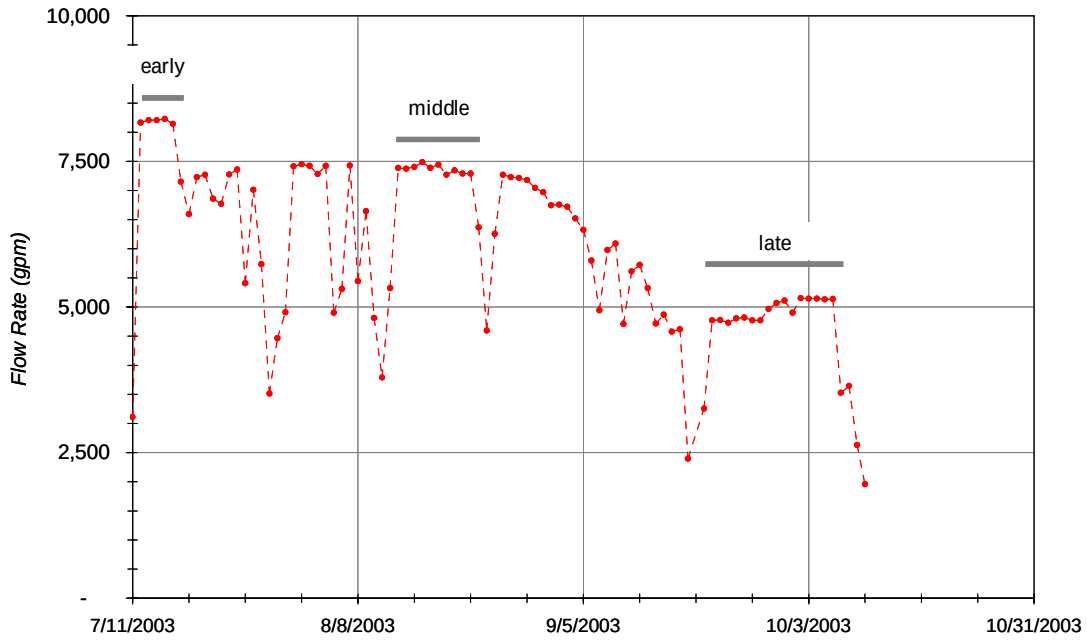
Appendix A - Pumping Test Analysis

This appendix summarizes the data collected for the 2003 through 2005 Wadesville demonstration project, including observed pumping records, water table variations as recorded in mine pool level, and projected yield or yield interpretations.

Pumping Observations

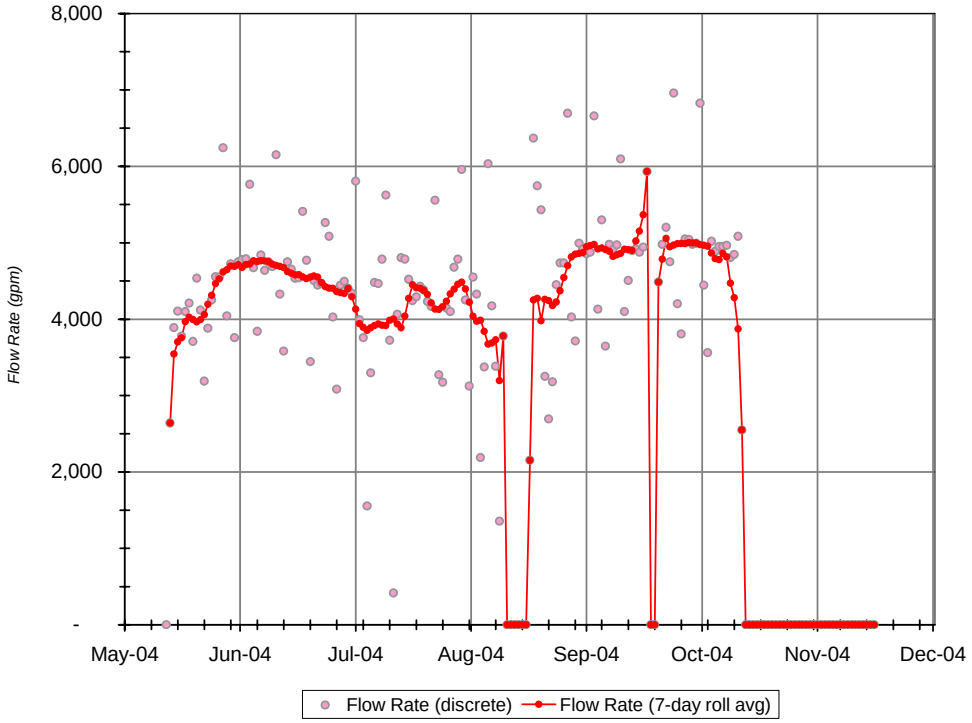
Year 2003: Between July 11, 2003 and October 10, 2003, water was pumped from the Wadesville mine at daily rates ranging from 2.82 million gallons per day (mgd) to 11.85 mgd, corresponding to pumping rates of 1,958 gallons per minute (gpm) to 8,230 gpm. The estimated pumping rates varied over time as follows:

Figure 1A: Water Withdrawal Rates (July – October 2003)



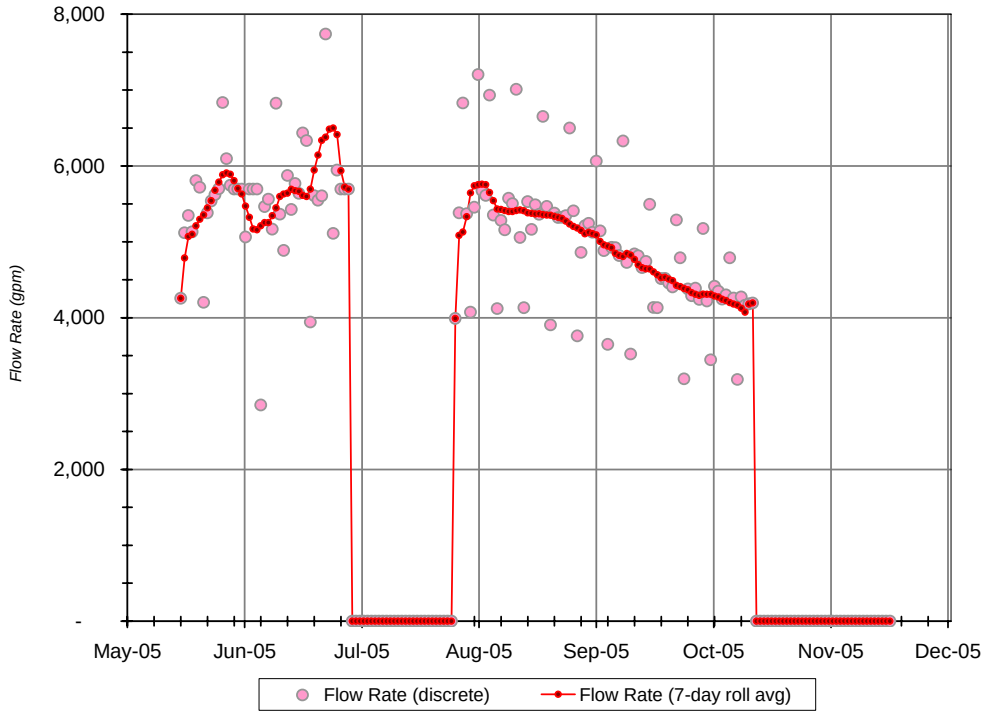
Year 2004: Between May 14 and October 12, 2004, water was pumped from the Wadesville mine at daily rates ranging from 0.60 mgd to 10.02 mgd, corresponding to pumping rates of 417 gallons per minute (gpm) to 6,960 gpm. The estimated pumping rates varied over time as follows (Figure 1B):

Figure 1B: Water Withdrawal Rates (May – October 2004)



Year 2005: Between May 16 and October 13, 2005, water was pumped from the Wadesville mine at daily rates ranging from 2.64 mgd to 14.01 mgd, corresponding to pumping rates of 1,830 gallons per minute (gpm) to 9,730 gpm. The estimated pumping rates varied over time as follows (Figure 1C):

Figure 1C: Water Withdrawal Rates (May – October 2005)



In 2003 there was an overall decreasing trend of water withdrawal rates with several intervals during the pumping test when water withdrawal rates were approximately constant (Figure 1A). These were (a) an 'early' phase withdrawal at approximately 8,200 gpm; (b) a 'middle' phase withdrawal at approximately 6,400 gpm; and (c) a 'late' phase withdrawal at approximately 5,000 gpm.

In 2004, water withdrawal rates scattered significantly about a mean rate of approximately 4,220 gpm. The median water withdrawal rate was approximately 4,490 gpm. Figure 1B shows the discrete daily water withdrawal rates and a 7-day rolling average rate to account for the significant daily variations.

In 2005, water withdrawal rates followed an erratic pattern with pumping rates scattering between approximately 4,000 and 8,000 gpm during May and June 2005 and an overall decreasing trend of pumping rates due to lowering mine water levels from August through October 2005 These patterns are partially due to pump issues but is mostly due to the different timing of the daily flow readings taken on weekends. There was no water withdrawal from July 1 through 25, 2005. Overall, the average pumping rate was 4,300 gpm (including days when pumping did not occur). Excluding the hiatus in water withdrawal, the average pumping rate was 5200 gpm. Decreasing water withdrawal rates between August and October 2005 are expressed in the following average monthly rates: 5,400 gpm in August 2005, 4,700 gpm in September 2005, and 4,200 gpm in October 2005. Figure 1C shows the discrete daily water withdrawal rates and a 7-day rolling average rate to account for the daily reporting variations.

Drawdown Observations

In response to water withdrawal from the mine shaft, the mine pool drawdown was monitored. From an initial depth to mine pool of 400 feet (year 2003), 435 feet (year 2004), and 432 feet (year 2005), the daily readings of the mine pool level were as follows (Figures 2A through 2C):

Figure 2A: Observed Mine Pool Level and Water Withdrawal Rates (July – October 2003)

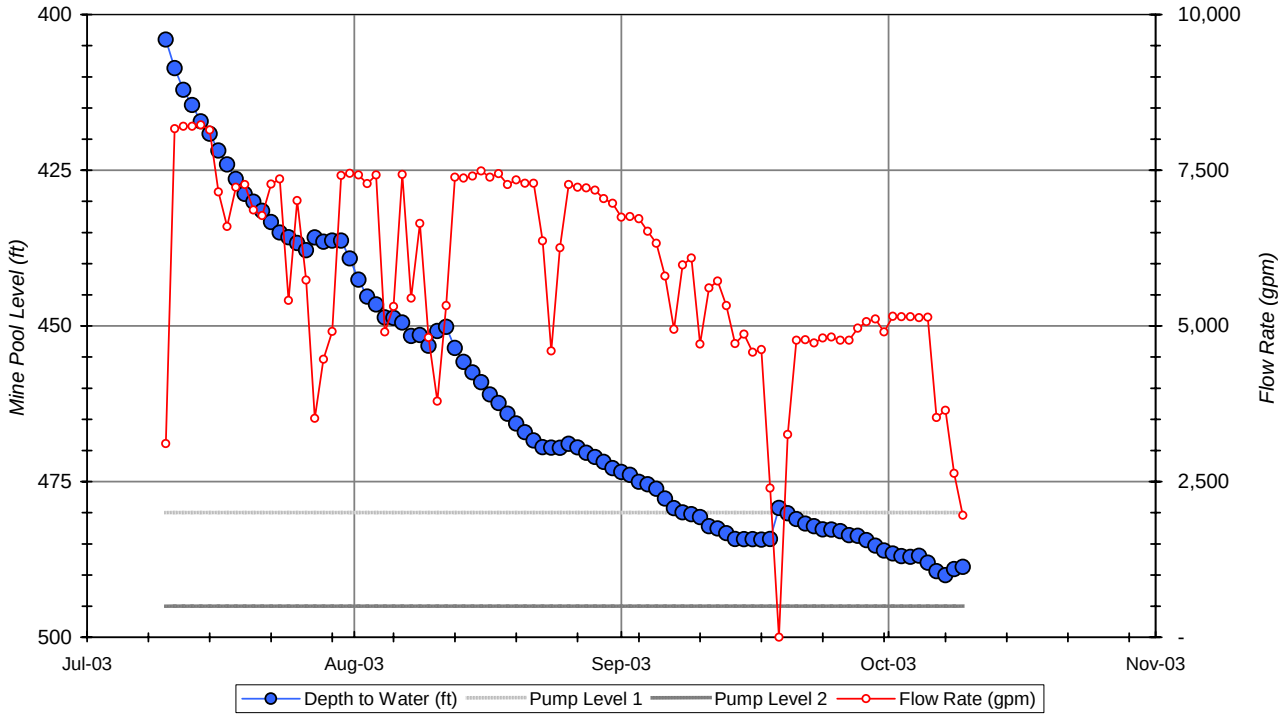


Figure 2B: Observed Mine Pool level and Water Withdrawal Rates (May – October 2004)

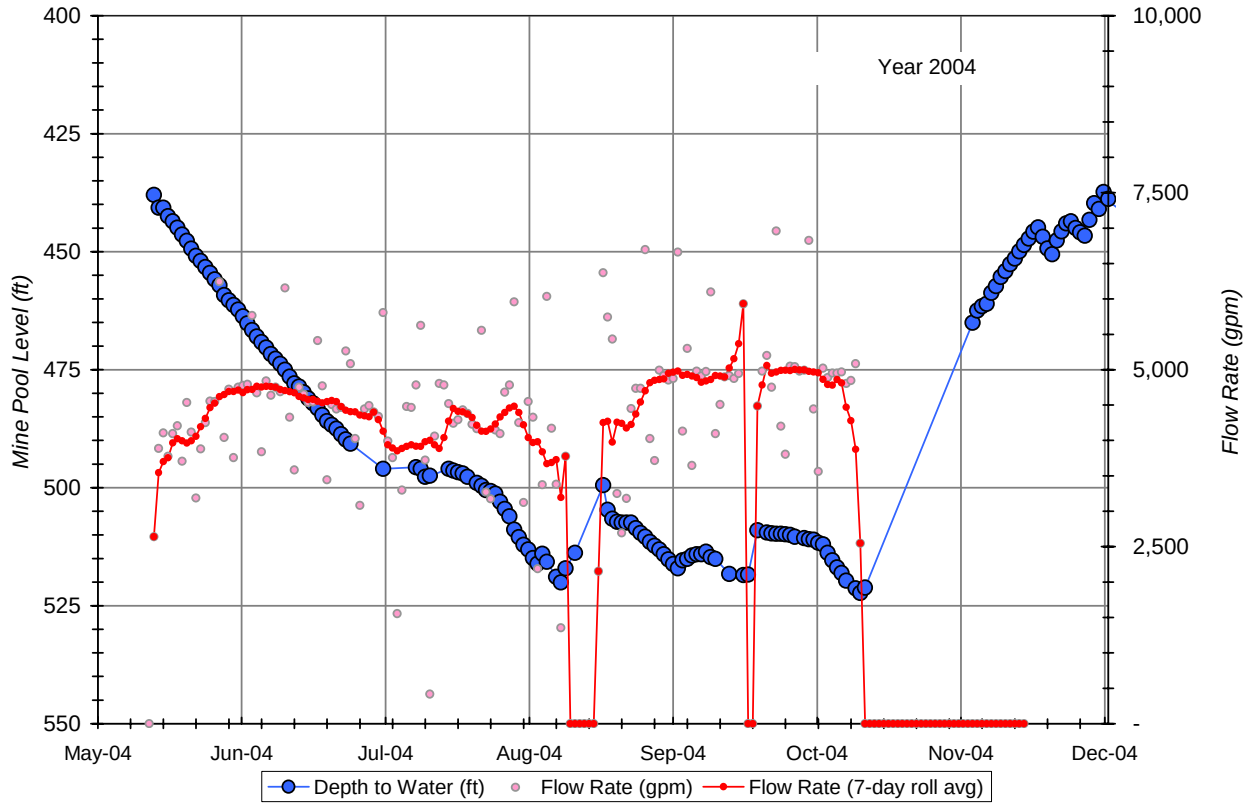


Figure 2C: Observed Mine Pool level and Water Withdrawal Rates (May – October 2005)

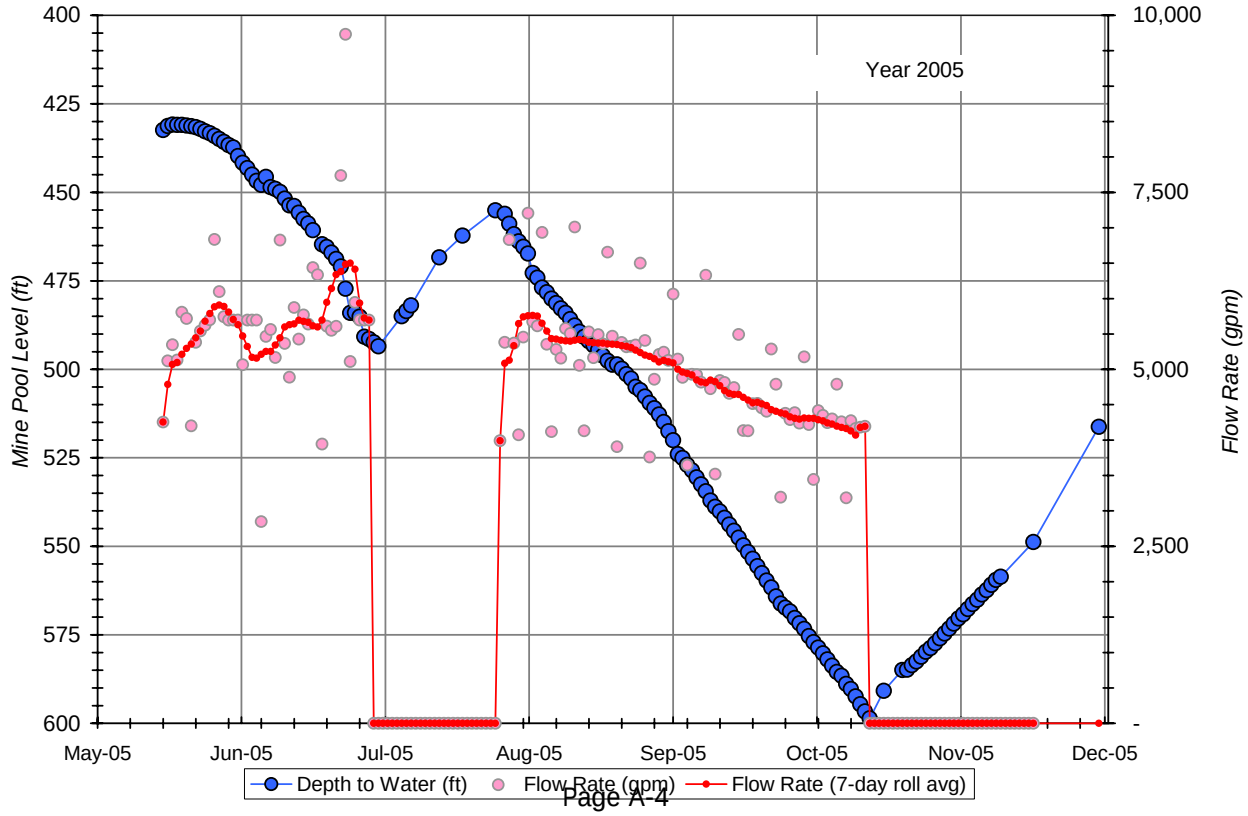
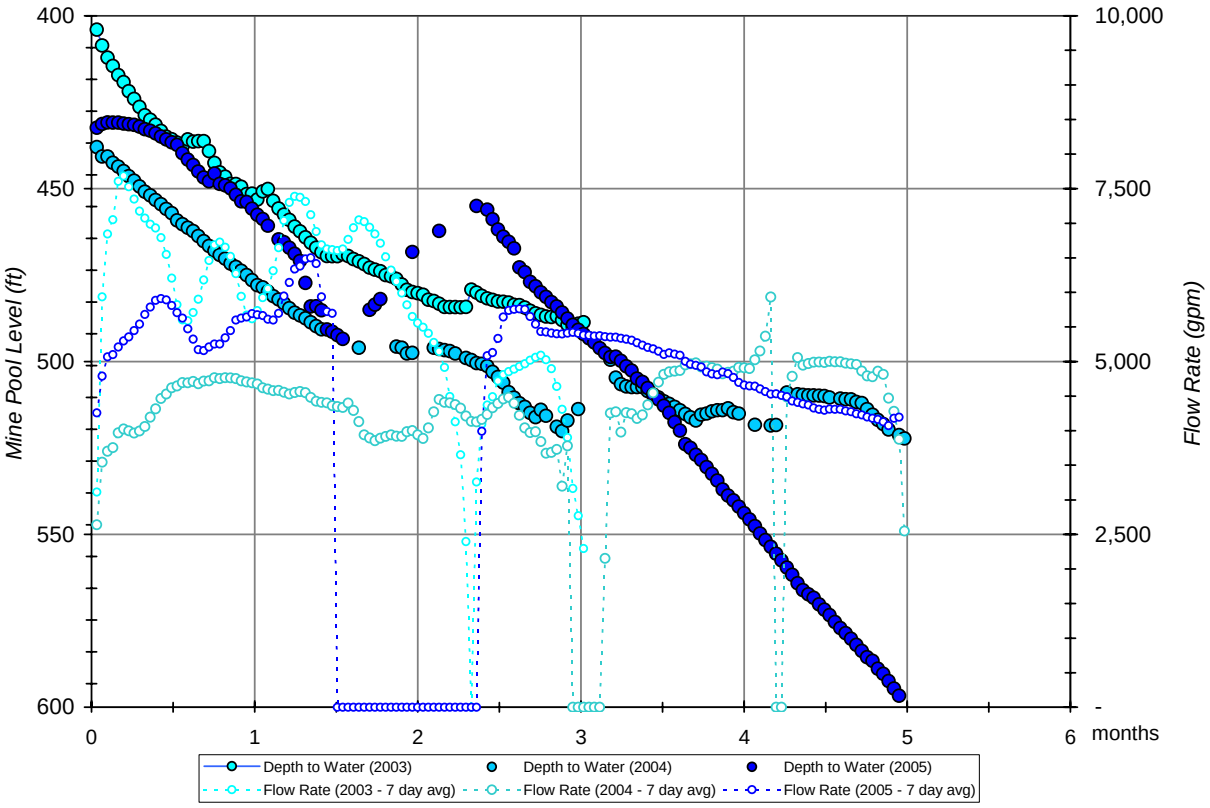


Figure 3 shows the year 2003 data, 2004 data, and 2005 data superimposed onto a linear scale of "months pumped". This provides a common scale and allows for the projection of long-term pumping trends.

Figure 3: Comparison Year 2003 through 2005 (Mine Pool level and Pumping Rate):



For the year 2003, it is apparent from Figures 2A and 3 that periods of approximately constant water withdrawal rates correspond to approximately linear decreases in the mine pool level (in other words, the rate of drawdown is constant for a given rate of water withdrawal). Note also that brief periods of lower withdrawal rates resulted in lesser rates of drawdown or even no change in mine pool level, representing long-term (truly) sustainable water withdrawal conditions.

For the year 2004, the daily variations of water withdrawal rates were more pronounced than in 2003. Unlike the 2003 data, there was no obvious relation between rate of water withdrawal and rate of drawdown. Specifically, the rate of drawdown for the first 1.5 months of pumping was nearly constant at about 1.2 feet/day, followed by an approximate 1-month period of relatively little drawdown. Starting at 2.5 month, drawdown accelerated again to a rate of about 1.5 feet/day. After a temporary hiatus in pumping (at 3 month), water withdrawal recommenced and resulted in drawdown rates of 0.9 to 1.4 feet /day, with intervening periods of very little drawdown (e.g., at around 4.5 months).

For the year 2005, the first two weeks of pumping (May 15—31, 2005) resulted in a slowly increasing rate of dewatering. The average pumping rate for this initial period was 5,490 gpm, and the average drawdown rate was 0.31 ft/day. From May 31 through June 30, 2005 (average

pumping rate of 5,715 gpm), the rate of drawdown steepened (the average rate was 1.78 ft/day), made worse by increased water withdrawal rates on June 23 (7,740 gpm) and June 24 (9,730 gpm). The instantaneous rate of drawdown in response to these higher rates was was approximately 6.6 ft/day. In contrast, less than average withdrawal rates resulted in slowed rates of drawdown or even water level rebound (for example on June 6, 2005, only 2,850 gpm were pumped, and the water table rebounded by more than 2 feet). No water was withdrawn from June 30 through July 26, 2005, and the water table recovered at an averaged rate of 1.4 ft/day. This recovery rate is nearly identical to the average rate of drawdown in June 2005 (when not considering the increased water withdrawal on June 23-24, 2005). As pumping resumed in late July 2005, the resulting long-term linear rate of drawdown was approximately 1.8 ft/day. Although average pumping rates slowed steadily from late July through the end of pumping in October, rates of drawdown did not respond in the same fashion. By month, the corresponding average rates were:

Month	Average Rate of Pumping	Standard Deviation	Average Rate of Drawdown
	(gpm)	(gpm)	(ft/day)
August 2005	5,420	816	1.64
September 2005	4,685	656	1.93
October 2005	4.155	409	1.78

Finally, the recovery rate upon termination of pumping on October 14, 2005, was observed to be approximately 1.4 ft/day (through November 18, 2005) and 1.65 ft/day (through December 2, 2005).

In summary, the observed year 2005 trends have the following characteristics:

Phase	from	to	#days	Rate (gpm)	Start Level	End Level	Rate(ft/day)
Drawdown	5/15/05	5/31/05	16	5,490	432.4	437.3	0.31
Drawdown	6/1/05	6/29/05	29	5,715	439.8	491.4	1.78
Recovery	6/30/05	7/25/05	27	0	492.4	455.1	1.38
Drawdown	7/26/05	10/13/05	80	4,915	455.1	598.6	1.79
Recovery	10/14/05	12/2/05	50	0	598.6	516.2	1.65

Based on Figure 3, the main characteristic of the year 2005 project was the near linear dewatering response of the mine over a relatively wide range of pumping rates and pool levels. Whereas the year 2004 project did not result in significant dewatering to less than 520 ft mine pool level, the current year project did not show any such slowing of dewatering. Instead, a relatively constant dewatering rate of approximately 1.8 ft/day was observed. However, note in Figure 3 that the periods of steep drawdown in 2003 and 2004 have very similar rates of drawdown compared to those consistently observed in 2005. Therefore, it may be concluded that the absence of major precipitation recharge events in between May and October 2005 (and therefore the lack of water level rebounds while pumping) contributed to the steady dewatering rate, regardless of pumping rate or mine pool level.

The key parameters for the project years 2003 through 2005 are summarized in the table below:

Summary Table (Year 2003 through 2005)

Parameter	Unit	Year 2003	Year 2004	Year 2005
Period of Pumping		July 11 – Oct 10	May 14 – Oct 12	May 16 – Oct 13
Days of Pumping	days	91	144	125
Days not pumped	days	1	8	27
Water Withdrawal	Mgal	776	924	933
Daily Rate (avg.)	Mgal/day	8.43	6.08	6.18
Daily Rate (avg.)	gpm	5,860	4,220	4,250
Start Pool level	feet	404	438	432
End Pool level	feet	489	522	599
Total Drawdown	feet	85	84	167
Total Drawdown Rate	feet/day	0.92	0.55	1.11
Aggregate Spec Cap	gpm/ft	6,370	7,670	3,865
30-day Recovery	feet	45	67	41
30-day Recovery Rate	feet/day	1.5	2.2	1.4

Spec Cap = specific capacity

Conclusion

The 2005 project data differed from the 2003 and 2004 project data. The 2003 data was interpreted to predict that 6-month period of pumping at 6,500 gpm (starting at a pool level of 400 feet) would result in a sustainable mine pool level to no deeper than 600 feet. This prediction was based on the apparent correlation of mine water yield to recorded pumping rates.

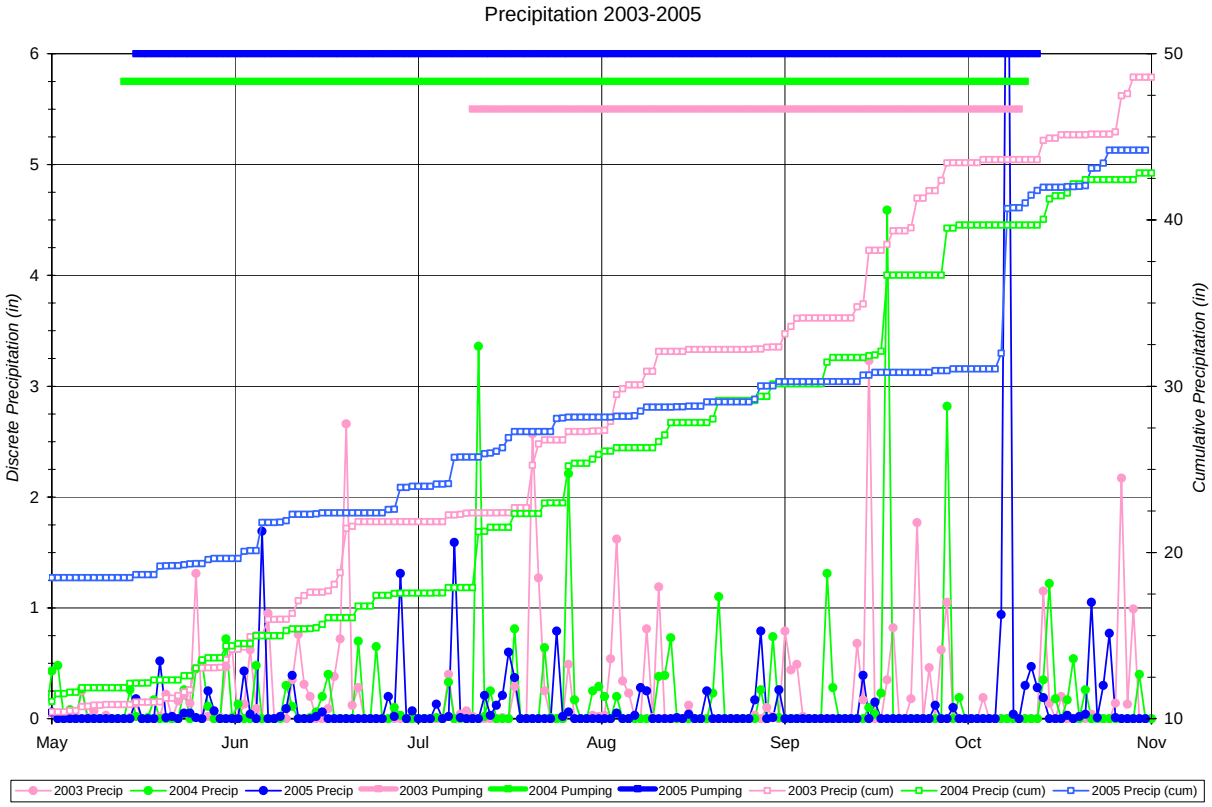
The year 2004 did not indicate any such correlation. Instead, it was suggested that additional mine areas / recharge areas were tapped during the 2004 project, which contributed added yield and complexity to the simple conceptual site model derived from the 2003 data. The 2004 data suggested that continued pumping at rates between 4,000 and 5,000 gpm would not drop the pool level at a rate greater than 0.25 – 0.50 feet/day, provided that a few intervals (say every month or so) of no pumping were to be considered in the water withdrawal schedule. This recommendation was based on the 2004 data and the apparent effect that time of recharge (zero pumping) had on minimizing the immediately ensuing rate of drawdown, as pumping was started up again.

The year 2005 project, unlike the previous year, did not show any distinct slowing of dewatering as a result of either decreased pumping or recharge events. Although there were again periodic

changes in the specific conductivity of the effluent (varying between 1,200 and 1,600 μmhos, as in 2004), these changes did not correlate with the observed rates of drawdown.

It is suspected that the lack of significant surface recharge in August and September 2005 (compared to 2004; see Figure 4) did not allow for replenishment of the mine storage available for withdrawal. Therefore, the presence / absence of precipitation recharge appears to govern in large part the sustainability of pumping from the mine. Without detailed modeling of the recharge behavior (taking into account the surface exposure and topography of the mine), there does not seem to be a good method for "predicting" drawdown rates, either as a function of pumping rate or a function of mine pool level. However, since the year 2005 project yielded a 'linear' rate of depletion (1.8 ft/day) during August and September 2005, with no appreciable recharge, it may not be too speculative to assign this depletion rate as a conservative recharge rate for other years as well. This is supported by the observation that the previous project years did not indicate any greater drawdown rates than 1.8 ft /day. (see also Figure 3).

Figure 4: Comparison of 2004 vs. 2005 Precipitation



Using a conservative estimate for water depletion at a rate of 1.8 ft/day, the estimated 'reservoir' of water in the mine (at a composite water withdrawal rate of approximately 5,000 gpm (7.2 Mgd) is approximately 54 ft per month. Note that excessive water withdrawal (like that on June 23-24, 2005) has deleterious effects on the overall sustainability. Using a maximum dewatering level of 600 ft, this 'reservoir' estimate translates into pumping duration as follows:

Starting Level:	400 ft	Sustained Pumping:	111 days (approx. 3.75 months)
Starting Level:	425 ft	Sustained Pumping:	97 days (approx. 3.25 months)
Starting Level:	450 ft	Sustained Pumping:	83 days (approx. 2.75 months)