STAFF SUMMARY

TO: Board of Directors
FROM: Frederick A. Laskey, Executive Director
DATE: September 14, 2022
SUBJECT: Reservoir and Drought Status Update

COMMITTEE: Water Policy & Oversight

X INFORMATION
VOTE

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On August 24, 2022, following seven months of lower than normal rainfall, the Secretary of Energy and Environmental Affairs declared all regions in Massachusetts to be in Level-3 critical drought, except for the Western and Island Regions, which she declared to be in Level-2 significant drought. Although MWRA is not directly impacted by these designations, staff are providing an update on the impact of the drought on MWRA operations. Quabbin Reservoir is currently 91% full, which is within its normal operating range for this time of the year. Even if the drought continued for several years, adequate supply exists in Quabbin and Wachusett Reservoirs to fully meet the needs of MWRA's full and partial water communities and, if needed, to augment the supplies of adjacent stressed communities. While no water use restrictions are required for MWRA fully supplied customers, MWRA is urging consumers to use water wisely and continues to provide conservation information.

RECOMMENDATION:

For information only.

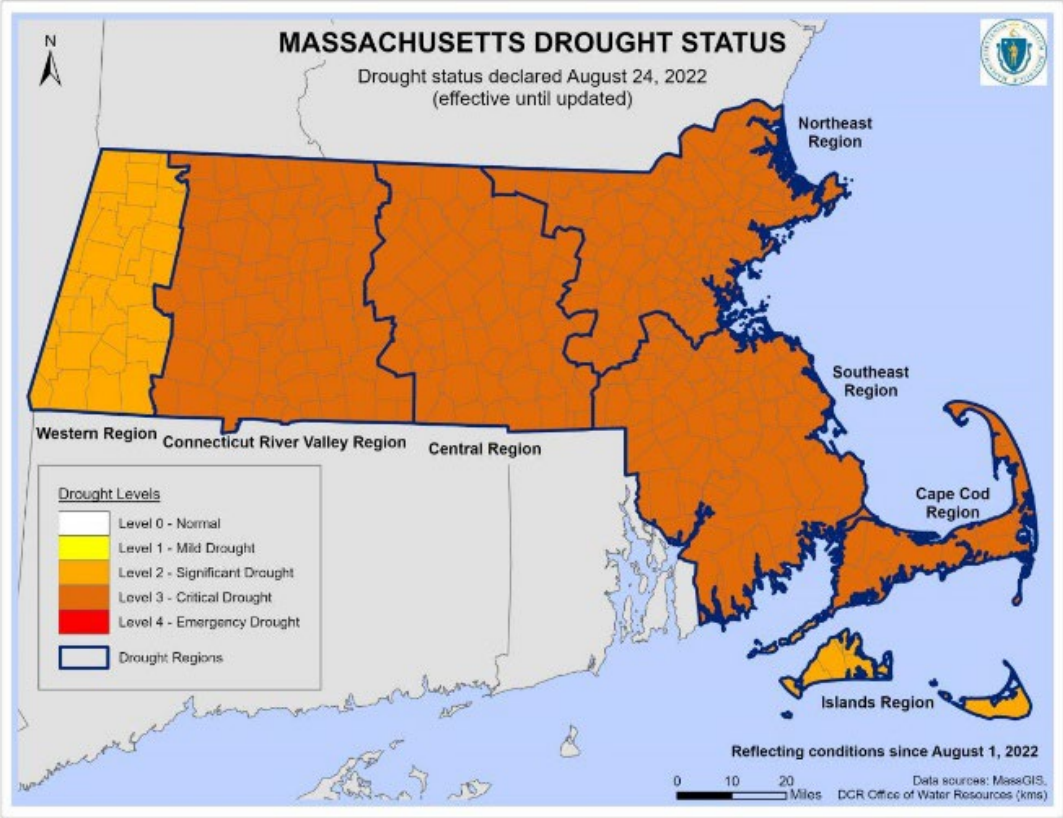
DISCUSSION:

The past seven months have been very dry, and as of August 24, upon advice of the Massachusetts Drought Management Task Force, the Secretary of Energy and Environmental Affairs Secretary has raised nearly the entire state to a Level 3 – Critical Drought status. MWRA is an active participant in the Massachusetts Drought Management Task Force and has participated in the development of the state drought response plan. The plan outlines agency responsibilities during drought conditions and sets drought stage triggers based on hydrologic conditions across the state.

The state drought plan acknowledges that MWRA has a separate drought response plan with specific triggers based on Quabbin storage levels (originally developed and approved by MassDEP during the 1989 drought). The state plan is regionally flexible; for example, small water systems may need water use restrictions during a short-term drought, while only a long-term multi-year drought affecting Quabbin and Wachusett would lead to significant restrictions in MWRA's service area. The state drought plan also leaves MWRA with primary responsibility for communication with its service area communities and customers during a drought.

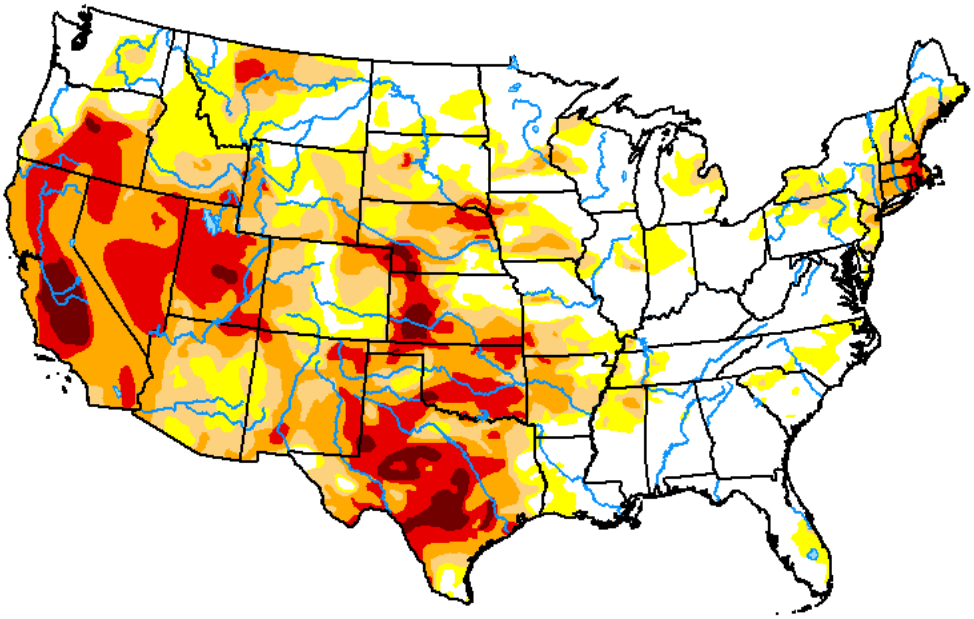
Figure 1 below shows the Massachusetts drought regions and their status as of August 24. The Drought Management Task Force meets monthly to review the series of indices that are the basis for determining appropriate action levels for the different regions within the state. The five state drought action levels are: Level 0 – Normal, Level 1 - Mild Drought (formerly Advisory), Level 2 - Significant Drought (formerly Watch), Level 3 - Critical Drought (formerly Warning), Level 4 - Emergency Drought. The task force last met on August 23 and recommended downgrading all regions of Massachusetts to Level-3 critical drought except for the Western and Island Regions.

Figure 1 – Massachusetts Drought Status
Designations August 24, 2022



The national drought status map in Figure 2 on the next page shows how this regional drought fits into the national drought picture.

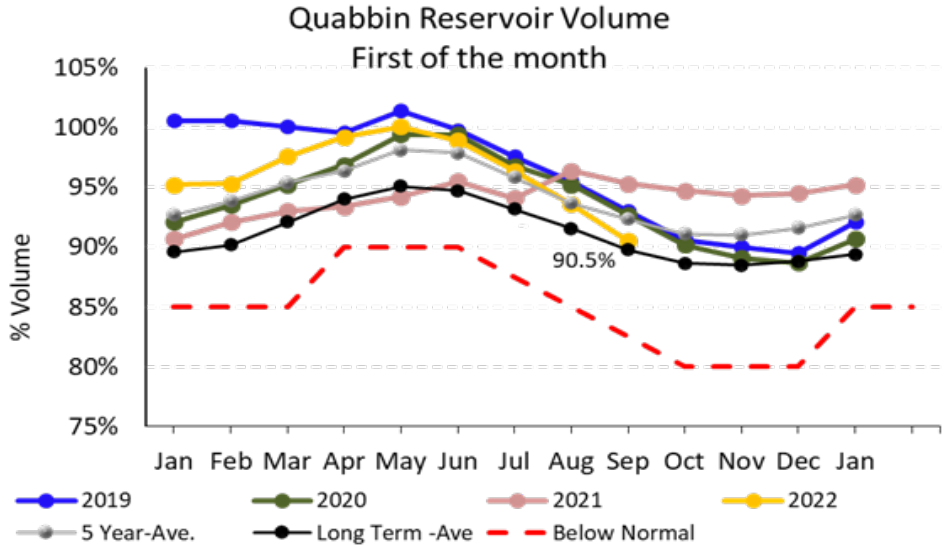
Figure 2: National Drought Status (NDMC Designation as of 8/23/2022)



MWRA Supply Outlook

Due to the long-term reductions in water use by MWRA's customers, and the immense storage volumes of the Quabbin and Wachusett reservoirs, MWRA's water system is in very good shape despite the drought. Quabbin Reservoir started the calendar year above typical levels as a result of significant rainfall during the summer and fall of 2021. In fact, Quabbin was spilling over its lower spillway right up to the fourth of July. The reservoir was 90.5 percent full at the end of August, which is within its normal operating range for this time of the year, as shown on Figure 3. Even if the drought continues for several more years, adequate supply exists in Quabbin and Wachusett Reservoirs to fully meet the needs of MWRA water communities and if needed, to augment the supplies of some of the adjacent stressed communities.

Figure 3 – Quabbin Status



During drought conditions, MWRA staff use reservoir modeling tools to project how the system

would perform under different weather conditions. Modeling of the reservoir system indicates the level will stay in its Normal Operating Range if precipitation returns to average conditions, and even if the Driest conditions ever seen persist[1], would not drop to 'Below Normal' before 6 months. Quabbin was last 'Below Normal' in 2016. Operationally, MWRA uses the Below Normal designation as a first level alert to begin planning for drought actions.

Table 1 – Quabbin Reservoir Modeled Drought Status
Looking Forward from September 1, 2022

	1-Month	3-Months	6-Months	12-Months
Median Yield	Normal	Normal	Normal	Normal
Dry (25th Percentile)	Normal	Normal	Normal	Normal
Driest (of Record)	Normal	Normal	Below Normal[2]	Below Normal

Based on current conditions as discussed above, MWRA is likely to stay in Normal Operating Range under almost all conditions. It would take the very driest conditions ever experienced for more than a year for the system to drop lower than Below Normal. Nonetheless, MWRA is urging its customers to use water wisely, and is providing additional information on water conservation. However, MWRA has not called for any mandatory water use restrictions.

MWRA Drought Management Plan

The MWRA Drought Management Plan calls for conservation of water through successively more stringent demand reduction measures as drought conditions deepen. Table 2 presents the stages of this plan. Drought response actions are triggered by the level of water in Quabbin Reservoir – the seasonal saw-tooth pattern shown in Figure 4.

Table 2: MWRA Drought Management Stages

Stage	Target Water Use Reduction
Normal Operation	0
Below Normal	Previous year's use (Voluntary)
Drought Warning	5% (Primarily Voluntary)
Drought Emergency	(Mandatory Restrictions)
Stage 1	10%
Stage 2	15%
Stage 3	30%

1 For drought modeling, Dry is defined as driest one quarter of all periods, and Driest is the driest period experienced since Quabbin Reservoir was constructed.

2 As shown in Table 2, MWRA drought plan has six status ranges: Normal, Below Normal, Drought Warning, and Drought Emergency 1, 2, and 3 based on storage volumes in Quabbin Reservoir.

Figure 4: Quabbin End of Month Storage, Annual System Demand and Safe Yield from 1950 to 2022

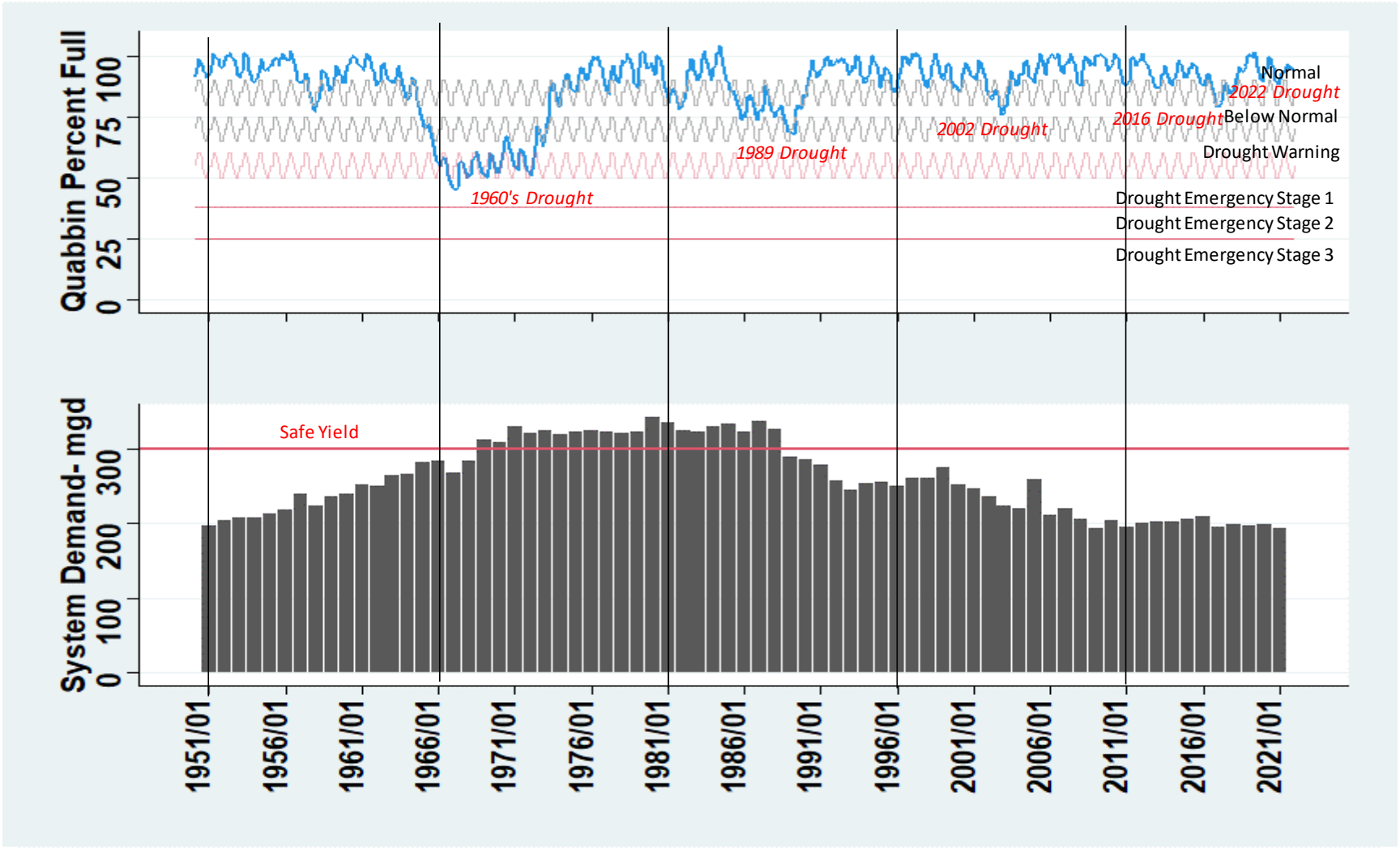


Figure 4 above shows Quabbin elevations since 1950. The saw-tooth bands correspond to MWRA drought plan stages. Past major droughts are labeled and it can be seen that, compared to previous droughts, Quabbin levels are still relatively high at this point. The lower part of the figure shows system demands for visual comparison. For a given drought, the reservoir will drop further if demands are higher. The system demand in the years prior to the 1989 drought was higher than the system's 'Safe Yield,' (the amount of water that can be reliably supplied during a critical drought by the watershed/reservoir system). As reported to the Board of Directors at the beginning of each year and shown in Figure 5, system demand has reduced significantly since 1980 and is now much lower than the system's Safe Yield. MWRA uses a Safe Yield of 300 million gallons per day (mgd) for planning and policy purposes. Given the current system demand of around 200 mgd, the MWRA system could reliably supply an additional 100 mgd through a drought as severe as the 1960s one.

The longest climate record in the region is the Amherst record that dates from 1848. However, using tree ring data, scientists have been able to discern precipitation patterns dating as far back as the 1670s. Based on these sources, the severest drought of record occurred in the 1960s. The 1960s drought was extraordinary, consisting of multiple consecutive years with record low precipitation; certainly the greatest drought in 140 years of local weather history and 300 years of tree ring data. It has been projected that it was likely a one in 400-year drought. Staff therefore regard the 1960s drought as the critical drought and use this to compute the system's Safe Yield.

Drought Impact on Partially Supplied, Emergency and Adjacent Communities

MWRA's drought planning assumes that there will be additional demand from partial users and potentially from neighboring non-user communities. Staff are tracking the status of all partially supplied communities to assess the impact of the drought on their supplies, and to be ready to assist if necessary. MWRA's drought planning assumes that as a drought deepens, its partially supplied member communities will use more MWRA water. Worcester's system is just within its Normal operating band at 72.5 percent of capacity, has declared a Stage 1 drought, and has called for some water use reductions. It has no current expectations of needing MWRA water. Lynn's system was at 57 percent full on August 24 and is calling for voluntary water use reductions. No non-MWRA communities have reached out to MWRA for emergency water at this time. In addition to drought concerns, several communities are taking additional water due to water quality issues. Cambridge and Wakefield are currently using 100 percent MWRA water due to concerns of elevated levels of PFAS in their local sources. At this time, Cambridge believes that it will use MWRA water for three or four months while upgrades are being made at its treatment plant. Wellesley and Burlington are also using additional water due to PFAS issues. Dedham-Westwood Water District is using additional MWRA water as it makes system improvements to reduce disinfection byproducts levels.

Total water use in July 2022 was almost 30 percent higher than July of 2021, not surprisingly, as last July was a record wet month, and this July was a record dry month. Year to date water use through July is around seven percent over the same period last year. Use is still over 90 mgd below the system safe yield.

Impact on Deer Island Sewer Flows

The drought has resulted in a reduction in sewer flows. New monthly low flow records were set at the Deer Island Wastewater Treatment Plant successively in May, June, July and August.

Next Steps

MWRA staff will continue to participate in the state Drought Management Task Force, and coordinate with other state agencies to periodically assess the status of the drought and the ongoing needs of the partial users and emergency connections. Staff will continue to do monthly forecasting of MWRA system conditions as long as the situation calls for it, and will report to the Board of Directors if conditions worsen.

BUDGET/FISCAL IMPACT:

Additional use by all other MWRA fully or partially supplied communities will be through the normal assessment process based on their proportionate share of water usage. If Worcester were to need to take water through its pump station at Shaft 3 of the Quabbin Aqueduct, it will pay the prevailing wholesale rate for any water used. Any emergency users either will also pay the prevailing rate directly to MWRA or will be billed by the community that it is interconnected to, plus a surcharge if applicable.