



Richard F. Celeste
Governor

Joseph J. Sommer
Director



JANUARY 1988/9

DIVISION OF WATER

MONTHLY WATER INVENTORY REPORT FOR OHIO

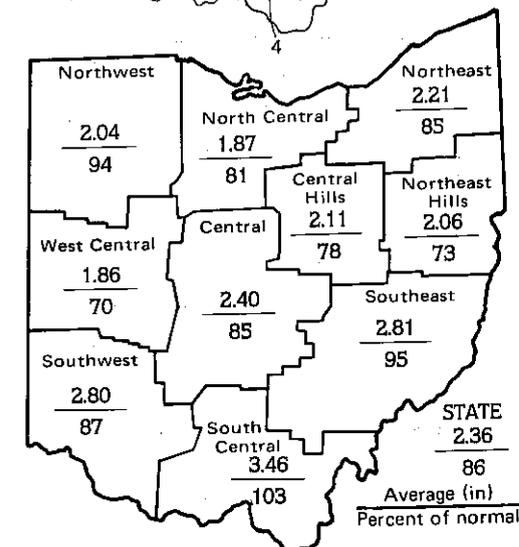
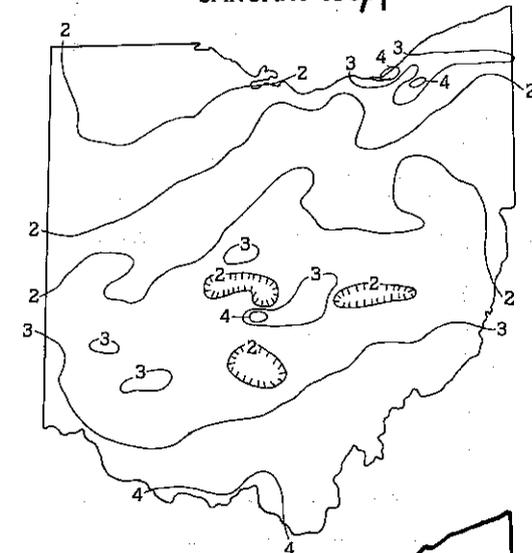
Compiled By David H. Cashell
Water Inventory Unit

PRECIPITATION for January was below normal throughout the state except in the South Central Region where it was slightly above normal. The average for the state as a whole was 2.36 inches, 0.40 inch below normal. Regional averages ranged from 3.46 inches, 0.09 inch above normal, for the South Central Region to 1.86 inches, 0.81 inch below normal, for the West Central Region. Greenup Locks and Dam (Scioto County) reported the greatest amount of precipitation for the month, 4.67 inches. Congress (Wayne County) reported the least, 1.18 inches.

Generally, the bulk of the precipitation for most stations fell during the first two weeks and the last week of the month. Very little precipitation fell during the third week except along the Ohio River. With the above normal temperatures, most of the precipitation was in the form of rain. Chardon (Geauga County) reported 7.1 inches of snow for the month, 16.9 inches below normal. Generally, precipitation amounts for any particular day were less than 0.5 inch at most stations. In the southern portion of the state daily amounts of more than 1 inch were reported at some stations on January 8, 11, and 16. Minor flooding was reported in the northwestern portion of the state on January 9 and 11.

Precipitation for the 1989 water year so far is above normal statewide except in the Northeast Hills Region where it is slightly below normal. The average for the state as a whole is 11.34 inches, 1.01 inches above normal. Regional averages range from 12.80 inches, 1.46 inches above normal, for the South Central Region to 9.97 inches, 0.57 inches below normal, for the Northeast Hills Region. Precipitation was slightly above normal in October, noticeably above normal in November, but below normal in December and January. Precipitation in the first four months of the 1989 water year is 3.5 inches greater than it was for the same period in the 1988 water year. Adequate precipitation during the next few months (the remainder of the water supply recharge season) will be necessary for a continuation in the improvement of water supplies noted over the past few months.

PRECIPITATION
JANUARY 1988/9



SUMMARY

PRECIPITATION was below normal throughout most of the state. Streamflow was above normal statewide except in the northeast portion. Reservoir storage increased and was above normal. Ground-water levels rose noticeably, but still range up to 3.5 feet below normal. Lake Erie level increased contra-seasonally but is at its lowest January level in 22 years.

NOTES AND COMMENTS

TWO NEW EMPLOYEES JOIN GWRS STAFF

The ODNR Division of Water, Ground-Water Resources Section (GWRS) has added two new employees to its staff. Mike Angle, an Akron native, has joined the GWRS Mapping Unit as a hydrogeologist. He will be mapping the state's ground-water resources and using the DRASTIC system to produce pollution potential maps. Mike received his bachelor and master of science degrees in geology from the University of Akron. While working toward a Ph.D. at Miami University (Oxford), he traveled twice to the Dry Valleys region of Antarctica. Mike worked with the ODNR Division of Geological Survey from 1984 until present as a glacial geologist. Mike, with his wife Katie and two children live near Pataskala.

Linda Fair, a Columbus native, joined the GWRS in December as a technical typist. Previously, she was employed with Trans Union Credit and The Ohio State University theatrical department. This spring, Linda will begin pursuing a degree in secretarial science. Linda and her husband Tom reside in Columbus and are expecting their first child in August.

OHIO RIVER BASIN CONSORTIUM FOR RESEARCH AND EDUCATION ANNUAL SYMPOSIUM

The fifth annual scientific symposium will be held in the Stocker Center, Ohio University, Athens, Ohio, on September 6-8, 1989. The symposium theme is Water Quantity and Quality Problems in the Ohio River Basin. Papers are sought in the areas of surface and ground water, droughts, water pollution, natural hazards, floods, management systems and social and economic impacts.

Abstracts should be submitted to the Symposium Program Chairman Dr. Tiao J. Chang, Department of Civil Engineering, 135 Stocker Center, Ohio University, Athens, Ohio 45701, (614) 593-1462. Please submit three (3) copies of each abstract. The abstract should be typed and double-spaced (200 words maximum) including the paper's title, author(s) name(s), and affiliation(s). The submitting author must include, on a separate page, his full mailing address and telephone number. **THE DEADLINE FOR SUBMISSION OF ABSTRACTS IS MARCH 15, 1989.**

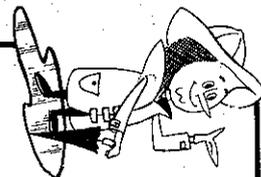
RIPARIAN WATER RIGHTS CONFERENCE

A conference to discuss riparian water rights will be held on April 6, 1989 in Cincinnati, Ohio. Several organizations have joined to sponsor the conference: the Ohio Water Advisory Council, the Ohio River Basin Commission, The Ohio State University Water Resources Center and The Water Management Association of Ohio. For further information, contact the OSU Water Resources Center at (614) 292-6108 or ODNR Division of Water at (614) 265-6758.

ACKNOWLEDGEMENTS

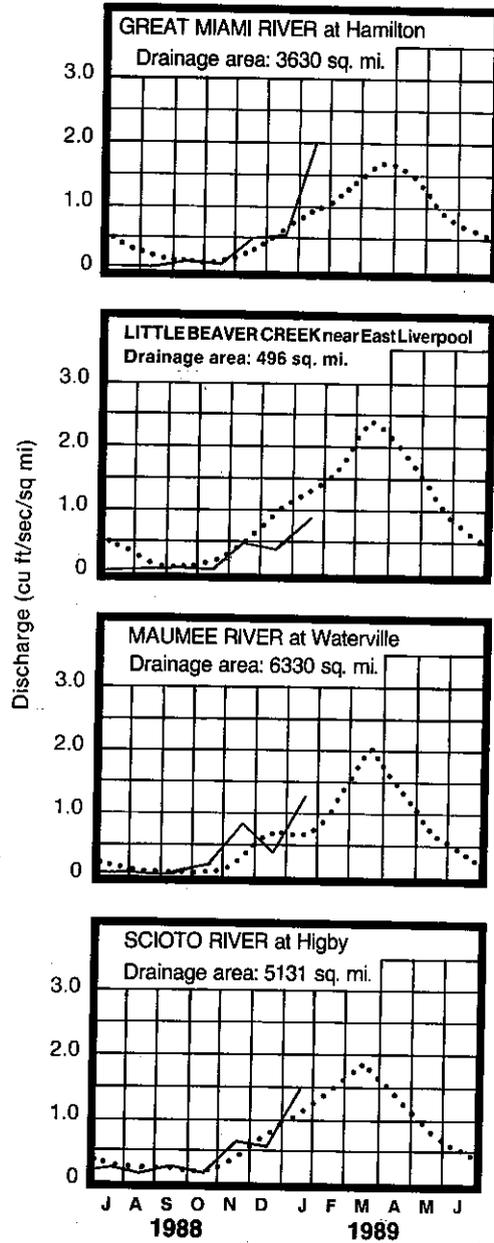
This report has been compiled from Division of Water data and from information supplied by the following:

- Precipitation data:
U.S. Department of Commerce, National Oceanic and Atmospheric Administration,
National Weather Service; The Miami Conservancy District; U.S. Army Corps of Engineers, Muskingum Area.
Streamflow and reservoir storage data:
U.S. Geological Survey, Water Resources Division.
Lake Erie level data:
U.S. Corps of Engineers, Detroit District.



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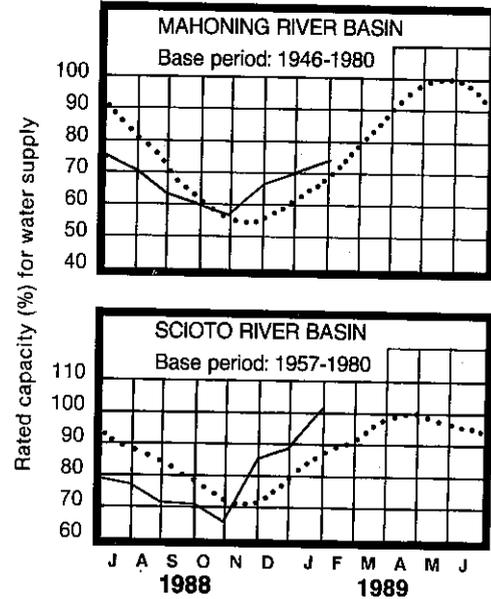
MEAN STREAM DISCHARGE



Base period for all stream: 1951-1980

Normal current _____

RESERVOIR STORAGE FOR WATER SUPPLY



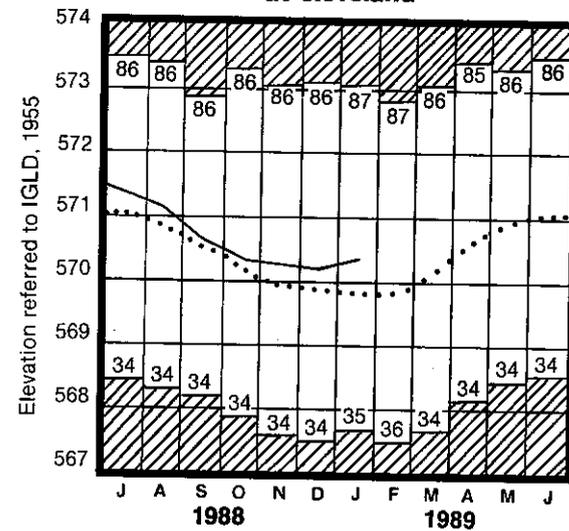
RESERVOIR STORAGE for water supply for January increased in both the Mahoning and Scioto river basins. Storage was above normal in both basins.

Reservoir storage at the month's end for the Mahoning basin index reservoirs was 74 percent of rated capacity for water supply compared with 69 percent for last month and 61 percent for January 1988. Storage at the month's end for the Scioto basin index reservoirs was 102 percent of rated capacity for water supply compared with 88 percent for last month and 47 percent for January 1988. This is the first time since March 1986 that the month end storage in the Scioto basin index reservoirs was greater than its rated capacity for water supply.

STREAMFLOW for January was above normal throughout most of the state. Only in the northeastern portion were flows below normal. Flows in the southwestern portion of the state were great enough to be considered excessive. Generally, flows slowly decreased during the first week of the month; increased significantly during the second week when the highest flows were observed; and slowly decreased the remainder of the month. Flows at the month's end were above normal in the western half of the state and below normal in the eastern half. January flows were greater than December flows throughout the state.

Mean discharge and percent of normal at the index gauging stations for January were: Great Miami River, 7,315 cfs, 226 percent; Little Beaver Creek, 450 cfs, 72 percent; Maumee River, 7,998 cfs, 207 percent; and Scioto River, 7,566 cfs, 134 percent.

LAKE ERIE LEVELS at Cleveland

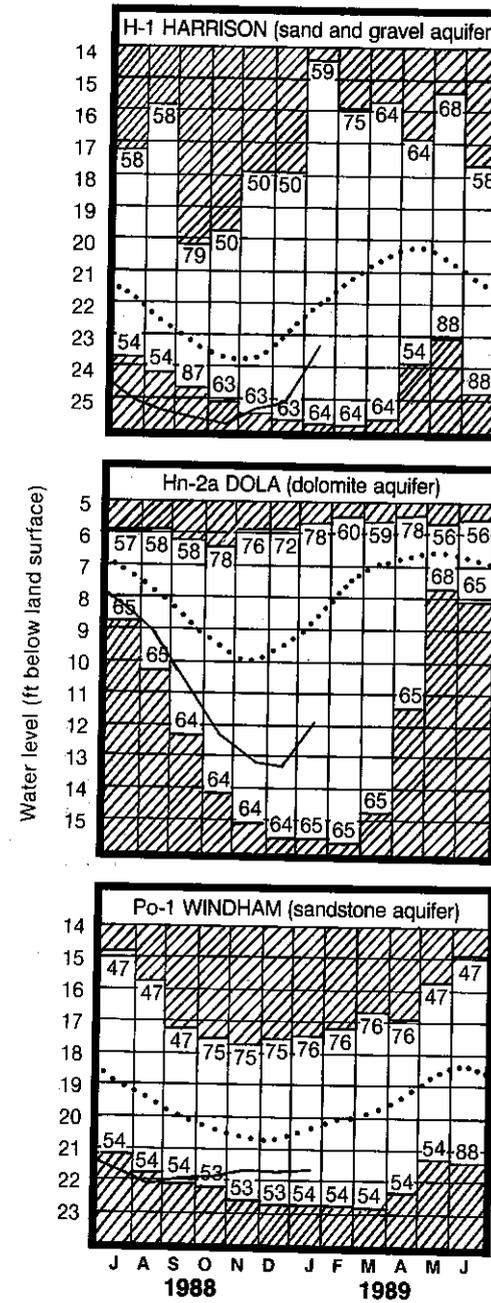


LAKE ERIE level for January increased contra-seasonally. The mean level for January was 570.37 feet (IGLD-1955), 0.16 foot above last month's mean level and 0.90 foot below the January 1988 mean level. This month's level is 0.55 foot above normal and 1.77 feet above Low Water Datum. This is the lowest January level since 1967.

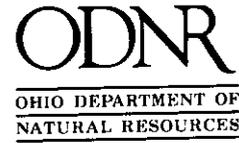
GROUND-WATER levels rose during January throughout the state. Rises in most aquifers were greater than those usually observed. Generally, ground-water levels rose steadily throughout the month. Exceptions to this were noted in some unconsolidated aquifers where levels declined slightly during the second half of the month. Generally, levels in the southern portion of the state are higher than those of a year ago and lower in the northern portion. Ground-water levels range from near normal to 3.5 feet below normal statewide. Greatest departures from normal are in the limestone/dolomite aquifers in the northern and western portions of the state. Observation well Tu-1 (Strasburg, Tuscarawas County), representing a sand and gravel aquifer, reached a record January low on the first before beginning to rise.

Generally, recharge to ground-water supplies has been better thus far in the 1989 water year than in the 1988 water year. Last year, levels continued to decline through January in most areas of the state. Unseasonal warm temperatures during this January kept the soils from freezing, thus allowing the precipitation that fell during the month to infiltrate easily. With normal precipitation during the next few months, a continuation in the improvement of ground-water storage can be expected; however, a return to normal ground-water storage may take a longer period of time.

GROUND-WATER LEVELS



Base periods: H-1, 1951-1979. Hn-2a, 1955-1979. Po-1, 1947-1979



Richard F. Celeste
Governor
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FEBRUARY 1989

DIVISION OF WATER

MONTHLY WATER INVENTORY REPORT FOR OHIO

Compiled By David H. Cashell
Water Inventory Unit

ERRATA: Please note that the date of last month's report (January 1989) was inadvertently printed as January 1988. Also, the precipitation isoheytal map was incorrectly dated as January 1988. Please make these corrections on your copy.

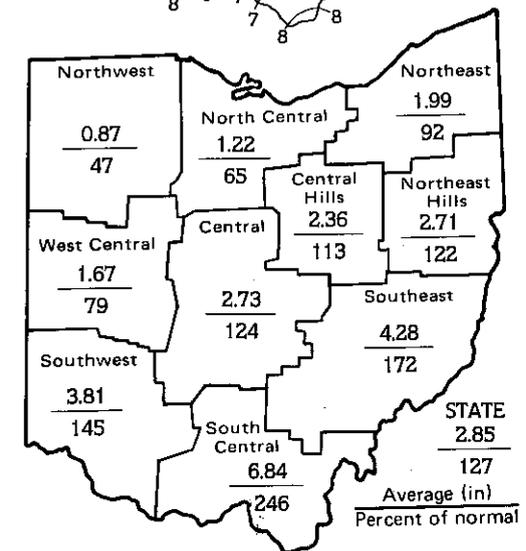
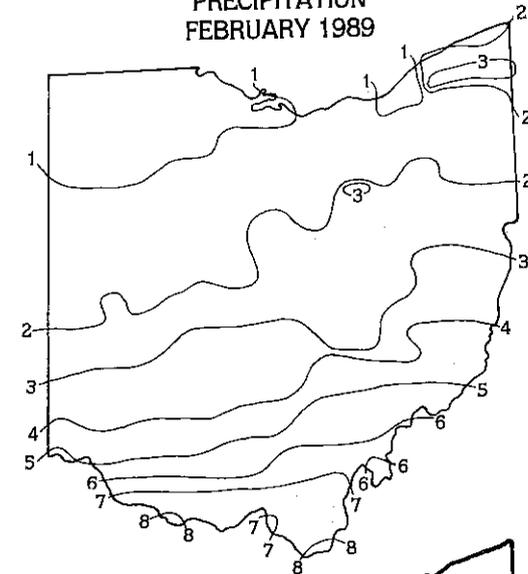
PRECIPITATION for February varied greatly throughout the state being noticeably below normal in the northwest portion increasing to noticeably above normal in the southeast portion. The average for the state as a whole was 2.85 inches, 0.61 inch above normal. Regional averages ranged from 6.84 inches, 4.06 inches above normal, for the South Central Region to 0.87 inch, 0.97 inch below normal, for the Northwest Region. Chesapeake (Lawrence County) reported the greatest amount of precipitation for the month, 8.67 inches. Grand Rapids (Wood County) reported the least, 0.54 inch.

Precipitation fell during every week of the month. Two notable storm periods brought heavy precipitation to areas in the extreme southern portion of the state, decreasing to almost nothing in the northwest portion. The first storm on February 13-15 produced precipitation amounts of up to 4 inches and the second storm on February 20-21 amounts of up to 3 inches. Greatest amounts in both storms were received along the Ohio River. Minor flooding was reported following both storms.

Precipitation for the 1989 calendar year thus far is above normal in the southern half of the state and below normal in the northern half. The average for the state as a whole is 5.22 inches, 0.22 inch above normal. Regional averages range from 10.30 inches, 4.15 inches above normal, for the South Central Region to 2.91 inches, 1.11 inches below normal, for the Northwest Region.

Precipitation for the first five months of the 1989 water year is above normal statewide; an exception is in the Northeast Hills Region where it is slightly below normal. The average for the state as a whole is 14.18 inches, 1.61 inches above normal. Regional averages range from 19.64 inches, 5.52 inches above normal, for the South Central Region to 11.65 inches, 0.63 inch above normal, for the North Central Region.

PRECIPITATION
FEBRUARY 1989



NOTES AND COMMENTS

Bayliss L. "Rock" Prater Honored

Bayliss L. "Rock" Prater received the "Water Conservationist of the Year Award" from the League of Ohio Sportsmen at their annual meeting on February 25 in Akron. Prater was recognized for his efforts as chairman of the Ohio Water Advisory Council, a seven-person council appointed by the governor to advise the chief of the Division of Water in carrying out the duties of the division. Prater has also been active in speaking out for wise water use, wetland protection and restoration, and the need for floodplain legislation. Prater and his wife Kathleen have put into practice many of their water conservation principles at their farmstead "The Last Resort" near Willard.

NEW PUBLICATION

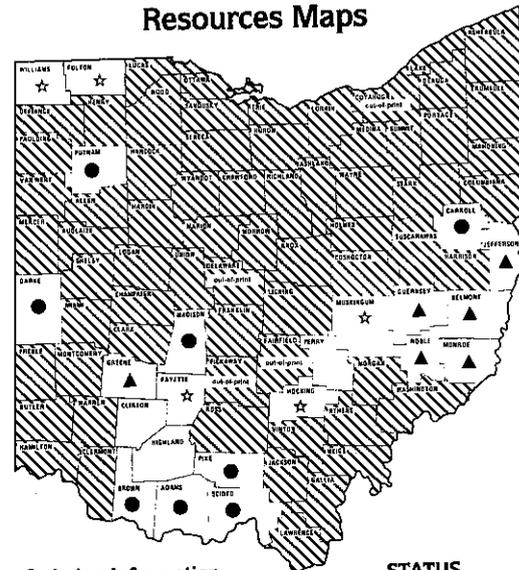
The Division of Water announces the availability of the following new publication:

THE GROUND-WATER RESOURCES OF TUSCARAWAS COUNTY by DOUGLAS J. BARBER.

Ground-water resources maps are prepared by staff hydro-geologists. These maps show the regional ground-water characteristics based on interpretations of water well drilling records and local geology. These color-coded maps provide well log data for many point locations. Information provided by the maps include typical depths of wells, water-bearing formations and estimated yields for wells in the area.

Ground-water resources maps can be used as a guide to locating new or expanding existing ground-water supplies. They are useful to homeowners, ground-water consultants, engineers, planners and developers.

Available County Ground-Water Resources Maps



Ordering Information

Ground-Water Resources Maps are available for \$6.53 (includes postage, handling and tax), from ODNR Publications, Fountain Square, Bldg. B-1, Columbus, Ohio 43224.

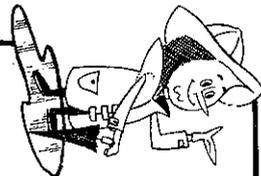
STATUS

- Published
- ★ Field Work in Progress
- ▲ Field Work Completed
- In Production

ACKNOWLEDGEMENTS

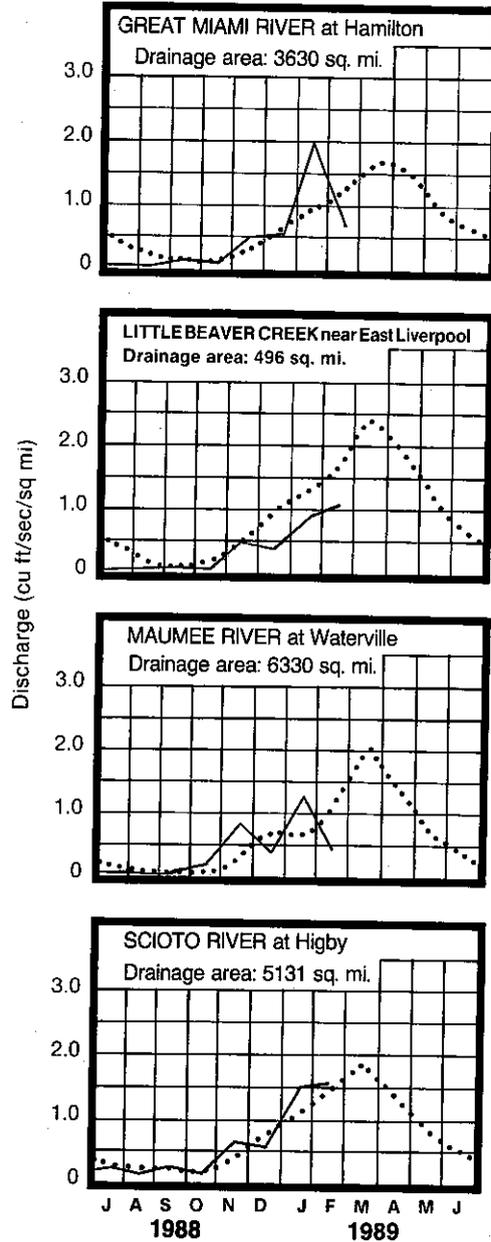
This report has been compiled from Division of Water data and from information supplied by the following:

- Precipitation data: U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Weather Service; The Miami Conservancy District; U.S. Army Corps of Engineers, Muskingum Area.
- Streamflow and reservoir storage data: U.S. Geological Survey, Water Resources Division.
- Lake Erie level data: U.S. Corps of Engineers, Detroit District.



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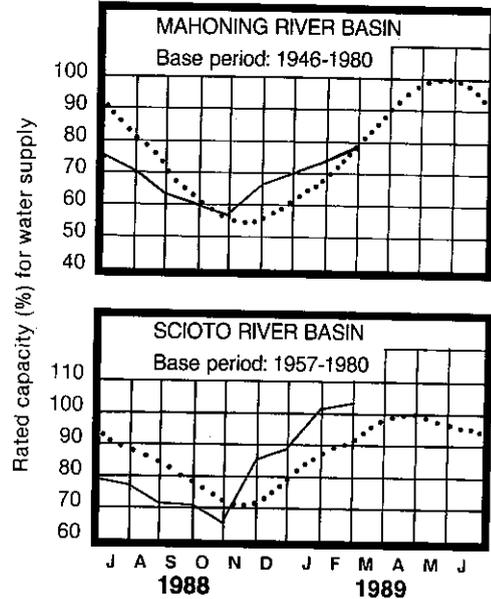
MEAN STREAM DISCHARGE



Base period for all stream: 1951-1980

Normal current _____

RESERVOIR STORAGE FOR WATER SUPPLY

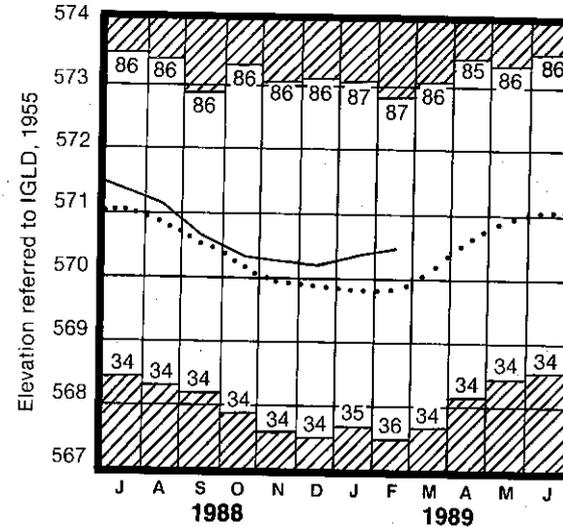


RESERVOIR STORAGE for water supply for February increased in both the Mahoning and Scioto river basins. Storage was normal in the Mahoning River basin and above normal in the Scioto River basin.

Reservoir storage at the month's end for the Mahoning basin index reservoirs was 77 percent of rated capacity for water supply compared with 74 percent for last month and 73 percent for February 1988. Storage in the Scioto basin index reservoirs was 104 percent of rated capacity for water supply compared with 102 percent for last month and 88 percent for February 1988.

STREAMFLOW for February was below normal throughout most of the state. Only the south central and southeastern portions had above normal flows. February flows in the western portion of the state were less than January flows and in the eastern portion, greater. Generally, flows slowly decreased during the first two weeks of the month and increased sharply on February 14 in response to precipitation. Minor flooding was reported on February 15-16 in the south central and southeastern portions of the state. Greatest daily flows occurred on February 16 in these portions of the state. Significant precipitation on February 20-21 also resulted in minor flooding of low-lying areas in the southern portions of the state on February 22. Greatest daily flows in the southwestern and north-eastern portions of the state occurred on February 22. Generally, flows at the month's end were greater than flows at the beginning of the month, but below normal.

LAKE ERIE LEVELS at Cleveland



Mean discharge and percent of normal at the index gauging stations for February were: Great Miami River, 2,498 cfs, 52 percent; Little Beaver Creek, 542 cfs, 66 percent; Maumee River, 2,874 cfs, 47 percent; and Scioto River, 8,192 cfs, 114 percent.

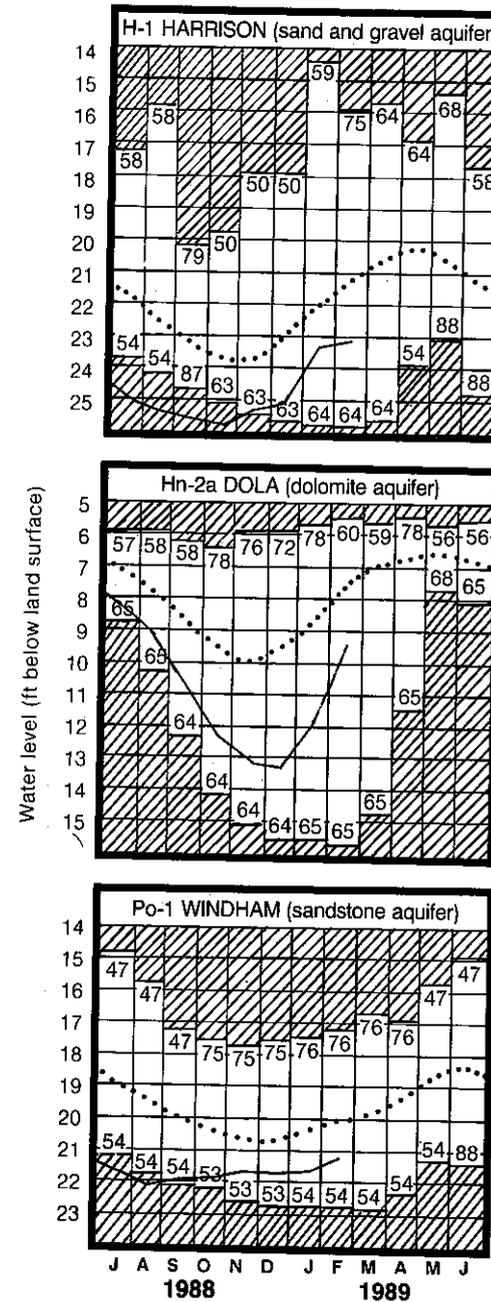
LAKE ERIE level rose during February. The mean level for February was 570.45 feet (IGLD-1955), 0.08 foot above last month's level and 0.65 foot above normal. This month's mean level is 0.87 foot below the February 1988 level and 1.85 feet above Low Water Datum.

GROUND-WATER LEVELS for February rose throughout the state. Generally, levels remained stable or declined slightly the first half of the month and rose the second half. Ground-water levels in the southern portion of the state are noticeably higher than those of a year ago and in the northern portion, lower. Ground-water storage has increased considerably during the past few months but levels remain from near normal to 3 feet below normal. As the end of the water supply recharge season begins to draw near and with above information in mind, we urge those responsible for managing water supplies, especially ground-water supplies, to monitor their respective situations and plan accordingly.

SUMMARY

Precipitation was noticeably above normal in the southern portion of the state and below normal in the northern portion. Reservoir storage increased and was above normal. Streamflow was below normal except in the southeastern portion where it was above normal. Lake Erie level rose and is 0.65 foot above normal. Ground-water levels rose but still remain below normal.

GROUND-WATER LEVELS



Base periods: H-1, 1951-1979. Hn-2a, 1955-1979. Po-1, 1947-1979



MONTHLY WATER INVENTORY REPORT FOR OHIO

MARCH 1989

Richard F. Celeste
Governor

Compiled By David H. Cashell
Water Inventory Unit

Joseph J. Sommer
Director

PRECIPITATION for March was above normal throughout most of the state; exceptions were in the Northwest and North Central regions where precipitation was below normal. The average for the state as a whole was 4.01 inches, 0.63 inch above normal. Regional averages ranged from 5.43 inches, 1.51 inches above normal, for the Southwest Region to 2.07 inches, 0.80 inch below normal, for the Northwest Region. Fernbank (Hamilton County) reported the greatest amount of precipitation for the month, 8.95 inches. Stryker (Williams County) reported the least, 1.17 inches.

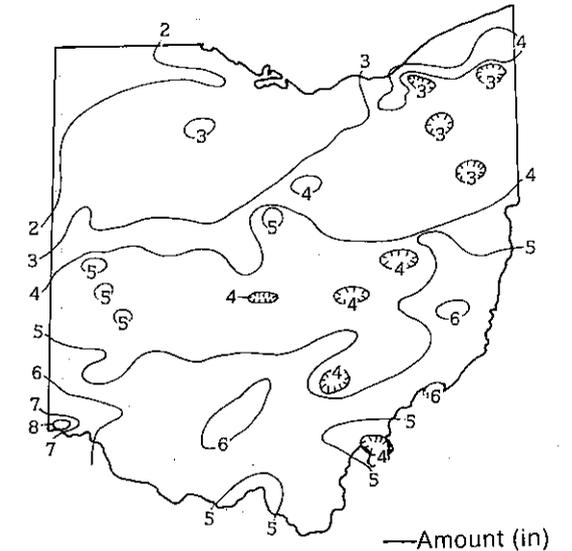
Precipitation fell during every week of the month. A pattern of variation very similar to February was observed with the greatest amount of precipitation occurring in the southern portion of the state decreasing to the north and west. Three notable storm periods produced the bulk of the month's precipitation for most stations. Storms during March 5-6, 19-21 and 29-31 each produced amounts of 1 to 3 inches at various locations. Minor flooding was reported on the last day of the month.

Precipitation for the 1989 calendar year thus far is above normal in the southern half of the state and below normal in the northern half. The average for the state as a whole is 9.22 inches, 0.84 inch above normal. Regional averages range from 15.48 inches, 5.24 inches above normal, for the South Central Region to 4.98 inches, 1.91 inches below normal, for the Northwest Region.

Precipitation for the first half of the 1989 water year is above normal throughout the state. The average for the state as a whole is 18.19 inches, 2.24 inches above normal. Regional averages range from 24.82 inches, 6.61 inches above normal, for the South Central Region to 14.18 inches, 0.30 inch above normal, for the North Central Region. The above normal precipitation during the 1989 water year recharge season has been beneficial for water supplies.

The new precipitation table shows short- and long-term departures from normal precipitation for each region for various time periods. This table facilitates short- and long-term precipitation comparisons. The month end Palmer Drought Severity Index, supplied by NOAA, is also provided.

PRECIPITATION MARCH 1989

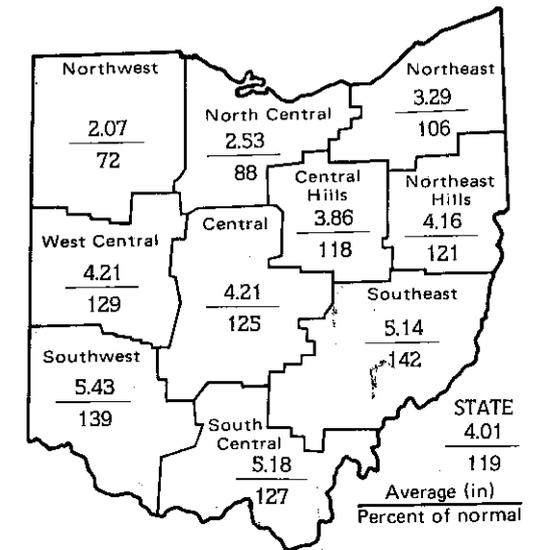


PRECIPITATION

Region	DEPARTURE FROM NORMAL (IN.)					Palmer Drought Severity Index*
	This Month	Past				
		3 Mos.	6 Mos.	12 Mos.	24 Mos.	
Northwest	-0.80	-1.91	+1.04	-5.43	-8.27	+1.6
North Central	-0.33	-1.41	+0.30	-7.60	-6.58	+0.6
Northeast	+0.18	-0.38	+1.24	-2.45	-1.29	+0.7
West Central	+0.95	-0.30	+1.28	-5.78	-10.34	-1.4
Central	+0.84	+0.95	+2.21	-0.83	-7.08	+1.4
Central Hills	+0.60	+0.28	+1.12	-2.30	-1.33	+0.9
Northeast Hills	+0.71	+0.42	+0.62	-4.99	-6.29	-1.9
Southwest	+1.51	+2.27	+3.76	-1.61	-7.95	+1.7
South Central	+1.09	+5.24	+6.61	-1.57	-12.51	+1.8
Southeast	+1.52	+3.15	+4.27	-0.99	-4.31	+1.5
State	+0.63	+0.83	+2.25	-3.36	-6.60	////

*Above +4 = Extreme Moist Spell
3.0 To 3.9 = Very Moist Spell
2.0 To 2.9 = Unusual Moist Spell
1.0 To 1.9 = Moist Spell
0.5 To 0.9 = Incipient Moist Spell
0.4 To -0.4 = Near Normal

-0.5 To -0.9 = Incipient Drought
-1.0 To -1.9 = Mild Drought
-2.0 To -2.9 = Moderate Drought
-3.0 To -3.9 = Severe Drought
Below -4.0 = Extreme Drought



SUMMARY

Precipitation was above normal throughout most of the state except in the northwestern portion where it was below normal. Streamflow was below normal throughout the state. Reservoir storage increased and was above normal in the Scioto River basin but below normal in the Mahoning River basin. Lake Erie level rose and is 0.54 foot above normal. Ground-water storage continues to improve but remains below normal.

NOTES AND COMMENTS

NEW FORMAT FOR MONTHLY WATER INVENTORY REPORT

In response to the comments and suggestions solicited and received last fall, I have incorporated some new information and redesigned the format of this report. Some additional information and changes may be included at a later date. Comments from readers are always welcome.

-DAVID H. CASHELL

NEW PUBLICATIONS

THE GROUND-WATER RESOURCES OF SCIOTO COUNTY BY JAMES M. RAAB

Ground-water resources maps are prepared by staff hydrogeologists. These maps show the regional ground-water characteristics based on interpretations of water well drilling records and local geology. These color-coded maps provide well log data for many point locations. Information provided by the maps include typical depths of wells, water-bearing formations and estimated yields for wells in the area.

Ground-water resources maps can be used as a guide to locating new or expanding existing ground-water supplies. They are useful to homeowners, ground-water consultants, engineers, planners and developers. The cost is \$6.53 (includes postage and tax).

GROUND-WATER POLLUTION POTENTIAL OF MERCER COUNTY BY DAVID J. SUGAR

Ground-water pollution potential maps are designed to determine an area's relative potential for ground-water pollution. The maps can be used as a planning and management tool for administrators, commissioners, zoning boards and others to help them make educated decisions about local development and siting of potentially polluting operations or activities. The system optimizes the use of existing data to rank areas with respect to pollution potential to help direct investigations and resource expenditures and to prioritize protection, monitoring and clean-up efforts.

Mapping an area's potential for ground-water pollution is a relatively new idea. This map uses the DRASTIC system as developed for the U.S. Environmental Protection Agency by the National Water Well Association. DRASTIC values, as shown on the map, indicate an area's relative vulnerability to contamination through the use of a numerical rating scheme and the mapping of hydrogeologic settings. Low DRASTIC values indicate low potential and high DRASTIC values indicate a high potential for contamination. Areas of similar DRASTIC values are color coded for ease of reading. The cost is \$12.30 (includes postage and tax).

Copies of the two above publications may be obtained from:

ODNR-Publications Center
Fountain Square, Building B-1
Columbus, Ohio 43224

Make checks payable to ODNR Publications Center.

NEW EMPLOYEE JOINS GWRS STAFF

The ODNR Division of Water, Ground-Water Resources Section (GWRS) has added a new employee to its staff. Tina Ray started as a temporary in GWRS and recently became a permanent clerical specialist. Tina comes to this section with much experience in the technical and human service fields. She attended Capital University and plans to complete her degree in the near future. Tina, her husband Al and three children live in Columbus. In her spare time she enjoys traveling, reading and gourmet cooking.

ACKNOWLEDGEMENTS

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Streamflow and reservoir storage data:
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Lake Erie level data:
U.S. Corps of Engineers, Detroit District.
Palmer Drought Severity Index:
U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Weather Service.



DIVISION OF WATER
1939 FOUNTAIN SQUARE
COLUMBUS, OHIO 43224

ODNR
OHIO DEPARTMENT OF
NATURAL RESOURCES

MEAN STREAM DISCHARGE

This Month

River and Location	Drainage Area (Sq. Mi.)	Mean Discharge (CFS)	% of Normal	% of Normal, Past		
				3 Mos.	6 Mos.	12 Mos.
Grand River near Painesville	685	1,305	55	70	78	68
Great Miami River at Hamilton	3,630	4,727	78	92	85	65
Huron River at Milan	371	256	34	62	59	52
Killbuck Creek at Killbuck	464	750	76	85	85	69
Little Beaver Creek near East Liverpool	496	791	66	64	60	53
Maumee River at Waterville	6,300	3,375	26	55	66	55
Muskingum River at McConnelsville	7,422	14,400	87	93	89	70
Scioto River near Prospect	567	444	45	49	44	38
Scioto River at Higby	5,131	9,040	93	101	95	75
Stillwater River at Pleasant Hill	503	700	92	69	58	44

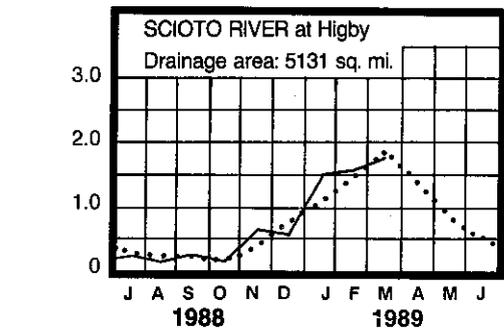
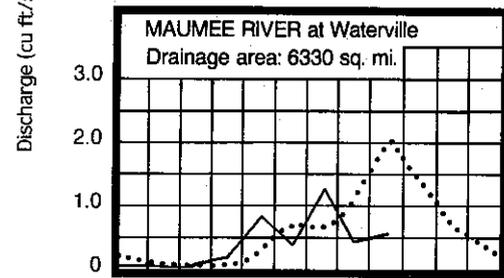
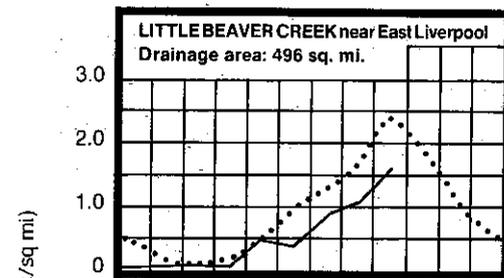
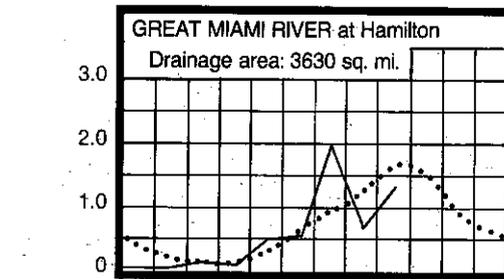
STREAMFLOW for March was below normal throughout the state. Flows in the northern portion of the state were low enough to be considered deficient. March flows were greater than February flows. Greatest daily flows occurred on the last day of the month except in the northwest portion where they occurred late in the third week. Flows at the month's end were noticeably above normal statewide except in the northwest portion where they remained deficient. Widespread heavy precipitation during the last few days of the month resulted in minor flooding in the southern portion of the state.

The new streamflow table provides monthly data for ten stations as well as cumulative data for various time periods. We will continue to provide the graphs of the four "Index" gauging stations.

RESERVOIR STORAGE for water supply for March increased in both the Mahoning and Scioto river basins. Storage was above normal in the Scioto River basin but slightly below normal in the Mahoning River basin.

Reservoir storage at the month's end for the Mahoning basin index reservoirs was 88 percent of rated capacity for water supply compared with 77 percent for last month and 78 percent for March 1988. Month end storage in the Scioto basin index reservoirs was 110 percent of rated capacity for water supply compared with 104 percent for last month and 100 percent for March 1988.

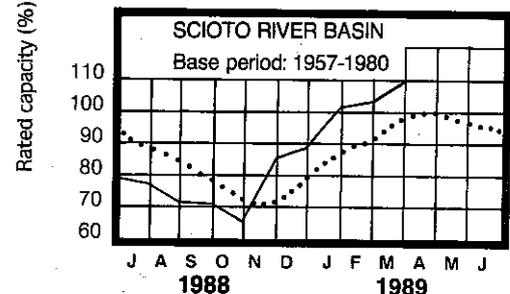
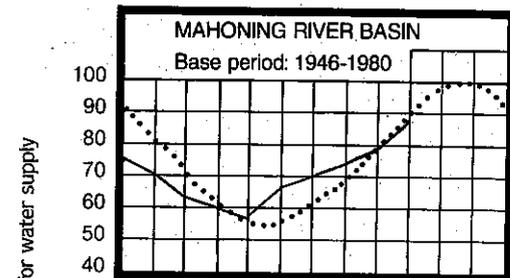
MEAN STREAM DISCHARGE



Base period for all streams: 1951-1980

Normal current _____

RESERVOIR STORAGE FOR WATER SUPPLY



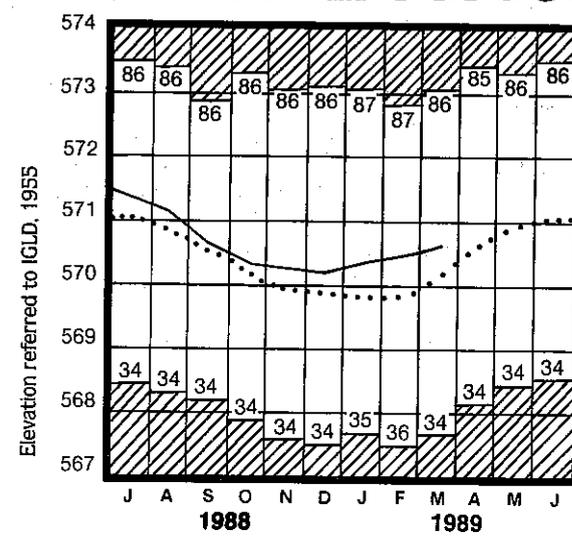
Base period: 1946-1980 (Mahoning), 1957-1980 (Scioto)

GROUND-WATER LEVELS rose throughout the state during March. Generally, net rises were greater than those usually observed in consolidated aquifers and less than those usually observed in unconsolidated aquifers. Levels in the southern portion of the state are higher than those of a year ago and lower in the northern portion. Ground-water storage has improved considerably during the past few months but levels still remain below normal throughout most of the state.

The new ground-water level table contains the current monthly information for the seven "Index" wells used by the Water Inventory Unit to evaluate the ground-water conditions statewide. We will continue to provide graphs representing the three major types of aquifers in Ohio. Additional observation wells are being analyzed to determine if they meet the criteria as an "Index" well, and if so, may be included at a later date.

LAKE ERIE level rose slightly during March. The mean level for March was 570.59 feet (IGLD-1955), 0.14 foot above last month's mean level and 0.54 foot above normal. This month's level is 0.86 foot lower than the March 1988 level and 1.99 feet above Low Water Datum.

LAKE ERIE LEVELS at Cleveland



Base period: 1900-1986
 Record high and low, year of occurrence

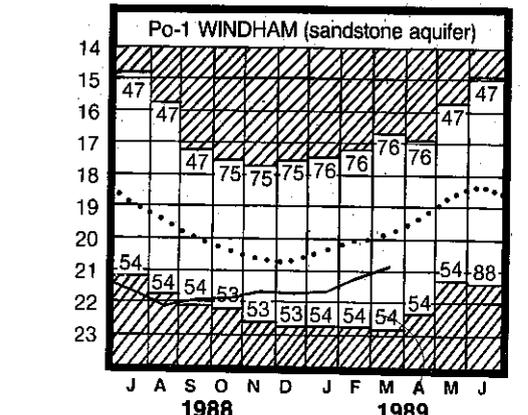
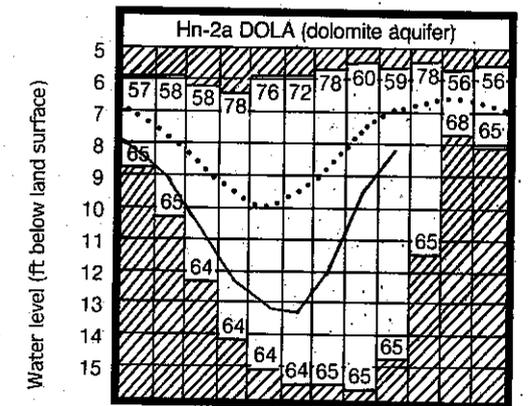
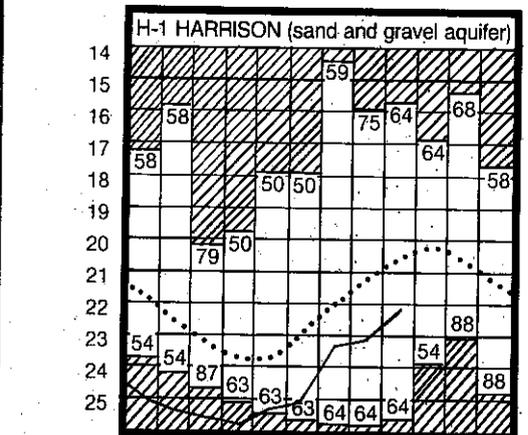
Normal current _____

GROUND-WATER LEVELS

Based on daily lowest level in feet below land-surface datum

Index Well	Location	Aquifer	Mean This Month	Departure From Normal	Change in feet from:	
					Last Month	Year Ago
F-1	W. Rushville, Fairfield Co.	Sandstone	13.52	-0.57	+2.41	+1.31
Fa-1	Jasper Mill, Fayette Co.	Limestone	6.63	+0.13	+0.24	+0.95
Fr-10	Columbus, Franklin Co.	Gravel	43.26	+0.07	+0.29	+0.54
H-1	Harrison, Hamilton Co.	Gravel	22.13	-1.71	+1.00	+0.54
Hn-2a	Dola, Hardin Co.	Dolomite	8.14	-1.16	+1.40	-1.35
Po-1	Windham, Portage Co.	Sandstone	20.90	-1.14	+0.39	+0.10
Tu-1	Strasburg, Tuscarawas Co.	Gravel	13.99	-3.02	+0.57	-1.03

GROUND-WATER LEVELS



Base periods: H-1, 1951-1979. Hn-2a, 1955-1979. Po-1, 1947-1979
 Record high and low, year of occurrence

Normal current _____



MONTHLY WATER INVENTORY REPORT FOR OHIO

APRIL 1989

Richard F. Celeste
Governor

Compiled By David H. Cashell
Water Inventory Unit

Joseph J. Sommer
Director

continued from front

of the state has resulted in substantial improvement after several years of below normal precipitation. Streamflow, reservoir and ground water storage have all improved statewide. As the water-supply discharge season draws near, the water supply situation appears favorable.

NOTES AND COMMENTS NEW PUBLICATION GROUND WATER POLLUTION POTENTIAL OF HAMILTON COUNTY

BY THE GROUNDWATER RESEARCH CENTER, UNIVERSTIY OF CINCINNATI

Ground-water pollution potential maps are designed to determine an area's relative vulnerability to ground-water pollution. The maps can be used as a planning and management tool for administrators, commissioners, zoning boards and others to help them make educated decisions about local development and siting of potentially polluting operations or activities. The system optimizes the use of existing data to rank areas with respect to pollution potential to help direct investigations and resource expenditures and to prioritize protection, monitoring and clean-up efforts.

Mapping an area's potential for ground-water pollution is a relatively new idea. This map uses the DRASTIC system as developed for the U.S. Environmental Protection Agency by the National Water Well Association. DRASTIC values, as shown on the map, indicate an area's relative vulnerability to contamination through the use of a numerical rating scheme and the mapping of hydrogeologic setting. Low DRASTIC values indicate relatively low potential and high DRASTIC values indicate a high potential for contamination. Areas of similar DRASTIC values are color coded for ease of interpretation.

In addition to Hamilton County, ground-water pollution potential maps are available for Lorain, Madison and Mercer counties. Each map costs \$12.30 (includes postage and tax). Copies of these publications may be obtained from:

ODNR-PUBLICATIONS CENTER
4383 Fountain Square, Building B-1
Columbus, Ohio 43224
Make checks payable to ODNR PUBLICATION CENTER

NEW GROUND-WATER LEGISLATION PROPOSED

Representative David Hartley, of the 62nd House District (Clark County), has introduced a ground-water bill (HB 476) which provides additional authority to the Chief, Division of Water, in a ground-water conflict mediation process and in the designation of ground-water stress areas. It clarifies water use registration requirements and factors used to determine reasonable use of water.

The 10-page bill also redefines a "well," authorizes the chief to perform ground-water measurements, and expands the information requirements in filing well logs. In designating a ground-water stress area, the chief would also gather information about an area's water use and establish a threshold withdrawal capacity for the area. All persons owning a water withdrawal facility within such area would register that facility with the division unless it falls below the established threshold withdrawal capacity.

The bill outlines nine factors to be considered in determining whether a particular use of water is reasonable, and thus would alter legislation passed in the last session (HB 662) which added several factors not in accordance with Section 858 of the Second Restatement of Torts of the American Law Institute. This reasonable use section would apply to both surface and ground water.

Mr. Hartley's legislation attempts to address certain ground-water quantity management initiatives of the state's Ground-Water Protection and Management Strategy. Ground-water quality initiatives are expected to be addressed in separate legislation.

OHIO WATER WELL ASSOCIATION'S WELL CONSTRUCTION CONFERENCE

The Ohio Water Well Association (OWWA), Ohio Department of Natural Resources (ODNR) and Ohio Department of Health (ODH) are co-sponsoring a well construction conference to be held on June 23, 1989 at Camp Berry near Findlay, Ohio. Demonstrations of specific drilling and well construction techniques as well as educational lectures will be offered. Experts from manufacturers and suppliers of well drilling and construction companies will also be present to demonstrate equipment and answer technical questions.

For more information contact Joe Lewis, Executive Secretary OWWA, 429 Forestdale Road, Ashland, OH. 44805, at (419) 281-9631. You may also contact ODNR at (614) 265-6739, or ODH at (614) 466-1390.

PRECIPITATION for April was above normal throughout most of the state; exceptions were in the Northwest, Northeast, Northeast Hills and Central Hills regions where precipitation was below normal. The average for the state as a whole was 4.17 inches, 0.66 inch above normal. Regional averages ranged from 6.06 inches, 2.25 inches above normal, for the Southwest Region to 2.65 inches, 0.74 and 0.75 inch below normal respectively in the Northeast and Northeast Hills regions. Sayre (Perry County) reported the greatest amount of precipitation for the month, 9.54 inches. Moreland Hills (Cuyahoga County) reported the least, 1.54 inches.

Precipitation fell during every week of the month. Light to moderate precipitation occurred statewide almost daily during the first nine days of the month. The northern portion of the state received the bulk of its precipitation during this period. Other notable storm periods occurred during April 17-19 and 25-29. Storms during April 25 produced amounts of 1-2 inches throughout many locations in the southern portion of the state with over 4 inches reported in areas near Piqua and Versailles in the western portion of the state. Storms during April 28 also produced 1 to 2 inches at many locations in the southern half of the state. Minor flooding was reported in the southern portion of the state following these storms.

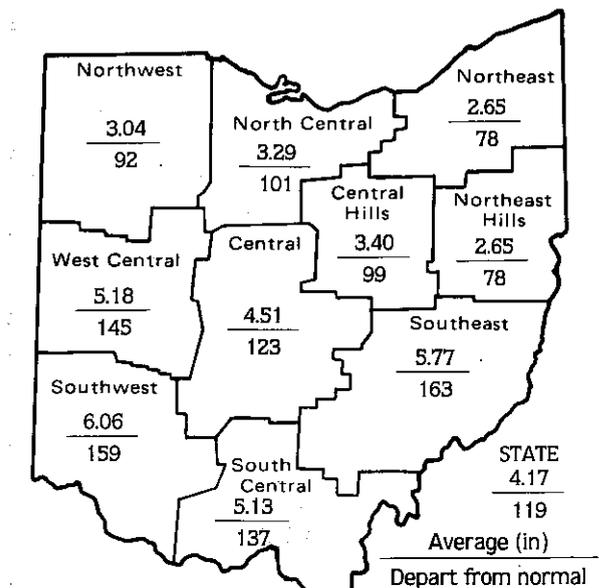
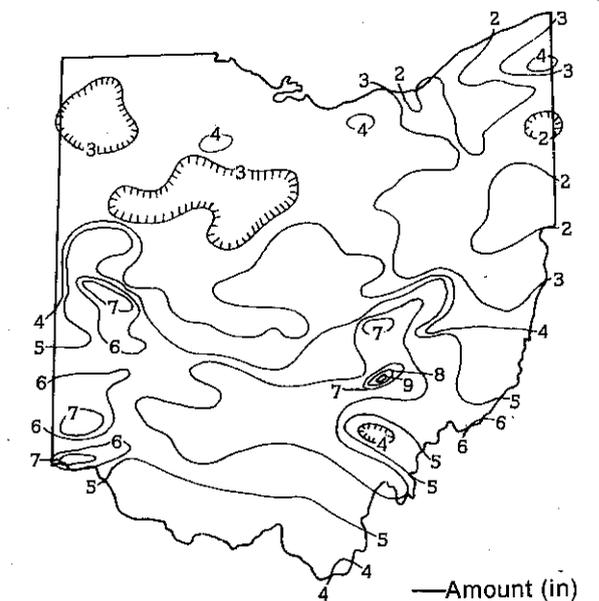
Precipitation for the first four months of the 1989 calendar year is above normal in the southern two-thirds of the state and below normal in the northern third. The average for the state as a whole is 13.39 inches, 1.5 inches above normal. Regional averages range from 20.61 inches, 6.63 inches above normal, for the South Central Region to 8.02 inches, 2.18 inches below normal, for the Northwest Region.

Precipitation for the 1989 water year (Oct. 1988 to Sept. 1989) thus far is above normal throughout the state with only the Northeast Hills Region being slightly below normal, 0.13 inch. The average for the state as a whole is 22.36 inches, 2.9 inches above normal. Regional averages range from 29.95 inches, 8 inches above normal, for the South Central Region to 17.47 inches, 0.34 inch above normal, for the North Central Region.

The above normal precipitation during the past six or seven months, the water supply recharge period, has improved the water supply situation considerably. Noticeably above normal precipitation in the southern portion

continued on back

PRECIPITATION APRIL 1989



PRECIPITATION

Region	DEPARTURE FROM NORMAL (IN.)					Palmer Drought Severity Index*
	This Month	Past				
		3 Mos.	6 Mos.	12 Mos.	24 Mos.	
Northwest	-0.27	-2.04	-0.84	-4.30	-6.75	-0.7
North Central	+0.04	-0.94	-0.03	-6.35	-5.44	+0.5
Northeast	-0.74	-0.74	-0.43	-2.58	-1.65	-0.7
West Central	+1.60	+2.11	+3.35	-2.28	-7.37	+0.8
Central	+0.85	+2.21	+3.42	+1.25	-4.69	+1.6
Central Hills	-0.05	+0.82	+1.39	-1.76	-1.00	-0.6
Northeast Hills	-0.75	+0.44	+0.47	-4.26	-7.29	-2.2
Southwest	+2.25	+4.95	+5.81	+1.22	-5.05	+2.0
South Central	+1.39	+6.54	+8.09	+0.66	-11.31	+1.8
Southeast	+2.23	+5.54	+6.62	+2.27	-1.86	+1.6
State	+0.66	+1.90	+2.80	-1.31	-5.09	//////

*Above +4 = Extreme Moist Spell
3.0 To 3.9 = Very Moist Spell
2.0 To 2.9 = Unusual Moist Spell
1.0 To 1.9 = Moist Spell
0.5 To 0.9 = Incipient Moist Spell
0.4 To -0.4 = Near Normal
-0.5 To -0.9 = Incipient Drought
-1.0 To -1.9 = Mild Drought
-2.0 To -2.9 = Moderate Drought
-3.0 To -3.9 = Severe Drought
Below -4.0 = Extreme Drought

ACKNOWLEDGEMENTS
This report has been compiled from Division of Water data and from information supplied by the following:
Precipitation data:
U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Weather Service; The Miami Conservancy District; U.S. Army Corps of Engineers, Muskingum Area.
Streamflow and reservoir storage data:
U.S. Geological Survey, Water Resources Division.
Lake Erie Level data:
U.S. Corps of Engineers, Detroit District.
Palmer Drought Severity Index:
U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Weather Service.

ODNR
OHIO DEPARTMENT OF
NATURAL RESOURCES
DIVISION OF WATER
1939 FOUNTAIN SQUARE
COLUMBUS, OHIO 43224

Naturally
OHIO
the heart of it all!

MEAN STREAM DISCHARGE

This Month

River and Location	Drainage Area (Sq. Mi.)	Mean Discharge (CFS)	% of Normal	% of Normal Past		
				3 Mos.	6 Mos.	12 Mos.
Grand River near Painesville	685	1,944	143	76	87	78
Great Miami River at Hamilton	3,630	12,081	216	110	112	87
Huron River at Milan	371	493	100	62	66	56
Killbuck Creek at Killbuck	464	1,008	140	84	90	73
Little Beaver Creek near East Liverpool	496	900	98	74	68	58
Maumee River at Waterville	6,330	8,798	93	50	69	59
Muskingum River at McConnelsville	7,422	19,140	147	98	99	79
Scioto River near Prospect	567	1,197	169	67	63	53
Scioto River at Higby	5,131	15,131	203	120	114	91
Stillwater River at Pleasant Hill	503	2,406	337	137	109	83

STREAMFLOW for April was above normal throughout most of the state; exceptions were in the northwestern and eastern portions where flows were slightly below normal. Flows in the western, southwestern, and south central portions of the state were high enough to be considered excessive. April flows were greater than March flows.

Greatest daily flows occurred during the first five days of the month resulting from widespread heavy precipitation during the last few days of March and the first week of April. An exception would be in some western portions of the state where heavy thundershowers on April 25 resulted in the month's greatest flows

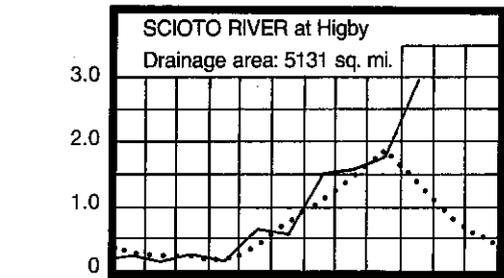
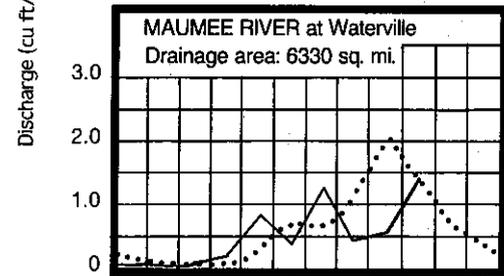
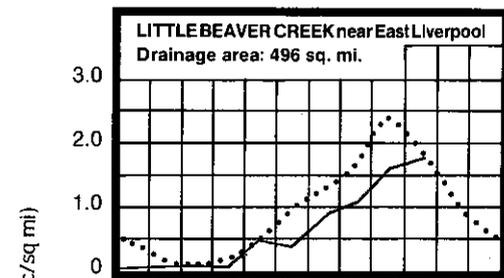
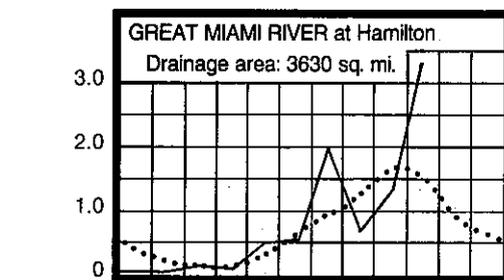
occurring the last few days of the month. Generally, flows decreased the last three weeks of the month statewide with increases the last week noted only in the western and southern portions of the state. Flows at the month's end were excessive in the western and southern portions of the state, decreasing northward to deficient flows in the northeastern portion.

Minor local flooding was reported statewide the first week of the month and in the southern portion of the state the last week.

RESERVOIR STORAGE for water supply for April increased in the Mahoning River basin reservoirs and decreased slightly in the Scioto River basin reservoirs. Storage was slightly above normal in both basins. This was the first month since May 1984 that the Mahoning River basin reservoirs were impounding the total water supply capacity available at the month's end.

Reservoir storage at the month's end for the Mahoning basin index reservoirs was 100 percent of rated capacity for water supply compared with 88 percent for last month and 86 percent for April 1988. Month end storage in the Scioto River basin index reservoirs was 107 percent of rated capacity for water supply compared with 110 percent for last month and 100 percent for April 1988.

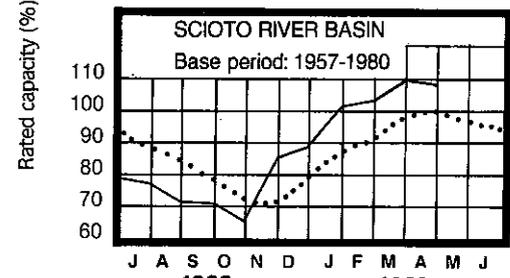
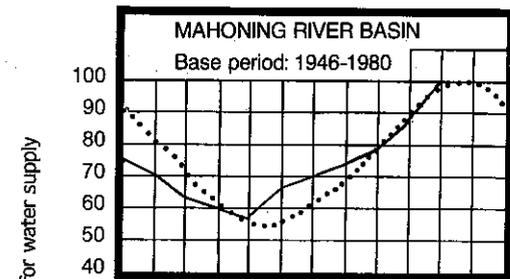
MEAN STREAM DISCHARGE



Base period for all streams: 1951-1980

Normal current _____

RESERVOIR STORAGE FOR WATER SUPPLY



Base period: 1946-1980 (Mahoning), 1957-1980 (Scioto)

GROUND-WATER LEVELS showed marked improvement throughout the state during April. Unconsolidated aquifers rose sharply during the first week of the month in response to widespread heavy precipitation during the last few days of March and early April, but declined during the remainder of the month. Consolidated aquifers showed a steady rise throughout the month. Generally, net rise from last month's levels ranged from equal to over three times greater than usually observed. Ground-water levels range from slightly above normal to 2 feet below normal throughout the state. Greatest departures from normal are in the northeastern portion of the state.

The 1989 recharge season has been very beneficial for ground-water supplies. Above normal precipitation during the past six months in most areas of the state has produced a substantial improvement in ground-water storage. There are positive indications that the current recharge season may extend into May. Ground-water levels in most areas of the state are higher than those of a year ago. As the end of the recharge season approaches, the ground-water supply situation is favorable in contrast with the past year. Levels remain below normal in some portions of the state and water supply managers are encouraged to monitor their respective situations.

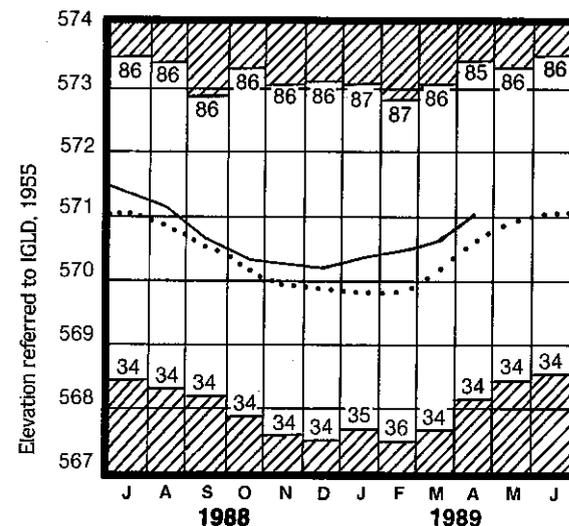
LAKE ERIE level rose during April. The mean level for April was 571.04 feet (IGLD-1955), 0.45 foot above last month's mean level and 0.43 foot above normal. This month's level is 0.75 foot below the April 1988 level and 2.44 feet above Low Water Datum.

The U.S. Army Corps of Engineers reports that the probable monthly mean levels of Lake Erie will range between 0.1 foot below to 0.8 foot above normal levels with levels predicted to average about 0.3 foot above normal through the summer months. These predicted levels are similar to last summer's levels.

SUMMARY

Precipitation was above normal in the southern two-thirds of the state and below normal in the northern third. Streamflow was above normal in the southern portion and slightly below normal in the north. Reservoir storage was above normal. Ground-water storage increased considerably. Lake Erie level rose and is 0.43 foot above normal. The water-supply situation has improved markedly the past 6 months and appears favorable as the summer season approaches.

LAKE ERIE LEVELS at Cleveland



Base period: 1900-1986
 Record high and low, year of occurrence

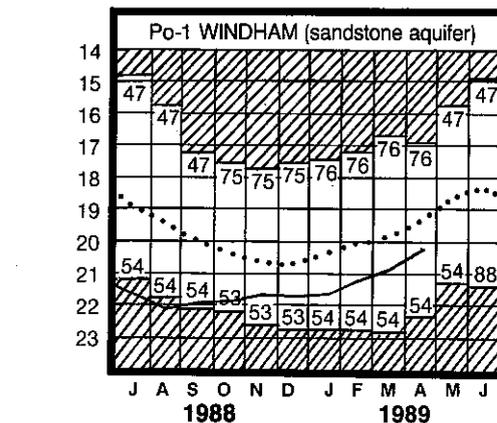
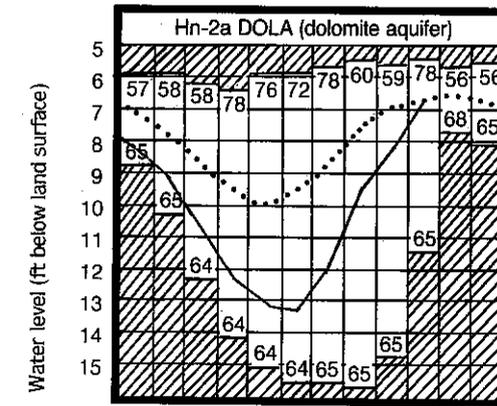
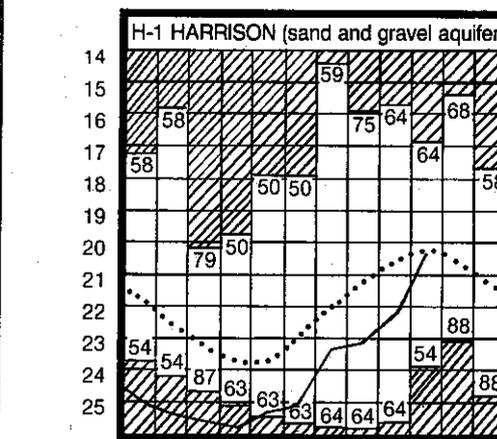
Normal current _____

GROUND-WATER LEVELS

Based on daily lowest level in feet below land-surface datum

Index Well	Location	Aquifer	Mean This Month	Departure From Normal	Change in feet from:	
					Last Month	Year Ago
F-1	W. Rushville, Fairfield Co.	Sandstone	12.50	-0.55	+1.02	+1.66
Fa-1	Jasper Mill, Fayette Co.	Limestone	6.34	+0.33	+0.29	+0.83
Fr-10	Columbus, Franklin Co.	Gravel	42.57	+0.50	+0.69	+0.81
H-1	Harrison, Hamilton Co.	Gravel	20.35	-0.18	+1.78	+2.32
Hn-2a	Dola, Hardin Co.	Dolomite	6.68	+0.06	+1.46	-0.21
Po-1	Windham, Portage Co.	Sandstone	20.23	-1.01	+0.67	+0.55
Tu-1	Strasburg, Tuscarawas Co.	Gravel	12.51	-1.99	+1.48	+0.30

GROUND-WATER LEVELS



Base periods: H-1, 1951-1979; Hn-2a, 1955-1979; Po-1, 1947-1979
 Record high and low, year of occurrence

Normal current _____



MONTHLY WATER INVENTORY REPORT FOR OHIO

May 1989

Richard F. Celeste
Governor

Compiled By David H. Cashell
Water Inventory Unit

Joseph J. Sommer
Director

PRECIPITATION for May was above normal throughout the state. The average for the state as a whole was 6.06 inches, 2.31 inches above normal. Regional averages ranged from 7.03, 3.50 inches above normal, for the Northeast Region to 4.46 inches, 0.53 inch above normal, for the South Central Region. Andover (Ashtabula County) reported the greatest amount of precipitation for the month, 11.00 inches. The Columbus Hap Cremean Water Plant (Franklin County) reported the least, 3.24 inches.

Precipitation fell during every week of the month. Light to moderate precipitation fell almost daily the first two weeks of the month at many locations throughout the state. On May 7 up to 2 inches of snow fell in the central and northern portions of the state. Total precipitation for the first week ranged from 0.5 inch to 1.5 inches and for the second week from 1 to 2 inches, except in the northwestern portion where totals were generally less than 0.75 inch. The third week of the month was the driest week for most areas with weekly amounts generally ranging between 0.3 to 0.6 inch at most stations.

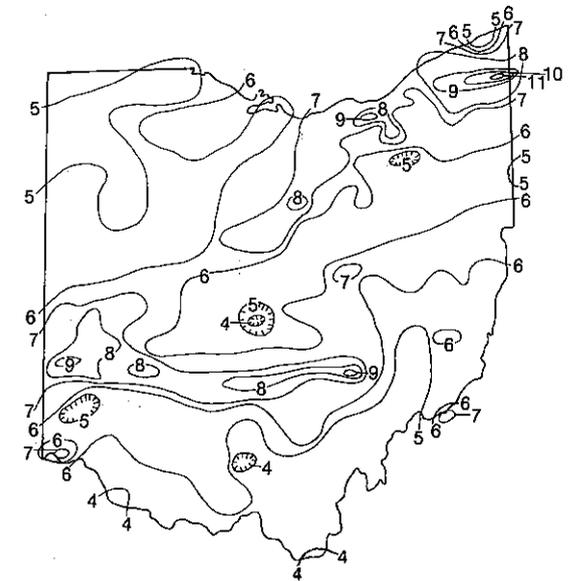
The most notable storms occurred during the last 10 days of the month. Storms on May 22-23 produced amounts of 1 to 2 inches at many locations with up to 3.6 inches reported in the west central portion of the state. On May 25-26 storms again produced 1 to 2 inches at many locations with 2.5 to 3.5 inches falling from the Dayton area in southwestern Ohio up through the north central and northeastern portions of the state. Serious flooding resulted from these storms in the southwestern and northeastern areas of the state. On May 30-31 storms produced 1 to over 2 inches across the extreme northern portion of the state.

Precipitation for the 1989 calendar year thus far is above normal throughout most of the state; the only exception is in the Northwest Region where precipitation is slightly below normal. The average for the state as a whole is 19.45 inches, 3.81 inches above normal. Regional averages range from 25.07 inches, 7.16 inches above normal, for the South Central Region to 12.97 inches, 0.77 inch below normal, for the Northwest Region.

Precipitation for the 1989 water year is above normal statewide. The average for the state as a whole is 28.42 inches, 5.21 inches above normal. Regional averages range from 34.41 inches, 8.53 inches above normal, for

continued on back

PRECIPITATION MAY 1989



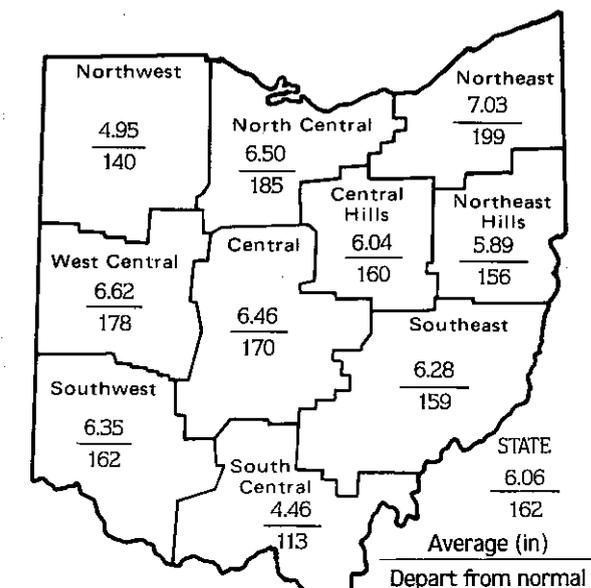
—Amount (in)

PRECIPITATION

Region	DEPARTURE FROM NORMAL (IN.)					Palmer Drought Severity Index*
	This Month	Past				
		3 Mos.	6 Mos.	12 Mos.	24 Mos.	
Northwest	+1.41	+0.34	-1.15	-0.37	-5.19	+1.4
North Central	+2.99	+2.70	+1.34	-0.56	-2.47	+1.5
Northeast	+3.50	+2.94	+2.24	+2.30	+3.32	+1.4
West Central	+2.90	+5.45	+4.14	+3.00	-4.17	+1.7
Central	+2.65	+4.34	+4.37	+6.02	-2.38	+2.0
Central Hills	+2.27	+2.82	+2.00	+2.18	+1.06	+1.7
Northeast Hills	+2.11	+2.07	+1.32	-0.23	-4.41	-1.3
Southwest	+2.43	+6.19	+6.71	+6.18	-1.87	+2.8
South Central	+0.53	+3.01	+6.82	+2.70	-9.49	+1.9
Southeast	+2.34	+6.09	+7.40	+5.94	+0.94	+2.0
State	+2.31	+3.60	+3.53	+2.94	-2.37	//////

*Above +4 = Extreme Moist Spell
3.0 To 3.9 = Very Moist Spell
2.0 To 2.9 = Unusual Moist Spell
1.0 To 1.9 = Moist Spell
0.5 To 0.9 = Incipient Moist Spell
0.4 To -0.4 = Near Normal

-0.5 To -0.9 = Incipient Drought
-1.0 To -1.9 = Mild Drought
-2.0 To -2.9 = Moderate Drought
-3.0 To -3.9 = Severe Drought
Below -4.0 = Extreme Drought



Average (in)
Depart from normal

continued from front

the South Central Region to 22.95 inches, 2.18 inches above normal, for the Northwest Region.

The above normal precipitation during the past several months has improved the water supply situation considerably, which is in a favorable position at this time. However, this precipitation and the number of days on which precipitation has occurred, has plagued farmers working the fields and placed most behind in their spring planting schedule.

SUMMARY

Precipitation was noticeably above normal throughout the state. Streamflow was excessive throughout most of the state with severe flooding occurring in the southwestern and northeastern portions. Reservoir storage increased and was above normal. Ground-water storage increased and has improved markedly during the 1989 recharge season. Lake Erie level rose and is 0.39 foot above normal. The water supply situation is favorable as the summer season approaches.

NOTES AND COMMENTS

GVERNOR CELESTE REQUESTS FEDERAL FLOOD DISASTER AID

Governor Celeste has requested that the federal government declare 10 counties in Ohio a flood disaster area. Those counties are Butler, Cuyahoga, Geauga, Greene, Lake, Lorain, Mercer, Montgomery, Preble, and Warren. About 5,000 residences and 50 businesses were affected, with damages estimated to exceed \$20 million.

The severe flooding followed widespread precipitation during the week of May 22-26. The heaviest precipitation occurred on May 25-26 with amounts of 3-4 inches common in many locations. Unconfirmed amounts of 5 inches were reported. A temporary bridge spanning the Great Miami River in Miamitown (Hamilton County) collapsed during these high flow conditions with the loss of several lives. Flows in some areas of the state reached the 25-year recurrence interval.

YOUTHS EXCEL ON STATE SCIENCE DAY

State Science Day is sponsored by the Ohio Academy of Science and is the culmination of many local and district science fairs throughout the state. The ODNR Division of Water has coordinated the special award in water since Governor Celeste established the Youth Science Award series in 1984.

Winners of the "Governor's Award for Excellence in Water Resources Research" at the State Science Day on April 22 were:

First—Daniel G. Woodard, grade 10, Kenton HS, Kenton, "Differences in Plant Growth and Fruit Production According to Frequency of Watering."
Second—Andrew L. Burkart, grade 11, South HS, Columbus, "Eutrophication."
Third—Whitney L. Waugh, grade 8, McKinley HS, Portsmouth, "What Toxic Effects do Chemicals Have on Aquatic Life?"

Also, receiving Honorable Mention were:

Craig A. Joseph, grade 8, Pleasant Valley School for the Arts, Canton;
Sarin Po, grade 12, South HS, Columbus;
Patricia A. Sheridan, grade 8, St. Agatha School, Upper Arlington; and Duane T. Moore, grade 9, George Washington JS, Hamilton.

NEW DIVISION OF WATER LOGO-THE WATER CYCLE

Water is Ohio's most remarkable and precious renewable natural resource. The water cycle symbolizes the duties and responsibilities of the Ohio Department of Natural Resources, Division of Water. The components of the water cycle logo illustrate the various functions of the Division of Water.

The rain, in its intermittent and unpredictable pattern, illustrates the beginning of the water cycle. It reminds one of the need for *Water Resources Development Section*. When excessive rain occurs, the flow on the surface requires the management and planning of the *Floodplain Management Unit*. The downturned arrow represents the percolation of surface water into the ground and, hence, the *Ground-Water Resources Section*.

The diagonal line impeding the movement of the wavy lines represents the impoundment of water in a reservoir and indicates the protective functions performed by the *Dam Safety Section*—engineering the management, use and conservation of the waters of Ohio. The waves remind one of Lake Erie and the fact that Ohio is truly one of the coastal states requiring a *Coastal Management* team.

The upturned arrow suggests the continuation of the cycle illustrating the loss of water from the Earth's surface, driven by the energy of the Sun. The variation, flux and unpredictable redistribution pattern of the water cycle requires the constant monitoring and information gathering of the *Water Inventory Unit*. The precious nature of our water resources requires the need for planning and *Administration* of its wise use.

The Division of Water—intricately involved with the water cycle.

ACKNOWLEDGEMENTS

This report has been compiled from Division of Water data and from information supplied by the following:

Precipitation data:
U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Weather Service; The Miami Conservancy District; U.S. Army Corps of Engineers; Muskingum Area.
Streamflow and reservoir storage data:
U.S. Geological Survey; Water Resources Division.
Lake Erie Level data:
U.S. Corps of Engineers, Detroit District; Palmer Drought Severity Index;
U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Weather Service.



OHIO DEPARTMENT OF
NATURAL RESOURCES
DIVISION OF WATER
1939 FOUNTAIN SQUARE
COLUMBUS, OHIO 43224

ODNR

Ohio
The Heart of It All!

MEAN STREAM DISCHARGE

This Month

River and Location	Drainage Area (Sq. Mi.)	Mean Discharge (CFS)	% of Normal	% of Normal Past		
				3 Mos.	6 Mos.	12 Mos.
Grand River near Painesville	685	2,695	797	127	106	95
Great Miami River at Hamilton	3,630	11,047	359	169	137	112
Huron River at Milan	371	801	364	95	85	77
Killbuck Creek at Killbuck	464	802	162	108	94	86
Little Beaver Creek near East Liverpool	496	1,165	201	101	82	72
Maumee River at Waterville	6,330	7,074	140	69	69	69
Muskingum River at McConnelville	7,422	18,850	193	125	109	96
Scioto River near Prospect	567	2,950	855	180	126	108
Scioto River at Higby	5,131	14,350	304	156	132	114
Stillwater River at Pleasant Hill	503	2,042	626	232	154	121

STREAMFLOW for May was above normal throughout the state. Flows were high enough to be considered excessive in all but the northwestern portion of the state. May mean flows were greater than April mean flows in the northern half of the state and lower in the southern half.

Flows at the beginning of the month were above normal in the southern half of the state and below normal in the northern half. Generally, flows declined the first week of the month and fluctuated the second and third weeks in response to local precipitation. The last week of the month had the greatest flows in most areas of the state. Generally, greatest daily flows throughout the state occurred during May 26-28 following widespread precipitation during May 22-26 with the heaviest precipitation occurring on May 25-26.

ing on May 25-26.

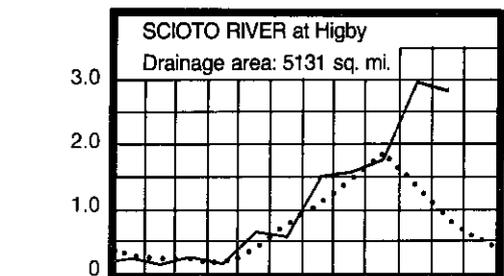
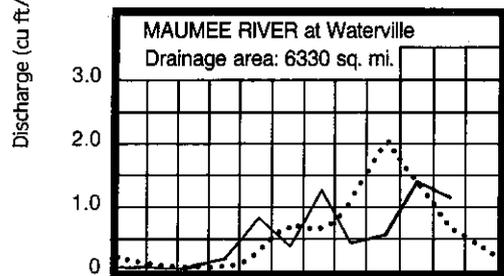
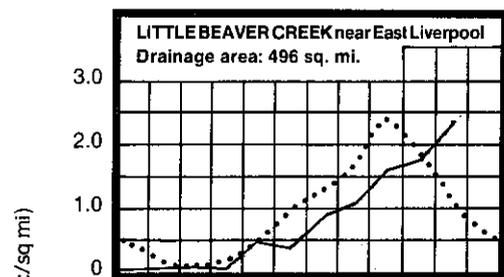
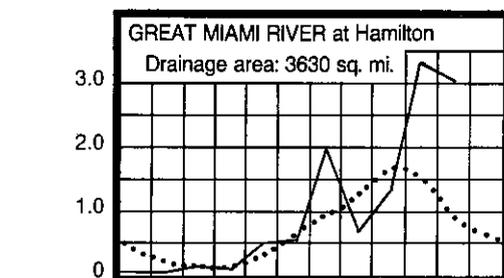
Moderate flooding was reported following these storms at many locations with severe flooding occurring at some locations in the western, southwestern and northeastern portions of the state (see Governor Requests Federal Flood Disaster Aid on the last page of this report). Most flows during this period were within the 5 year recurrence interval; some flows reached the 15-25 year recurrence interval in the southwestern and northeastern portions of the state. Flows remained above normal throughout most of the state at the month's end.

RESERVOIR STORAGE for water supply for May increased in the Mahoning River basin reservoirs and was unchanged in the Scioto River basin reservoirs. Storage was above normal in both basins.

Reservoir storage at the month's end for the Mahoning basin index reservoirs was 108 percent of rated capacity for water supply compared with 100 percent for last month and 87 percent for May 1988. Month end storage in the Scioto basin index reservoirs was 107 percent of rated capacity for water supply compared with the same for last month and 91 percent for May 1988.

Generally, reservoirs throughout the state are at capacity or at their normal summer pool elevation. Both on-stream and off-stream (up-ground) reservoirs have been able to fill this spring due to adequate streamflows.

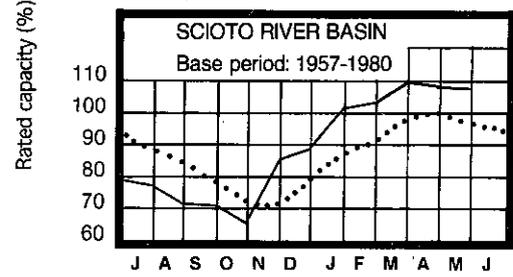
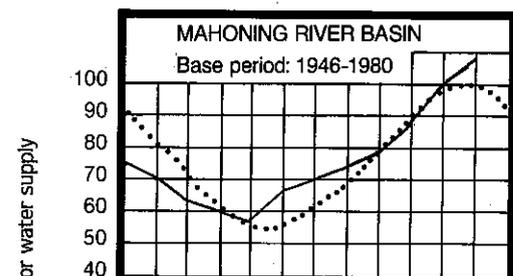
MEAN STREAM DISCHARGE



Base period for all streams: 1951-1980

Normal current _____

RESERVOIR STORAGE FOR WATER SUPPLY



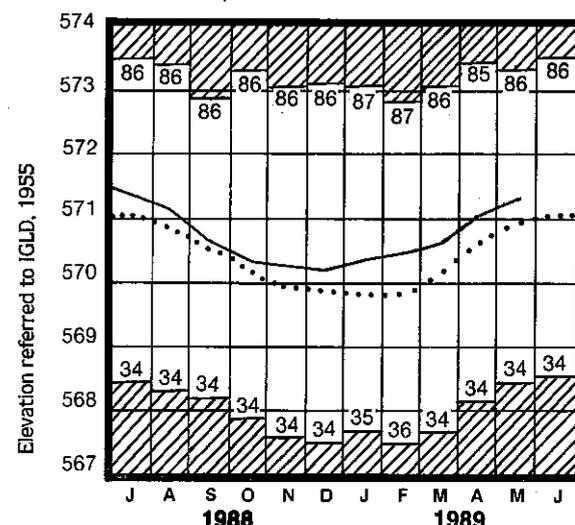
Base period: 1946-1980 (Mahoning), 1957-1980 (Scioto)

GROUND-WATER LEVELS continued to improve throughout most of the state during May. Generally, levels in unconsolidated aquifers declined or remained stable the first half of the month and rose noticeably the second half in response to the excessive precipitation. Levels in consolidated aquifers rose throughout the month in response to delayed recharge. Generally, net rises from last month's levels were greater than usually observed. Ground-water levels are markedly higher than levels of a year ago, ranging from 1 to 4.5 feet above those levels. Ground-water levels have risen to near or above normal in most areas of the state; the only notable exception is in the eastern and northeastern portions of the state where levels still range from 1 to 2 feet below normal.

The 1989 recharge season has been very beneficial for ground-water supplies. Above normal precipitation throughout most of the state has produced a substantial improvement in ground-water storage. Levels throughout the state are noticeably higher than the record-setting low levels of last year. The ground-water supply situation is favorable as the summer season approaches.

LAKE ERIE level rose during May. The mean level for May was 571.31 feet (IGLD-1955), 0.27 foot above last month's mean level and 0.39 foot above normal. This month's level is 0.45 foot below the May 1988 level and 2.71 feet above Low Water Datum.

LAKE ERIE LEVELS at Cleveland



Base period: 1900-1986

Record high and low, year of occurrence

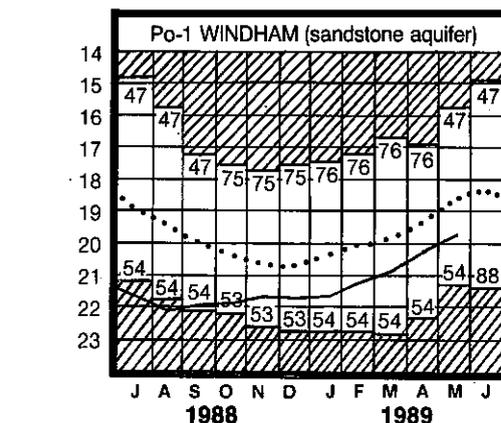
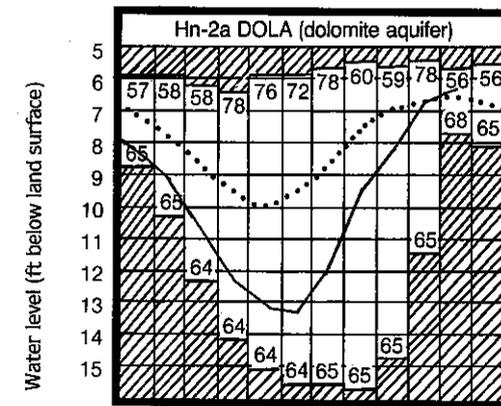
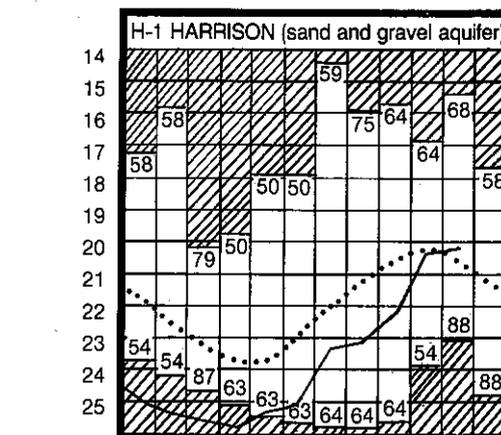
Normal current _____

GROUND-WATER LEVELS

Based on daily lowest level in feet below land-surface datum

Index Well	Location	Aquifer	Mean This Month	Departure From Normal	Change in feet from:	
					Last Month	Year Ago
F-1	W. Rushville, Fairfield Co.	Sandstone	11.46	+0.65	+1.04	+4.54
Pa-1	Jasper Mill, Fayette Co.	Limestone	6.29	+0.73	+0.05	+1.55
Fr-10	Columbus, Franklin Co.	Gravel	42.11	+1.17	+0.46	+1.43
H-1	Harrison, Hamilton Co.	Gravel	20.21	+0.30	+0.14	+3.32
Hn-2a	Dola, Hardin Co.	Dolomite	6.35	+0.28	+0.33	+0.59
Po-1	Windham, Portage Co.	Sandstone	19.75	-1.16	+0.48	+1.13
Tu-1	Strasburg, Tuscarawas Co.	Gravel	12.74	-1.87	-0.23	+1.01

GROUND-WATER LEVELS



Base periods: H-1, 1951-1979; Hn-2a, 1955-1979;

Po-1, 1947-1979

Normal current _____



MONTHLY WATER INVENTORY REPORT FOR OHIO

JUNE 1989

Richard F. Celeste
Governor

Compiled By David H. Cashell
Water Inventory Unit

Joseph J. Sommer
Director

continued from front
state average of 25.20 inches makes this the 7th wettest January to June period since reliable records began in 1883.

Precipitation for the 1989 water year thus far is above normal throughout the state. The average for the state as a whole is 34.16 inches, 6.99 inches above normal. Regional averages range from 39.75 inches, 9.99 inches above normal, for the South Central Region to 27.15 inches, 2.55 inches above normal, for the Northwest Region. The Southeast Region also has the greatest departure for the 1989 water year thus far, 10.49 inches above normal. ERRATA: In the May 1989 report, the state of Ohio map shows regional precipitation averages and percent of normal, not departure from normal.

NOTES AND COMMENTS

The Ohio Department of Natural Resources and The Division of Water Celebrate 40th Anniversary

The Division of Water became a reality in legislation which created the Ohio Department of Natural Resources (ODNR) on August 11, 1949. Senate Bill 13, introduced in the 98th General Assembly by Senators Jackson and Mechem, also created six other divisions in the new ODNR. The new department replaced the Division of Conservation and Natural Resources in the Department of Agriculture.

The Division of Water followed several other water agencies. In 1931 the General Assembly created a nine-member State Water Conservation Board of Ohio. The board worked with other state and federal agencies to outline a survey of water and related resources and prepared a reservoir construction program as part of an emergency drought relief measure.

The board had a short life; in 1936 Governor Davey vetoed its appropriation which included funds for the cooperative stream gauging program at The Ohio State University. This caused a three-year gap in all streamflow records, including the period of the "Super Flood of 1937."

A bill was introduced in 1939 to create a new water board. Continued water shortages and public concern finally led to creation of the Ohio Water Supply Board in 1941, which replaced the State Water Conservation Board.

The new Water Supply Board had a five-man advisory committee, later expanded to include a well driller and a member each from the House and Senate. The new board started studies on the situation in the Mill Creek Valley and in the Mansfield area, as well as ground-water surveys, and flood magnitudes and frequencies.

In 1945 the Water Supply Board was transferred to the Department of Public Works, and its name changed to the Ohio Water Resources Board. The powers of this new board were greatly expanded to give the state contracting authority to plan water supply storage in Corps of Engineers reservoirs.

C.V. Younquist, a professional engineer with the U.S. Geological Survey, was appointed chief engineer and became architect of Ohio's new water program. He was later to serve the state as the first chief of the Division of Water for a quarter of a century with esteem and high professional principle.

The work of the Water Resources Board continued to expand. By 1947, Younquist reported on 25 different programs of the board, including industrial water supplies, area water studies, floods, streamflow, well gauging, test drilling, artificial recharge to ground water, and reservoir sedimentation.

Between 1941 and 1949, the state had been able to build a nucleus of professional and regulatory expertise in water. It already had staff, policy, advisors, cooperators and budgets. All of these assets were transferred to a new agency, the Division of Water, and a new home in the Department of Natural Resources.

The new division was empowered to collect data on water resources, perform stream gauging, furnish information to the public, assist and advise public entities and agencies, and accept gifts. The division could collect well logs, and prescribe rules and regulations for drilling and abandoning wells. It required plans for dams, but could review them only with respect to the overall use of water resources. Some new duties transferred to the Division of Water from the Department of Public Works gave the chief authority to construct dams, levees and other water-related works, and to issue bonds to finance such improvements. The new division was also funded to study pollution along Ohio's Lake Erie waters and to study industrial waste treatment.

Forty years of intense activity were to follow these initial programs. The Division of Water, now under its fifth chief, Robert L. Goettemoeller, continues in its role of studying Ohio's water resources; collecting data; receiving well logs; inspecting and permitting dams, dikes, and levees; and encouraging wise use of flood hazard areas.

Note: The above was extracted, in part, from the forthcoming book, *A Legacy of Stewardship*. Division of Water chapter by Sherman L. (Jack) Frost.

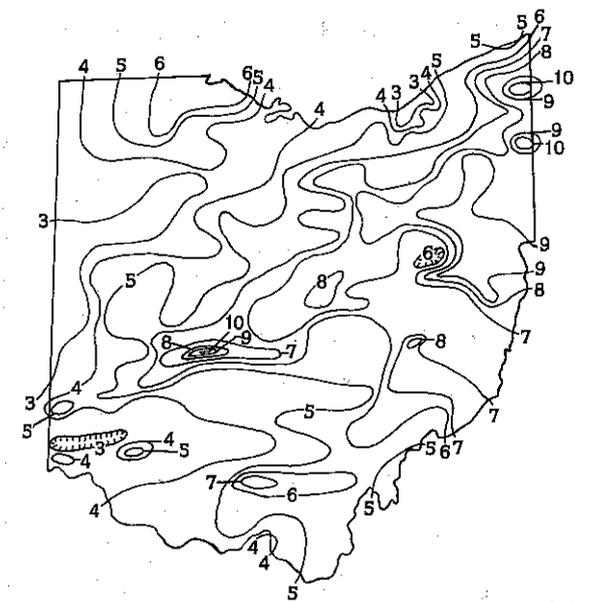
PRECIPITATION for June was above normal throughout the state. The average for the state as a whole was 5.75 inches, 1.79 inches above normal. Regional averages ranged from 7.99 inches, 4.03 inches above normal, for the Northeast Hills Region to 4.11 inches, 0.06 inch above normal, for the Southwest Region. Andover (Ashtabula County) reported the greatest amount of precipitation for the month, 10.84 inches. This is the second consecutive month for which Andover has reported the greatest amount of precipitation. Greenville (Darke County) reported the least amount of precipitation for the month, 2.45 inches.

Precipitation fell during every week of the month, mostly in the form of summer type showers and thunderstorms. Precipitation during the first week varied throughout the state with storms on June 3-4 producing amounts of 1-2 inches at many locations in the central and northeastern portions of the state. The second and third weeks of the month had measurable precipitation on nearly every day at many locations, especially in the eastern two-thirds of the state, due to stalled and slow-moving weather systems. The northwestern portion of the state was very dry from June 5 to 12. Rainfall on June 13-14 exceeded 1 inch at many locations with stations in the northeastern area reporting up to 3 inches. Remnants of tropical storm Allison supplied moisture for storms during the last week of the month. Storms on June 21 and June 27-28 caused small stream and urban flooding in many locations in the central and eastern portions of the state. Totals of up to 3.80 inches were reported on June 21 and totals of 1-2 inches were common on June 27-28.

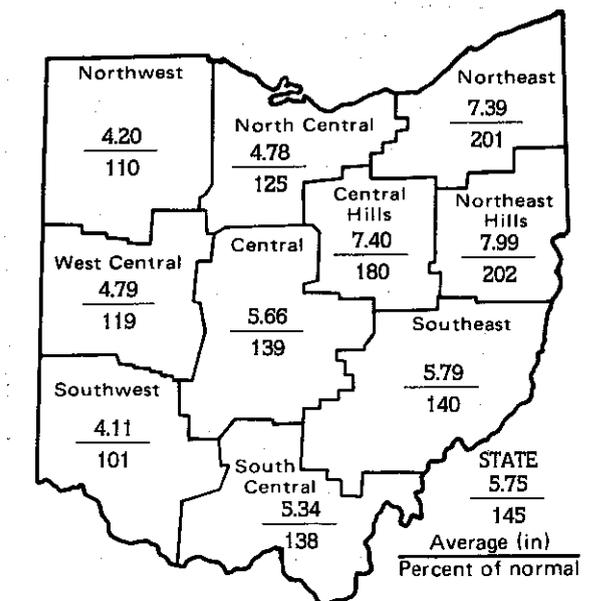
Precipitation for the first half of the 1989 calendar year is above normal throughout most of the state; the only exception is in the Northwest Region where precipitation is slightly below normal. The average for the state as a whole is 25.20 inches, 5.59 inches above normal. Regional averages range from 30.41 inches, 8.62 inches above normal, for the South Central Region to 17.17 inches, 0.40 inch below normal, for the Northwest Region. The Southeast Region has the greatest departure from normal, 9.37 inches (see departure from normal, past 6 months column in precipitation table). The

continued on back

PRECIPITATION JUNE 1989



—Amount (in)



PRECIPITATION

Region	DEPARTURE FROM NORMAL (IN.)					Palmer Drought Severity Index*
	This Month	Past				
		3 Mos.	6 Mos.	12 Mos.	24 Mos.	
Northwest	+0.37	+1.51	-0.40	+3.40	-5.57	-0.6
North Central	+0.96	+3.99	+2.58	+3.61	-3.88	+0.6
Northeast	+3.71	+6.47	+6.09	+8.77	+5.03	+3.0
West Central	+0.75	+5.25	+4.95	+6.65	-3.94	+1.7
Central	+1.60	+5.10	+6.05	+10.50	-0.92	+1.7
Central Hills	+3.29	+5.51	+5.79	+8.84	+2.23	+0.8
Northeast Hills	+4.03	+5.39	+5.81	+6.67	-0.65	+1.9
Southwest	+0.06	+4.74	+7.01	+9.37	-1.40	+2.2
South Central	+1.46	+3.38	+8.62	+7.44	-6.89	+1.1
Southeast	+1.65	+6.22	+9.37	+10.68	+2.53	+2.2
State	+1.79	+4.76	+5.60	+7.84	-1.23	//////

*Above +4 = Extreme Moist Spell
3.0 To 3.9 = Very Moist Spell
2.0 To 2.9 = Unusual Moist Spell
1.0 To 1.9 = Moist Spell
0.5 To 0.9 = Incipient Moist Spell
0.4 To -0.4 = Near Normal

-0.5 To -0.9 = Incipient Drought
-1.0 To -1.9 = Mild Drought
-2.0 To -2.9 = Moderate Drought
-3.0 To -3.9 = Severe Drought
Below -4.0 = Extreme Drought

ACKNOWLEDGEMENTS

This report has been compiled from Division of Water data and from information supplied by the following:

Precipitation data:
U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Weather Service, The Miami Conservancy District, U.S. Army Corps of Engineers, Muskingum Area.
Streamflow and reservoir storage data:
U.S. Geological Survey, Water Resources Division.
Lake Erie Level data:
U.S. Corps of Engineers, Detroit District.
Palmer Drought Severity Index:
U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Weather Service.



DIVISION OF WATER
1939 FOUNTAIN SQUARE
COLUMBUS, OHIO 43224

ODNR
OHIO DEPARTMENT OF
NATURAL RESOURCES

MEAN STREAM DISCHARGE

This Month

River and Location	Drainage Area (Sq. Mi.)	Mean Discharge (CFS)	% of Normal	% of Normal Past		
				3 Mos.	6 Mos.	12 Mos.
Grand River near Painesville	685	2,615	991	317	144	115
Great Miami River at Hamilton	3,630	6,613	303	234	155	127
Huron River at Milan	371	685	425	191	110	96
Killbuck Creek at Killbuck	464	1,331	269	132	109	96
Little Beaver Creek near East Liverpool	496	1,792	603	193	119	98
Maumee River at Waterville	6,330	10,567	480	139	90	86
Muskingum River at McConnsville	7,422	18,986	391	192	134	114
Scioto River near Prospect	567	646	359	287	144	119
Scioto River at Higby	5,131	9,729	322	224	152	130
Stillwater River at Pleasant Hill	503	397	166	289	164	128

STREAMFLOW for June was excessive throughout the state. Generally, June mean flows were less than May flows except in the northwestern and eastern portions of the state where they were greater.

Flows at the beginning of the month, in response to widespread precipitation the last week of May, were above normal at most locations throughout the state. Flows in the western half of the state generally were the greatest the first week of the month and declined during the remainder of the month with the lowest flows occurring during the last few days. Flows in the eastern half of the state fluctuated the first half of the month in response to local precipitation and were generally lowest around June 12; flows increased rapidly in response to heavy precipitation during the third and fourth weeks of the month.

month and were generally the greatest during the last week of the month. Flows at the month's end were above normal throughout most of the state except in the western and northwestern portions where they were below normal.

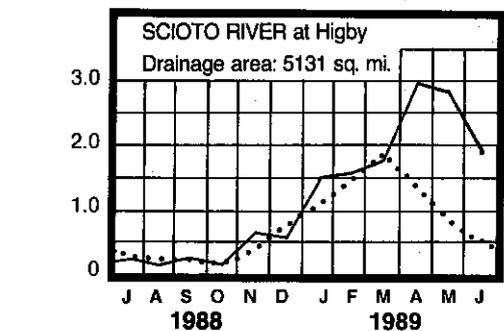
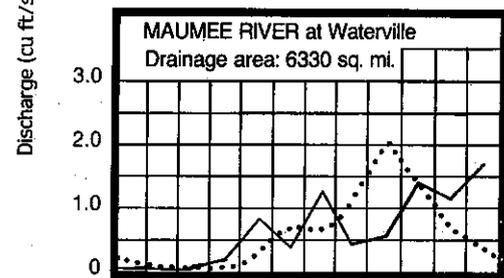
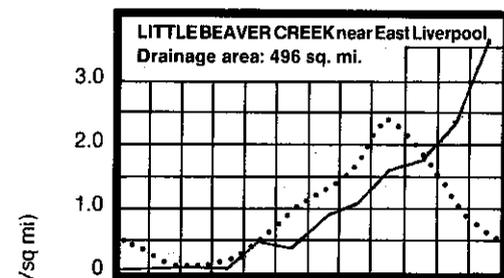
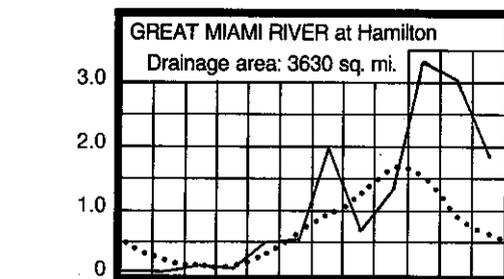
Moderate small stream and local urban flooding occurred after isolated thunderstorm cells produced heavy local precipitation on June 21 and 27. Amounts of up to 5.8 inches were reported near Utica (Licking County). The most severe flooding occurred in Coshocton, Franklin and Licking counties.

Governor Celeste requested and received from the federal government a flood disaster area declaration for the above counties following these storms. These three counties join the 10 counties that were declared flood disaster areas as the result of severe flooding the last week of May. Affected residents and businesses may apply for low interest loans and/or grants through a variety of disaster assistance programs.

RESERVOIR STORAGE for water supply increased in the Mahoning River basin reservoirs and was unchanged in the Scioto River basin reservoirs. Storage was above normal in both basins.

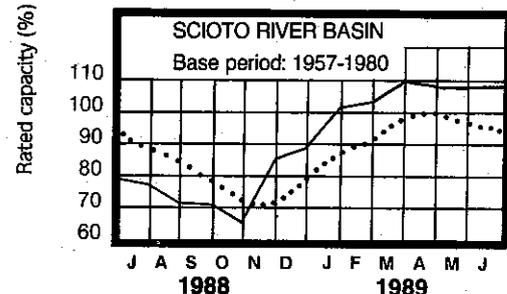
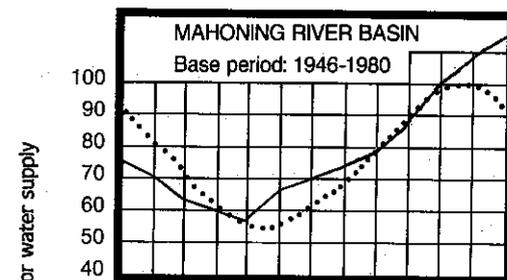
Reservoir storage at the month's end for the Mahoning basin index reservoirs was 115 percent of rated capacity for water supply compared with 108 percent for last month and 77 percent for June 1988. Month-end storage in the Scioto basin index reservoirs was 107 percent of rated capacity for water supply compared with the same for last month and 78 percent for June 1988.

MEAN STREAM DISCHARGE



Base period for all streams: 1951-1980

RESERVOIR STORAGE FOR WATER SUPPLY



GROUND-WATER LEVELS during June generally rose in the central and northeastern portions of the state and declined in the southern portion. Levels usually begin their seasonal decline in June; therefore, the above normal precipitation was beneficial for ground-water storage in the central and northeastern portion of the state.

Generally, levels declined throughout the month in the southern and western portions of the state; in the central and eastern portions, levels in consolidated aquifers rose throughout the month while levels in unconsolidated aquifers declined until mid-month and then rose during the last two weeks in response to the above normal precipitation. Levels in the northeastern and eastern portions of the state still remain slightly below normal even following the significant improvement this month. Ground-water levels are above normal throughout the remainder of the state.

Ground-water levels have shown a marked improvement during the 1989 recharge season. Levels range from 1 to nearly 6 feet above those levels of a year ago. The ground-water storage situation has returned to normal after many years of below normal precipitation and is in a favorable position at this time.

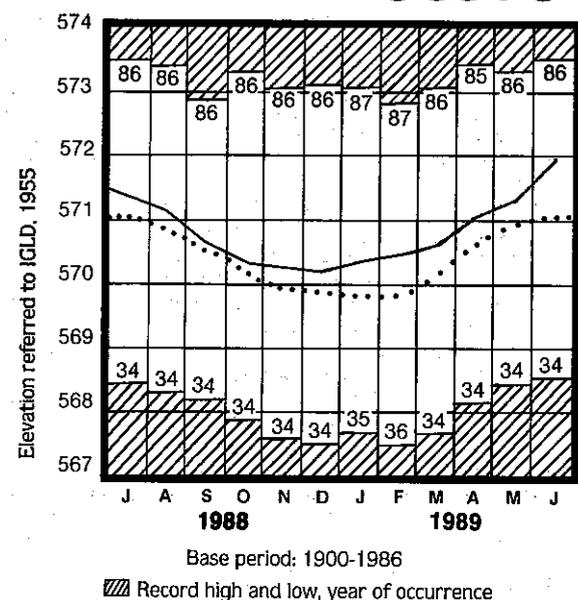
LAKE ERIE level rose noticeably during June. The mean level for June was 571.97 feet (IGLD-1955), 0.66 foot above last month's mean level and 0.92 foot above normal. This month's level is 0.38 foot above the June 1988 level and 3.37 feet above Low Water Datum.

Precipitation has been noticeably above normal throughout the Lake Erie basin in May and June. The U.S. Army Corps of Engineers reports preliminary estimates of precipitation for the Lake Erie basin for May was 170 percent of normal and 143 percent of normal for June. The corps also estimates that the entire Great Lakes basin received 115 and 116 percent of normal precipitation in May and June respectively.

SUMMARY

Precipitation was above normal throughout most of the state. Streamflow was excessive with flooding occurring in some areas of the central and eastern portions of the state. Reservoir storage was noticeably above normal at the month's end. Ground-water levels declined in the southern portion of the state but generally rose elsewhere. Ground-water levels are near or above normal throughout most of the state. Lake Erie level rose noticeably and is 0.92 foot above normal.

LAKE ERIE LEVELS at Cleveland



Base period: 1900-1986

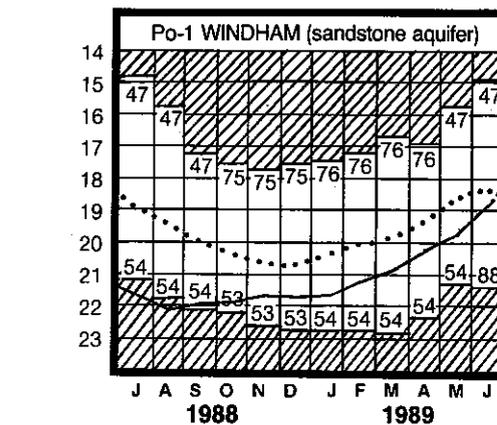
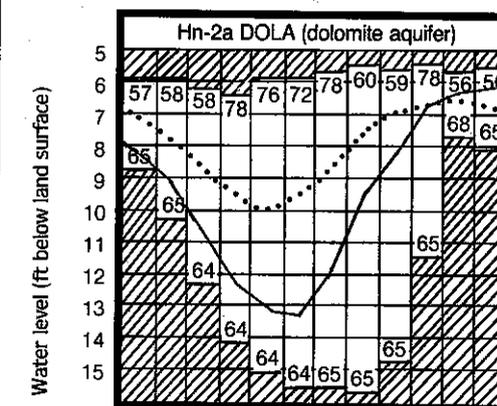
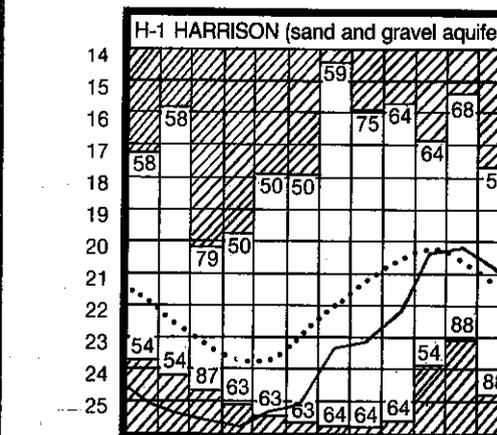
Record high and low, year of occurrence

GROUND-WATER LEVELS

Based on daily lowest level in feet below land-surface datum

Index Well	Location	Aquifer	Mean This Month	Departure From Normal	Change in feet from:	
					Last Month	Year Ago
F-1	W. Rushville, Fairfield Co.	Sandstone	12.23	+1.50	-0.77	+5.62
Fa-1	Jasper Mill, Fayette Co.	Limestone	6.71	+0.64	-0.42	+1.93
Fr-10	Columbus, Franklin Co.	Gravel	41.57	+1.86	+0.54	+2.67
H-1	Harrison, Hamilton Co.	Gravel	20.92	+0.20	-0.71	+3.43
Hn-2a	Dola, Hardin Co.	Dolomite	6.14	+0.63	+0.21	+1.33
Po-1	Windham, Portage Co.	Sandstone	18.78	-0.35	+0.97	+2.42
Tu-1	Strasburg, Tuscarawas Co.	Gravel	12.23	-0.45	+0.51	+2.06

GROUND-WATER LEVELS



Base periods: H-1, 1951-1979. Hn-2a, 1955-1979.

Po-1, 1947-1979 Record high and low, year of occurrence

Normal current _____

Normal current _____



MONTHLY WATER INVENTORY REPORT FOR OHIO

JULY 1989

Richard F. Celeste
Governor

Compiled By David H. Cashell
Water Inventory Unit

Joseph J. Sommer
Director

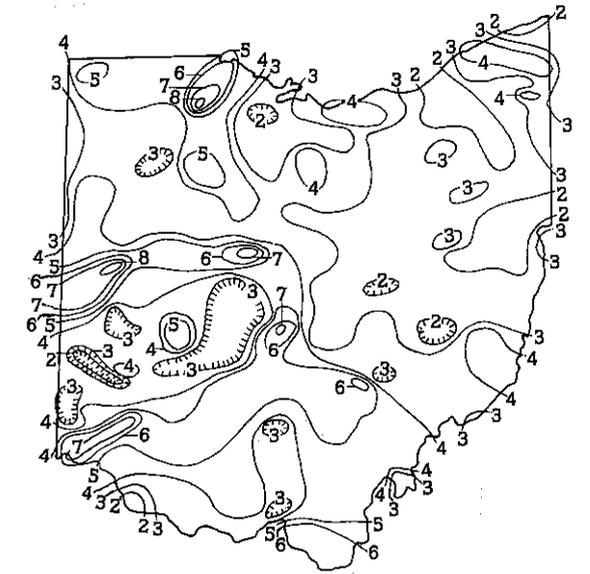
PRECIPITATION for July was distributed unevenly throughout the state but generally was above normal in the western half and below normal in the eastern half of the state. The average for the state as a whole was 3.61 inches, 0.31 inch below normal. Regional averages ranged from 4.57 inches, 1.13 inches above normal, for the Northwest Region to 2.45 inches, 1.76 inches below normal, for the Northeast Hills Region. Bowling Green (Wood County) reported the greatest amount of precipitation for the month, 8.62 inches, of which 4.08 inches fell on July 26. Ft. Loramie (Shelby County) reported 8.60 inches for the month. Fremont (Sandusky County) and Mayfield Heights (Cuyahoga County) reported the least amount of precipitation for the month, 1.06 inches.

Precipitation fell in most areas of the state during every week of the month and came in the form of widely scattered summer-type showers and thunderstorms. Isolated, locally heavy thunderstorms produced amounts of 1 to over 4 inches of precipitation at many locations on various days throughout the month. Weekly totals for most stations generally ranged from 0.3 to 1 inch; exceptions being at specific locations which received the local downpours. The most notable of these local events occurred during the second half of the month. On July 19-20 some locations in western Ohio received in excess of 3 inches with over 5 inches reported at Greenville (Darke County). Storms on July 25-26 produced 4.08 inches at Bowling Green (Wood County). The night of July 27-28 brought severe thunderstorms to Columbus (Franklin County) with over 4 inches reported at many locations throughout the city (see "Governor Celeste Requests Federal Flood Disaster Aid" on the last page of this report). The Columbus area reported the only serious flooding following these storms.

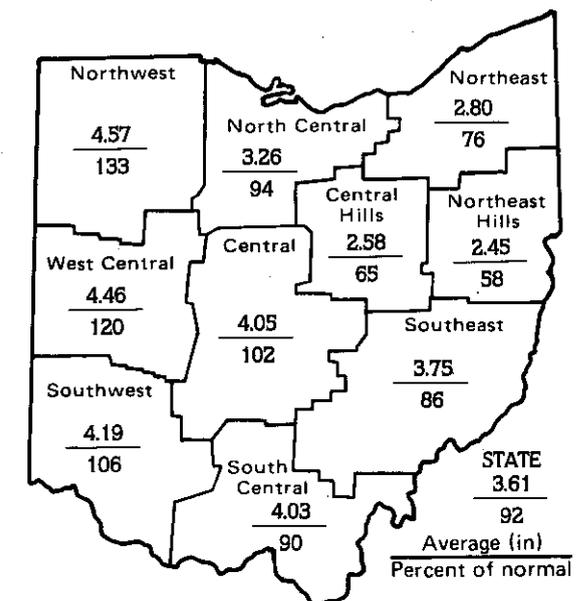
Precipitation for the 1989 calendar year thus far is above normal throughout the state. The average for the state as a whole is 28.81 inches, 5.29 inches above normal. Regional averages range from 34.44 inches, 8.19 inches above normal, for the South Central Region to 21.74 inches, 0.73 inch above normal, for the Northwest Region.

Precipitation for the 1989 water year thus far is above normal throughout the state. The average for the state as a whole is 37.78 inches, 6.69 inches above normal. Regional averages range from 43.78 inches, 9.56 inches above normal, for the South Central Region to 31.72 inches, 3.68 inches above normal, for the Northwest Region.

PRECIPITATION JULY 1989



—Amount (in)



Average (in)
Percent of normal

NOTES AND COMMENTS

GOVERNOR CELESTE REQUESTS FEDERAL FLOOD DISASTER AID

During the night of July 27-28, heavy thunderstorms dumped more than 4 inches of rainfall over parts of Columbus and central Ohio. More than 300 homes suffered damages; 20 had major losses. The governor has requested federal disaster aid to help victims recover from flood damage estimated to be in excess of \$1 million.

NEW EMPLOYEE JOINS GWRS STAFF

The ODNR Division of Water, Ground-Water Resources Section (GWRS) has added a new employee to its staff. Wayne Jones has joined the GWRS Technical Services Unit as a hydrogeologist. He will be answering inquiries from the public, as well as technical requests from drilling contractors and consultants. Wayne received his bachelor's degree in geology from The Ohio State University. Wayne lives in Columbus with his wife Vickie and two daughters.

OHIO'S CANAL LANDS ADMINISTRATION TRANSFERRED TO ODNR

Effective July 1, 1989, responsibility for the administration and management of the state-owned portions of Ohio's historic canal system was transferred to the Ohio Department of Natural Resources (ODNR) from the Department of Administrative Services. Language for this transfer was included in Amended Substitute H.B. 111 signed by Governor Celeste on July 1. Built between 1825 and 1840, the canal system was Ohio's first major statewide transportation network connecting the Ohio River with Lake Erie. Construction of railroads in the mid-1800's brought an end to the active era of the canals. Included with this transfer are the field hydraulic and water management operations at Grand Lake St. Marys (Mercer and Auglaize counties) and the Portage Lakes in Akron (Summit County) as well as 700 land leases in 44 counties. The land leases and future transfers and sales of land will be administered through the Real Estate Section in the ODNR Office of Outdoor Recreation Services.

The ODNR Division of Water was given the responsibility for the operational offices at Grand Lake St. Marys and the Portage Lakes. The Miami and Erie Canal operations office at Grand Lake St. Marys includes four employees with Supervisor Carl Chiles. This office has operation and maintenance responsibility for the Miami and Erie Canal system including the bulkhead and aqueduct at the east end of Grand Lake, several feeder lakes and channel dams on the Maumee and Great Miami rivers.

The Ohio and Erie Canal Operations office in Akron includes six employees with Supervisor Ron Gray. This office operates the Portage Lakes system, which includes the East Reservoir, North Reservoir, West Reservoir, Nimisila Reservoir, Tuscarawas Diversion Dam, Long Lake, and Summit Lake and portions of the canal channel.

Within the Division of Water, the water sales will be coordinated by Richard Bartz, Water Resources Development Section administrator, and the two operational offices will be under the direction of Joel Reed, Permits and Hydraulics Section administrator. The Division of Water welcomes the new staff at both locations and looks forward to the challenges this new responsibility will bring.

PRECIPITATION

Region	DEPARTURE FROM NORMAL (IN.)					Palmer Drought Severity Index*
	This Month	Past				
		3 Mos.	6 Mos.	12 Mos.	24 Mos.	
Northwest	+1.13	+2.91	+0.87	+4.54	-3.83	-1.3
North Central	-0.20	+3.75	+2.81	+3.79	-4.55	+0.1
Northeast	-0.88	+6.33	+5.59	+7.07	+3.82	+1.4
West Central	+0.75	+4.40	+6.51	+7.10	-5.50	+0.7
Central	+0.09	+4.34	+6.55	+8.86	-1.02	+2.2
Central Hills	-1.41	+4.15	+4.97	+5.38	+0.21	+0.2
Northeast Hills	-1.76	+4.38	+4.82	+5.04	-1.62	-0.2
Southwest	+0.22	+2.71	+7.66	+8.81	-1.77	+1.0
South Central	-0.43	+1.56	+8.10	+8.29	-6.97	+0.8
Southeast	-0.62	+3.37	+8.91	+9.70	+3.78	+1.3
State	-0.31	+3.79	+5.69	+6.97	-1.78	////

*Above +4 = Extreme Moist Spell
3.0 To 3.9 = Very Moist Spell
2.0 To 2.9 = Unusual Moist Spell
1.0 To 1.9 = Moist Spell
0.5 To 0.9 = Incipient Moist Spell
0.4 To -0.4 = Near Normal

-0.5 To -0.9 = Incipient Drought
-1.0 To -1.9 = Mild Drought
-2.0 To -2.9 = Moderate Drought
-3.0 To -3.9 = Severe Drought
Below -4.0 = Extreme Drought

ACKNOWLEDGEMENTS

This report has been compiled from Division of Water data and from information supplied by the following:

Precipitation data:
U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Weather Service, The Miami Conservancy District, U.S. Army Corps of Engineers, Muskingum Area.
Streamflow and reservoir storage data:
U.S. Geological Survey, Water Resources Division.
Lake Erie Level data:
U.S. Corps of Engineers, Detroit District.
Palmer Drought Severity Index:
U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Weather Service.

ODNR

OHIO DEPARTMENT OF
NATURAL RESOURCES

DIVISION OF WATER
1939 FOUNTAIN SQUARE
COLUMBUS, OHIO 43224

OHIO
The Heart of It All!

MEAN STREAM DISCHARGE

River and Location	Drainage Area (Sq. Mi.)	Mean Discharge (CFS)	% of Normal	% of Normal Past		
				3 Mos.	6 Mos.	12 Mos.
				This Month		
Grand River near Painesville	685	269	93	480	144	117
Great Miami River at Hamilton	3,630	4,908	365	257	160	138
Huron River at Milan	371	85	98	234	108	97
Killbuck Creek at Killbuck	464	361	168	172	115	102
Little Beaver Creek near East Liverpool	496	340	161	248	128	103
Maumee River at Waterville	6,330	1,682	125	172	83	89
Muskingum River at McConnelsville	7,422	6,663	188	220	138	120
Scioto River near Prospect	567	366	489	419	156	125
Scioto River at Higby	5,131	3,931	233	242	157	135
Stillwater River at Pleasant Hill	503	653	568	289	184	140

STREAMFLOW for July was above normal throughout most of the state; exceptions were at some locations in the northern portion of the state where flows were slightly below normal. Flows were high enough at some locations in the western and south central portions of the state to be considered excessive. July mean flows were less than June mean flows statewide.

Generally, flows at the beginning of the month were above normal except in the northern portion of the state where flows were below normal. Flows in the eastern half of the state generally were the greatest at the beginning of the month and declined throughout the month. Flows did fluctuate with local precipitation, but generally were the lowest the last week of the month in the eastern part of the state. Flows in the

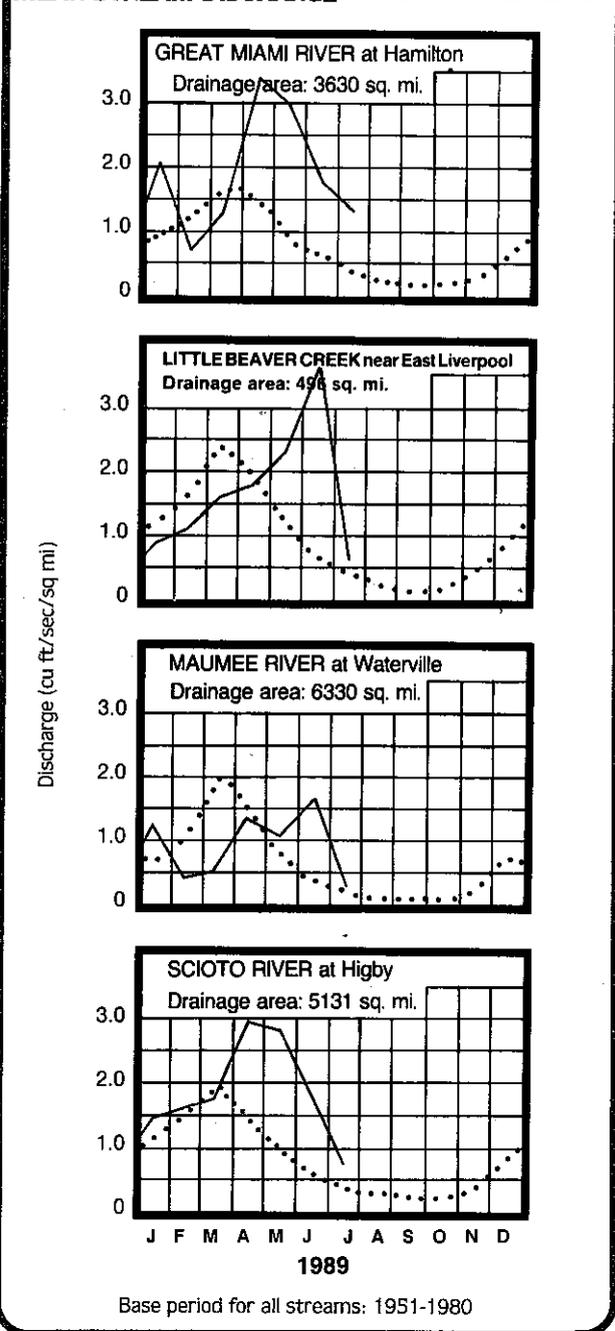
western half of the state fluctuated with local precipitation throughout the month and generally were the greatest around July 22; lowest flows generally occurred between July 11-19. Flows at the month's end were above normal throughout most of the state except in the northeastern portion where flows were below normal.

No major stream flooding occurred following the numerous locally heavy thunderstorms, but, at times, smaller streams filled their banks and urban flooding was observed.

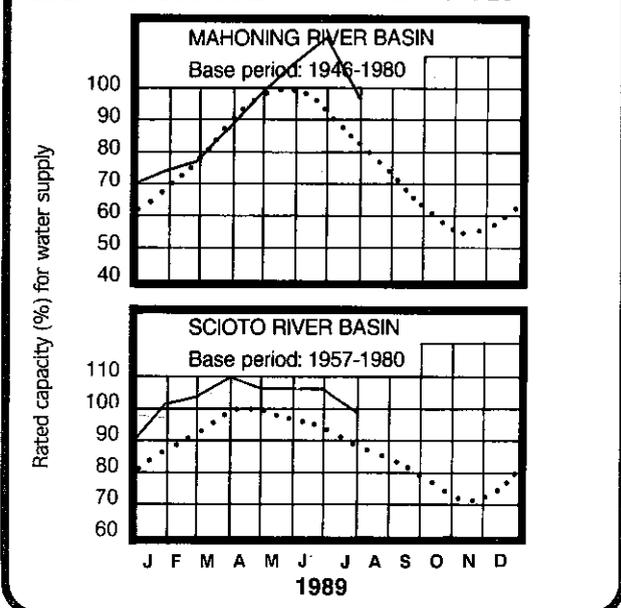
RESERVOIR STORAGE for water supply decreased in both the Mahoning and Scioto river basins. Storage at the month's end was above normal in both basins.

Reservoir storage at the month's end for the Mahoning basin index reservoirs was 97 percent of rated capacity for water supply compared with 115 percent for last month and 72 percent for July 1988. Month-end storage in the Scioto basin index reservoirs was 99 percent of rated capacity for water supply compared with 107 percent for last month and 76 percent for July 1988.

MEAN STREAM DISCHARGE



RESERVOIR STORAGE FOR WATER SUPPLY



GROUND-WATER LEVELS generally declined throughout the state during July. July mean levels were lower than June mean levels in most areas of the state, but were higher in some wells in the central and northeastern portions of the state. Although levels declined gradually during the month in these wells, July mean levels were still higher than the June mean levels due to significant rises in levels late in June.

Despite the usual seasonal declines, ground-water levels have now returned to near or above normal throughout most of the state. Current levels are noticeably higher than levels of a year ago. Recharge to ground-water storage continued into June this year, and although levels have peaked and have started their natural seasonal decline, ground-water storage remains in a favorable position at this time.

LAKE ERIE level declined slightly during July. The mean level for July was 571.96 feet (IGLD-1955), 0.01 foot below last month's mean level and 0.96 foot above normal. This month's mean level is 0.62 foot above the July 1988 level and 3.36 feet above Low Water Datum.

SUMMARY

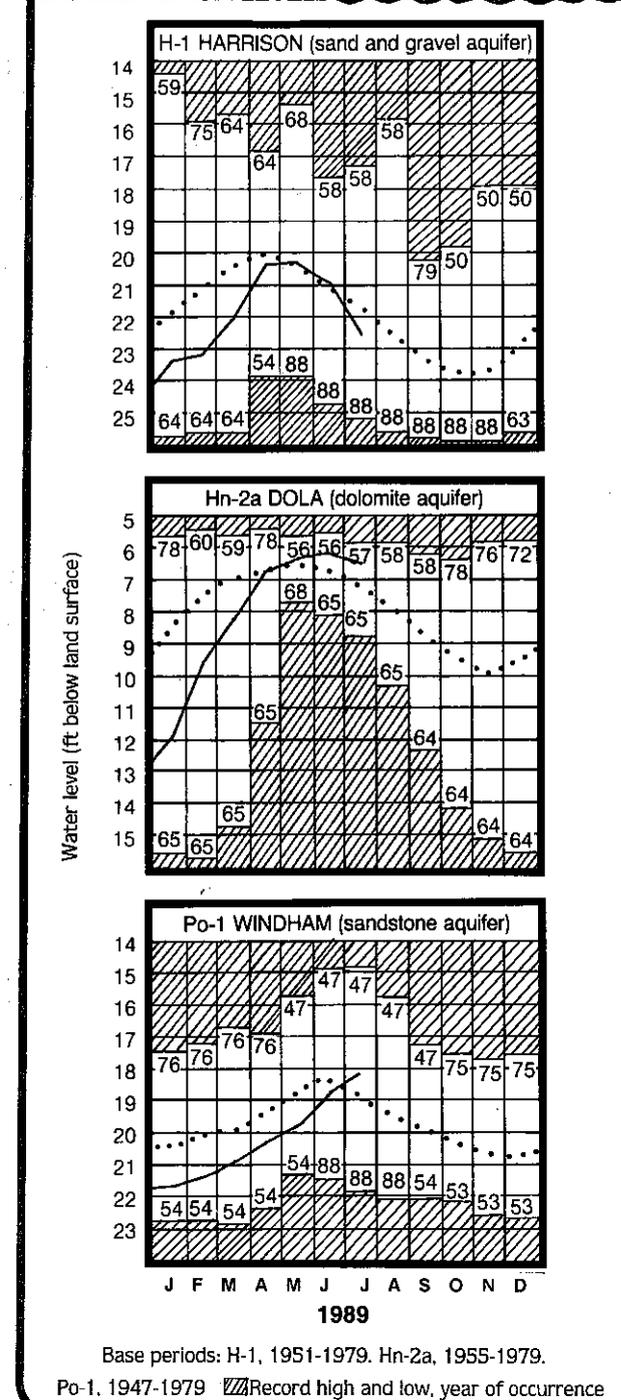
Precipitation was generally above normal in the western half of the state and below normal in the eastern half. Streamflow was above normal throughout most of the state. Reservoir storage declined but remains above normal. Ground-water levels have started their normal seasonal decline, but ground-water storage remains in a favorable position. Lake Erie level declined slightly and is 0.96 foot above normal.

GROUND-WATER LEVELS

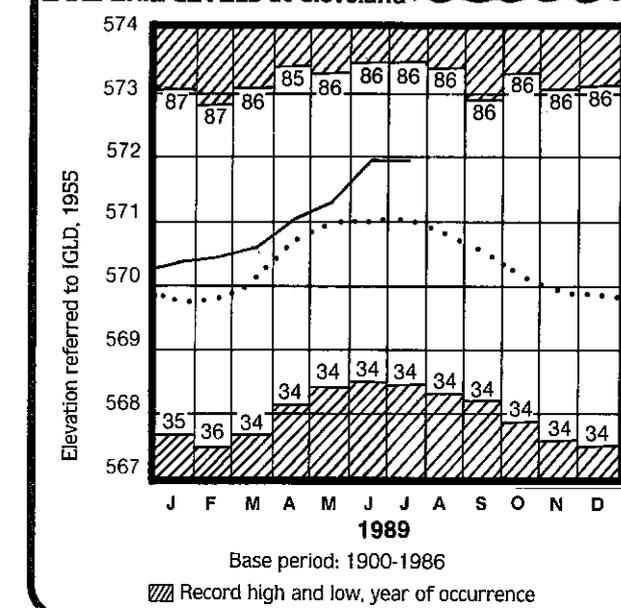
Based on daily lowest level in feet below land-surface datum

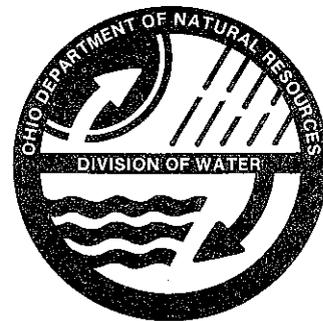
Index Well	Location	Aquifer	Mean This Month	Departure From Normal	Change in feet from:	
					Last Month	Year Ago
F-1	W. Rushville, Fairfield Co.	Sandstone	13.91	+1.00	-1.68	+4.94
Fa-1	Jasper Mill, Fayette Co.	Limestone	7.17	+0.63	-0.46	+1.93
Fr-10	Columbus, Franklin Co.	Gravel	41.30	+2.72	+0.27	+3.71
H-1	Harrison, Hamilton Co.	Gravel	22.48	-0.79	-1.56	+2.49
Hn-2a	Dola, Hardin Co.	Dolomite	6.44	+0.78	-0.30	+1.67
Po-1	Windham, Portage Co.	Sandstone	18.14	+0.83	+0.64	+3.58
Tu-1	Strasburg, Tuscarawas Co.	Gravel	12.44	-0.01	-0.21	+2.65

GROUND-WATER LEVELS



LAKE ERIE LEVELS at Cleveland





MONTHLY WATER INVENTORY REPORT FOR OHIO

AUGUST 1989

Compiled By David H. Cashell
Water Inventory Unit

Robert L. Goettermoeller
Chief

NOTES AND COMMENTS NEW PUBLICATIONS

The Division of Water announces the availability of the following new publications:

The Ground-Water Resources of Brown County by David J. Sugar
The Ground-Water Resources of Pike County by James M. Raab
These new maps are two in a series of 69 county ground-water resources maps which have been completed for the state thus far. Ground-water resources maps are prepared by staff hydrogeologists. These maps show the regional ground-water characteristics based on interpretations of water well drilling records and local geology. These color-coded maps provide well log data for many point locations. Information provided by the maps include typical depths of wells, water-bearing formations and estimated yields for wells in the area.

Ground-water resources maps can be used as a guide for locating new or expanding existing ground-water supplies. They are useful to homeowners, ground-water consultants, engineers, planners and developers.

These new maps and the other available maps cost \$6.53 (includes postage, handling and tax) and may be ordered from ODNR Publications Center, Fountain Square, Building B-1, Columbus, Ohio, 43224.

Make checks payable to ODNR Publications Center.

OHIO HAS NEW DROUGHT RESPONSE PLAN

The "Drought of 1988" is just a memory for many Ohioans, but state and local government officials have continued thinking about its effects and examining government's role in planning for and being prepared to assist Ohioans when the next drought occurs.

The Ohio Drought Response Plan was signed by Governor Richard F. Celeste on August 16, 1989. This plan, in part, establishes different phases for the state's response in relation to the increasing severity of the drought conditions, identifies specific responsibilities of the pertinent state agencies and identifies guidelines and recommendations that local governments may consider using or following in the various phases of a continually worsening drought. The plan is being distributed to all county emergency management directors/coordinators and all federal, state and local departments and agencies with responsibilities for response. Copies may be obtained from The Ohio Emergency Management Agency Disaster Assistance Branch, 2825 West Dublin-Granville Road, Columbus, Ohio, 43230. Telephone number (614) 889-7176.

U.S. GEOLOGICAL SURVEY MARKS 100 YEARS OF STREAM GAUGING

This year marks the 100th anniversary of the United States Geological Survey's (USGS) program of measuring flows in the rivers and streams throughout the nation. The first stream gauge was established on the Rio Grande River at Embudo, New Mexico, a small community 50 miles north of Santa Fe. From these meager beginnings, the cooperative water-monitoring network of the USGS has grown to its current size of about 50,000 stations. In addition to streamflow, these stations now monitor the quantity and quality of the nation's surface water and ground-water resources. With more than 1,000 cooperating state, federal and local agencies nationwide, the USGS has become the nation's largest water resources information organization.

In Ohio, the first streamflow station was established in 1898 and located on the Scioto River at Columbus. The number of streamflow stations in Ohio increased to a maximum of 180 in 1980, but has since been reduced to its current number of 135. The Ohio Department of Natural Resources, Division of Water, is the largest cooperater with the USGS in Ohio, but many other state, federal and local agencies are also involved with the USGS's cooperative program in Ohio. In addition to the 135 streamflow stations, there are over 450 other stations that monitor the quantity and quality of Ohio's surface water and ground-water resources.

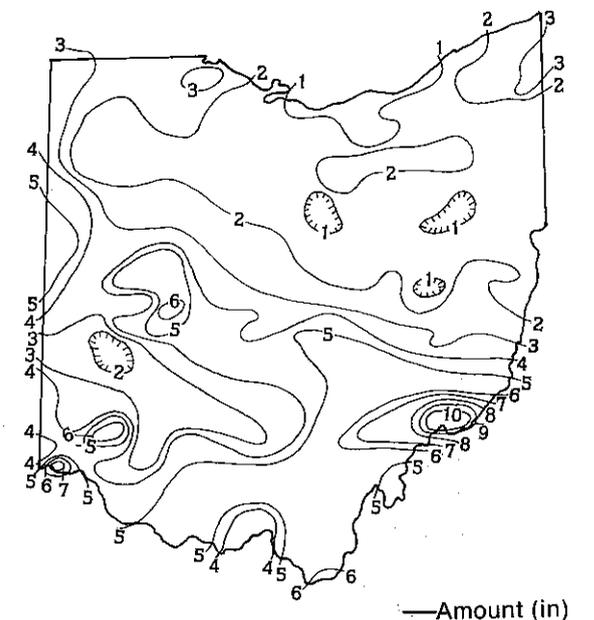
PRECIPITATION for August was below normal in the northern portion of the state and above normal in the southern portion. The average for the state as a whole was 3.02 inches, 0.46 inch below normal. Regional averages ranged from 5.31 inches, 1.47 inches above normal, for the Southeast Region to 1.25 inches, 1.98 inches below normal, for the North Central Region. Marietta Lock #1 (Washington County) reported the greatest amount of precipitation for the month, 10.68 inches of which 4.78 inches occurred on August 5. Lagrange (Lorain County) reported the least, only 0.49 inch.

Precipitation varied greatly throughout the state during every week of the month. During the first week, totals generally averaged 0.25 to 0.5 inch across the northern portion of the state increasing to between 1 and 2 inches in the southeastern portion. Local, isolated thunderstorm cells dumped more than 4 inches of rain in portions of northern Columbus (Franklin County) and Marietta (Washington County) on August 5. During the second week of the month very little precipitation fell with many stations throughout the state reporting no precipitation at all. The third week was also rather dry with most locations throughout the state reporting less than 0.5 inch. Only areas in the southern portion of the state along the Ohio River and the extreme northwestern corner reported between 1 and 2 inches. Totals for the last 10 days of the month continued this pattern with very little precipitation in the northern portion of the state, and increasing to between 1 and 2 inches in the southern portion.

Precipitation for the 1989 calendar year is above normal throughout the state. The average for the state as a whole is 31.83 inches, 4.83 inches above normal. Regional averages range from 39.39 inches, 9.25 inches above normal, for the South Central Region to 24.35 inches, 0.41 inch above normal, for the Northwest Region.

Precipitation for the 1989 water year is above normal throughout the state. The average for the state as a whole is 40.80 inches, 6.23 inches above normal. Regional averages range from 48.73 inches, 10.62 inches above normal, for the South Central Region to 33.26 inches, 2.11 inches above normal, for the North Central Region.

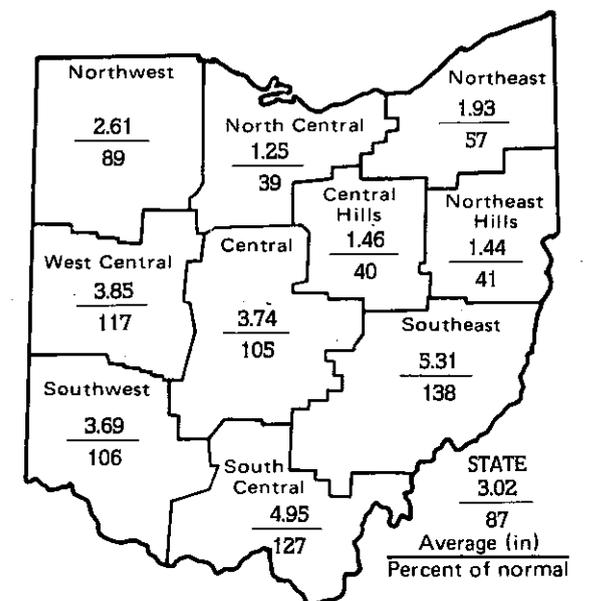
PRECIPITATION AUGUST 1989



PRECIPITATION

Region	DEPARTURE FROM NORMAL (IN.)					Palmer Drought Severity Index*
	This Month	Past				
		3 Mos.	6 Mos.	12 Mos.	24 Mos.	
Northwest	-0.32	+1.18	+1.52	+2.95	-5.75	-1.3
North Central	-1.98	-1.22	+1.48	+1.00	-8.75	-0.5
Northeast	-1.47	+1.36	+4.30	+5.47	-0.48	-0.8
West Central	+0.55	+2.05	+7.50	+8.17	-4.09	+0.7
Central	+0.19	+1.88	+6.22	+9.43	+0.64	+2.9
Central Hills	-2.20	-0.32	+2.50	+3.61	-3.58	-1.7
Northeast Hills	-2.08	+0.19	+2.26	+2.30	-6.39	-1.6
Southwest	+0.22	+0.50	+6.69	+9.72	+0.06	+2.0
South Central	+1.06	+2.09	+5.10	+10.03	-3.61	+2.2
Southeast	+1.47	+2.50	+8.59	+11.66	+4.65	+2.2
State	-0.46	+1.02	+4.62	+6.44	-2.60	

*Above +4 = Extreme Moist Spell
3.0 To 3.9 = Very Moist Spell
2.0 To 2.9 = Unusual Moist Spell
1.0 To 1.9 = Moist Spell
0.5 To 0.9 = Incipient Moist Spell
0.4 To -0.4 = Near Normal
-0.5 To -0.9 = Incipient Drought
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Palmer Drought Severity Index:
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ODNR

OHIO DEPARTMENT OF
NATURAL RESOURCES

DIVISION OF WATER
1939 FOUNTAIN SQUARE
COLUMBUS, OHIO 43224

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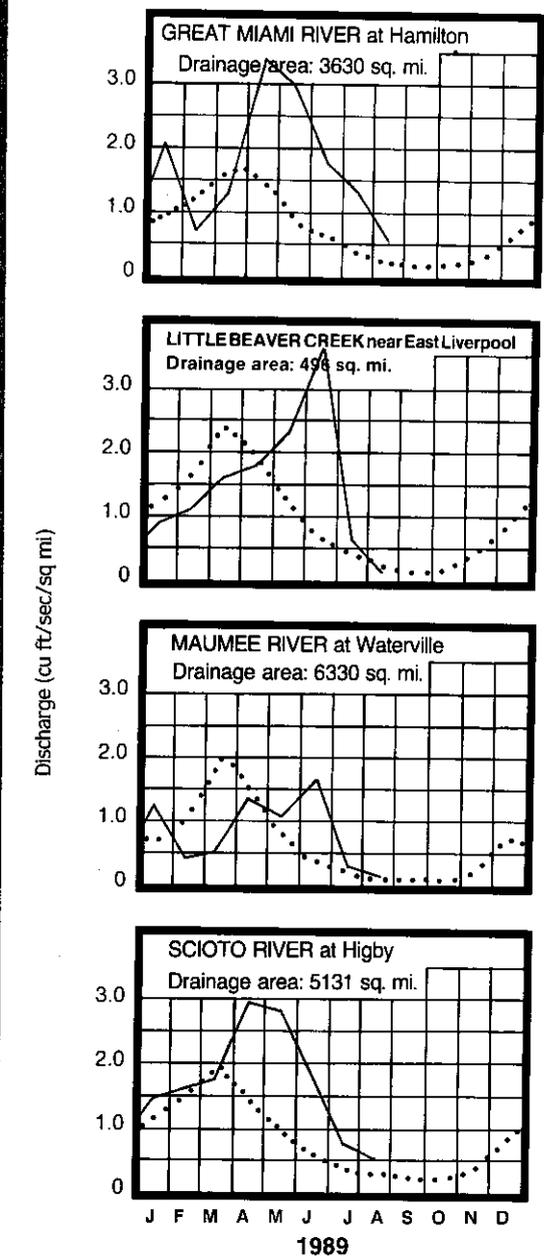


MEAN STREAM DISCHARGE

This Month

River and Location	Drainage Area (Sq. Mi.)	Mean Discharge (CFS)	% of Normal	% of Normal Past		
				3 Mos.	6 Mos.	12 Mos.
Grand River near Painesville	685	97	82	297	166	122
Great Miami River at Hamilton	3,630	1,902	249	205	179	142
Huron River at Milan	371	17	43	158	109	94
Killbuck Creek at Killbuck	464	96.2	78	215	138	116
Little Beaver Creek near East Liverpool	496	98.3	89	255	137	103
Maumee River at Waterville	6,330	1,008	164	193	94	90
Muskingum River at McConnesville	7,422	2,574	100	197	144	121
Scioto River near Prospect	567	112	278	191	182	128
Scioto River at Higby	5,131	2,544	206	197	166	138
Stillwater River at Pleasant Hill	503	140	282	142	207	143

MEAN STREAM DISCHARGE



Base period for all streams: 1951-1980

Normal current

STREAMFLOW for August was above normal in the southern and western portions of the state and below normal in the north central and northeastern portions. Flows in the central and south central portions were high enough to be considered excessive for August while flows in the north central portion were low enough to be considered deficient. August mean flows were less than July mean flows statewide.

Generally, flows at the beginning of the month were above normal throughout the state. Highest flows during the month generally were observed on August 1 in the northern portion of the state and on August 5-6 in the southern portion following widespread thunderstorm activity. Exceptions were generally on smaller streams which may have had their highest flows following locally

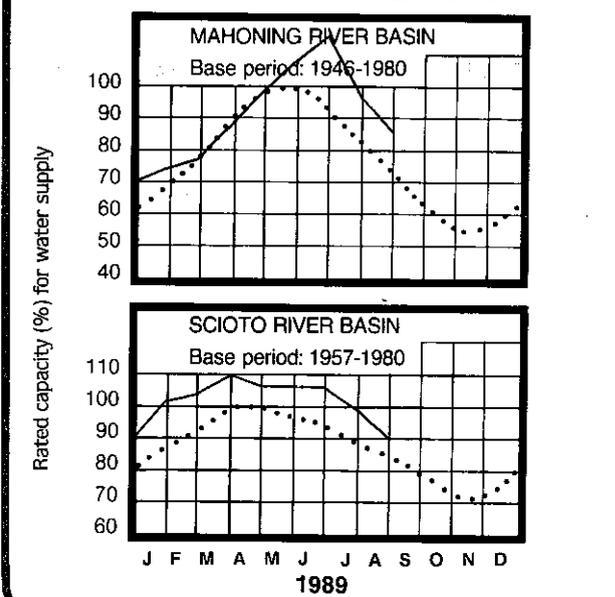
heavy thunderstorms. Flows declined steadily following these peak flows until August 18-20 in the southern portion of the state and August 25-31 in the northern portion when the lowest flows were observed. Flows at the month's end were above normal statewide except in portions of the north central and east central areas where flows were below normal.

In the early evening of August 29, an isolated, locally severe thunderstorm dumped 4 inches of rain along the headwaters of Gregory Creek in southeastern Butler County causing flash flooding conditions. About 20 mobile homes, 75 condominium units and five businesses were damaged downstream. The governor has requested that this area receive a limited disaster declaration from the federal government.

RESERVOIR STORAGE for water supply during August decreased in both the Mahoning and Scioto river basins. Storage at the month's end was above normal in both basins.

Reservoir storage at the month's end for the Mahoning basin index reservoirs was 86 percent of rated capacity for water supply compared with 97 percent for last month and 63 percent for August 1988. Month-end storage in the Scioto basin index reservoirs was 90 percent of rated capacity for water supply compared with 99 percent for last month and 70 percent for August 1988.

RESERVOIR STORAGE FOR WATER SUPPLY



GROUND-WATER LEVELS declined seasonally throughout the state during August. Net changes from last month's levels ranged from about one-quarter to nearly three times greater than usually observed. Greatest departures from the normal August declines generally occurred in sand and gravel aquifers in the north central and east central portions of the state where precipitation was noticeably below normal.

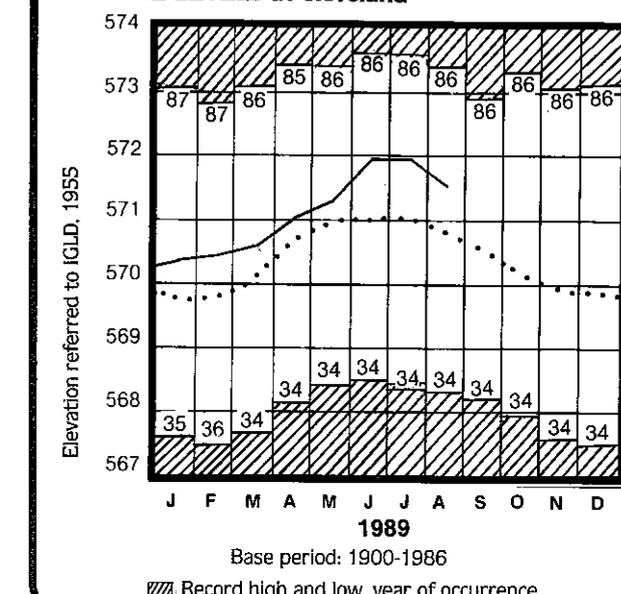
Ground-water levels are near normal throughout the state generally ranging from 1 foot above to 1 foot below normal. Current levels are noticeably higher than levels of a year ago generally ranging from 1.5 to 4.5 feet above August 1988 levels. The above normal precipitation and resulting recharge to ground-water storage during the soon-to-be-ending 1989 water year has been most beneficial to ground-water supplies and turned the rapidly deteriorating situation in 1988 into a more favorable position at this time.

LAKE ERIE level declined noticeably during August in response to two months of below normal precipitation in the basin. The mean level for August was 571.55 feet (IGLD-1955), 0.41 foot below last month's mean level and 0.74 foot above normal. This month's mean level is 0.41 foot above the August 1988 level and 2.95 feet above Low Water Datum.

SUMMARY

Precipitation was above normal in the southern portion of the state and below normal in the northern portion. Streamflow was above normal in the southern and western portions of the state and below normal in the north central and northeastern portions. Reservoir storage declined but remains above normal. Ground-water levels declined but continue to be in the normal range statewide. Lake Erie level declined noticeably but remains 0.74 foot above the long-term August normal level.

LAKE ERIE LEVELS at Cleveland



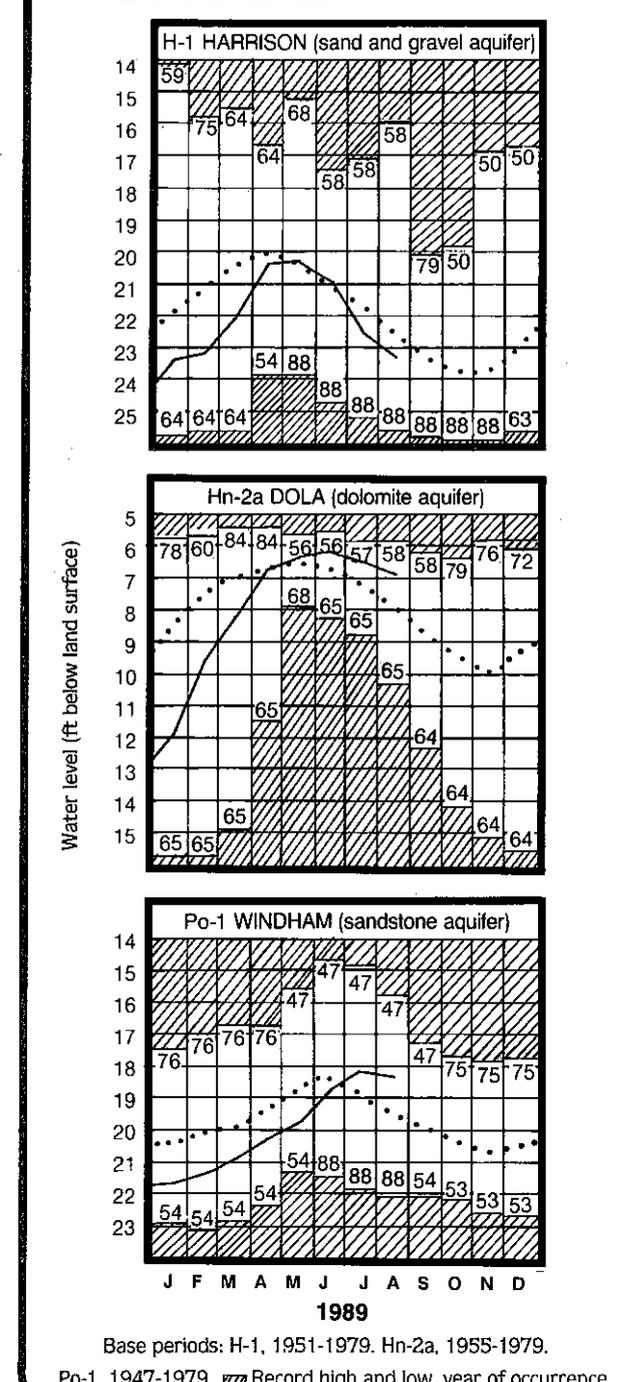
Normal current

GROUND-WATER LEVELS

Based on daily lowest level in feet below land-surface datum

Index Well	Location	Aquifer	Mean This Month	Departure From Normal	Change in feet from:	
					Last Month	Year Ago
F-1	W. Rushville, Fairfield Co.	Sandstone	15.19	+0.33	-1.28	+4.35
Fa-1	Jasper Mill, Fayette Co.	Limestone	7.24	+1.04	-0.07	+2.48
Fr-10	Columbus, Franklin Co.	Gravel	42.06	+2.42	-0.76	+3.28
H-1	Harrison, Hamilton Co.	Gravel	23.29	-0.76	-0.81	+2.06
Hn-2a	Dola, Hardin Co.	Dolomite	6.89	+1.00	-0.45	+2.34
Po-1	Windham, Portage Co.	Sandstone	18.46	+1.05	-0.32	+3.59
Tu-1	Strasburg, Tuscarawas Co.	Gravel	13.77	-0.85	-1.33	+1.53

GROUND-WATER LEVELS



Normal current



MONTHLY WATER INVENTORY REPORT FOR OHIO

September 1989

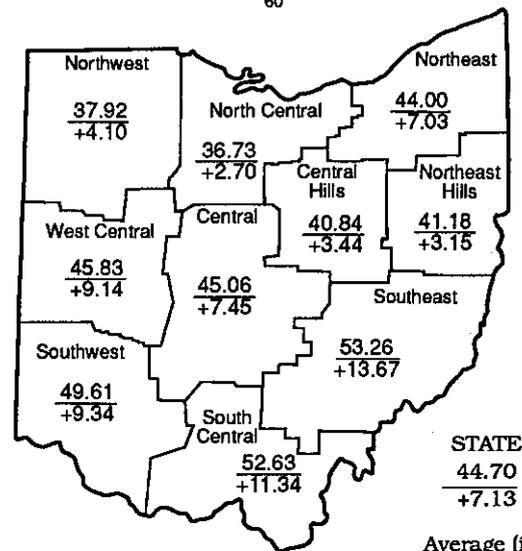
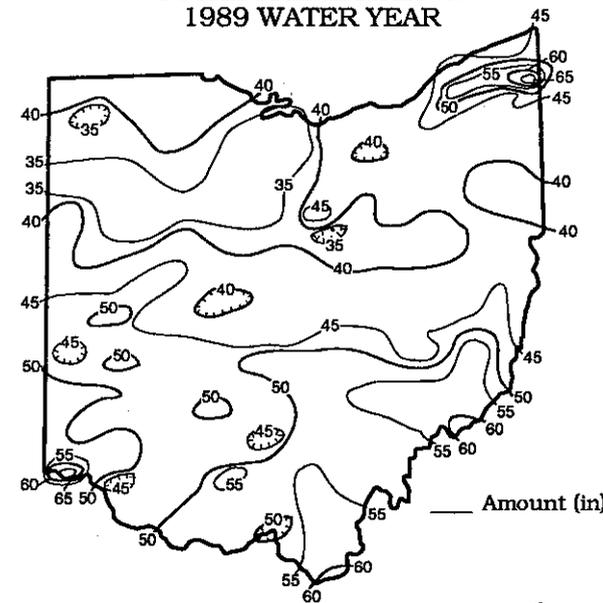
Compiled By David H. Cashell
Hydrologist
Water Inventory Unit

(continued from front page)

Huntington, WV (Chesapeake, Ohio, Lawrence County) reported 65.74 inches, 61.26 inches, 62.78 inches and 61.61 inches respectively. Sandusky (Erie County) reported the least amount, 32.08 inches, which is slightly below normal. Other stations from Sandusky south to Upper Sandusky (Wyandot County) and west to Grover Hill (Paulding County) also reported near to slightly below normal precipitation for the water year. An isohyetal map and regional averages and departures from normal for the 1989 water year appear below.

Generally, conditions during the 1989 water year were wet in most locations. November 1988 precipitation was noticeably above normal statewide. December 1988 and January 1989 were rather dry, but conditions began to improve in the spring. February, March and April were noticeably wet in the southern two-thirds of the state. Although the northern one-third was still rather dry, widespread heavy precipitation during May eliminated these conditions. Wet conditions across the state continued through June, and farmers throughout the state were delayed in planting field crops. Conditions during July through September were generally normal with scattered thunderstorms leaving some areas wet and some areas dry. Generally, conditions during the water year were very beneficial for water supplies. Recharge to ground-water storage continued into June and surface supplies maintained favorable conditions. After the drought of 1988, the 1989 water year was "just what the doctor ordered."

TOTAL PRECIPITATION
1989 WATER YEAR



Average (in)
Depart from normal

PRECIPITATION for September was above normal throughout most of the state; the only exception was in the Central Region where precipitation was slightly below normal. The average for the state as a whole was 3.92 inches, 0.92 inch above normal. Regional averages ranged from 4.88 inches, 1.70 inches above normal, for the Northeast Region to 2.73 inches, 0.16 inch below normal, for the Central Region. North Royalton (Cuyahoga County) reported the greatest amount of precipitation for the month, 8.29 inches. Delaware Dam (Delaware County) reported the least, 1.71 inches.

The bulk of September's precipitation for most locations fell during the first half of the month; only the eastern half of the state received substantial precipitation the second half. Storms on September 1-2 in the western portion of the state and on September 7 in the northern portion brought totals to generally between 1 and 2 inches for the first week in all but the eastern portion of the state. Scattered storms on September 10 in the western portion and widespread precipitation during September 14-16 produced an additional 1 to 2 inches at most locations throughout the state. On September 22-23 the remnants of Hurricane Hugo moved through the eastern half of the state, generally dumping 1 to 2 inches of precipitation at most locations. However, locally heavy downpours occurred especially in the northeastern portion of the state with 3 to over 6 inches reported south of and in the eastern suburbs of Cleveland. Minor urban flooding was reported.

Precipitation for the 1989 calendar year is above normal throughout the state. The average for the state as a whole is 35.74 inches, 5.74 inches above normal. Regional averages range from 44.45 inches, 12.55 inches above normal, for the Southeast Region, to 27.85 inches, 1.06 inches above normal, for the Northwest Region.

Precipitation for the 1989 water year which ended September 30 was above normal throughout most of the state. The average for the state as a whole was 44.70 inches, 7.13 inches above normal. This ranks the 1989 water year as the fifth wettest in 106 years of record keeping. Regional averages ranged from 53.26 inches, 13.67 inches above normal, for the Southeast Region to 36.73 inches, 2.70 inches above normal, for the North Central Region. Fernbank (Hamilton County) reported the greatest amount of precipitation for the water year, 66.19 inches. Andover (Ashtabula County), Marietta State Nursery and Willow Island Lock and Dam (Washington County) and

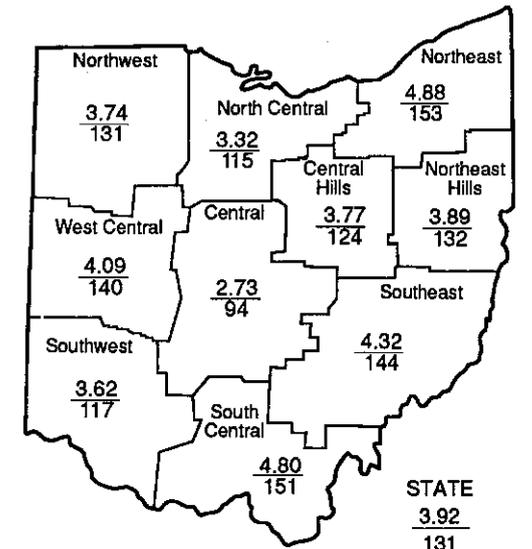
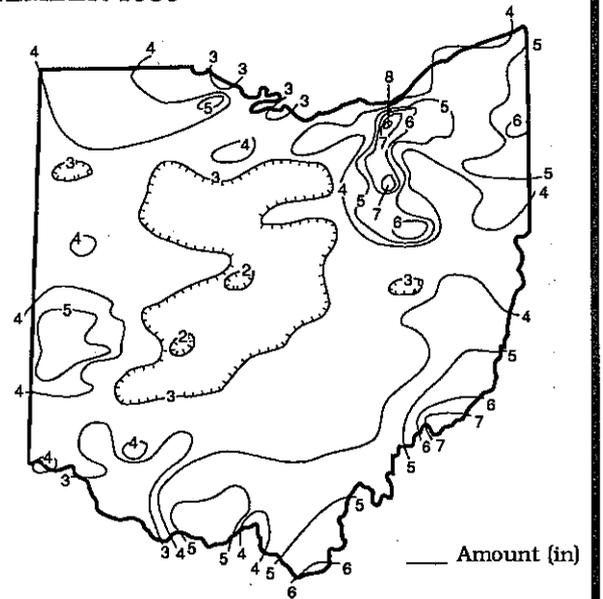
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PRECIPITATION

Region	DEPARTURE FROM NORMAL (IN.)					Palmer Drought Severity Index*
	This Month	Past				
		3 Mos.	6 Mos.	12 Mos.	24 Mos.	
Northwest	+0.89	+1.50	+2.96	+4.10	-3.72	-0.9
North Central	+0.44	-1.54	+2.51	+2.70	-7.28	+0.3
Northeast	+1.70	-0.65	+5.82	+7.03	+1.16	+0.7
West Central	+1.16	+2.32	+7.87	+9.14	-0.47	+0.9
Central	-0.16	+0.48	+5.40	+7.45	+2.11	+1.8
Central Hills	+0.74	-2.89	+2.49	+3.44	-1.73	-0.5
Northeast Hills	+0.95	-2.90	+2.49	+3.15	-5.15	+0.6
Southwest	+0.53	+1.03	+5.77	+9.34	+2.23	+2.1
South Central	+1.62	+1.87	+5.32	+11.34	-1.88	+2.8
Southeast	+1.33	+2.48	+8.98	+13.67	+7.53	+2.7
State	+0.92	+0.17	+4.96	+7.13	-0.61	

*Above +4 = Extreme Moist Spell
3.0 To 3.9 = Very Moist Spell
2.0 To 2.9 = Unusual Moist Spell
1.0 To 1.9 = Moist Spell
0.5 To 0.9 = Incipient Moist Spell
0.4 To 0.4 = Near Normal
-0.5 To -0.9 = Incipient Drought
-1.0 To -1.9 = Mild Drought
-2.0 To -2.9 = Moderate Drought
-3.0 To -3.9 = Severe Drought
Below -4.0 = Extreme Drought

PRECIPITATION
SEPTEMBER 1989



Average (in)
Percent of normal

ACKNOWLEDGEMENTS

This report has been compiled from Division of Water data and from information supplied by the following:

- Precipitation data:
 - U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Weather Service: The Miami Consergency District: U.S. Army Corps of Engineers, Muskingum Area.
 - Streamflow and reservoir storage data: U.S. Geological Survey, Water Resources Division.
 - Lake Erie level data: U.S. Army Corps of Engineers, Detroit District.
 - Palmer Drought Severity Index: U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Weather Service.

ODNR

OHIO DEPARTMENT OF
NATURAL RESOURCES

DIVISION OF WATER
1939 FOUNTAIN SQUARE
COLUMBUS, OHIO 43224

Richard F. Celeste
Governor

Joseph J. Sommer
Director

Robert L. Goettemoeller
Chief



MEAN STREAM DISCHARGE

This Month

River and Location	Drainage Area (Sq. Mi.)	Mean Discharge (CFS)	% of Normal	% of Normal Past		
				3 Mos.	6 Mos.	12 Mos.
Grand River near Painesville	685	155	63	35	224	123
Great Miami River at Hamilton	3,630	3,086	462	368	252	149
Huron River at Milan	371	14.3	61	70	162	94
Killbuck Creek at Killbuck	464	137	153	147	180	116
Little Beaver Creek near East Liverpool	496	116	147	135	176	100
Maumee River at Waterville	6,330	2,061	528	138	131	90
Muskingum River at McConnelsville	7,422	2,507	159	141	171	122
Scioto River near Prospect	567	52.4	181	283	355	128
Scioto River at Higby	5,131	1,639	157	172	207	142
Stillwater River at Pleasant Hill	503	860	1,907	637	357	158

STREAMFLOW for September was above normal throughout most of the state with only the north central and northeastern portions having below normal flows. Flows in the northwestern, western and southern portions of the state were high enough to be considered excessive. September flows were greater than August flows except in the central and north central portions of the state where flows were less.

Generally, flows at the beginning of the month were above normal in all but the north central and northeastern portions of the state. Flows fluctuated throughout the month in response to precipitation and were generally the greatest just after mid-month in the western half of the state and during September 23-26 in the eastern half

following passage of the remnants of Hurricane Hugo. Lowest flows generally occurred at the month's end except in the northeastern portion where they occurred around the end of the first week of the month. Flows at the month's end were generally above normal except in the central and north central portions where they were below normal.

Streamflow for the 1989 water year was above normal throughout most of the state. The only exceptions were in the northwestern and north central portions where flows were slightly below normal. Streamflows the past six months were noticeably above normal throughout the state. Stream and urban flooding conditions occurred several times following local and widespread thunderstorm activity. The most notable flooding event occurred during the last week of May in the southwestern and northeastern areas of the state.

Cumulative runoff and departure from normal for the index gauging stations for the 1989 water year were: Great Miami River, 18.26 inches, 6.02 inches above normal; Little Beaver Creek, 15.23 inches, 0.06 inch below normal; Maumee River, 9.74 inches, 1.25 inches below normal; and Scioto River, 17.28 inches, 5.03 inches above normal.

RESERVOIR STORAGE for water supply during September decreased in both the Mahoning and Scioto river basins. Storage at the month's end was above normal in both basins.

Reservoir storage at the month's end for the Mahoning basin index reservoirs was 82 percent of rated capacity for water supply compared with 86 percent for last month and 60 percent for September 1988. Month-end storage in the Scioto basin index reservoirs was 82 percent of rated capacity for water supply compared with 90 percent for last month and 70 percent for September 1988.

Surface water supplies maintained a favorable position throughout most of the 1989 water year. The above normal precipitation and

resulting streamflows were beneficial in filling and maintaining normal pools in both on and off-stream reservoirs. In contrast with last year at this time, most reservoirs are at or above normal September levels. Surface water supplies are in a favorable position at this time.

GROUND-WATER LEVELS generally declined in most areas of the state during September. A few exceptions were noted in sand and gravel aquifers along streams in the south central and southwestern portions of the state where levels were stable or rose slightly during the month in response to precipitation and excessive streamflows. Ground-water levels are generally above normal throughout most of the state. The only exception is in sand and gravel aquifers in the northeastern quadrant of the state where levels are below normal in response to below normal cumulative precipitation during the past three months.

The 1989 water year was very beneficial to ground-water storage. Although levels were noticeably below normal at the beginning of the 1989 water year in response to the drought conditions in 1988, above normal precipitation throughout the state during the winter and spring recharge period resulted in a steady improvement in ground-water storage. Levels improved steadily during the recharge period and levels in many aquifers continued rising into June. Levels generally returned to normal by the late spring period in most areas of the state. Generally, levels throughout the state have remained in the near-normal range throughout the summer season with the only exception noted above. As the 1990 water year begins, ground-water storage is in a favorable position.

LAKE ERIE level declined seasonally during September. The mean level for September was 571.26 feet (IGLD-1955), 0.29 foot below last month's mean level and 0.74 foot above normal. This month's mean level is 0.54 foot above the September 1988 level and 2.66 feet above Low Water Datum.

SUMMARY

Precipitation was above normal throughout most of the state. Streamflow was excessive in the western and southern portions of the state but slightly below normal in the north central and northeastern portions. Reservoir storage declined but remained above normal. Ground-water storage declined but generally remains near to above normal. Lake Erie level declined seasonally.

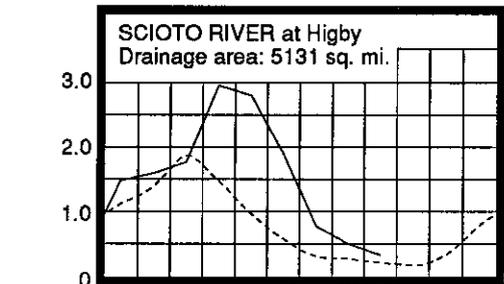
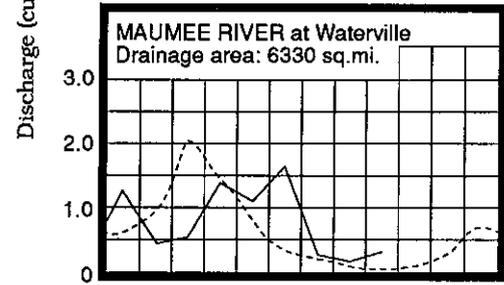
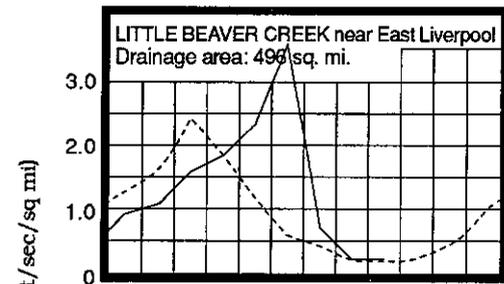
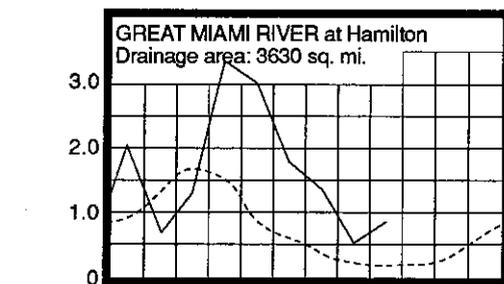
Precipitation during the 1989 water year was above normal throughout most of the state. The state average of 44.70 inches ranks this year as the fifth wettest in 106 years of record keeping. Water supplies throughout the state recovered substantially from last year's drought and are in a favorable position at this time.

GROUND-WATER LEVELS

Based on daily lowest level in feet below land-surface datum

Index Well	Location	Aquifer	Mean This Month	Departure From Normal	Change in feet from:	
					Last Month	Year Ago
F-1	W. Rushville, Fairfield Co.	Sandstone	15.81	+0.11	-0.62	+4.14
Fa-1	Jasper Mill, Fayette Co.	Limestone	7.86	+0.75	-0.62	+2.22
Fr-10	Columbus, Franklin Co.	Gravel	42.58	+2.50	-0.52	+2.62
H-1	Harrison, Hamilton Co.	Gravel	23.14	+0.08	+0.15	+2.49
Hn-2a	Dola, Hardin Co.	Dolomite	7.95	+0.92	-1.06	+2.90
Po-1	Windham, Portage Co.	Sandstone	19.07	+0.91	-0.61	+2.87
Tu-1	Strasburg, Tuscarawas Co.	Gravel	14.50	-1.22	-0.73	+0.79

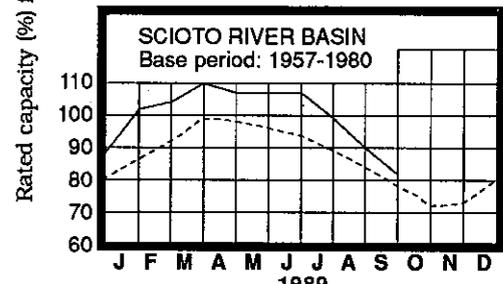
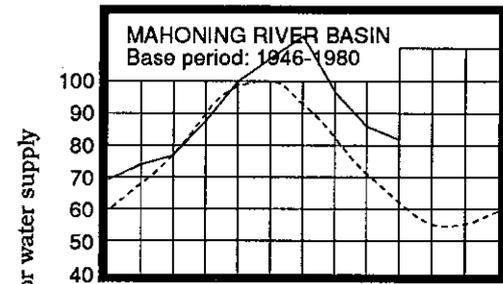
MEAN STREAM DISCHARGE



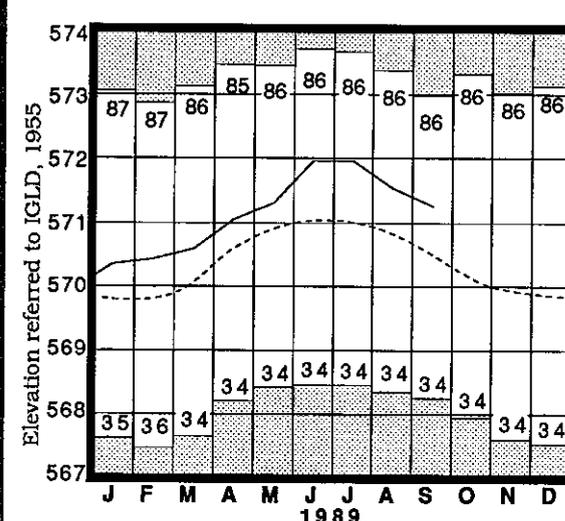
Base period for all streams: 1951-1980

Normal - - - - Current - - - -

RESERVOIR STORAGE FOR WATER SUPPLY



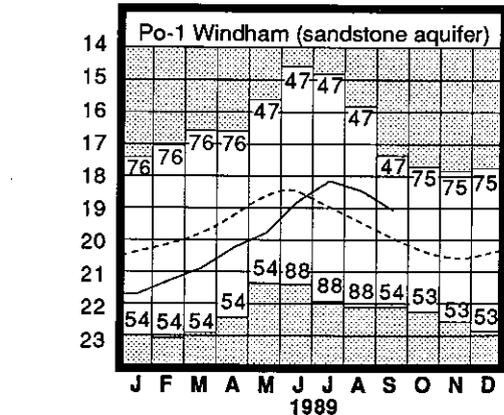
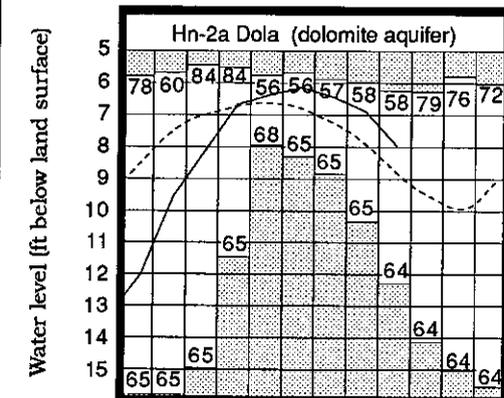
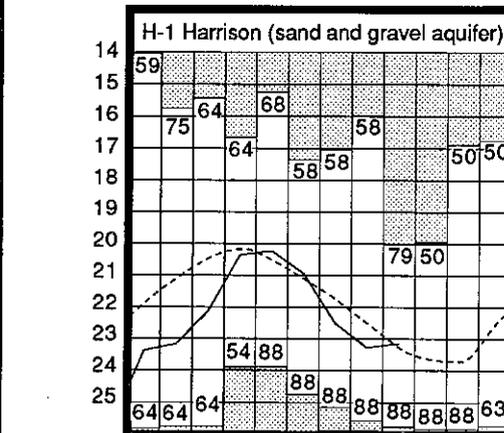
LAKE ERIE LEVELS at Cleveland



Record high and low, year of occurrence

Normal - - - - Current - - - -

GROUND-WATER LEVELS



Base periods: H-1, 1951-1979; Hn-2a, 1955-1979; Po-1, 1947-1979

Record high and low, year of occurrence

Normal - - - - Current - - - -



MONTHLY WATER INVENTORY REPORT FOR OHIO

October 1989

Compiled By David H. Cashell
Hydrologist
Water Inventory Unit

(continued from front page)

most areas of the state as far as precipitation is concerned. Conditions augur well for continued improvement in water supplies throughout the upcoming recharge period. Water supplies throughout the state are in a favorable position at this time.

NOTES AND COMMENTS NEW PUBLICATIONS

The Division of Water announces the availability of the following new publications:

The Ground-Water Resources of Adams County by James M. Raab

This new map is one in a series of 70 county ground-water resources maps which have been completed for the state. Ground-water resources maps are prepared by staff hydrogeologists. These maps show the regional ground-water characteristics based on interpretations of water well drilling records and local geology. These color-coded maps provide well log data for many point locations. Information provided by the maps include typical depths of wells, water-bearing formations and estimated yields for wells in the area.

Ground-water resources maps can be used as a guide for locating new or expanding existing ground-water supplies. They are useful to homeowners, ground-water consultants, engineers, planners and developers.

The cost for this map and the other available maps is \$6.53 (includes postage, handling and tax).

Ohio Department of Natural Resources Calendar

The 1990 Ohio Department of Natural Resources (ODNR) calendars are available now. These 13-month calendars feature a full-color photo of a different Ohio bird each month. In addition, each month has a listing of ODNR-sponsored events, as well as notations for holidays and lunar phases. Included in the back pages are useful reference guides to the various facilities located at Ohio's state parks, forests, wildlife areas, nature preserves and boating sites. District offices throughout the state for various ODNR divisions are also listed.

The cost for the 1990 ODNR calendar is \$4.00 (includes postage, handling and tax). The two publications may be ordered from the ODNR Publications Center, Fountain Square, Building B-1, Columbus, Ohio, 43224. Make checks or money orders payable to ODNR Publication Center.

U.S. GEOLOGICAL SURVEY PUBLISHES GROUND-WATER LEVEL MAP

The U.S. Geological Survey has published a report titled "Potentiometric-Surface Map of the Carbonate Aquifer in Silurian and Devonian Rocks, Lucas, Sandusky and Wood Counties, Northwestern Ohio, July 1986" by Kevin J. Breen. This map, published in cooperation with several county and municipal agencies, shows generalized ground-water levels which represent the potentiometric surface (the level to which ground-water will rise in cased wells) in the carbonate (limestone/dolomite) aquifer used extensively as a water source throughout northwestern Ohio. This map is suitable for defining generalized directions of horizontal ground-water flow and as a reference for identifying future ground-water level rises or declines in this area. Published as U.S. Geological Survey Water-Resources Investigations Report 88-4144, this map costs \$3.25 and can be ordered from the Books and Open-File Reports Section, U.S. Geological Survey, Box 25425, Federal Center, Denver, CO., 80225.

SAN FRANCISCO EARTHQUAKE MAKES ITS MARK IN OHIO

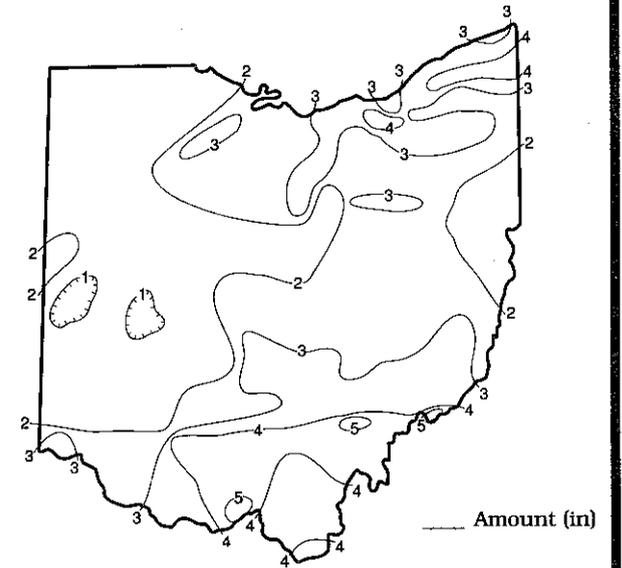
On October 17 at 8:04 pm EDT, an earthquake measuring 7.1 on the open-ended Richter scale rocked the San Francisco Bay area in California causing severe damage and the loss of several lives. Shock waves, radiating out from the quake's epicenter, traveled through rock formations and reached Ohio. Seismic waves, as they pass through rock formations, cause an alternate compression and expansion of the material. Water levels in some wells finished in certain rock formations may rise and fall with the passing of these waves. Several wells in Ohio's observation well network have shown responses to earthquakes in the Western Hemisphere. Minimum Richter scale readings of 6.5 to 7.0, depending on the quake's location, are necessary for wells in Ohio to show response. The most sensitive well in Ohio's observation well network is Vw-1, located in Van Wert. Seismic waves from the San Francisco earthquake caused a .22 foot fluctuation of water levels in this well. The most notable event in this well occurred March 27, 1964 when the fluctuation was 5.8 feet following the Alaskan earthquake that had a Richter magnitude of 8.4.

ACKNOWLEDGEMENTS

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Precipitation data:
U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Weather Service; The Miami Conservancy District; U.S. Army Corps of Engineers, Muskingum Area.
Streamflow and reservoir storage data:
U.S. Geological Survey, Water Resources Division.
Lake Erie level data:
U.S. Army Corps of Engineers, Detroit District.
Palmer Drought Severity Index:
U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Weather Service.

PRECIPITATION OCTOBER 1989



PRECIPITATION for October was above normal in most of the eastern two-thirds of the state and noticeably below normal in the western one-third. The average for the state as a whole was 2.50 inches, 0.16 inch above normal. Regional averages ranged from 4.08 inches, 1.84 inches above normal, for the South Central Region to 1.24 inches, 1.10 inches below normal, for the West Central Region. Shawnee State Forest (Scioto County) reported the greatest amount of precipitation for the month, 5.40 inches; Athens (Athens County) reported 5.32 inches. St. Paris (Champaign County) reported the least amount, 0.66 inch; Versailles (Darke County) reported 0.68 inch.

Precipitation varied greatly throughout the state during the month. The bulk of the precipitation fell during the first three weeks with October 16-21 being the period with the most widespread precipitation. Precipitation totals during the first week were usually less than .25 inch except in the southern and northeastern portions of the state where storms on October 1-2 produced from .5 to over 1.5 inches at some locations. During the second week, scattered showers on October 9-10 generally produced about .5 inch at most locations with slightly higher amounts occurring again in the southern portion of the state. The third week brought the bulk of the month's precipitation for most locations which reported precipitation daily from October 16-21. The most notable event during this period occurred on October 19 when up to 6 inches of snow fell in the southwestern portion of the state. Weekly totals for the third week ranged from less than .5 inch in the western portion of the state to between 2 and 3 inches in the southern portion and over 3 inches in the Cleveland area. No precipitation occurred during the fourth week of the month as the entire state enjoyed "Indian summer" conditions. Light precipitation returned the last day of the month with less than .25 inch totals throughout much of the state.

Precipitation for the 1989 water year is above normal throughout the state. The average for the state as a whole is 38.24 inches, 5.90 inches above normal. Regional averages range from 48.08 inches, 13.85 inches above normal, for the Southeast Region to 29.30 inches, 0.22 inch above normal, for the Northwest Region. With two months left in the calendar year, the state average of 38.24 inches is already 0.67 inch above the annual 50-year state average of 37.57 inches.

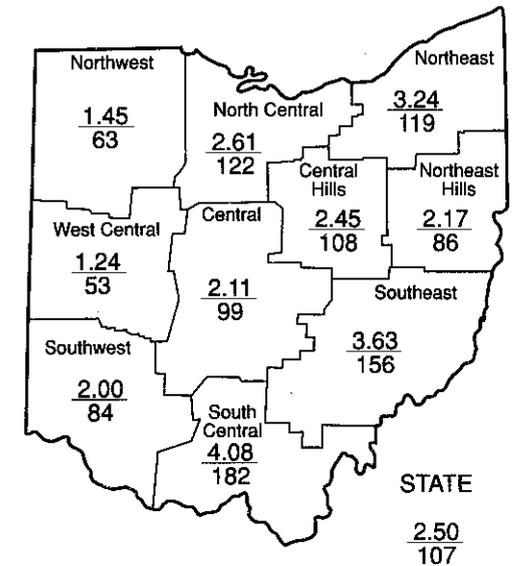
The first month of the new 1990 water year is off to a good start in

(continued on back)

PRECIPITATION

Region	DEPARTURE FROM NORMAL (IN.)					Palmer Drought Severity Index*
	This Month	Past				
		3 Mos.	6 Mos.	12 Mos.	24 Mos.	
Northwest	-0.84	-0.47	+2.22	+1.56	-4.30	-0.4
North Central	+0.47	-0.95	+2.94	+2.88	-6.62	+0.4
Northeast	+0.52	+0.75	+7.08	+6.62	+0.84	+1.2
West Central	-1.10	+0.52	+5.12	+8.51	-0.80	+0.6
Central	-0.03	+0.29	+4.52	+7.74	+2.61	+2.2
Central Hills	+0.19	-1.29	+2.73	+3.95	-1.44	+0.2
Northeast Hills	-0.36	-1.50	+2.88	+3.39	-4.75	+0.8
Southwest	-0.39	+0.28	+3.03	+8.79	+3.02	+1.8
South Central	+1.84	+4.34	+5.68	+13.27	+1.27	+3.4
Southeast	+1.30	+4.44	+8.15	+15.09	+9.62	+2.8
State	+0.16	+0.64	+4.43	+7.18	+0.10	

*Above +4 = Extreme Moist Spell
3.0 To 3.9 = Very Moist Spell
2.0 To 2.9 = Unusual Moist Spell
1.0 To 1.9 = Moist Spell
0.5 To 0.9 = Incipient Moist Spell
0.4 To 0.4 = Near Normal
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Below -4.0 = Extreme Drought



Average (in)
Percent of normal

ODNR

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MEAN STREAM DISCHARGE

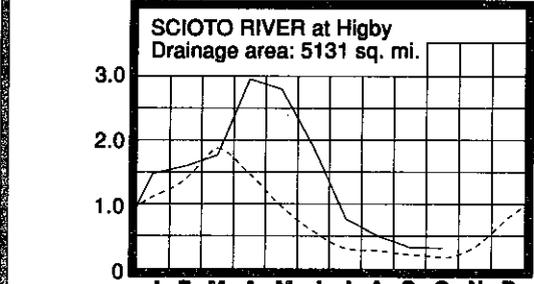
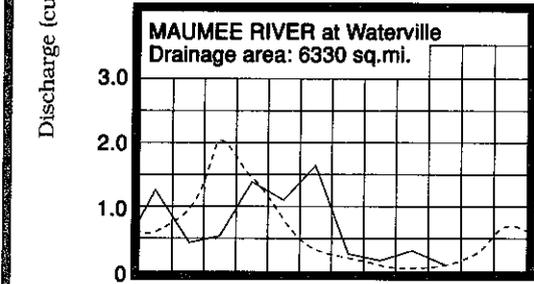
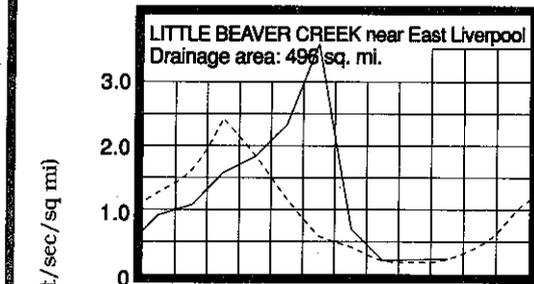
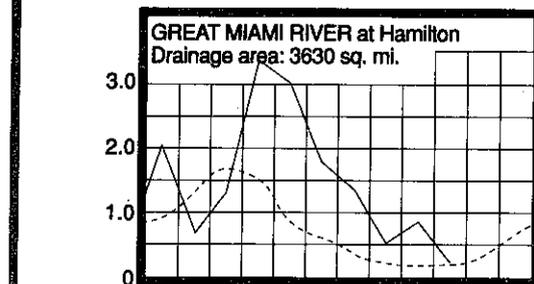
River and Location	Drainage Area (Sq. Mi.)	This Month		% of Normal Past		
		Mean Discharge (CFS)	% of Normal	3 Mos.	6 Mos.	12 Mos.
Grand River near Painesville	685	500	208	52	241	123
Great Miami River at Hamilton	3,630	994	147	238	284	150
Huron River at Milan	371	18.6	84	43	209	94
Killbuck Creek at Killbuck	464	145	178	90	236	117
Little Beaver Creek near East Liverpool	496	112	103	92	209	104
Maumee River at Waterville	6,330	620	112	154	176	90
Muskingum River at McConnelsville	7,422	2,590	154	114	196	123
Scioto River near Prospect	567	43.5	145	151	471	129
Scioto River at Higby	5,131	1,915	252	176	228	141
Stillwater River at Pleasant Hill	503	110	201	579	435	160

STREAMFLOW for October was above normal throughout the state except in the north central portion where flows were below normal. Flows in the central and south central portions were high enough to be considered excessive. Flows in the western portion of the state were sustained from last month's precipitation as this area received noticeably below normal precipitation this month. Flows at the beginning of the month were above normal except in the northern portion of the state where they were below normal. Flows fluctuated throughout the month in response to precipitation and were the greatest during the October 20-24 period throughout the state following the widespread precipitation the previous week. Lowest flows occurred the first few days of the month in the northern and central portions of the state and around October 16-17 elsewhere before the widespread precipitation started. Flows at the month's end were still above normal throughout the state except in the northern portion where they returned to below normal after reaching maximum flows.

RESERVOIR STORAGE for water supply during October decreased in both the Mahoning and Scioto river basins. Storage at the month's end was above normal in both basins.

Reservoir storage at the month's end for the Mahoning basin index reservoirs was 73 percent of rated capacity for water supply compared with 82 percent for last month and 57 percent for October 1988. Month-end storage in the Scioto basin index reservoirs was 74 percent of rated capacity for water supply compared with 82 percent for last month and 65 percent for October 1988.

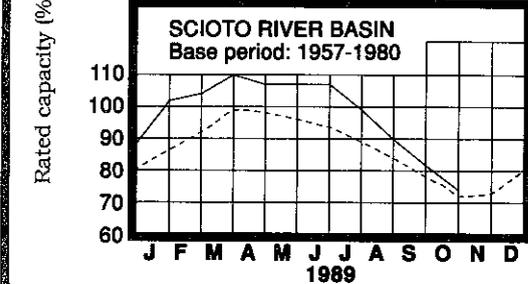
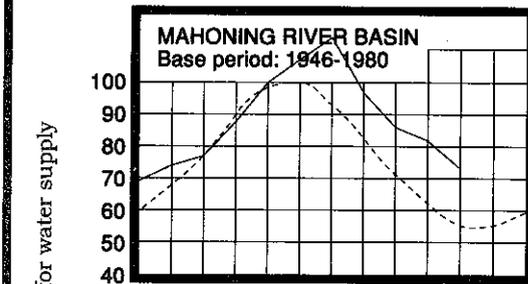
MEAN STREAM DISCHARGE



Base period for all streams: 1951-1980

Normal - - - - Current - - - -

RESERVOIR STORAGE FOR WATER SUPPLY



GROUND-WATER LEVELS

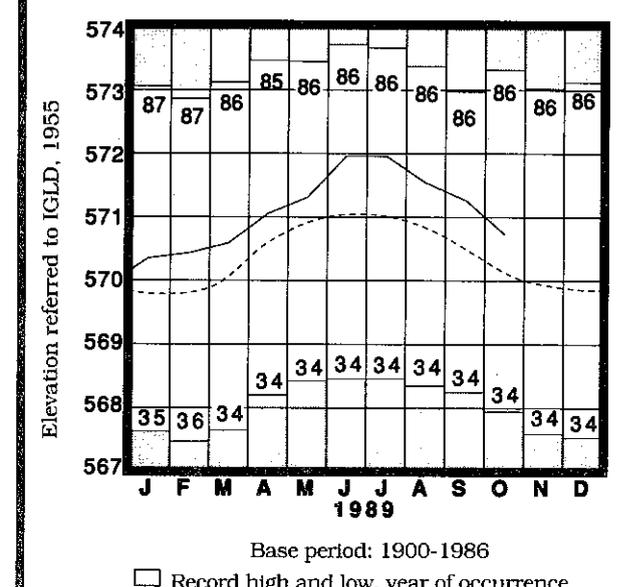
declined throughout the month in most areas of the state. A few exceptions were noted in shallow sand and gravel aquifers in the south central and southeastern portions of the state where the above normal precipitation resulted in slight net recharge causing levels to remain stable or rise slightly during the month. Generally, ground-water levels are above normal throughout most of the state. Exceptions are in sand and gravel aquifers in the western and northeastern portions of the state where levels are below normal in response to below normal precipitation. Ground-water levels throughout the state are noticeably above those levels of a year ago, ranging from about 1 to over 4.5 feet above those 1988 levels. Ground-water storage is in a favorable position as the 1990 water year begins.

LAKE ERIE level declined during October. The mean level for October was 570.76 feet (IGLD-1955), 0.50 foot below last month's mean level and 0.56 foot above normal. This month's mean level is 0.40 foot above the October 1988 level and 2.16 feet above Low Water Datum.

SUMMARY

Precipitation was above normal in the eastern two-thirds of the state and below normal in the western one-third. Streamflow was above normal throughout most of the state. Reservoir storage declined but remained above normal. Ground-water levels declined in most aquifers in the state. Lake Erie level declined but remains above normal.

LAKE ERIE LEVELS at Cleveland

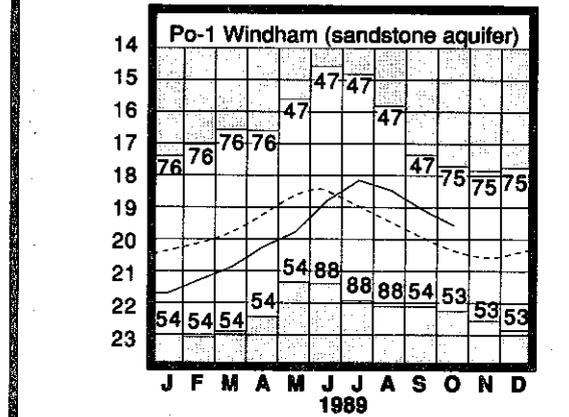
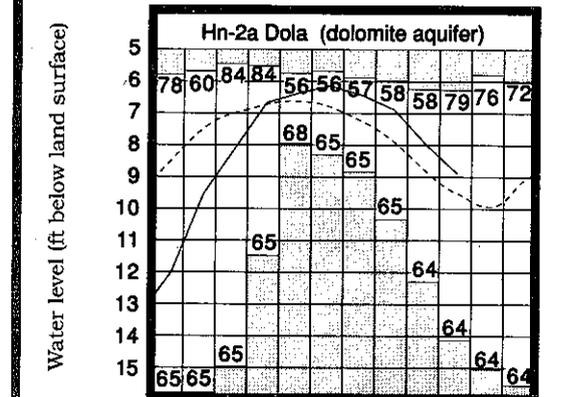
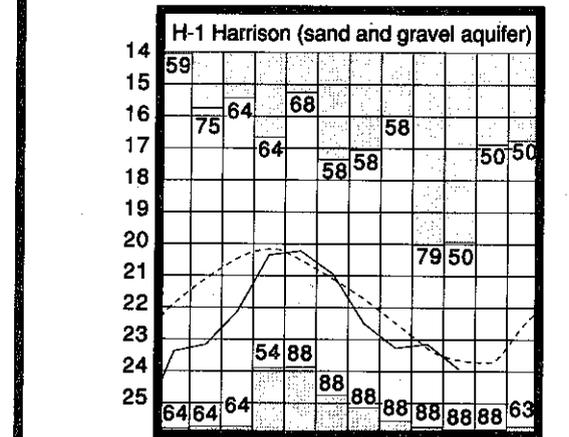


GROUND-WATER LEVELS

Based on daily lowest level in feet below land-surface datum

Index Well	Location	Aquifer	Mean This Month	Departure From Normal	Change in feet from:	
					Last Month	Year Ago
F-1	W. Rushville, Fairfield Co.	Sandstone	15.90	+0.70	-0.09	+4.50
Fa-1	Jasper Mill, Fayette Co.	Limestone	8.39	+0.53	-0.53	+1.88
Fr-10	Columbus, Franklin Co.	Gravel	42.44	+2.64	+0.14	+2.44
H-1	Harrison, Hamilton Co.	Gravel	23.93	-0.29	-0.79	+1.96
Hn-2a	Dola, Hardin Co.	Dolomite	8.91	+0.82	-0.96	+3.39
Po-1	Windham, Portage Co.	Sandstone	19.58	+0.76	-0.51	+2.34
Tu-1	Strasburg, Tuscarawas Co.	Gravel	14.80	-1.42	-0.30	+0.76

GROUND-WATER LEVELS



Base periods: H-1, 1951-1979. Hn-2a, 1955-1979. Po-1, 1947-1979 □ Record high and low, year of occurrence

Normal - - - - Current - - - -



MONTHLY WATER INVENTORY REPORT FOR OHIO

NOVEMBER 1989

Compiled By David H. Cashell
Hydrologist
Water Inventory Unit

SUMMARY
Precipitation was above normal in most of the state but slightly below normal in the northwestern and southeastern portions. Streamflow was above normal throughout most of the state. Reservoir storage declined and was near to above normal. Groundwater levels showed mixed responses during the month but remained above normal throughout most of the state. Lake Erie level declined seasonally and was 0.45 foot above normal.

NOTES AND COMMENTS

Water Withdrawal Registration Forms Available

The Division of Water is initiating the Water Withdrawal Registration Program pursuant to Section 1521.16 of the Ohio Revised Code. The program focuses upon owners of any facilities or combination of facilities with the capacity to withdraw at least 100,000 gallons of water daily (70 gallons per minute). Owners of water withdrawal facilities which meet this criterion must register the facility with the Division of Water and then submit annual reports of withdrawals on forms provided by the division. The registration forms will be available in January 1990 from the Division of Water. All existing facilities must be registered in 1990. An incentive to register is that if a court ever considers a conflict between users and if priority in time is a consideration, the date of registration shall be conclusive evidence of which use was established first. For more information or registration forms, write to the Division of Water, Water Resources Development Section or call (614)265-6750.

Two "New" Employees Added To GWRS Staff

Two longtime employees formerly with the Division of Water have come out of retirement and rejoined the Ground-Water Resources Section (GWRS) as part-time employees. Geologists Alfred C. (Al) Walker and James J. (Jim) Schmidt, each employed with the state of Ohio for over 30 years before retiring, have returned to complete the remaining county ground-water resources maps. Their vast knowledge of Ohio's geology and experience in ground-water resources will be used in mapping the final 18 counties, projected for completion in 1990.

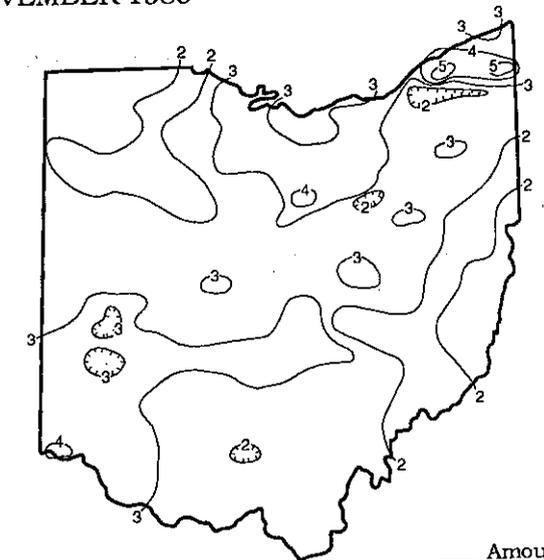
PRECIPITATION for November was slightly above normal throughout much of the state; exceptions were in the Northwest, Northeast Hills, South Central and Southeast regions where precipitation was slightly below normal. The average for the state as a whole was 2.69 inches, 0.04 inch above normal. Regional averages ranged from 3.23 inches, 0.35 inch above normal, for the Northeast Region to 2.09 inches, 0.34 inch below normal, for the Northwest Region. Andover (Ashtabula County) reported the greatest amount of precipitation for the month, 5.44 inches. Caldwell (Noble County) reported the least, 1.58 inches.

Precipitation fell during every week of the month; snowfall was scarce with only the northern portion of the state, especially the northeastern snow belt areas, receiving more than an inch or so. Precipitation totals during the first week of the month were around 0.5 inch at most locations with lesser amounts in the northwestern portion of the state. During the second week, totals were again around 0.5 inch at most locations increasing to slightly over 1 inch in the southwestern portion of the state. The third week of the month brought the bulk of the precipitation for most locations. Storms during November 15-16 produced 1-2 inches of precipitation at most locations. Additional precipitation during the week came mostly in the form of lake-effect snow in the north central and northeastern portions of the state. The remainder of the month was rather dry with local totals ranging from 0.1 to 0.5 inch with slightly higher amounts in the southwestern portion of the state.

Precipitation for the 1989 calendar year is above normal throughout most of the state with only the Northwest Region being slightly below normal. The average for the state as a whole is 40.92 inches, 5.93 inches above normal. Regional averages range from 50.25 inches, 13.38 inches above normal, for the Southeast Region to 31.39 inches, 0.12 inch below normal, for the Northwest Region.

Precipitation for the first two months of the 1990 water year is above normal throughout most of the eastern two-thirds of the state; precipitation is below normal in the Northwest, West Central, Southwest and Northeast Hills regions. The average for the state as a whole is 5.18 inches, 0.19 inch above normal. Regional averages range from 6.47 inches, 0.87 inch above normal, for the Northeast Region to 3.54 inches, 1.18 inches below normal, for the Northwest Region.

PRECIPITATION
NOVEMBER 1989

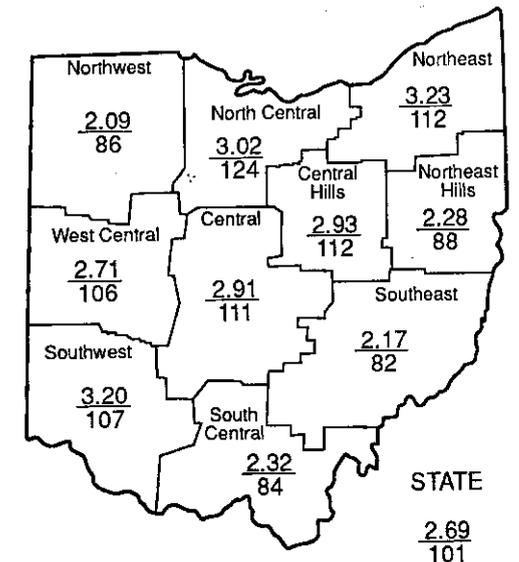


— Amount (in)

PRECIPITATION

Region	DEPARTURE FROM NORMAL (IN.)					Palmer Drought Severity Index*
	This Month	Past				
		3 Mos.	6 Mos.	12 Mos.	24 Mos.	
Northwest	-0.34	-0.29	+0.47	-0.50	-4.59	+0.6
North Central	+0.59	+1.50	+0.63	+1.86	-5.47	+1.1
Northeast	+0.35	+2.57	+3.93	+6.14	+2.51	+2.7
West Central	+0.15	+0.21	+2.32	+6.55	+0.09	+2.6
Central	+0.29	+0.10	+2.19	+6.36	+4.04	+2.5
Central Hills	+0.32	+1.25	+0.78	+2.69	+0.16	+1.0
Northeast Hills	-0.32	+0.27	+0.45	+1.81	-4.70	+0.7
Southwest	+0.22	+0.36	+0.94	+7.57	+4.18	+2.6
South Central	-0.45	+3.01	+4.72	+11.02	+1.88	+3.2
Southeast	-0.47	+2.16	+5.24	+13.06	+9.86	+3.6
State	+0.04	+1.12	+2.17	+5.66	+1.02	

*Above +4 = Extreme Moist Spell
3.0 To 3.9 = Very Moist Spell
2.0 To 2.9 = Unusual Moist Spell
1.0 To 1.9 = Moist Spell
0.5 To 0.9 = Incipient Moist Spell
0.4 To 0.4 = Near Normal
-0.5 To -0.9 = Incipient Drought
-1.0 To -1.9 = Mild Drought
-2.0 To -2.9 = Moderate Drought
-3.0 To -3.9 = Severe Drought
Below -4.0 = Extreme Drought



STATE
2.69
101

Average (in)
Percent of normal

ACKNOWLEDGEMENTS

This report has been compiled from Division of Water data and from information supplied by the following:

- Precipitation data: U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Weather Service; The Miami Conservancy District; U.S. Army Corps of Engineers, Muskingum Area.
- Streamflow and reservoir storage data: U.S. Geological Survey, Water Resources Division.
- Lake Erie level data: U.S. Army Corps of Engineers, Detroit District.
- Palmer Drought Severity Index: U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Weather Service.

ODNR

OHIO DEPARTMENT OF
NATURAL RESOURCES

DIVISION OF WATER
1939 FOUNTAIN SQUARE
COLUMBUS, OHIO 43224

Richard F. Celeste
Governor

Joseph J. Sommer
Director

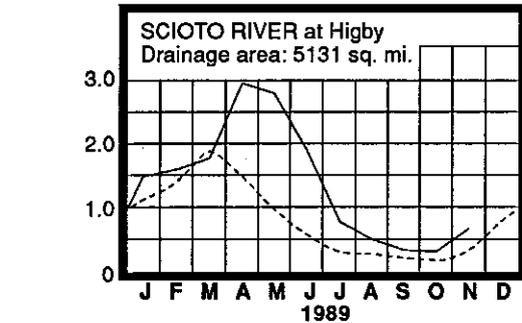
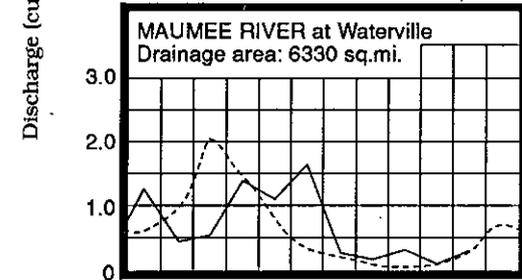
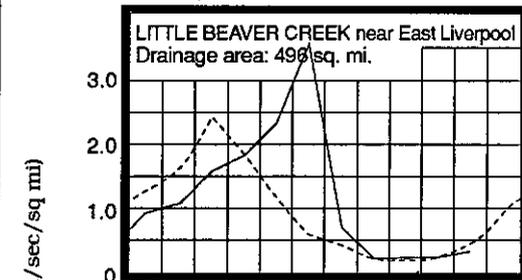
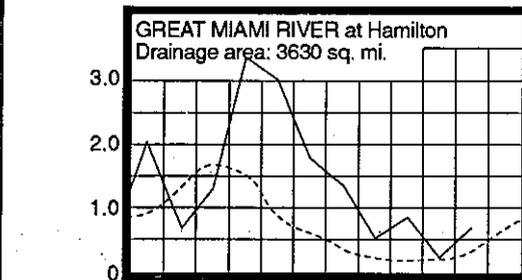
Robert L. Goettmoeller
Chief



MEAN STREAM DISCHARGE

River and Location	Drainage Area (Sq. Mi.)	Mean Discharge (CFS)	% of Normal	% of Normal Past		
				3 Mos.	6 Mos.	12 Mos.
				This Month		
Grand River near Painesville	685	1,297	117	91	175	123
Great Miami River at Hamilton	3,630	2,452	223	239	262	151
Huron River at Milan	371	121	149	82	142	93
Killbuck Creek at Killbuck	464	268	180	133	205	115
Little Beaver Creek near East Liverpool	496	152	75	79	195	103
Maumee River at Waterville	6,330	1,847	114	116	203	84
Muskingum River at McConnelsville	7,422	4,865	132	142	186	122
Scioto River near Prospect	567	177	317	141	210	130
Scioto River at Higby	5,131	3,320	204	176	200	141
Stillwater River at Pleasant Hill	503	317	377	525	307	164

MEAN STREAM DISCHARGE



Base period for all streams: 1951-1980

Normal - - - - Current - - - -

STREAMFLOW for November was above normal throughout most of the state with only the extreme eastern portion having below normal flows. Flows in the southwestern and central portions of the state were high enough to be considered excessive. Flows throughout the state were greater than last month's flows.

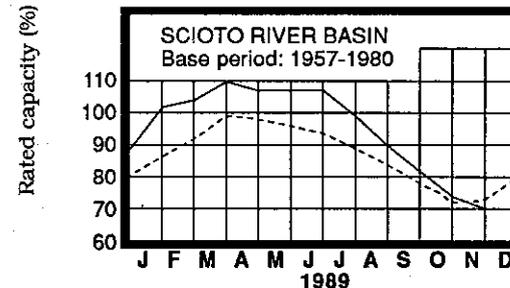
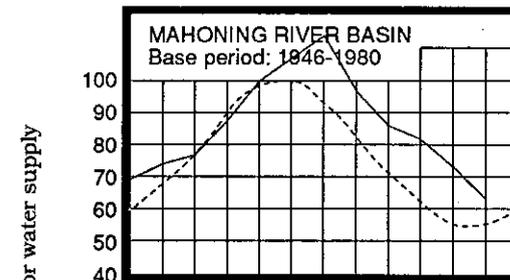
Flows at the beginning of the month were below normal throughout most of the state. Flows decreased the first week with the lowest flows for the month occurring during this period. Slight increases were noted early in the second week of the month, but flows again continued to decrease until mid-month. Flows increased rapidly after substantial widespread precipitation on November 15-16 with the greatest

flows for the month occurring soon after this event then declining until the end of the month. Month-end flows were above normal in the southern portion of the state and below normal in most areas of the northern portion.

RESERVOIR STORAGE for water supply during November declined in both the Mahoning and Scioto river basins. Storage remained above normal in the Mahoning basin reservoirs but fell to below normal in the Scioto basin reservoirs for the first time since October 1988.

Reservoir storage at the month's end for the Mahoning basin index reservoirs was 63 percent of rated capacity for water supply compared with 73 percent for last month and 66 percent for November 1988. Month-end storage in the Scioto basin index reservoirs was 70 percent of rated capacity for water supply compared with 74 percent for last month and 84 percent for November 1988.

RESERVOIR STORAGE FOR WATER SUPPLY



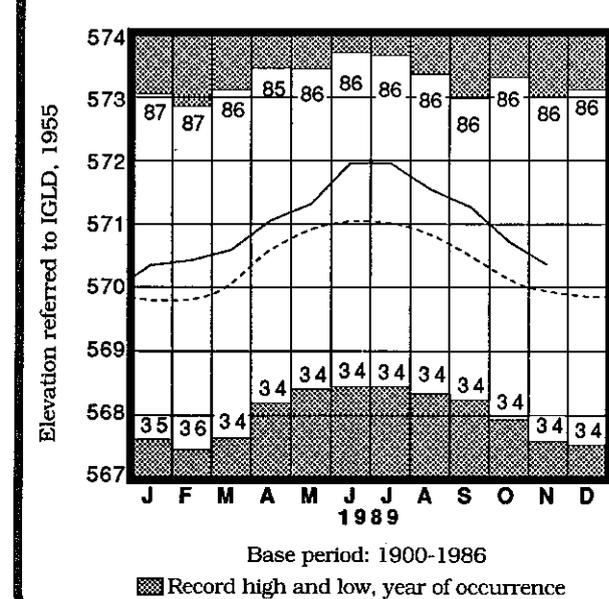
GROUND-WATER LEVELS during November showed mixed responses throughout the state. Generally, ground-water levels rose slightly from last month's levels in the southern half of the state and declined slightly from last month's levels in the northern half of the state. Consolidated aquifers declined throughout the month in the northern portion of the state whereas in the southern portion levels declined through mid-month and then began to rise. In shallow sand and gravel aquifers state wide, levels were stable or declined slightly until the middle of the month when levels rose in response to the widespread precipitation on November 15-16.

Ground-water levels throughout the state are slightly above normal with only unconsolidated aquifers in the eastern portion of the state being below normal. Levels throughout the state are noticeably above levels of a year ago. Ground-water storage is in a favorable position at this time and continued improvement can be expected during the up-coming recharge period provided precipitation and other meteorological conditions are near normal.

LAKE ERIE level declined seasonally during November. The mean level for November was 570.37 feet (IGLD-1955), 0.39 foot below last month's mean level and 0.45 foot above the long-term November normal level. This month's mean level is 0.10 foot above the November 1988 level and 1.77 feet above Low Water Datum.

The United States Army Corps of Engineers reports that 1989 precipitation through October for the entire Great Lakes basin has been below normal in seven of the 10 months. Levels for Lakes Superior, Michigan and Huron are below normal while the remaining lake levels are above normal.

LAKE ERIE LEVELS at Cleveland

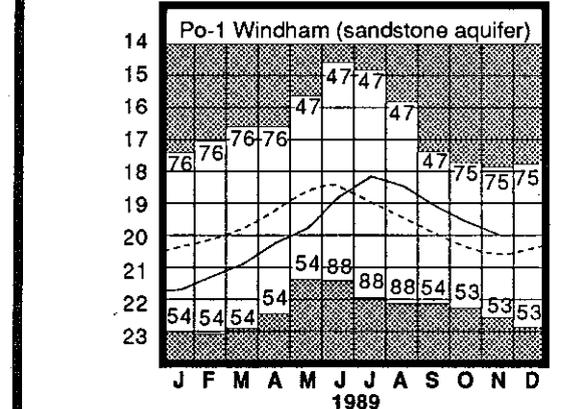
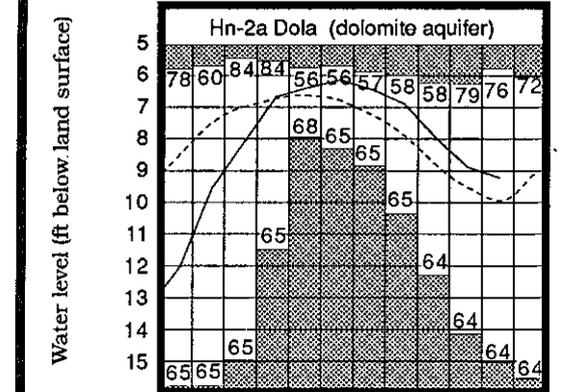
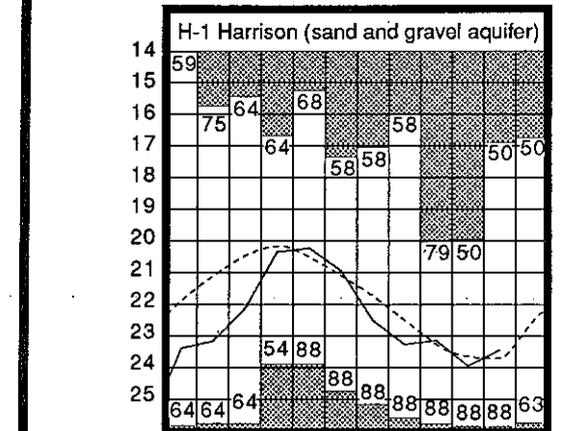


GROUND-WATER LEVELS

Based on daily lowest level in feet below land-surface datum

Index Well	Location	Aquifer	Mean This Month	Departure From Normal	Change in feet from:	
					Last Month	Year Ago
F-1	W. Rushville, Fairfield Co.	Sandstone	16.66	+0.36	-0.76	+3.88
Fa-1	Jasper Mill, Fayette Co.	Limestone	8.17	+0.87	+0.22	+1.12
Fr-10	Columbus, Franklin Co.	Gravel	42.26	+2.52	+0.18	+2.30
H-1	Harrison, Hamilton Co.	Gravel	23.43	+0.27	+0.50	+1.96
Hn-2a	Dola, Hardin Co.	Dolomite	9.23	+0.69	-0.32	+3.94
Po-1	Windham, Portage Co.	Sandstone	19.99	+0.57	-0.41	+1.75
Tu-1	Strasburg, Tuscarawas Co.	Gravel	14.81	-1.47	-0.01	+0.48

GROUND-WATER LEVELS



Normal - - - - Current - - - -



MONTHLY WATER INVENTORY REPORT FOR OHIO DECEMBER 1989

Compiled By David H. Cashell
Hydrologist
Water Inventory Unit

(continued from front page)

third wettest year in the South Central Region since records began. Fernbank (Hamilton County) reported the greatest amount of precipitation for the year, 66.83 inches. Grover Hill (Paulding County) reported the least amount for the year, 29.10 inches. Several other locations including Hicksville, Defiance, Ottawa, Lima and Sandusky also reported less than 30 inches of precipitation for the year. An isohyetal map and regional averages and departures from normal for the 1989 calendar year appear on the last page of this report.

Precipitation during 1989 was noticeably greater than during 1988. Although the year started off with below normal precipitation in January, conditions improved throughout the remainder of the water supply recharge period. Precipitation was noticeably above normal in the southern two-thirds of the state from February through April, but remained generally below normal in the northern portion. In May and June, precipitation was noticeably above normal throughout the state. These wet conditions delayed spring crop planting in many areas. Conditions during the summer months were typical with scattered thunderstorms leaving some areas wet and some areas dry. The fall months continued this trend of variable statewide precipitation with most areas averaging slightly below normal during this period. Although the year ended with below normal precipitation and record-breaking cold temperatures statewide in December, water supply conditions had improved noticeably during the year and were in a favorable position at the year's end.

PRECIPITATION for December was below normal statewide. The average for the state as a whole was 1.64 inches, 0.94 inch below normal. Regional averages ranged from 2.02 inches, 0.62 inch below normal, for the Northeast Region to 1.25 inches, 1.06 inches below normal, for the Northwest Region. Andover (Ashtabula County) reported the greatest amount of precipitation for the month, 5.03 inches. Crane Creek State Park (Ottawa County) reported the least amount, 0.75 inch.

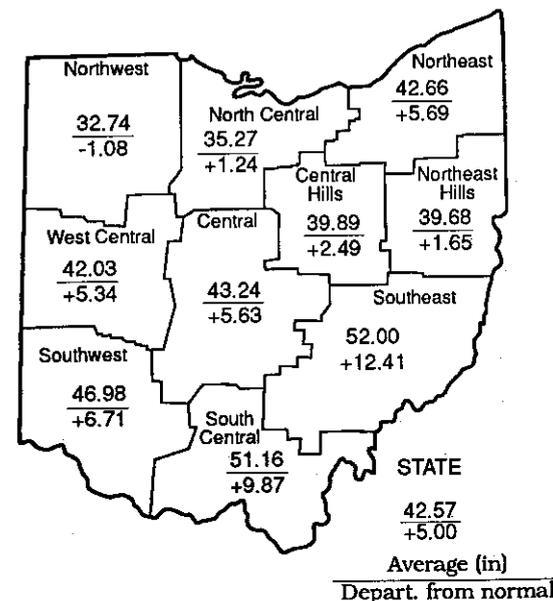
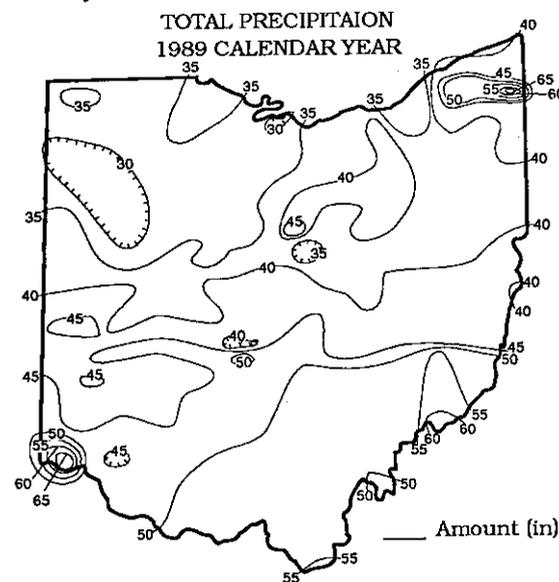
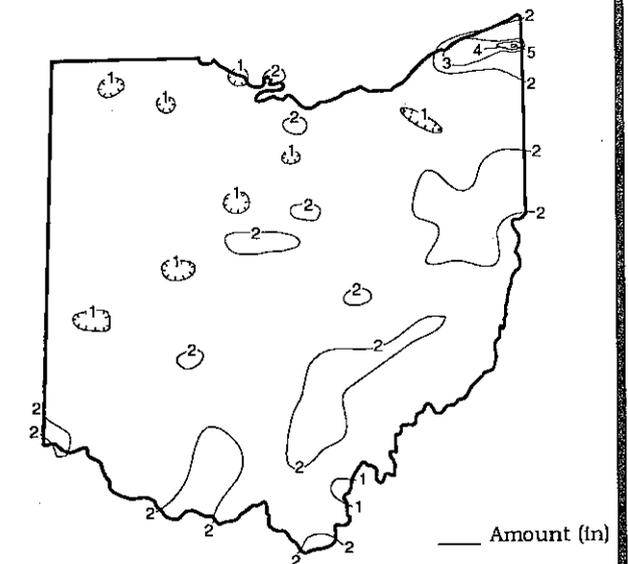
Precipitation was rather light during most of the month. Weekly totals were generally around 0.25 inch for most locations the first and third weeks and less the second and fourth weeks; slightly greater amounts were received in the northeastern snowbelt areas. The bulk of the precipitation during this period was in the form of snow. Snow that fell after December 15 remained on the ground until the last day or two of the month as the entire state endured record-breaking cold temperatures. In fact, this was the coldest December on record throughout the state. Finally, temperatures started to warm-up on December 29 accompanied by widespread precipitation until the end of the month. Precipitation totals during the last few days of the month were around 1 inch at most locations with slightly lower amounts in the western and northwestern portions of the state. This precipitation, coupled with the melting snow and frozen ground, resulted in minor flooding of low-lying areas in several areas of the state.

Precipitation for the 1990 water year is below normal throughout most of the state; exceptions are in the North Central, Northeast and South Central regions where precipitation is slightly above normal. The average for the state as a whole is 6.84 inches, 0.73 inch below normal. Regional averages range from 8.49 inches, 0.25 inch above normal, for the Northeast Region to 4.79 inches, 2.24 inches below normal, for the Northwest Region.

Precipitation for the 1989 calendar year was above normal throughout most of the state with only the Northwest Region having slightly below normal precipitation. The average for the state as a whole was 42.57 inches, 5.00 inches above normal. This ranks 1989 as the 17th wettest year during the past 107 years. Regional averages ranged from 52.00 inches, 12.41 inches above normal, for the Southeast Region to 32.74 inches, 1.08 inches below normal, for the Northwest Region. This was the wettest year in the Southeast Region and the

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PRECIPITATION DECEMBER 1989

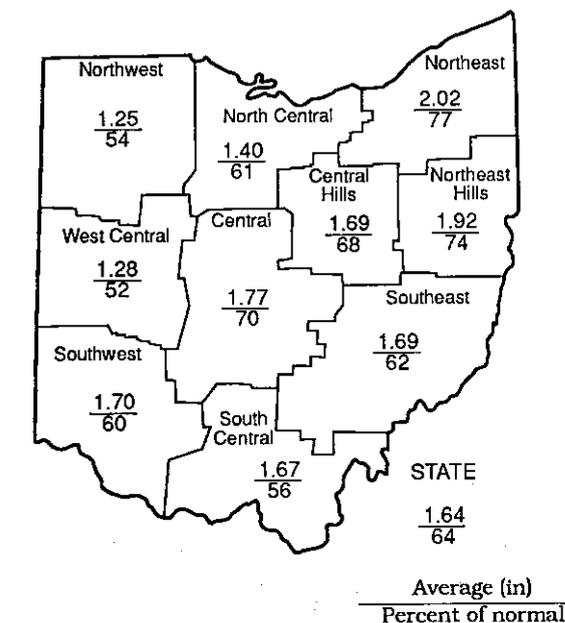


PRECIPITATION

Region	DEPARTURE FROM NORMAL (IN.)					Palmer Drought Severity Index*
	This Month	3 Mos.	6 Mos.	12 Mos.	24 Mos.	
Northwest	-1.06	-2.24	-0.64	-1.08	-6.73	+0.4
North Central	-0.88	+0.20	-1.36	+1.24	-6.97	+0.9
Northeast	-0.62	+0.25	-0.40	+5.69	+1.72	+2.5
West Central	-1.19	-2.16	+0.10	+5.34	-1.67	+2.4
Central	-0.76	-0.49	-0.09	+5.63	+3.02	+2.6
Central Hills	-0.78	-0.20	-2.99	+2.49	-0.34	+0.7
Northeast Hills	-0.66	-1.30	-4.20	+1.65	-5.05	+0.2
Southwest	-1.12	-1.25	-0.24	+6.71	+2.65	+2.5
South Central	-1.29	+0.04	+1.77	+9.87	+0.75	+3.1
Southeast	-1.03	-0.14	+2.34	+12.41	+8.44	+3.4
State	-0.94	-0.72	-0.57	+5.00	-0.23	

*Above +4 = Extreme Moist Spell
3.0 To 3.9 = Very Moist Spell
2.0 To 2.9 = Unusual Moist Spell
1.0 To 1.9 = Moist Spell
0.5 To 0.9 = Incipient Moist Spell
0.4 To -0.4 = Near Normal

-0.5 To -0.9 = Incipient Drought
-1.0 To -1.9 = Mild Drought
-2.0 To -2.9 = Moderate Drought
-3.0 To -3.9 = Severe Drought
Below -4.0 = Extreme Drought



ACKNOWLEDGEMENTS

This report has been compiled from Division of Water data and from information supplied by the following:

Precipitation data:
U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Weather Service; The Miami Conservancy District; U.S. Army Corps of Engineers, Muskingum Area.
Streamflow and reservoir storage data:
U.S. Geological Survey, Water Resources Division.
Lake Erie level data:
U.S. Army Corps of Engineers, Detroit District.
Palmer Drought Severity Index:
U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Weather Service.

ODNR

OHIO DEPARTMENT OF
NATURAL RESOURCES

DIVISION OF WATER
1939 FOUNTAIN SQUARE
COLUMBUS, OHIO 43224

Richard F. Celeste
Governor

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Director

Robert L. Goetmoeller
Chief



MEAN STREAM DISCHARGE

River and Location	Drainage Area (Sq. Mi.)	Mean Discharge (CFS)	% of Normal	% of Normal Past		
				3 Mos.	6 Mos.	12 Mos.
				This Month		
Grand River near Palmsville	685	1,212	68	95	75	123
Great Miami River at Hamilton	3,630	1,159	49	94	166	148
Huron River at Milan	371	80	51	53	45	91
Killbuck Creek at Killbuck	464	170	63	101	98	114
Little Beaver Creek near East Liverpool	496	128	28	53	64	102
Maumee River at Waterville	6,330	1,580	35	46	70	83
Muskingum River at McConnelsville	7,422	2,788	48	85	108	120
Scioto River near Prospect	567	86	36	73	107	130
Scioto River at Higby	5,131	1,397	34	100	132	138
Stillwater River at Pleasant Hill	503	103	31	88	232	163

STREAMFLOW for December was below normal throughout the state. Flows in some eastern portions of the state were low enough to be considered deficient. Flows throughout the state decreased contra-seasonally from last month's flows in response to the below normal precipitation and frozen conditions.

Flows at the beginning of the month were below normal throughout the state. Generally, flows statewide decreased during the month, with slight increases noted following local precipitation, until the last few days when flows increased noticeably in response to the widespread precipitation and snow melt. Greatest flows throughout the state occurred the last day of the month. Minor flooding of

low-lying areas occurred at the month's end resulting from the precipitation, snow melt and in-stream ice jams. Flows at the month's end were above normal statewide except in the northwestern and western portions where they were slightly below normal.

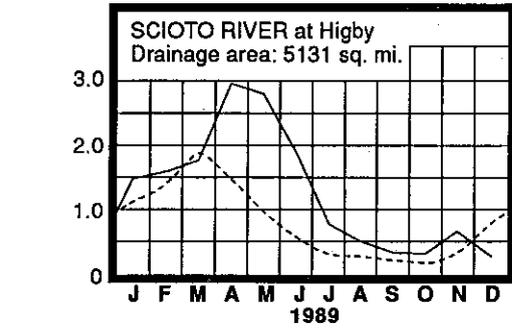
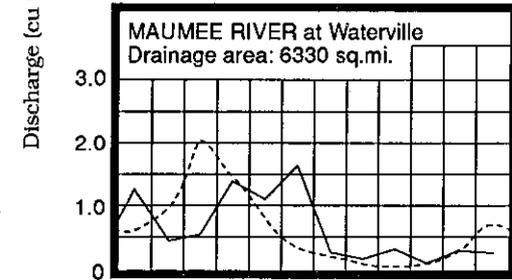
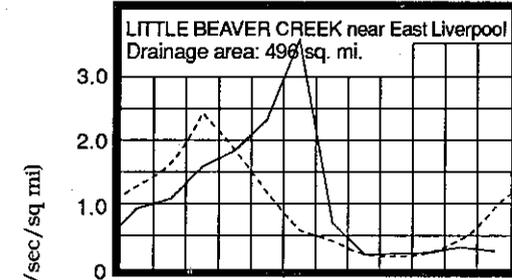
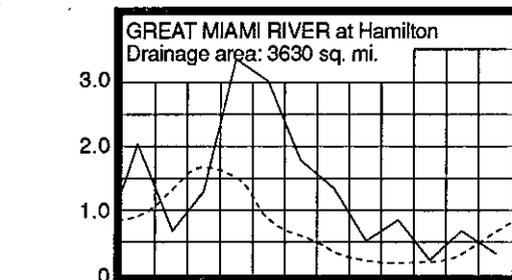
Streamflow during 1989 was above normal throughout the state except in the north central and northwestern portions where it was below normal. Excessive streamflows were noted throughout most of the year in the southern portion of the state. Notable stream and urban flooding occurred during the last week of May and to a lesser extent in June, July and August in many southwestern, western, central and northeastern areas of the state. Ten counties were declared major flood disaster areas following several flooding events.

RESERVOIR STORAGE for water supply during December decreased in both the Mahoning and Scioto river basins. Storage was below normal in both basins.

Reservoir storage at the month's end for the Mahoning basin index reservoirs was 58 percent of rated capacity for water supply compared with 63 percent for last month and 69 percent for December 1988. Month-end storage in the Scioto basin index reservoirs was 64 percent of rated capacity for water supply compared with 70 percent for last month and 88 percent for December 1988.

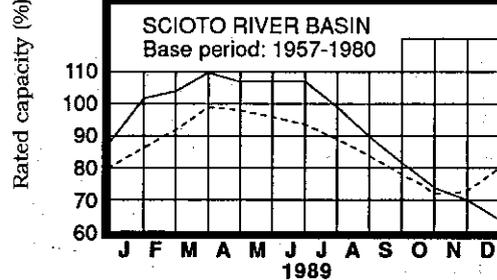
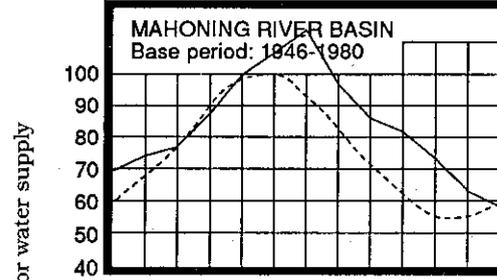
Surface water supplies during 1989 were in a favorable position throughout the year. The above normal precipitation and resulting streamflows were beneficial in filling and maintaining normal pools in both on and off-stream reservoirs. Only the March and December month-end storage for the Mahoning basin reservoirs and the November and December month-end storage for the Scioto basin reservoirs were below normal.

MEAN STREAM DISCHARGE



Base period for all streams: 1951-1980.

RESERVOIR STORAGE FOR WATER SUPPLY



Normal - - - - Current - - - -

GROUND-WATER LEVELS during December declined throughout the state in response to the below normal precipitation and frozen conditions. Levels in shallow unconsolidated aquifers, especially those adjacent to streams, were beginning to rise at the month's end in response to the New Year's Eve weekend precipitation and snow melt. December mean ground-water levels were near to below the November mean levels; ground-water levels normally rise in December throughout the state. Ground-water levels are near normal throughout most of the state but have fallen to below normal in unconsolidated aquifers in some eastern and southwestern portions of the state.

Ground-water storage improved markedly during 1989. Ground-water levels started the year noticeably below normal, but rose steadily through May and into June when levels finally returned to normal throughout most of the state. Levels declined seasonally from mid-summer through mid-fall, showed mixed responses in November, and then continued to decline contra-seasonally during December. At the year's end, ground-water levels were up to 4 feet above the December 1988 levels. Ground-water storage is in a favorable position at this time.

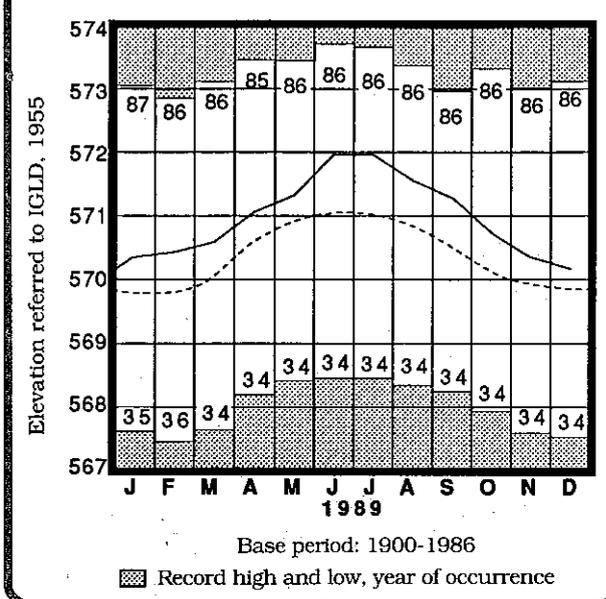
LAKE ERIE level declined during December. The mean level for December was 570.18 feet (IGLD-1955), 0.19 foot below last month's mean level and 0.33 foot above normal. This month's mean level is 0.03 foot below the December 1988 level and 1.58 feet above Low Water Datum.

The December 1989 mean level was the lowest monthly mean level for Lake Erie during the 1980s and the lowest level since March 1967. Conversely, the highest monthly mean level for Lake Erie occurred in June 1986, 573.70 feet (IGLD-1955).

SUMMARY

Precipitation was below normal throughout the state. Streamflow was below normal and reservoir storage declined to below normal. Ground-water levels and Lake Erie level both declined contra-seasonally. Lake Erie is at its lowest level since March 1967. Calendar year 1989 was a good year as far as water supplies were concerned. The state average of 42.57 inches rank 1989 as the 17th wettest year during the past 107 years. This was the wettest year on record for the Southeast Region.

LAKE ERIE LEVELS at Cleveland



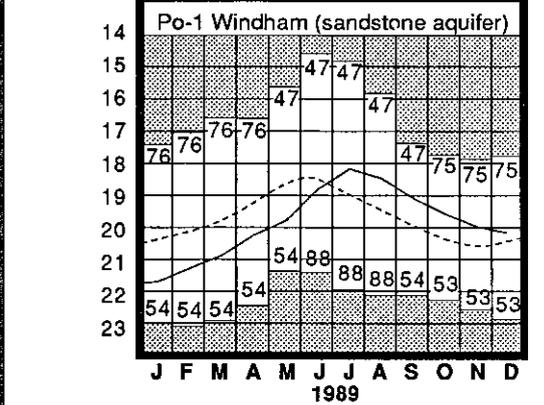
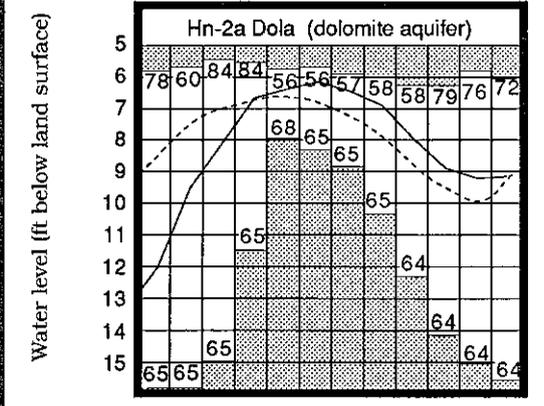
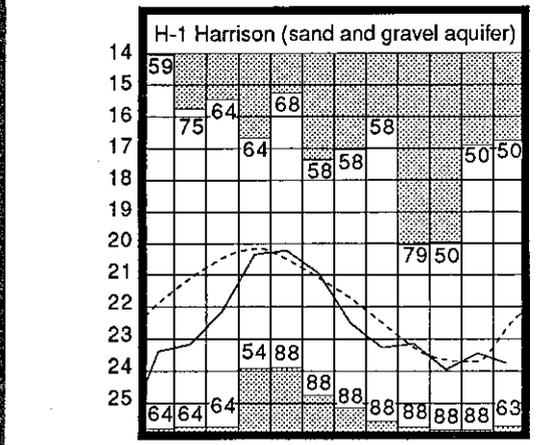
Normal - - - - Current - - - -

GROUND-WATER LEVELS

Based on daily lowest level in feet below land-surface datum

Index Well	Location	Aquifer	Mean This Month	Departure From Normal	Change in feet from:	
					Last Month	Year Ago
F-1	W. Rushville, Fairfield Co.	Sandstone	16.82	-0.04	-0.16	+3.20
Fa-1	Jasper Mill, Fayette Co.	Limestone	8.15	+0.14	+0.02	+0.05
Fr-10	Columbus, Franklin Co.	Gravel	42.39	+2.08	-0.07	+2.02
H-1	Harrison, Hamilton Co.	Gravel	23.75	-1.09	-0.32	+1.28
Hn-2a	Dola, Hardin Co.	Dolomite	9.18	+0.09	+0.05	+4.12
Po-1	Windham, Portage Co.	Sandstone	20.17	+0.31	-0.18	+1.54
Tu-1	Strasburg, Tuscarawas Co.	Gravel	14.84	-1.74	-0.03	+0.28

GROUND-WATER LEVELS



Base periods: H-1, 1951-1979. Hn-2a, 1955-1979. Po-1, 1947-1979

Normal - - - - Current - - - -