysis\HRES20_90day Test\HRES09\Hyd_Mon_HRES09_2008_2013_11x17 10-Dec-2013

Depth to Water Level (feet bmp)

Barometric Pressure (feet of water)

HRES-09

HRES-20 Pumping Period

Note: Water level measurement record started 23-Apr-2010

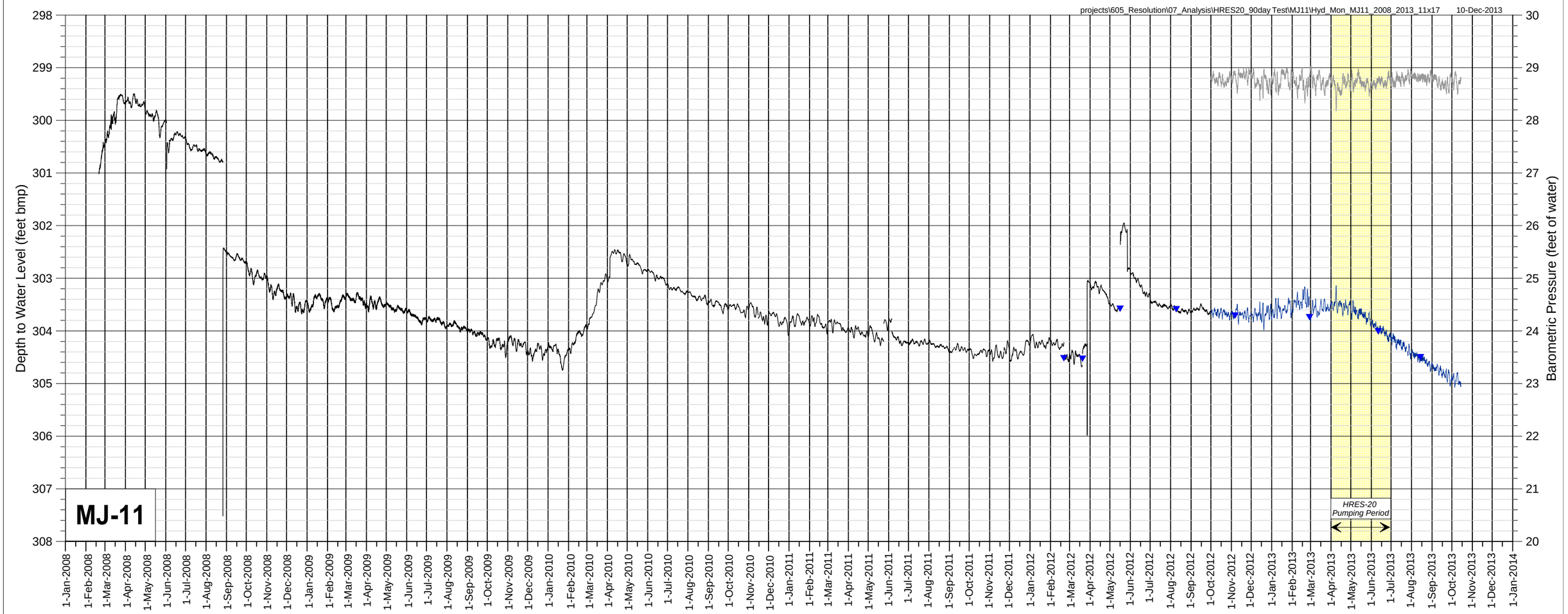
EXPLANATION

- Depth to Water (no correction)
- Depth to Water (baro corrected)
- Depth to Water (measuring point change)
- Depth to Water (manual)
- Barometric Pressure (DHRES-14)

FIGURE B-15. LONG-TERM HYDROGRAPH FOR MONITOR WELL HRES-09

Client: Resolution Copper Mining LLC
Project: Well HRES-20 90-day Aquifer Test
Location: Pinal County, Arizona

MONTGOMERY & ASSOCIATES



Note: Water level measurement record started 24-Oct-2006

EXPLANATION

- Depth to Water (no correction)
- Depth to Water (baro corrected)
- Depth to Water (manual)
- Barometric Pressure (DHRES-14)

FIGURE B-16. LONG-TERM HYDROGRAPH FOR MONITOR WELL MJ-11

Client: Resolution Copper Mining LLC
Project: Well HRES-20 90-day Aquifer Test
Location: Pinal County, Arizona

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