

# Water Supplies During Dry Periods

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Water supply operators often worry about the reliability of their water sources during extended dry periods. A helpful USGS website at:

<http://waterdata.usgs.gov/ny/nwis/rt> shows daily flow in many streams (Figure 1). When streams fall below normal levels, it is time to carefully watch groundwater well sources or reservoirs since streams, reservoirs, and aquifers are all closely inter-related.

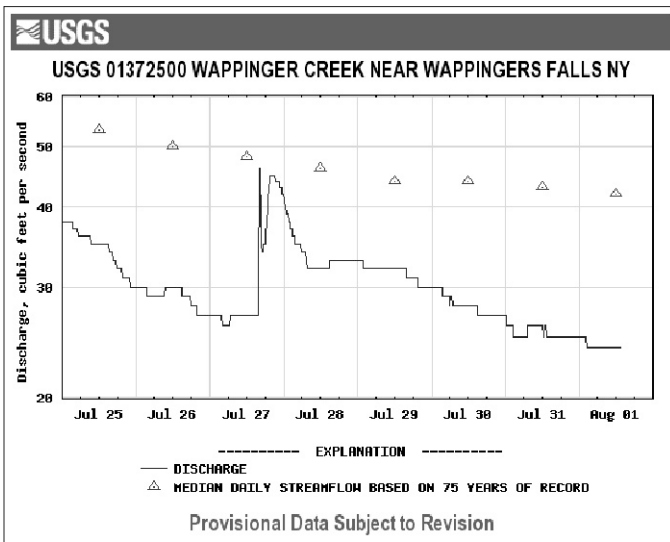


Figure 1: Sample USGS website screen showing stream levels well below the normal (triangle) levels. The example is from the Wappinger Creek in eastern New York during July and early August, 2005. Stream levels in this example are approximately half of normal flows. The flow spike on July 27 documents runoff from a brief summer storm. The effect of the July 27 storm does not last long.

Maximizing source productivity during droughts is one of the hardest technical challenges faced by water system managers. Some tools to help are described below.

## Groundwater supplies

Three aquifer measurements can help judge whether wells can reliably serve the public during dry periods. The methods and their meaning are summarized on Table 1 on following page.

**Duty Cycle:** Duty cycle refers to the number of hours that wells are in service each day. Ideally, wells should operate only about 12 hours a day on average, leaving reserve capacity for peak demand periods.

Hour meters on pump control systems can help operators gather duty cycle information. If daily records from hour meters indicate that wells are being routinely used more than 15 to 18 hours each day, they may have limited reserve capacity. Additional wells may be a wise investment.

**Well Yield:** Water suppliers should also track the discharge rate from each well. Well yields often decrease after a well is installed. This can be due to wear and tear on the pump, changes in the aquifer system, or potentially to changes in the well and screen assembly.

Water plant administrators can gauge whether yields are decreasing by periodically monitoring amounts of water produced from wells over constant periods of pumping. These controlled yield periods can be compared to amounts of water pumped when the wells were first installed or to yields from prior years and seasons. Falling yields are an early indication that well productivity needs to be evaluated.

**Dynamic Water Level:** Measurements of the depth of the water in pumping wells and in nearby wells are some of the most useful ways to assess whether aquifer levels are declining. Water levels in production wells always decline during dry periods, but if levels fall ever lower each year, these can be indications of aquifer overpumping or of failures in specific wells.

Water level readings can be collected in well stilling tubes using manual meters, or automatic data logging instruments can economically collect continuous water level readings. Either method makes data observation easy and accurate and allows important interpretation of aquifer conditions and responses to pumping.

## Surface Water Sources

For water suppliers who are reliant on surface water sources, a calibrated staging graph can help monitor the adequacy of surface sources. A staging graph describes the volume of water in a reservoir relative to the water level in the reservoir. A staging graph can establish the number of months or days of water remaining in a reservoir. With experience, the staging graph can also be used to predict reservoir recovery associated with rainfall events of different magnitudes. When coupled with such localized precipitation measurements, water plant administrators use the staging tool on a daily or weekly basis to adjust calculations of reserve capacity, and accurately gauge the severity of the current drought on their water supply.

## Conclusion

Even though we can't make it rain, this brief article has outlined ways that system operators can prepare now to deal with dry-season water supply stresses. As dry periods persist, limited supplies can be stretched to their maximum and conservation measures will be needed to minimize low-priority uses of water. Data collection reviewed here, and interpretation of the data, are key water supply management

tools during droughts. Depending on what the data show, aquifer analysis, well redevelopment, or new wells may be required and should be initiated early to minimize lengths of hardship periods. ♪

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Observation Technique	Healthy Condition	Sign of Distress
Duty Cycle	Pumps on between 10 and 12 hours daily to meet average daily demand	Pumps must operate longer and longer to meet average or peak demands.
Well Yield	Yields in gallons per minute remain reliable when compared to earlier yield data	Yields in gallons per minute decline over months or years when compared to earlier yield data.
Dynamic Water Level	Water levels in pumping and nearby wells remain about the same when compared to earlier data.	Water levels in pumping wells or nearby wells are lower than earlier levels. If water levels decline only in one well, the well should be investigated. If water levels fall throughout a wide area, the aquifer is becoming dewatered.

Table 1: Groundwater Observation Techniques and Response Matrix.