

WARREN COUNTY DROUGHT RESPONSE PLAN
Warren County, Virginia

The water resources of Warren County are key to our quality of life. The County receives an average of 41.8 inches of rainfall annually, spread fairly evenly throughout the year. In most years, rainfall is adequate to maintain and replenish our ground and surface water supplies. However, the occurrence of droughts is a normal part of the weather cycle and should be expected. In the Shenandoah Valley drought is a cyclical phenomenon with a historical pattern of extreme drought occurring every thirty years with less severe droughts occurring roughly every decade. During droughts, water available from our streams, rivers, springs, and wells can be severely diminished. In addition, water use can increase drastically during these conditions. Severe drought throughout the Commonwealth from 1999-2002 prompted the state government to establish a Drought Response Technical Advisory Committee. This committee was tasked with the development of a Drought Assessment and Response Plan for the Commonwealth.

The statewide Drought Assessment and Response Plan and the Clarke County, Virginia Plan were used as a framework for this Drought Response Plan. Most of the text was taken directly from these two documents. This was done in order to provide consistency with the State Plan and other plans in the area and to utilize the expertise and effort that went into the development of these documents.

Important differences between the State Drought Assessment and Response Plan and this local plan include:

- 1) Drought onset and stage declarations shall be made by the County staff under advisement from, but responsive to, USGS and the State Drought Monitoring Task Force.
- 2) Local data available from the USGS Groundwater Study, regional stream gages, and precipitation data will be utilized in drought stage declarations.

The extent to which rural residents' and communities' drinking water supplies are impacted by drought depends on many factors. Obviously, the more severe and long-lasting the drought is, the greater the impact will be. Responding proactively to a developing water shortage can greatly reduce the risk that residents will face serious drinking water shortages during drought. The County website www.warrencountyva.net will be used to provide local officials and citizens with information regarding current drought conditions, recommended responses, and where to get additional information.

This Drought Response Plan is part of an overall water use policy that emphasizes the efficient use of water at all times, not just during drought. Overall water conservation efforts include:

- **Water Loss Reduction:** Eliminate water leaks and reduce unaccounted-for water. The following website provides estimates of the volume water used/wasted? by water leaks:
<http://ga.water.usgs.gov/drought/dripcalculator.html>
- **Water Efficiency:** Improve water use efficiency through education, drought tolerant landscaping, and reuse.
- **Public Education and Outreach:** Improve the effectiveness of drought awareness by increasing public education efforts.

Drought Monitoring

This plan includes a monitoring framework that relies upon the periodic monitoring of drought indicators to determine drought stages and resulting actions in the County. At the State level, during periods of normal moisture conditions, the Virginia Department of Environmental Quality (DEQ) monitors the National Oceanic and Atmospheric Administration (NOAA) U.S. Drought Monitor, and produces information from those reports specific to Virginia on a monthly basis. The Virginia drought map will be produced concurrent with the release of NOAA monthly and seasonal outlooks, which usually are released on the Thursday closest to the middle of the month. County staff will monitor the Drought Map and the advance of drought conditions in the Commonwealth using the drought indicators described herein and other indicators such as the Standardized Precipitation Index, Palmer Drought Severity Index, Crop Moisture Index, Keetch-Byrum Drought Index, and NOAA monthly and seasonal precipitation outlooks.

Drought Indicators (Local)

In order to monitor potential drought conditions staff will use four indicators to evaluate drought severity. These indicators include precipitation, streamflow, groundwater levels and the Palmer Drought Severity Index. Stream discharge, and groundwater levels are available through the Warren County WEB site <http://va.water.usgs.gov/warren/>. Precipitation data is available from the Drought Monitoring Task Force, current drought status reports, <http://www.deq.virginia.gov/waterresources/drought.php#DroughtStatusReports>. Refer to Appendix I for more details on each drought indicator.

Declaration of Drought Stages

The County will use the four drought indicators (precipitation, stream flows, ground water levels and the Palmer Drought Severity Index) as the initial indicators to be considered when advising the Board of Supervisors regarding the declaration of a particular drought stage. The drought stages are watch, warning, and emergency. When two indicators exceed the threshold for stage determination, this advisement may be to declare a specific drought stage or may include an explanation of why the particular drought stage should not be declared at that time.

As an example, when two of the three drought indicators indicate drought warning conditions, staff will evaluate all other drought information available and, if the majority of information warrants declaration, advise the declaration of a drought warning. In addition, the Board may declare local drought emergencies, adopt emergency ordinances to address those local emergencies, and implement those ordinances prior to the declaration of a Drought Emergency by the Governor of Virginia.

Response to Drought

Staff will use the following general descriptions of three drought stages when advising the Board of Supervisors concerning drought declarations. These descriptions should not be viewed as absolute requirements for drought designation, but as a mechanism to be used by staff to reach the appropriate drought advisement. The specific response activities that are delineated Appendix II and III, for the three drought stages should be viewed as activities that should be initiated in response to a drought stage declaration.

Drought Watch - responses are generally intended to increase awareness, in the public and private sector, to climatic conditions that are likely to precede the occurrence of a significant drought event. During this drought stage, the primary activities that are suggested are to prepare for the onset of a drought event. The response phase in this stage is voluntary conservation. Voluntary conservation involves the reduction of non-essential uses, fixing leaks, installing water saving devices, and a general increase in awareness to conserve water. It is unlikely that significant water use reductions will occur at this stage although it is possible that the increased public awareness of water conservation activities may reduce water use up to 5%.

Drought Warning - responses are generally required when the onset of a significant drought event is imminent. Water conservation and contingency plans that have been prepared during a drought watch stage would begin to be implemented. From the perspective of the Commonwealth, water conservation activities at this stage would

generally be voluntary. Voluntary water conservation activities generally result in reductions in water use of 5-10%. In this stage all water users would be encouraged to spread out water use. For example, rather than filling large livestock water troughs once a day, consider installing automatic waterers that respond to demand by livestock throughout the day.

Drought Emergency - responses are generally required during the height of a significant drought event. During these times, it is likely that some water supplies will not provide the quantity of water needed by all users. Nonessential uses of water should be eliminated. Mandatory water conservation requirements contained in water conservation and contingency plans should be initiated at this stage. Mandatory water conservation activities usually result in water use reductions of 10-15%.

While actions on the State level are important for the purpose of alerting localities and citizens of the advance of drought impacts, actions by local governments, individual water suppliers, and individual citizens are much more important and effective in actually addressing the impacts of drought.

Water sources used by public waterworks and self supplied water users vary considerably across the Commonwealth. Water conservation requirements for water users whose only source of water supply is a free-flowing stream with no significant storage will likely be different than requirements for a water user who relies entirely on groundwater for water supply. The development of a drought water conservation and contingency plan that takes into account the nature of a particular water source and the nature of the end use of water withdrawn is necessary to assure that proper water conservation activities are instituted at the proper times. In general, water supplies that rely on sources with significant storage (groundwater based systems) will realize greater benefits of water conservation activities initiated early in a drought cycle when compared to supplies that rely solely on free flowing streams. It is likely that individual private well users, especially those who rely on shallow water table wells, will receive the largest benefit from their early individual initiation of water conservation activities.

APPENDIX I DROUGHT INDICATORS

Precipitation Deficits – Precipitation deficits will be monitored by comparing current precipitation amounts with historical precipitation values as a percent of normal long-term average values. Comparisons will be made for each drought evaluation region using data compiled by the Office of the State Climatologist. Normal long-term average precipitation is defined as the mean precipitation for a thirty-year period of record for the area and time period being evaluated. Precipitation amounts will be evaluated based on the water year (beginning October 1). Water years are a natural dividing point for water supply drought, as precipitation that falls in the first six months of a water year is analogous to putting money in the bank. Precipitation that occurs during this six-month period has the potential to recharge ground water, which will sustain stream flows and support withdrawals from wells during the following six-month period when moisture deficits naturally develop as evaporation and plant transpiration generally exceed precipitation. If a precipitation deficit outside of the normal range exists at the end of a water year, the precipitation records will carry forward until a normal condition is reached (i.e. if a precipitation deficit exists on October 1, precipitation records for the previous twelve months will be evaluated until the twelve month deficit is eliminated).

Streamflow – Streamflow gages will be used to monitor streamflow responses to drought conditions. Representative 14-Day Average Streamflow values will be compared with historic flow statistics for the period of record. Current long term, regional gages are available on the South Fork Shenandoah River at Front Royal, Shenandoah River at Millville, West Virginia, and Passage Creek near Buckton. Staff will access USGS data utilizing the percentile methods described above in determining drought stages.

Ground Water Levels – The County currently has no ground water observation wells in the County. The County will use the wells located in Clarke County 46W175, 48X20 and 46X125 for observation. Ground water monitoring wells will be used to monitor shallow ground water responses to drought conditions. Measured ground water levels will be compared with historic level statistics for the period of record. Measured ground water levels above the 25th percentile for all historic levels will be defined as normal conditions. Measured ground water levels between the 10th and 25th percentiles for all historic levels will be defined as drought watch conditions. Measured ground water levels between the 5th and 10th percentile for all historic levels will be defined as drought warning conditions. Measured ground water levels below the 5th percentile for all historic levels will be defined as drought emergency conditions. Additional

quarterly and real time data will be available from the groundwater monitoring network established and maintained by USGS.

Other Indicators - Staff will evaluate all other available drought information during deliberations related to the development of drought stage recommendations. Other drought indicators that may be considered include the Standardized Precipitation Index, Palmer Drought Severity Index, Crop Moisture Index, NOAA monthly and seasonal precipitation outlooks. Also, antecedent effective ground-water recharge rates, as estimated from hydrograph separation techniques, will be considered.

**APPENDIX II
RESPONSE TO DROUGHT
(GOVERNMENT)**

Normal Conditions

Indications

No more than one indicator outside of the normal range:

- Precipitation exceeds the percent of normal precipitation for the time period in precipitation table.
- Stream flows are above the 25th percentile
- Ground water levels are above the 25th percentile for all historic levels.

Action to be taken

- None

Drought Watch

Indications

At least 3 indicators meet the following conditions:

- Precipitation levels are at or below the percent of normal precipitation for the time period in precipitation table
- Stream flows fall between the 10th and 25th percentile based on 14-Day average streamflow
- Ground water levels fall between the 10th and 25th percentile for all historic levels

Action to be taken

- Staff will advise the Board of Supervisors regarding the declaration of a Drought Watch
- The Board will issue a press release indicating the reasons for the declaration.
- Staff, under advisement from the Board will inform the Town of Front Royal public waterworks department of Drought Watch status.
- Citizens will be asked to begin voluntary water conservation (Appendix III)
- Staff will continue to monitor regional moisture conditions and provide monthly reports of drought conditions to the Board.
- The Board will make monthly reports of drought conditions available to media outlets.
- The Board will encourage all public waterworks (public wells) and self supplied water users who withdraw more than 10,000 gallons per day to review existing drought water conservation methods as outlined in this document.
- The County will include water conservation information on its website and will

distribute water conservation information as broadly as possible.

- Staff will continue monitoring problems incurred by the public, and the Town on a monthly basis.

Drought Warning

Indications

At least 3 indicators meet the following conditions:

- Precipitation levels are at or below the percent of normal precipitation for the time period in precipitation table
- Stream flows falls below the 10th percentile based on 14-Day average streamflow
-
- Measured ground water levels fall below the 10th percentile for all historic levels

Action to be taken

- Staff will advise the Board of Supervisors regarding the declaration of a Drought Warning
- The Board will issue a press release indicating the reasons for the declaration.
- Staff, under advisement from the Board will inform the Town of Front Royal public waterworks department of Drought Warning status.
- Staff will continue to monitor regional moisture conditions and provide monthly reports of drought conditions to the Board. Significant changes in drought conditions will be reported biweekly.
- The Board will make monthly reports of drought conditions available to media outlets.
- All public waterworks (public wells) and self supplied water users who withdraw more than 10,000 gallons per day will initiate voluntary water conservation requirements as described in this plan.
- All self-supplied users who withdraw less than 10,000 gallons per day, including private well users, will be encouraged to voluntarily reduce or eliminate nonessential uses of water.
- The County will include water conservation information on its website and will distribute water conservation information as broadly as possible.
- Staff will continue monitoring problems incurred by the public and Town on a monthly basis.
- All local government offices and institutions will initiate the reduction or elimination of nonessential uses of water with the goal of reducing total water usage by 5-10%.

Drought Emergency

Indications

At least 3 indicators meet the following conditions:

- Precipitation levels are at or below the percent of normal precipitation for the time period in the precipitation table
- Stream flows are at or below the 5th percentile
- Measured ground water levels fall to or below the 5th percentile for all historic levels

Action to be taken

- Staff will advise the Board of Supervisors regarding the declaration of a Drought Emergency
- The Board will issue a press release indicating the reasons for the declaration.
- Staff, under advisement from the Board will inform the Town of Front Royal public waterworks department of Drought Emergency status.
- Staff will continue to monitor regional moisture conditions and provide monthly reports of drought conditions to the Board. Significant changes in drought conditions will be reported weekly.
- The Board will encourage media outlets to publicize updates of drought conditions by developing weekly press releases.
- The Board will encourage all public waterworks (public wells) and self supplied water users who withdraw more than 10,000 gallons per day to initiate mandatory water conservation requirements listed as Mandatory Nonessential Water Use Restrictions in Appendix II.
- The County will include water conservation information on its website and will distribute water conservation information as broadly as possible.
- Staff will continue monitoring problems incurred by the public and Town on a monthly basis.
- All public waterworks (public wells) and self-supplied water users who withdraw more than 10,000 gallons per day will initiate mandatory water conservation requirements contained in drought water conservation and contingency plans that include the mandatory nonessential water use restrictions listed in Appendix II.
- Local governments and public waterworks may impose water use restrictions more or less stringent than the mandatory nonessential water use restrictions listed below consistent with local water supply conditions at any time.

**APPENDIX III
RESPONSE TO DROUGHT – CONSERVATION EFFORTS
(PUBLIC)**

CONSERVATION FOR DROUGHT WATCH STAGE (VOLUNTARY)

INDOOR RESIDENTIAL USE:

- Use dishwashers only when they are full.
- Wash only full loads of laundry. Adjust water level if possible.
- Turn off faucets while brushing teeth, shaving, etc. (save about 5 gallons per day).
- Reduce water used per flush by installing toilet tank displacement inserts. A plastic jug may often be used as an alternative. **DO NOT USE BRICKS** - They disintegrate when soaked and the resulting grit hinders closing of the flap valve, causing leakage.
- Do not use the toilet as a trash can (flushing down tissues, etc.).
- Keep a bottle of water in the refrigerator, so as not to run the tap to get cold water.
- Find and fix leaks in faucets and water-using appliances. Faucets can usually be fixed cheaply and quickly by replacing washers.
- Adapt plumbing with flow-restricting or other water-saving devices. These are usually inexpensive and easy to install.
- If you have a water meter, learn to read it so you can judge how much water you use and the difference conservation makes.
- Take shorter showers and shallow baths (save about 25 gallons per shower/bath).
- Do not use a garbage disposal.

OUTDOOR USE:

Lawns

- Water before 10:00 a.m. to prevent evaporation during the hottest part of the day. Morning is better than evening, when the dampness encourages growth of fungus.
- Water only when lawn shows signs of wilt. Grass that springs back when stepped on does not need water.
- Water thoroughly (long enough to soak roots); not frequently (a light sprinkling evaporates quickly and encourages shallow root systems).
- Water slowly to avoid runoff.
- Do not let the sprinkler run any longer than necessary (In an hour, 600 gallons can be wasted).
- Allow a maximum of one inch of water per week on your lawn.

- Use automatic shutoff nozzles on hoses to avoid waste when watering flowers and shrubs.
- Aerate lawns by punching holes 6 inches apart. This allows water to reach roots rather than run off.
- Position sprinklers to water the lawn, not the pavement.
- Avoid watering on windy days when the wind not only blows water off target, but also causes excess evaporation.
- Keep sprinkler heads clean to prevent uneven watering.
- Adjust hose to simulate a gentle rain. Sprinklers that produce a fine mist waste water through evaporation.
- Install automatic shut off devices on automatic sprinkler systems.
- Know how to turn off an automatic irrigation system in case of rain.
- Use an alarm clock or stove timer to remind you to shut off sprinklers that do not have timers.

Vegetables and Flower Gardens

- Water deeply, slowly, and weekly. Most vegetables require moisture to a depth of 6 to 8 inches.
- Keep soil loose so water can penetrate easily.
- Keep weeds out to reduce competition for water.
- Put the water where you want it and avoid evaporation by using soil-soakers or drip irrigation hoses, not sprinklers.

Trees and Shrubs

- Water deeply with a soil-soaker or drip-irrigation.
- Water only when needed. Check the depth of soil dryness by digging with a trowel.
- Mulch to reduce evaporation. A 2" - 3" layer of wood chips, pine needles, grass clippings, or straw keeps the soil cool in summer.
- Dig troughs around plants to catch and retain water.
- Water trees growing in full sun more often than those in shade.
- Do not use sprinklers. Apply water directly at the base of trees.
- Do not fertilize during the summer. Fertilizing increases a plant's need for water.
- Postpone planting until fall when there is generally less demand for water.
- If you have a water meter, determine the amount of water being used outdoors by comparing water bills for summer and winter.

Livestock

- Consider installation of automatic waterers. These devices spread water use out throughout the day rather than filling troughs once per day.

CONSERVATION FOR DROUGHT WARNING STAGE (VOLUNTARY)

INDOOR RESIDENTIAL USE:

- Use dishwashers only when they are full.
- Wash only full loads of laundry. Adjust water level if possible.
- Turn off faucets while brushing teeth, shaving, etc. (save about 5 gallons per day).
- Reduce water used per flush by installing toilet tank displacement inserts. A plastic jug may often be used as an alternative. DO NOT USE BRICKS - They disintegrate when soaked and the resulting grit hinders closing of the flap valve, causing leakage.
- Do not use the toilet as a trash can (flushing down tissues, etc.).
- Keep a bottle of water in the refrigerator, so as not to run the tap to get cold water.
- Find and fix leaks in faucets and water-using appliances. Faucets can usually be fixed cheaply and quickly by replacing washers.
- Adapt plumbing with flow-restricting or other water-saving devices. These are usually inexpensive and easy to install.
- If you have a water meter, learn to read it so you can judge how much water you use and the difference conservation makes.
- Take shorter showers and shallow baths (save about 25 gallons per bath/shower).
- Do not use a garbage disposal

OUTDOOR USE:

Lawns

- Water twice per week if necessary, before 10:00 am.
- Allow grass to maintain 4" height – grass will absorb water more efficiently
- Keep mower blades sharp – will reduce water loss

Vegetables and Flower Gardens

- Water deeply, slowly, and bi-monthly. Most vegetables require moisture to a depth of 6 to 8 inches.
- Keep soil loose so water can penetrate easily.
- Keep weeds out to reduce competition for water.
- Put the water where you want it and avoid evaporation by using soil-soakers or drip irrigation hoses, not sprinklers.

Trees and Shrubs

- Do not plant new landscaping or grass.
- Water deeply with a soil-soaker or drip-irrigation.
- Water only when needed. Check the depth of soil dryness by digging with a trowel.
- Mulch to reduce evaporation. A 2" - 3" layer of wood chips, pine needles, grass clippings, or straw keeps the soil cool in summer.
- Dig troughs around plants to catch and retain water.
- Water trees growing in full sun more often than those in shade.
- Do not use sprinklers. Apply water directly at the base of trees.
- Do not fertilize during the summer. Fertilizing increases a plant's need for water.
- Postpone planting until fall when there is generally less demand for water.
- If you have a water meter, determine the amount of water being used outdoors by comparing water bills for summer and winter.

CONSERVATION FOR DROUGHT EMERGENCY STAGE (MANDATORY)

Water use restrictions shall not apply to the agricultural production of food or fiber, the maintenance of livestock including poultry, nor the commercial production of plant materials so long as best management practices are applied to assure the minimum amount of water is utilized.

INDOOR USE:

In addition to measures listed above:

- Turn off shower while soaping up.
- Use disposable eating utensils.

OUTDOOR USE:

- Vegetable gardens and food trees should be given a minimal amount of water on an individual need basis only.
- Do not water lawns and inedible plants.
- Do not use sprinklers.
- Do not allow children to play with hose or sprinklers.
- No car washing.
- Be ready to catch rainfall. Place rain barrels under drain sprouts.
- Use leftover household water if available.
- Consider delaying seeding or sodding new lawns.
- Washing paved surfaces such as streets, roads, sidewalks, driveways, garages, parking areas, tennis courts, and patios is prohibited.
- Noncommercial use of water for washing or cleaning of mobile equipment including automobiles, trucks, trailers and boats is prohibited.
- Use of water for the operation of ornamental fountains, artificial waterfalls, misting machines, and reflecting pools is prohibited unless they use recycled water.
- Use of water to fill and top off outdoor swimming pools is prohibited.
- Irrigation of lawns is prohibited.
- Limited irrigation of golf course greens may be allowed.
- Irrigation of athletic fields is prohibited.

All residential, business and industrial water users, whether supplied by public water supplies, self-supplied sources, or private water wells, who do not normally utilize water for any of the listed prohibited uses are requested to voluntarily reduce water consumption by at least 10%. This reduction may be the result of elimination of other nonessential water uses, application of water conservation practices, or reduction in essential water uses.

State of Emergency

In some cases, the mandatory nonessential water use restrictions may not be sufficient to protect the supplies of an individual public waterworks. When water sources are so depleted as to threaten public health and safety, it may become necessary to ration water within that system in order to assure that water is available to support essential uses. Rationing water is a more severe measure than merely banning nonessential uses of water. Under rationing, each water user is allotted a given amount of water, based on a method of allotment developed by the local government. Generally, it will be based on a percentage of previous usage or on a specific daily quantity per household. Rationing is more likely to have some effect on welfare than mandatory nonessential use restrictions, because industrial and commercial water uses may be curtailed or eliminated to assure an adequate supply is available for human consumptive uses. The decision to ration water will typically be made by the Board of Supervisors. Staff will work closely with any entity where water rationing is required to assure that all available State resources are effectively used to support these highly stressed water supply systems. The Virginia Department of Emergency Management (VDEM) is the first point of contact for waterworks or local governments who decide to ration water. VDEM will coordinate the Commonwealth's response and assistance to such entities.