EAST-CENTRAL ILLINOIS WATER SUPPLIES VULNERABLE TO DROUGHTS OF RECORD

DROUGHT SUBCOMMITTEE of the REGIONAL WATER SUPPLY PLANNING COMMITTEE (RWSPC)

Recent rainfall has eased the drought situation somewhat, but precipitation for the year remains considerably below normal. The Drought Subcommittee has compiled a list of water supplies judged by the Illinois State Water Survey to be vulnerable to the possible recurrence of droughts of record. The droughts of record are identified from the historical records and are not predictions for the next twelve months. Nevertheless, we know that climate conditions that have occurred in the past can be expected to occur again in the future. It is prudent to assess the risks and be prepared.

SURFACE WATER

Springfield:

Lake Springfield was completed in 1935 and provides water for 133,000 people (2008). Lake water also is used to generate municipal electricity.

The drought of record occurred from June 1894 through December 1895 (19 months).

Nature of the risk: Inadequate water supply, i.e., there is greater than a 50 per cent probability that the system will be unable to meet projected water use with recurrence of a drought of record. Most of the city's electricity generating units would need to be shut down. The city's higher priority potable water supply is considered marginal to at-risk, i.e. there is less than 10 per cent probability that the system will fail to meet demands.

Bloomington

Lake Bloomington, completed in 1930, and Lake Evergreen, completed in 1971, provide water for 72,330 people (2008).

The drought of record occurred from July 1939 through March 1941 (20 months).

Nature of the risk: At-risk water supply, i.e., there is a 0-50 per cent probability that the system will be able to meet projected water use with recurrence of a drought of record. By 2020, the system will be inadequate to meet demand, i.e., there will be greater than a 50 per cent probability that the system will be unable to meet projected water use with recurrence of a drought of record.

Decatur

Lake Decatur was completed in 1922 and provides water for 90,243 people (2008). Private companies such as Archer Daniel Midland and Tate and Lyle also withdraw water from Lake Decatur.

The drought of record occurred from 15 July 1930 through 20 April 1931 (280 days).

Nature of the risk: At-risk water supply, i.e., there is 10-50 per cent probability that the system will be unable to meet projected water use with recurrence of drought of record. By 2020 the system will be inadequate to meet demand, i.e., there will be greater than a 50 per cent probability that the system will be unable to meet projected water use with recurrence of a drought of record.

Danville

Lake Vermilion was completed in 1971 and provides water for 55,000 people (2008).

The drought of record occurred from 1930 through 1931.

Nature of the risk: The system is currently adequate, but is projected to become at-risk by 2040, i.e., there will be a 10-50 per cent probability that the system will be unable to meet projected water use with recurrence of a drought of record.

GROUNDWATER

The impacts of drought on recharge to aquifers are less well-documented or understood.

i) Groundwater supplies developed from buried aquifers are relatively immune to droughts. However, the Mahomet Aquifer does appear to respond to droughts, e.g., the historical record shows step-wise declines in head at Petro North during droughts, but the mechanisms for the response have not been clearly established.

None of the current groundwater users obtaining water from the Mahomet Aquifer is considered at risk of future water shortage during a worst case drought.

Impacts from increased pumping during droughts include reductions in stream baseflow and reductions in head in wells constructed in the Mahomet and shallower aquifers. Reductions in stream baseflow indicate that surface and groundwater systems are linked and pumping groundwater can reduce surface water availability.

ii) Water levels in wells finished in unconfined portions of the Mahomet Aquifer, e.g., Havana Lowlands, drop during droughts, but water shortages can be avoided by ensuring that wells and pumps are sufficiently deep.

iii) Shallow aquifers do not have water stored in overlying deposits from which they can draw during times of drought. Therefore, water levels in such aquifers are more sensitive to climatic conditions and will decline in response to dry weather. The situation can be exacerbated by the effects of well interference.

Alluvial valley aquifers often are in hydraulic communication with the streams occupying the valleys in which the aquifer is situated. If streamflow is affected by drought, well yields can also be affected adversely.

Groundwater flow models are a good way to assess groundwater susceptibility to drought conditions, but it is simply not practical for the ISWS to develop detailed flow models for each of these supplies.

The ISWS has prioritized community groundwater supplies at risk to drought conditions based on a number of criteria [note: drought severity is not defined]: well depth; proximity to surface waters; well density; population served; and uncertainties. Private groundwater supplies from shallow aquifers and in areas where no aquifer exist are also susceptible to drought conditions. In 2006, the following communities in East-Central Illinois were deemed potentially vulnerable to drought conditions [well number; depth (ft); population served]:

CASS:
Chandlerville; 3; 65; 704
4; 60; 704
IROQUOIS:
Milford; 7; 78; 1369
8; 80; 1369
LOGAN:
Broadwell; 1, 48; 150
2; 53; 150
4; 52; 150
Illinois American Water – Lincoln; 11; 50; 15200
12; 50; 15200
14; 54; 15200
16; 52; 15200
18; 54; 15200
Mount Pulaski; 4; 34; 1800
5; 32; 1800
6; 39; 1800
McLEAN:
Heyworth; 1; 62; 2431
2; 59; 2431
3; 50; 2431
MENARD:
Athens; 3; 53; 4350
4; 57; 4350
Tallula; 3; 52; 900
4; 52; 900
SANGAMON:
Curran Gardner PWD; 1; 50; 4800
4; 55; 4800
5; 44; 4800
Dawson; 1; 36; 2220
2; 54; 2220
3; 41; 2220
5; 54; 2220
Pleasant Plains; 2; 60; 1236
3; 61; 1236
4; 61; 1236
TAZEWELL:
Groveland Township Water District; 1; 84; 2430
2; 85; 2430
Lake Windermere Estates subd; 1; 32; 300
3; 55; 300
WOODFORD:
Roanoke; 3; 52; 1994
5; 51; 1994

TOTAL GROUNDWATER: 38 wells serving some 40,000 people are at-risk public water supply systems. Other towns may need to be added due to heavy drought demands for nearby users, such as Weldon near Decatur's DeWitt wellfield. Some 110,000 people in the region have private water supplies and many of these also are at risk.

TOTAL SURFACE AND GROUNDWATER: water supplies for some 400,000 people in the region are inadequate or at-risk during a drought of record and with population growth there could be 50, 000 more by 2040.

CONCLUSIONS

Unless more adequate water supplies are provided, about half a million people could be at risk of water shortages during a worst-case drought by 2050. If temperature increases by 6°F, water demand could increase by about 15 percent, putting additional strains on water supplies.

Water shortages can be prevented by preparing for droughts in advance and by activating drought response plans when they occur. The costs of action can be weighed against the costs of no action.

Conservation measures are most effective for systems that are only marginally vulnerable to drought, but should never be viewed as a substitute when an additional or augmented source of supply is needed. For most communities classified as inadequate or at-risk, the development of supplemental sources of water and interconnection with larger systems having surplus yield are seen as solutions to resolve drought vulnerability issues.

References

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