



Fact Sheet

Commonwealth of Pennsylvania • Department of Environmental Protection

Drought Management In Pennsylvania

Introduction

Like all other states, Pennsylvania is subject to periodic droughts that impact our ability to meet all of our water needs. Droughts can have varying effects, depending upon their timing, severity, duration and location. Some droughts may have their greatest impact on agriculture, while others may impact water supply or other water use activities such as recreation. Most droughts cause direct impacts to aquatic resources.

Managing the Commonwealth's water resources during droughts is the responsibility of the Pennsylvania Emergency Management Agency (PEMA), with direct support from the Department of Environmental Protection (DEP). The Commonwealth Drought Coordinator is assigned by the Secretary of DEP and works closely with the Commonwealth Drought Task Force. The Drought Task Force includes membership from state agencies whose operations or programs may be impacted either by droughts directly or by drought management operations. Drought emergencies are managed in conformance with PEMA's drought emergency regulations, found at Pa. Code Chapters 118-120.

Drought Monitoring

In DEP, the Bureau of Watershed Management is responsible for drought management. Many drought management activities are coordinated at the county level, so the bureau's monitoring efforts are oriented primarily on a county basis as well. On a routine monthly basis, the bureau reviews precipitation,

stream flow, groundwater level, soil moisture and reservoir storage information. Regular attention to these drought "indicators" is designed to provide timely identification of developing drought conditions.

Precipitation Deficits

The earliest indicators of a potential drought are precipitation deficits, because it is rainfall that provides the basis for both our ground and surface water resources. The National Weather Service has long-term monthly averages of precipitation for each county. These averages are updated at the end of each decade, based upon the most recent 30 years, and are considered "normal" monthly precipitation.

Each month, the total cumulative precipitation values in each county, for periods ranging from three to 12 months, are compared against the normal values for the same periods. Totals that are less than the normal values represent deficits, which are then converted to percentages of the normal values. Table 1 lists the drought conditions that are indicated by various precipitation deficit percentages.

Stream Flows

After precipitation, stream flows provide the next earliest indication of a developing drought. Stream flows typically lag one to two months behind precipitation in signaling a drought. The U.S. Geological Survey (USGS) maintains a network of

Table 1
Precipitation Deficit Drought Indicators

| Duration of Deficit Accumulation (months) | Drought Watch (Deficit as Percent of Normal Precipitation) | Drought Warning (Deficit as Percent of Normal Precipitation) | Drought Emergency (Deficit as Percent of Normal Precipitation) |
|---|--|--|--|
| 3 | 25 | 35 | 45 |
| 4 | 20 | 30 | 40 |
| 5 | 20 | 30 | 40 |
| 6 | 20 | 30 | 40 |
| 7 | 18.5 | 28.5 | 38.5 |
| 8 | 17.5 | 27.5 | 37.5 |
| 9 | 16.5 | 26.5 | 36.5 |
| 10 | 15 | 25 | 35 |
| 11 | 15 | 25 | 35 |
| 12 | 15 | 25 | 35 |

stream gages across the state. DEP currently uses 73 of these gages, equipped with satellite communication transmitters, as its drought monitoring network. Similar to precipitation, long-term 30-day average stream flow values have been computed for each of the stream gages, but rather than using only the past 30 years, the entire period of record for each gage is used. For example, the Susquehanna River gage at Harrisburg has more than 110 years of record from which the long-term 30-day average, or normal, flows are now determined.

Drought status is determined from stream flows based on exceedances, rather than percentages, as are used for precipitation. Exceedances are similar to percentiles. A 75 percent exceedance flow value means that the current 30-day average flow is exceeded in the stream 75 percent of the time; in other words, the 30-day average flow in the stream is less than that value only 25 percent of the time. Similarly, with a 90 percent exceedance flow value, the 30-day average flows in the stream would be less than that value only ten percent of the time, and only five percent of the time for a 95 percent exceedance.

For stream flows, the 75, 90 and 95 percent exceedance 30-day average flows are used as indicators for drought watch, warning and emergency.

Groundwater Levels

Groundwater is usually the third indicator of a developing drought. Groundwater typically lags two to three months behind precipitation, largely because of the storage effect. About 80 trillion gallons of groundwater is stored throughout Pennsylvania, enough to cover the entire state with more than eight feet of water. Therefore, precipitation deficits can accumulate for several months before the resultant lack of groundwater recharge becomes clearly evident in groundwater levels.

The USGS also maintains a network of groundwater monitoring wells, just recently upgraded to at least one well in each county. Groundwater is used to indicate drought status in a manner similar to stream flows. Groundwater level exceedances of 75, 90 and 95 percent are used to indicate watch, warning and emergency. In this case, it is the 30-day average depth to groundwater that is measured and monitored, again in relation to long-term 30-day averages based on the period of record for each county well.

Soil Moisture – Palmer Drought Severity Index

Soil moisture information is provided by the National Oceanic and Atmospheric Administration in the form of the "Palmer Drought Severity Index." The Palmer Index is a computed value, based on a number of

meteorological and hydrological factors; it is compiled weekly by the Climate Prediction Center of the National Weather Service. Palmer values of -2.00 to -2.99 indicate a watch status; values of -3.00 to -3.99 indicate warning; and values of -4.00 and less indicate emergency. The Palmer Indices are available for the ten Palmer regions of the state.

Water Supply Reservoir Storage

Storage in several large public water supply reservoirs is the fifth indicator that DEP uses for drought monitoring. Depending on the total quantity of storage and the length of the refill period for the various reservoirs, DEP uses varying percentages of storage drawdown to indicate the three drought stages for each of the reservoirs.

Drought Declarations

DEP and PEMA manage droughts based on a three-stage process. As described in the previous section, the indicators are used to identify, generally on a county basis, the overall water supply conditions. These indicators are used by DEP and PEMA to manage water supply droughts. While some of the indicators could be used as well to help identify meteorological or agricultural or other types of droughts, the primary objective is to identify and manage water supply droughts.

Drought Watch

Generally, when three or more of the indicators are signaling a drought watch condition for a county or group of counties, DEP will notify PEMA of the developing conditions and will ask PEMA to convene a meeting of the Commonwealth Drought Task Force. Based upon recommendations from the Task Force, including direction from the Governor, the Secretary of DEP may issue a drought watch on behalf of the Governor. Press releases are issued to the media and letters are sent to all public water suppliers in the affected area, notifying them of the need to monitor their own supplies and begin following their drought contingency plans and to update their plans if necessary. Citizens are requested to voluntarily reduce water usage by about five percent. DEP increases its monitoring activities from monthly to weekly and begins to monitor the status of public water suppliers in the affected area. Regular meetings of the Task Force are also scheduled to review developing conditions.

Drought Warning

When the indicators signal a warning condition, a similar process is followed, leading to a drought warning announcement, again by the Secretary of DEP on behalf of the Governor. Press releases are issued to the media and letters are again sent to all public water suppliers in the affected area, notifying them of the developing conditions. Citizens are asked to voluntarily reduce water use by 10-15

percent. Frequency of Task Force meetings may be increased as well.

Drought Emergency

When an emergency is indicated, and upon the recommendation of the Task Force, PEMA convenes a meeting of the Emergency Management Council, under the chair of the Lt. Governor. Upon consideration of all the information available, including input from the county commissioners and county emergency management staff in the affected counties, the council may recommend that the Governor issue a proclamation of drought emergency. Upon issuance of the emergency proclamation by the Governor, Chapters 118, 119 and 120 of the Emergency Management Regulation become effective.

Again, letters are sent to the public water suppliers. DEP increases its monitoring activities from weekly to daily, and drought reports may be prepared daily and posted on the DEP drought website. PEMA's county drought task forces meet on a regular basis and the Commonwealth Drought Task Force may begin weekly meetings to ensure continued coordination among the agencies.

During an emergency, the Drought Coordinator is responsible for overseeing and coordinating the day-to-day drought management activities of the department. The coordinator is also responsible for reviewing and either granting or denying requests for variances from the Chapter 119 nonessential water use restrictions.

Drought Contingency Plans

Chapter 118 requires each public water supplier in the emergency area to develop a drought contingency plan, or update an existing one if necessary, and submit it to the Commonwealth Drought Coordinator for review and approval. In extreme droughts, large industrial and commercial water users may also be required to submit drought contingency plans if requested in the Governor's proclamation of emergency or if requested by the Commonwealth Drought Coordinator. Fortunately, Pennsylvania has never experienced a drought so severe as to require industrial and commercial cutbacks.

A public water supply drought contingency plan outlines the public water supplier's sources of water and identifies watch, warning and emergency conditions within the water supply system based on the water levels in those sources. Response actions appropriate to the individual water supply system are identified for each of the drought stages. Based upon the water supplier's individual drought contingency plan, the supplier may request voluntary or mandatory water use restrictions within its own

service area in advance of any state announcements or declarations.

Industrial and commercial plans are developed without any specific reference to the user's own supply sources. These plans identify actions the user can take to achieve cutbacks to various percentages of their normal water use, if ordered by the Drought Coordinator. The Drought Coordinator will order such cutbacks only if conditions become so severe that health and safety are threatened.

Nonessential Water Use Restrictions

The drought management activities most visible to the general public are the nonessential water use restrictions required by Chapter 119. These restrictions are designed to achieve a reduction in overall water use of up to 25 percent. The overall objective of all drought management activities is to protect public health, safety and welfare, with health and safety being paramount. To help protect welfare, water use restrictions are limited, at least initially, to nonessential uses. These restrictions apply generally to watering of lawns, gardens and shrubs; washing vehicles and paved surfaces; filling swimming pools; and use of water for ornamental purposes.

Chapter 119.6 states: "If compliance with the prohibition of nonessential use of water would result in extraordinary hardship upon a water user, the water user may apply for an exemption or variance. These requests are reviewed and variances are either granted or denied by the Commonwealth Drought Coordinator."

Water Rationing

In some cases, the Chapter 119 water use restrictions may not be sufficient to protect the supplies of an individual public water supplier. When an individual supplier's sources are so depleted as to threaten health and safety, it may become necessary to ration water within that system in order to protect the sources for these most essential uses. Under the provisions of Chapter 120, a public water supplier or a municipality may request approval to ration water within its service area.

Rationing water is a more severe measure than merely banning nonessential uses of water. Under rationing, each customer on the system is allotted a given amount of water, based on a method of allotment developed by the supplier or municipality. Generally it will be based on a percentage of previous usage or on a specific daily quantity per household. These restrictions are more likely to have some effect on welfare, because industry and commerce may be cut back as well.

Under Pennsylvania law, only the Governor has authority to ration resources, including water

resources. For this reason, approval from the Commonwealth Drought Coordinator, acting as agent for the Emergency Management Council and on behalf of the Governor, is required for a water supplier or municipality to ration water. Requests are reviewed by the Commonwealth Drought Coordinator to ensure that rationing is justified and that appropriate rationing methods will be employed.

River Basin Commission Coordination

Pennsylvania is a member of interstate compact commissions in the Delaware and Susquehanna river basins. These commissions have regulatory authority over the waters in those basins and play a significant role in managing basin waters during droughts. Droughts do not recognize political boundaries and frequently extend beyond Pennsylvania's borders into our neighboring states in those basins. Although these commissions have authority to declare drought emergencies, they both rely upon their respective member states to implement and enforce any actions they may dictate during a drought emergency. DEP coordinates

closely with the commissions in all its drought management activities. This helps to insure that response actions are coordinated to the extent possible across state borders in the watersheds that we share. Recent agreements in each of the commissions, resulting from experiences in the 1998-99 drought, have clarified the commissions' primary role as being one of ensuring effective coordination among the member states.

More Information

For more information on drought management in the Commonwealth, you can contact the Bureau of Watershed Management, Division of Water Use Planning, at 717-772-4048 or visit the DEP Web site at www.depweb.state.pa.us, Keyword: "Drought."

Note: This description of Pennsylvania's drought management program is a revised copy of an article that appeared in the August 2001 edition of "The Authority", a publication of the Pennsylvania Municipal Authorities Association.