HYDROLOGY

Precipitation

Average annual precipitation is approximately 36 inches (MDNR 1986, Vandike 1995).

USGS Gaging Station

There is one active gaging station in the basin (USGS 1997; LINK TO USGS). There was a gaging station at Bethel, Missouri from1930 to 1973.

Permanence of Flow and Average Annual Discharge

Average annual discharge at the North River gage station near Palmyra is 264 cfs (USGS 1997). All streams are subject to periods of no discharge. Nevertheless, one stream (Sees Creek) is denoted by a solid blue line along its entire length on USGS maps and is considered permanently flowing. North River and South Fork have a few short reaches considered intermittent while all other streams have extensive intermittent reaches.

Base Flow and Low-Flow Frequency Data

Base flows throughout the basin are not sustained by groundwater inflow during dry weather due to the relatively low permeability of overlying till. Seven day periods of no flow occur every 10 - 20 years (Skelton 1986). Also, stream discharge can fall below 1.0 cfs for thirty days or longer every 10 years.

Flow Duration

Flow duration statistics reflect the stream discharge that is exceeded for a specified proportion of time. Median discharge (flow exceeded 50% of the time) for the North River is 40.2 cfs. The ratio of flow that is exceeded 90% of the time to the flow exceeded 10% of the time (90:10 ratio) is indicative of the flashiness of variability of stream flow. The 90:10 ratio for North River is 1:145, indicating highly variable stream flow. Small amounts of precipitation cause rapid increase in stream flow. Presumably because most water runs off quickly due to the low permeability of underlying strata and because of extensive watershed conversion from natural vegetative cover to row crop and pasture.

Flood Frequency

Alexander and Wilson (1995) determined through multiple regression techniques that drainage area and main-channel slope can be used to estimate return period flows for unregulated streams in Missouri. The generalized least squares regression equations are as follows:

$Q_2 = 69.4 A^{0.703} S^{0.373}$

$Q_5 = 123 A^{0.690} S^{0.383}$

$$Q_{10}=170A^{0.680}S^{0.378}$$

$$Q_{25}=243A^{0.668}S^{0.366}$$

$$Q_{50}=305A^{0.660}S^{0.356}$$

$$Q_{100}=376A^{0.652}S^{0.346}$$

$$Q_{500}=569A^{0.636}S^{0.321}$$

where,

Q_t=estimated discharge in cubic feet per second

A= drainage area in square miles

S=main channel slope in feet per mile

Discharges of 19,500 cfs occur every five years in the North River at Palmyra (Table 4). Base (100 year) flood elevations have been determined for eight sites in the North River basin (Southard and Wilson 1998).

Dam and Hydropower Influences

There is a low-head dam on the North River just upstream from state highway 61 near Palmyra. There is a dam impounding 228 surface acres of water on the Hunnewell Conservation Area. There are no hydropower influences in the watershed.

Table 4. Flood discharges for 5, 25, and 100 year intervals at the North River at Palmyra gage station (Alexander and Wilson 1995).

Location	Drainage Area(mi^2)	Gradient (ft/mile)	Flood Discharge (cfs) for interval		
			5	25	100
North River, Palmyra	373	5.0	19,500	35,200	50,500