WATER QUALITY

Beneficial Use Attainment

Approximately 1026 reservoir acres and 272 stream miles within the North Fork Watershed have designated beneficial uses as defined in Tables G and H of the Rules of the Department of Natural Resources Division 20-Clean Water Commission Chapter 7-Water Quality (Table Wq01; MDNR 1996a). These streams and reservoirs must meet or exceed established criteria as defined in Table A of the Rules of the Department of Natural Resources Division 20-Clean Water Commission Chapter 7-Water Quality for those beneficial uses (MDNR 1999a). Noblett Lake is designated for livestock/wildlife watering, protection of aquatic life, and whole body contact recreation. Norfork Reservoir is designated for livestock/wildlife watering, protection of aquatic life, whole body contact recreation, and boating/canoeing. All watershed streams listed in Table H are designated for livestock/wildlife watering as well as protection of aquatic life. Several streams within the watershed have additional designated beneficial uses. These streams include The North Fork of the White River, Bryant Creek, Hunter Creek, Hurricane Creek, Lick Creek, and Spring Creek (Table Wq01). Approximately 22.0 miles of the North Fork of the White River is designated for irrigation, livestock/wildlife watering, protection of aquatic life, cold water fishery, whole body contact recreation, and boating/canoeing. Approximately 28.0 miles of the North Fork of the White River is designated for irrigation, livestock/wildlife watering, protection of aquatic life, cool water fishery, whole body contact recreation, and boating/canoeing (MDNR 1996a). In addition to the the aforementioned designated uses, 46.5 stream miles within the North Fork Watershed have been designated as "Outstanding State Resource Waters" (Table Wq02) (MDNR 1996a). No streams within the North Fork Watershed are designated for use as a drinking water supply. The streams of this watershed have no public surface water withdrawals.

Section 303(d) of the federal Clean Water Law requires that states identify those waters for which current pollution control measures are inadequate (MDNR 1999a). This is accomplished by comparing data from those waters with water quality criteria established for designated beneficial uses of those waters (MDNR 1999b). Those waters are then included in the 303(d) list. The state must then conduct Total Maximum Daily Load (TMDL) studies on those waters in order to determine what pollution control measures are required and then insure those measures are implemented (MDNR 1999a). No streams or reservoirs within the watershed are included in the 1998 list (MDNR 1999c). The Clean Water Act requires that the list be updated every 2 years thus the next 303(d) list should be available in the year 2000 (MDNR 1999b).

Chemical and Biological Water Quality

Data regarding the chemical and biological quality of stream flow within the North Fork Watershed has been collected by several different entities since the 1960s. The extensive amount of water quality data available for various parameters and varying time periods within the North Fork Watershed, makes an adequate summary of water quality data within this document, impractical.

In order to avoid going beyond the scope of this document by attempting to provide a comprehensive summary of all water quality data by all agencies for all available years, three stations within the North Fork Watershed have been selected in order to provide a spatial and temporal snapshot of selected water quality values. USGS stations 07057750 (Bryant Creek below Evans), 07057500 (North Fork River near Tecumseh), and 07057475 (Double Spring near Dora) have been selected for this purpose (Figure

Wq01). Data for the years 1993-1997 were used to examine selected parameters at stations 07057750 and 07057475. Data for the years 1983-1987 were used to examine selected parameters at station 07057500. The differences in time periods analyzed are due to the differences in time periods with available water quality data.

Tables Wq03, Wq04, and Wq05 list selected water quality parameters and state standards as well as maximum and minimum observations of selected parameters from stations 07057500, 07057750, and 07057475 for respective periods of record. Observations at the previously mentioned stations consistently met water quality standards for the selected parameters during the years examined with the exception of fecal coliform bacteria (USGS 1994, 1995, 1996, 1997, 1998a, 1999a, 2001). The data indicates that all three stations periodically experienced fecal coliform levels exceeding standards for whole body contact recreation (200 colonies/100ml) (Figures Wq02, Wq03, and Wq04). Out of 31 observations conducted from 1994 to 1997, fecal coliform levels at Station 07057750 exceeded these standards twice. Both instances occurred during the month of April. Fecal coliform levels at station 07057500 exceeded state standards 7 out of 44 observations. All of these instances occurred during the recreational period, April 1-October 31 (as designated by MDNR 1996a). Levels at Station 07057475 exceeded these standards 6 times out of 24 observations from 1994 to 1997. Five of these instances occurred during the recreational period. Even though Double (Rainbow) Spring has not been designated for whole body contact recreation, its waters flow directly into a portion of the North Fork River which does have this designation. Water quality data also indicates that water at stations 07057750 and 07057475 (data not available for 07057500) is hard to very hard as defined by the USGS (1999f).

As stated previously, a large amount of water quality data for a variety of parameters and time periods is available for the North Fork Watershed. Two previously discussed stations (07057750 and 07057500) have been part of the ambient water quality monitoring network in missouri http://missouri.usgs.gov/wtrqual/ambient.htm (USGS 2001). Water quality data is also available for additional parameters from the USGS Historical Water Quality Data Website http://wwwdmorll.er.usgs.gov/watdata/wtrqual/ and the annual USGS Water Resources Data Reports as well as the EPA Storage and Retrieval (STORET) Database http://www.epa.gov/storet/. In addition, volunteer water quality monitoring data is available from the Missouri Stream Team online database http://www.mostreamteam.org/vmsearch.html. Additional State Water Quality Standards are available in the most current document of the Rules of the Department of Natural Resources Division 20-Clean Water Commission Chapter 7-Water Quality http://mosl.sos.state.mo.us/csr/10csr/10c20-7a.pdf.

The United States Geological Survey conducted water quality samples within the North Fork Watershed from 1993-1995 as part of the Pesticides National Synthesis Project in order to determine the spatial and temporal distribution of contamination by pesticides in the water resources of the United States (USGS 1999g). The North Fork Watershed was part of the Ozark Plateau Study Unit of the National Water Quality Assessment Program. Two surface water and four ground water sampling sites were selected within the watershed (Figure Wq03)(USGS 1999h and 1999i). Ground water samples were only performed once at each site in 1993. However surface water samples were taken in 1994 and 1995 (USGS 1999j and 1999k). Analysis of data from these samples indicate pesticide compounds were not detected in either surface water sample from 1994. However pesticide compounds were detected in the 1995 samples at both sites with a maximum of 5 pesticide detections at one site (Table Wq06). Pesticide compounds were not detected in any of the four ground water samples. By Comparison, 39 of 43 surface water sites within the Ozark Plateaus Study Unit had detections of pesticides with 18 sites having samples with six or more pesticide detections (Bell et al. 1997). In addition 73 of 215 ground water

sample sites within the Ozark Plateaus Study Unit had pesticide detections with a maximum of 5 pesticides detected in any one sample (Adamski 1996).

Duchrow (1976) conducted water quality/aquatic invertebrate sampling at 6 sites on Bryant (2), Hunter Creeks (3), and Watered Hollow (1) in 1974-1975 (Figure Wq05)(Duchrow 1976). A total of 89 types of benthic invertebrates were collected in these samples. Water quality was evaluated by comparing calculated species diversity index values as well as the similarity of the benthic invertebrate communities at these sites to those criteria established for unpolluted Ozark streams. Invertebrate communities from these sites met or exceeded water quality criteria established for Ozark streams. Samples were conducted once again in 1976 at 2 sites on Hunter Creek in order to determine the impact, if any, of construction of the Ava Landfill which became operational in 1975 (Duchrow 1977). Results from these samples indicated that the stream had not been adversely impacted since the opening of the Ava Landfill. Future benthic invertebrate sampling will need to be performed in this area as well as throughout the watershed in order to consistently monitor potential pollution problems.

Ground Water Quality

Water quality tests performed by the Missouri State Public Health Laboratory in Springfield on 408 wells in Howell, Ozark, and Douglas Counties from July 1998 to August 1999 indicate that 138 (33.8%) well samples tested were unsafe. A well is considered unsafe if any coliform colonies result from the sample (Farmer, personal communication). Howell County had the highest percentage of unsafe wells with 40.9% of the wells tested in this group deemed as unsafe. It is important to note that other samples probably exist which are not included in these results. In addition, these results are inclusive of those portions of the counties mentioned which are outside the boundaries of the North Fork Watershed.

Point Source Pollution

Table Wq07 lists 9 National Pollution Discharge Elimination System (NPDES) sites currently within the North Fork Watershed (Figure Wq03) (MDNR 1998a). The city of Norwood is the only permitted (by MDNR) municipal wastewater discharge within the watershed in Missouri (MDNR 1998a). As of 1997, the Norwood Waste Water Treatment Facility (WWTF) was discharging .030 million gallons per day (mgd) into a tributary of Dry Creek. This is believed to impact less than 0.1 miles of the receiving stream (MDNR 1994).

The Missouri Department of Natural Resources, Division of Geology and Land Survey has identified 23 active mines and 137 past producers within the North Fork Watershed in Missouri (MDNR 1998b). Of the 23 active mines, all are gravel removal operations or limestone quarries. The highest percentage of past producers are iron mines. Nearly all of these are surface mines which dot the watershed. These open pits can act as a direct link to the ground water system and thus pose a threat to ground water quality if pollutants are allowed to enter in. This can effect wells from which the watersheds population receives its water.

Land disruption from road and bridge construction as well as urban expansion often results in increased sediment loads to receiving water systems. Bridge construction also results in stream channel modification, which affects stream flow both up and down stream from the bridge. Since 1995 there have been twenty-eight 404 permitted operations within the North Fork Watershed in Missouri. Eight of these involved bridge work or culvert work (Table Wq07)(USACOE 1999). According to the Missouri Department of Transportation Highway and Bridge Construction Schedule , there currently (1999) are no

state highway projects involving bridge work scheduled within the watershed from 2000-2004 (MDT 1999).

Gravel mining also has the potential to threaten water quality within the watershed. Poor gravel mining practices can negatively impact water quality, riparian and aquatic habitats, and aquatic biota. Increased sedimentation and turbidity are a few problems associated with poor

gravel mining practices. In 1998 there were 24 permitted operations within the North Fork Watershed (Figure Wq03)(USACOE 1998).

Non-point Source Pollution

Perhaps one of the more difficult challenges to address within any watershed is non-point source pollution. Whereas point source pollution can usually be traced to a single discharge point or area such as a waste water treatment plant discharge, non point source pollution, such as sheet erosion of topsoil, runoff of nutrients from pastures, or pesticide or fertilizer runoff from a fields, is much more difficult to detect as well as remedy. It takes the cooperation of the landowners within a watershed to minimize non-point source pollution and its impacts.

The greatest non-point threat in the North Fork Watershed is the potential contamination of the groundwater system. Seventy four percent of the water withdrawn within the watershed comes from the groundwater system. Domestic use is the single most prevalent use of this supply. In addition, much of the permanent flow within the watershed is enhanced by springs. Thus, any contaminant which affects groundwater quality is likely to affect surface water quality and vice versa. There are several ways in which contaminants can enter the groundwater system. These include losing streams, sinkholes, and abandoned wells. The potential for contamination by septic systems has been shown by Aley (1972 and 1974) to be increased in areas of soluble bedrock. (MDNR 1984). As indicated by dye traces performed within the watershed, ground water movement is not always restricted by surface watershed boundaries. Some groundwater does exhibit movement from other watersheds. The most notable example of this is groundwater movement from the Upper Gasconade Watershed to Hodgson Mill, Double (Rainbow) Spring, and North Fork Spring. Waste water from the Mansfield Waste Water Treatment Plant is discharged into a tributary of Fry Creek which, itself, is a tributary of Wolf Creek. As stated previously, water from both streams is lost to the ground water system and eventually emerges from Double, North Fork, and Hodgson Mill Springs. The North Fork River at Blue Springs and Double Spring (Rainbow Spring) changes from a clean substrate to a substrate which has an abundance of snails (MDNR 1984). The amount of filamentous algae also increases significantly. This condition continues for approximately 10 miles; indicating the influence of high nutrient loads from the spring flow.

A major contributor to the total organic waste within the North Fork Watershed is livestock waste (MDNR 1984). Livestock waste contributes to the Biological Oxygen Demand (BOD), suspended solids, fecal coliform, and fecal streptococci loads within streams. Table Wq08 lists the number of cattle and hogs within counties that intersect the watershed as well as percent of counties within the watershed. Most cattle within the watershed are on pasture and in most instances have direct access to streams. Results can include increased organics and bacterial loading, turbidity, and high concentrations of algae (MDNR 1984). The impact of livestock in streams is often more obvious than impacts from upstream point source discharges. In addition cattle may cause soil compaction, as well as reduce stream bank and corridor vegetation which can lead to increased erosion and/or flood plain scour. "No discharge" lagoons or pits serving confined lots also pose a threat to streams in cases of accidental discharges (MDNR

1984). In 1984, there were 16 of these facilities within the North Fork Watershed.

Water Pollution and Fish Kill Investigations

No chronic water pollution or fish kill areas are known within the North Fork Watershed. Table Wq10 lists eleven water pollution and/or fish kill investigations which have been conducted within the watershed since 1990 (MDC 1991-1995; MDNR 1999d; and MDC 1999a). Only one known fish kill has occurred within the watershed since 1990. The Missouri Department of Conservation has not performed toxicological sampling of fish from the North Fork Watershed.

Water Use

Estimates of water use for the North Fork Watershed obtained from the United States Geological Survey National Water Use Database (1998b) indicate that total water withdrawn within the watershed in 1995 was 6.52 million gallons per day (mgd) (Table Wq11). Most of the water withdrawn in the watershed is from the groundwater system. All surface water withdrawn is for livestock or irrigation use. Water withdrawal for livestock was the most prevalent use within the North Fork Watershed in 1995 (USGS 1998b). Domestic use was the second most prevalent (Table Wq09).

Major water use information for the North Fork Watershed was obtained from the Missouri Department of Natural Resources (MDNR), Division of Geology and Land Survey. The MDNR maintains records of "major" (those facilities capable of withdrawing 100,000 gallons/day) surface and ground water users throughout the state. Recent records (1997) indicate there were a total of six major water users, two of which were private surface water users with intakes on the North Fork River, Bryant Creek, Brush Creek, and Lick Creek (Table Wq12)(MDNR 1997). Surface water withdrawals for 1997 totaled approximately 156,480,000 gallons. The four major ground water users within the North Fork River Watershed included Fairview R-XI School, the City of Gainesville, Howell County Public Water Supply District #1 and a private entity. Ground water withdrawals by major water users in the watershed in 1997 totaled approximately 80,669,900 gallons.

Recreational Use

In 1982, the North Fork of the White River was ranked with 36 other major watersheds in Missouri according to recreational value (MDC and MDNR 1982). Results were obtained by surveying professional staff from six state and federal agencies. The North Fork River recreation rank was 12th within the state. This value was expected to drop due to problems associated with intensive recreational use, bank and shoreline development, and poor land use. Remote location was also listed as a reason for a future drop in recreational importance.

Angler surveys are useful for evaluating angler use, species preference, and satisfaction. Angler surveys can also be used to identify changes or trends in angler responses over time. These surveys provide the information necessary for managers to meet angler needs, as well as improve and validate decisions to change or maintain regulations. Results from statewide annual angler surveys which were conducted by the Missouri Department of Conservation from 1983 to 1986 estimate that on an annual basis, 12,437 total days were spent angling on the North Fork River and its tributaries (MDC 1987). During the period of record, catfish were the most preferred species. On average, 3268 (26%) days were spent fishing for catfish, 2699 (22%) days for rainbow trout, and 2654 (21%)days for bass sp. per year.

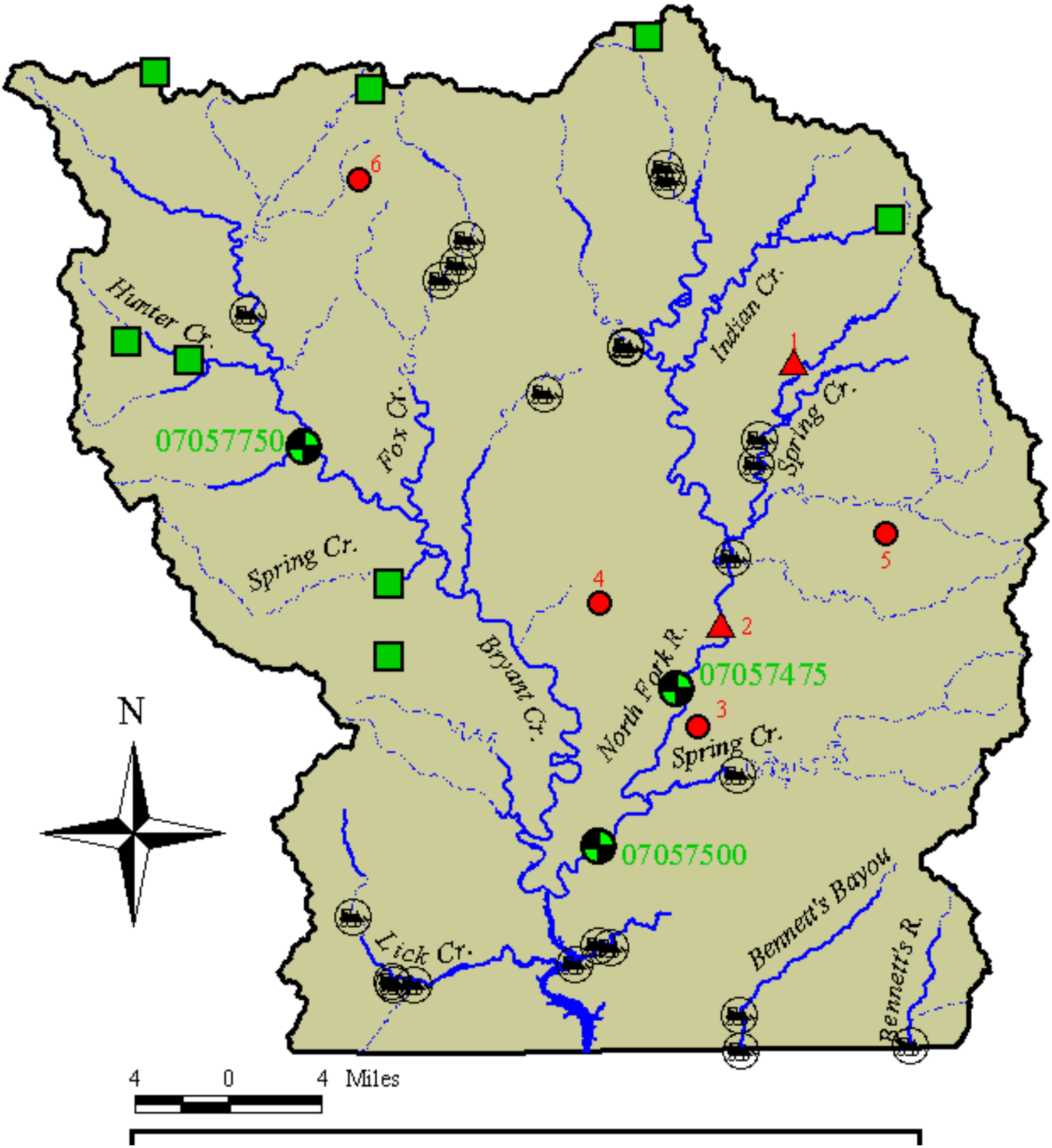
Besides fishing the North Fork Watershed receives a large amount of other recreational use including

floating. From May 29-August 8, 1999 canoe "put-ins" were counted at North Fork Recreation Area as part of a United States Forest Service (USFS) Study (Hyzer, personal communication and Dickens, personal communication). Counts were primarily done on weekends and usually ended around 12:00 p.m.-1:00 p.m. Data from these counts indicate an average of 163 canoe "put-ins" a day on the weekends during the previously mentioned time period. It is important to consider that the North Fork Recreation Area is just one of 11 public accesses within the watershed. Additional study will be needed in order to determine canoe use throughout the entire watershed.

Bank and shoreline development continues to occur in some areas on the major streams of the North Fork Watershed. Housing construction on the North Fork River down stream of the Mark Twain National Forest is one example. Problems associated with this type of development include destabilization of stream banks and flood plains due to vegetation removal which can then lead to increased sediment loads in streams, water quality impacts from poorly treated sewage, and loss of aesthetic value for recreational purposes.

Figure Wq01.

North Fork Watershed
Water Quality



Legend

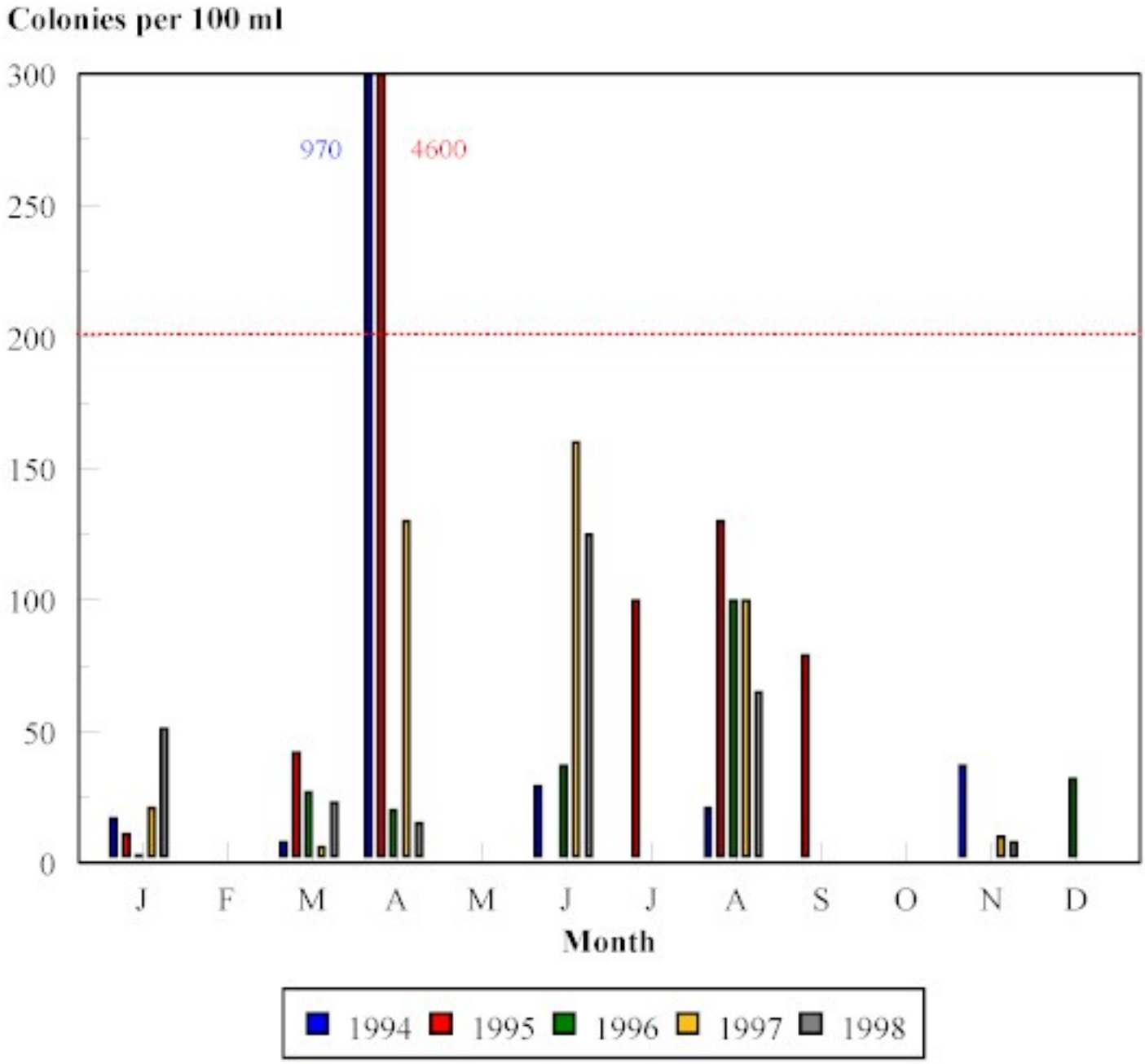
- NPDES Permit Site (1998)*
- Permitted Gravel Mining Operation (1998)*
- USGS Water Quality Station

USGS Pesticide National Synthesis Project Sites 1993-1995

- Ground Water Station
- Surface Water Station

*Data Subject to Change.

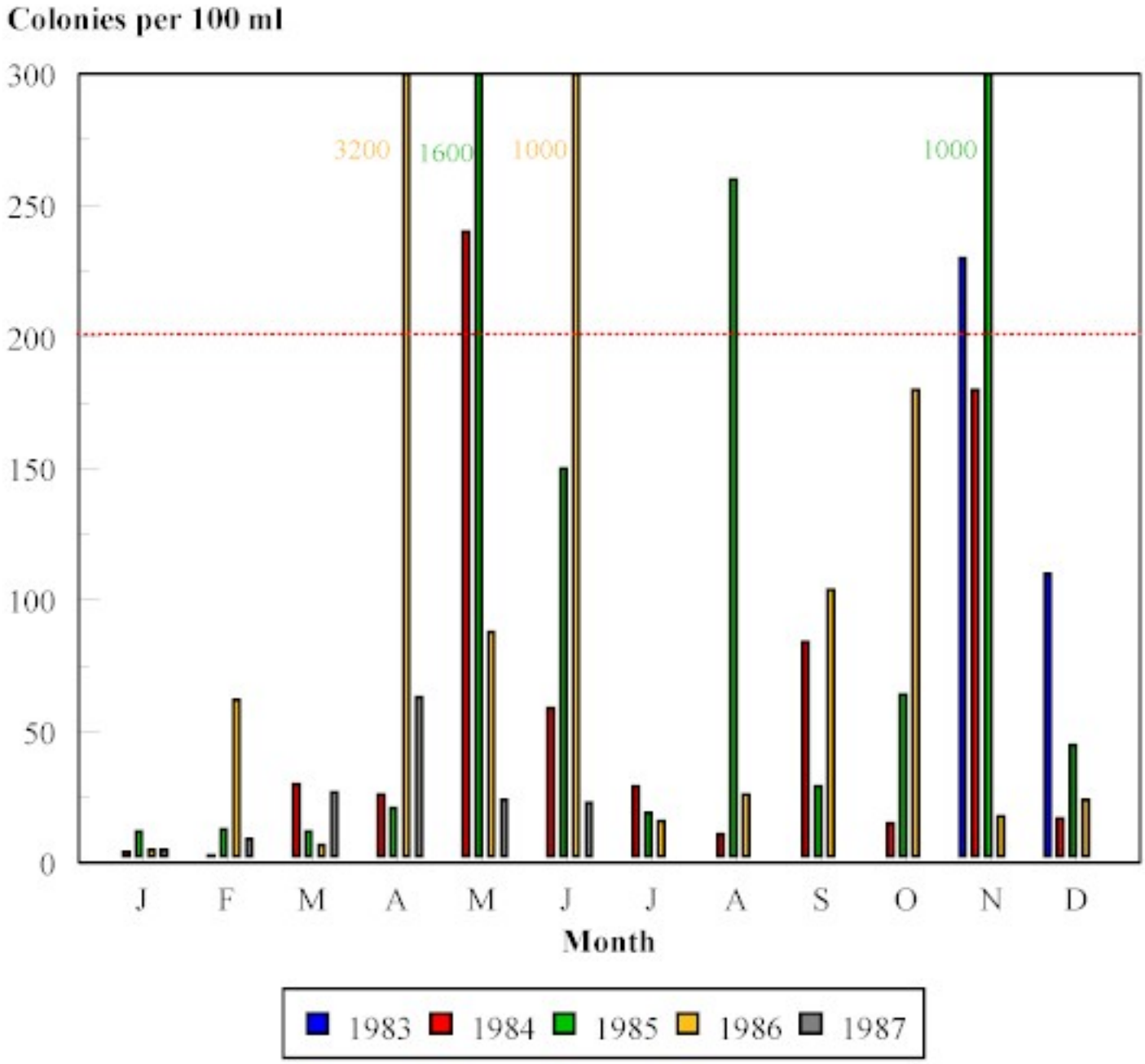
Figure Wq02. Fecal colliform colony counts per 100 milliliters at Station 07057750 (Bryant Creek Below Evens) (USGS 1995, 1996, 1997a, and 1998a).



Dashed red line represents limit in waters designated for whole body contact recreation from April 1-October 31 and any time for losing streams (MDNR 1996a).

Note: Data includes results based on colony count outside the acceptable range (non-ideal colony count). A non-ideal colony count refers to counts in which crowding and insufficient media (insufficient for full development of colonies) exist for an ideal colony count or the colony count is so low that its statistical validity is questionable (USGS 1997b).

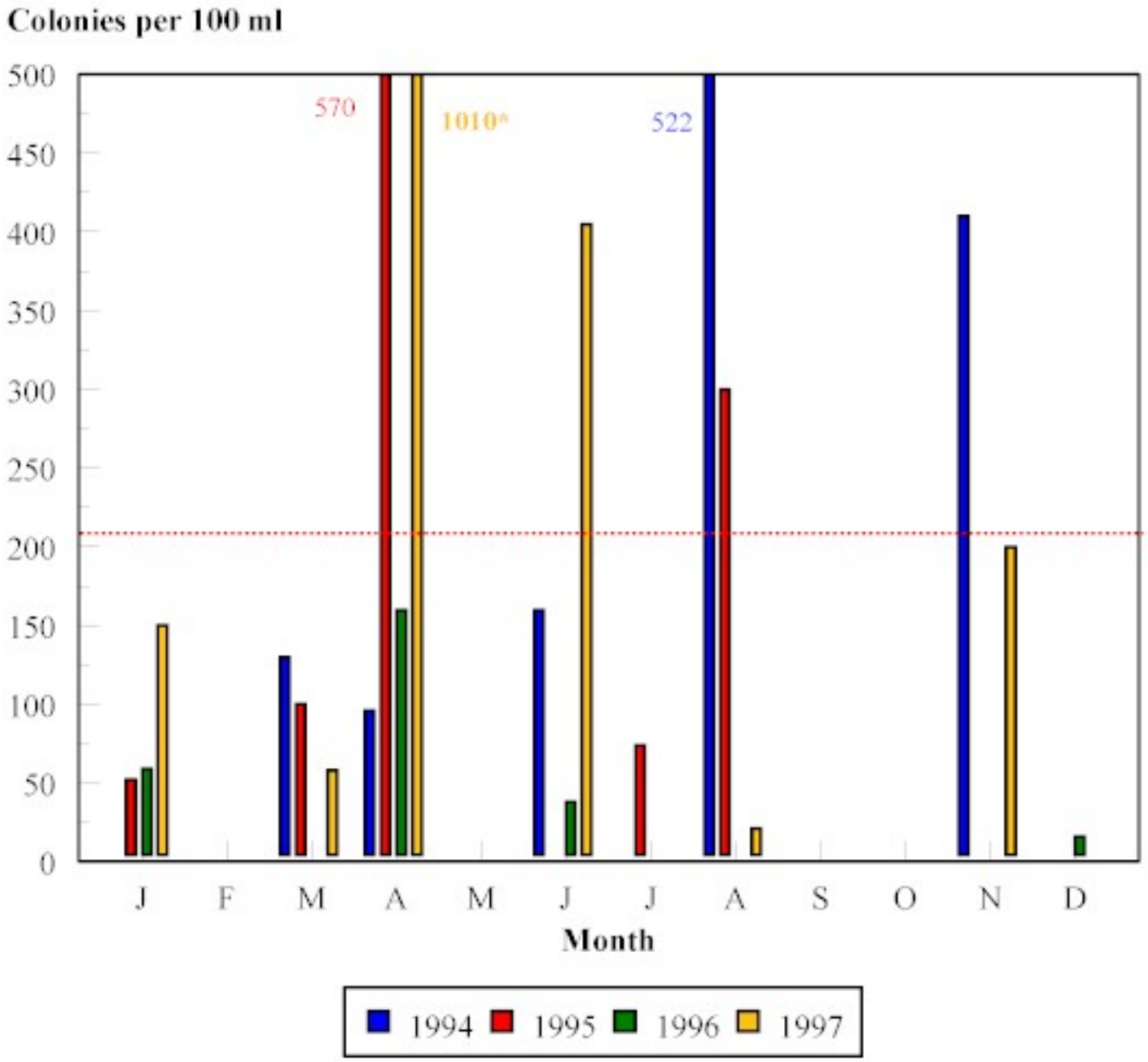
Figure Wq03. Fecal colliform colony counts per 100 milliliters at Station 07057500 (North Fork near Tecumseh) (USGS 1995, 1996, 1997a, and 1998a).



Dashed red line represents limit in waters designated for whole body contact recreation from April 1-October 31 and any time for losing streams (MDNR 1996a).

Note: Data includes results based on colony count outside the acceptable range (non-ideal colony count). A non-ideal colony count refers to counts in which crowding and insufficient media (insufficient for full development of colonies) exist for an ideal colony count or the colony count is so low that its statistical validity is questionable (USGS 1997b).

Figure Wq04. Fecal colliform colony counts per 100 milliliters at Station 07057475 (Double Spring near Dora, Missouri) (USGS 1995, 1996, 1997a, and 1998a).



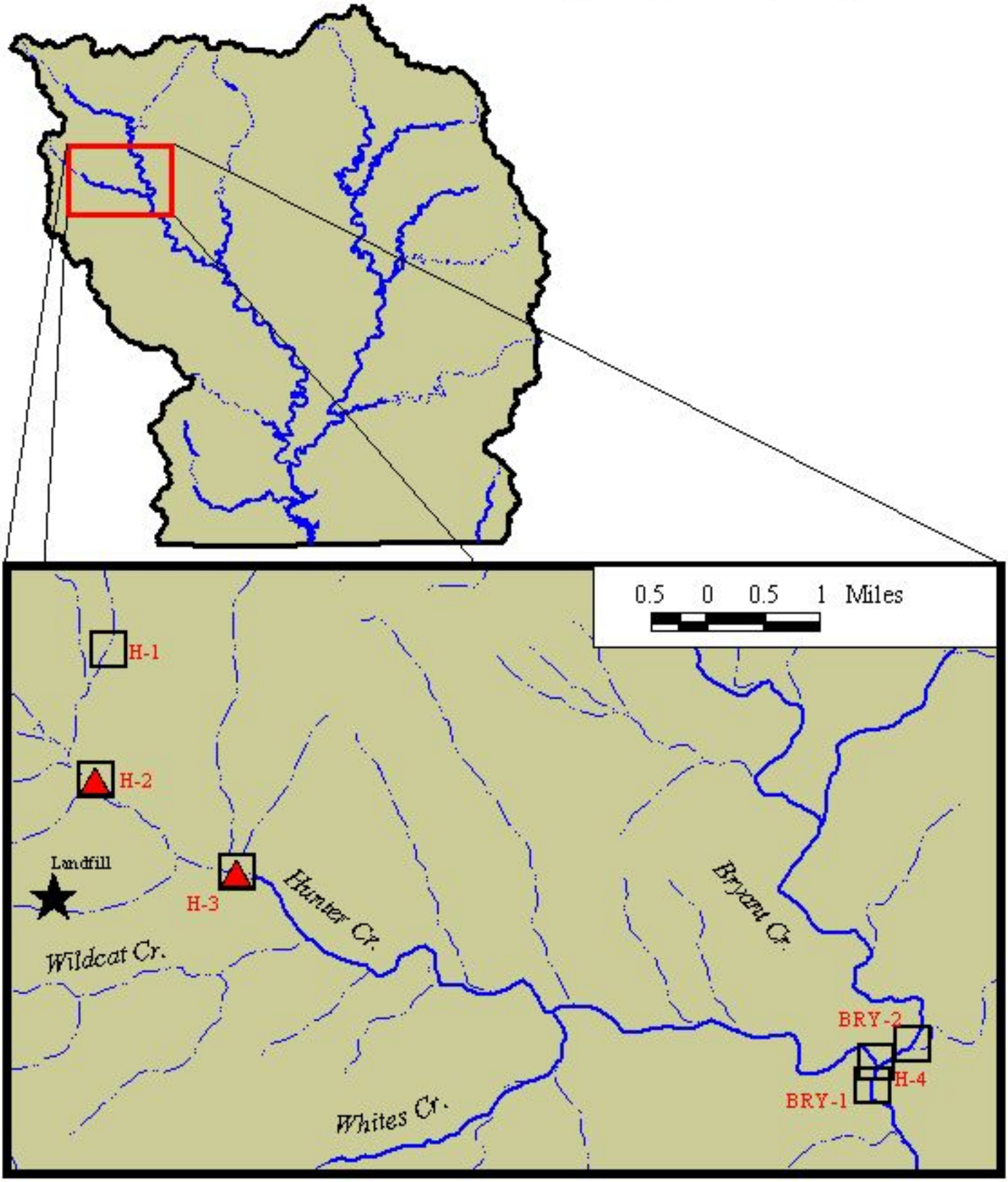
Dashed red line represents limit in waters designated for whole body contact recreation from April 1-October 31 and any time for losing streams (MDNR 1996a).

Note: Data includes results based on colony count outside the acceptable range (non-ideal colony count). A non-ideal colony count refers to counts in which crowding and insufficient media (insufficient for full development of colonies) exist for an ideal colony count or the colony count is so low that its statistical validity is questionable (USGS 1997b).

Figure Wq 05

North Fork Watershed

Benthic Invertebrate/Water Quality Sampling Sites.



Legend

Missouri Department of Conservation
Water Quality Sampling Sites

□ 1974-1975

▲ 1976

N

Table Wq01. Missouri Department of Natural Resources use designations for selected streams (1 of 4) within the North Fork Watershed (MDNR 1996a). Locations are given in section, township, range format.

Stream Name	Class[1]	Miles *acres	From	To	Designated Use*
Noblett Lake	L3	26*	25,26n,11w	25,26n,11w	lww,aql,wbc,
Norfork Lake	L2	1000*	21n12w	21n12w	lww,aql,wbc,btg
Barren Cr.	C	4.0	State Line	08,21n,11w	lww,aql
Bell Pond Hl.	C	1.5	Mouth	32,24n,11w	lww,aql
Bennett's Bayou	P	6.0	State Line	30,22n,10w	lww,aql
Bennett's Bayou	C	2.0	30,22n,10w	16,22n,10w	lww,aql
Bennett's R.	C	4.0	State Line	24,22n,10w	lww,aql
Big Gulch	C	1.5	Mouth	08,27n,11w	lww,aql
Blair Hl.	C	1.0	Mouth	01,22n,12w	lww,aql
Bollinger Br.	C	4.0	Mouth	15,24n,12w	lww,aql
Bridges Cr.	C	5.0	Mouth	17,22n,11w	lww,aql
Brixey Cr.	C	2.5	Mouth	17,24n13w	lww,aql
Brush Cr.	P	7.0	Mouth	11,25n,13w	lww,aql
Brush Cr.	C	1.5	11,25n,13w	01,25n,13w	lww,aql
Bryant Cr.	P	13.5	05,22n,12w	03,23n,12w	lww,aql,clf,wbc,btg
Bryant Cr.	P	1.0	03,23n,12w	34,24n,12w	lww,aql,cdf,wbc,btg
Bryant Cr.	P	43.0	34,24n,12w	17,27n,15w	lww,aql,clf,wbc,btg
Trib. to Bryant	C	1.5	Mouth	14,24n,13w	lww,aql
Caney Cr.	C	7.0	Mouth	05,23N,13W	lww,aql
Clifty	C	11.0	Mouth	16,27n,12w	lww,aql
Crooked Br.	C	1.0	Mouth	22,24n,11w	lww,aql
Davis	C	4.0	Mouth	13,23n,10w	lww,aql

Dicky Cr.	C	0.5	Mouth	14,26n,15w	lww,aql

Note: This table is not presented as a final authority.

Table Wq01. Missouri Department of Natural Resources use designations for selected streams

(2 of 4) within the North Fork Watershed (MDNR 1996a). Locations are given in section, township, range format.

Stream Name	Class1	Miles	From	To	Designated Use*
Dry Cr.	C	15.0	Mouth	08,25n,09w	lww,aql
Trib. Dry Cr.	C	2.0	Mouth	10,25n,09w	lww,aql
Trib. Dry Cr.	C	4.5	Mouth	20,25n,09w	lww,aql
Dry Cr.	C	1.5	Mouth	1,24n,13w	lww,aql
Fox Cr.	P	4.0	Mouth	09,25n,13w	lww,aql
Fox Cr.	C	5.0	09,25n,13w	29,26n,13w	lww,aql
Hagard Cr.	C	1.5	Mouth	01,22n,14w	lww,aql
Hungry Cr.	C	0.5	Mouth	05,27n,11w	lww,aql
Hunter Cr.	P	9.0	Mouth	06,26n,15w	lww,aql,wbc,btg
Hurricane Cr.	P	1.5	Mouth	30,24n,12w	lww,aql,cdf
Indian Cr.	P	10.0	Mouth	35,27n,11w	lww,aql
Indian Cr.	C	7.5	35,27n,11w	22,27n,10w	lww,aql
L. Indian Cr.	C	2.5	Mouth	19,27n,10w	lww,aql
Lick Br.	C	1.5	Mouth	02,24n,10w	lww,aql
Lick Cr.	P	3.0	Mouth	Hwy. J	lww,aql,wbc
Lick Cr.	P	4.5	Hwy J.	19,22n,12w	lww,aql
Lick Cr.	C	5.0	19,22n,13w	30,23n,13w	lww,aql
Liner Cr.	C	1.0	Mouth	09,21n,12w	lww,aql
Little Cr.	C	5.0	Mouth	17,24n,15w	lww,aql
Trib. To Little	C	1.0	Mouth	18,24n,15w	lww,aql

Little Cr.	C	2.0	Mouth	36,22n,14w	lww,aql
Lottie Cr.	C	0.5	Mouth	35,24n,12w	lww,aql
Ludecker Hl.	C	1.5	Mouth	04,23n,14w	lww,aql
N. Bridges Cr.	C	3.0	17,22n,11w	02,22n,11w	lww,aql
N. Fk Spring Cr.	C	1.0	Mouth	18,22n,14w	lww,aql

Note: This table is not presented as a final authority.

Table Wq01. Missouri Department of Natural Resources use designations for selected streams

(3 of 4) within the North Fork Watershed (MDNR 1996a). Locations are given in section, township, range format.

Stream Name	Class1	Miles	From	To	Designated Use*
N. Fk. White R.	P	22.0	03,22n,12w	02,24n,12w	irr,lww,aql,cdf,wbc,btg
N. Fk. White R.	P	28.0	34,25n,11w	17,27n,11w	irr,lww,aql,clf,wbc,btg
N. Fk. White R.	C	7.0	17,27n,11w	23,28n,12w	lww,aql
Trib. N. Fk. White R.	C	1.0	Mouth	34,23n,12w	lww,aql
Nance Cr.	C	0.5	Mouth	15,24n,14w	lww,aql
Noblett Cr.	P	2.0	Mouth	Noblett L. Dam	lww,aql
Noblett Cr.	P	4.0	24,26n,11w	09,26n,10w	lww,aql
Noblett Cr.	C	1.0	09,26n,10w	10,26n,10w	lww,aql
Panther Cr.	C	3.2	Mouth	18,28n,11w	lww,aql
Pigeon Cr.	C	1.0	State Line	11,21n,13w	lww,aql
Pine Cr.	P	1.5	Mouth	30,23n,12w	lww,aql
Pine Cr.	C	9.0	30,23n,12w	02,23n,13w	lww,aql
Possum Walk Cr.	C	4.0	Mouth	10,21n,13w	lww,aql
Prarie Cr.	C	3.0	Mouth	03,27n,15w	lww,aql
Racoon Hl.	C	1.0	Mouth	16,24n,11w	lww,aql
Rippee Cr.	P	4.5	Mouth	13,25n,15w	lww,aql

Rippee Cr.	C	2.0	13,25n,15w	14,25n,15w	lww,aql
S. Bridges Cr.	C	4.0	17,22n,11w	13,22n,11w	lww,aql
Sawmill Hl.	C	2.0	Mouth	17,24n,11w	lww,aql,
Smith Hl.	C	1.0	Mouth	30,23n,11w	lww,aql
Spring Cr.	P	5.0	Mouth	14,23n,11w	lww,aql,btg

Spring Cr.	P	7.5	14,23n,11w	17,23n,10w	lww,aql,wbc,btg,ind

Note: This table is not presented as a final authority.

Table Wq01. Missouri Department of Natural Resources use designations for selected streams

(4 of 4) within the North Fork Watershed (MDNR 1996a). Locations are given in section, township, range format.

Stream Name	Class1	Miles	From	To	Designated Use*
Spring Cr.	C	8.0	17,23n,10w	06,23n,09w	lww,aql
Spring Cr.	P	16.0	Mouth	23,26n,10w	lww,aql,btg
Spring Cr.	C	2.0	23,26n,10w	12,26n,10w	lww,aql
Trib. Spring Cr.	C	1.5	Mouth	13,26n,10w	lww,aql
Spring Cr.	P	6.0	Mouth	06,24n,13w	lww,aql,btg
Spring Cr.	C	5.0	06,24n,13w	08,24n,13w	lww,aql
Sweeten Cr.	C	1.0	Mouth	26,22n,13w	lww,aql
Sweeten Hl.	C	4.0	Mouth	05,24n,11w	lww,aql
Tabor Cr.	P	5.0	Mouth	09,24n,10w	lww,aql
Tabor Cr.	C	2.5	09,24n,10w	11,24n,10w	lww,aql
Teeter Cr.	C	3.0	Mouth	20,25n,14w	lww,aql
Trail Cr.	C	4.0	Mouth	03,24n,12w	lww,aql
Turkey Cr.	C	1.5	Mouth	09,26n,15w	lww,aql
Weidensaul Hl.	C	3.0	Mouth	27,23n,13w	lww,aql
Trib. Weidensaul Hl.	C	1.0	Mouth	35,23n,13w	lww,aql

Whites Cr.	C	3.0	Mouth	33,26n,15w	lww,aql
Willow Cr.	C	2.0	Mouth	18,23n,10w	lww,aql

Note: This table is not presented as a final authority.

*irr-irrigation clf-cool water fishery

lww-livestock & wildlife watering cdf-cold water fishery

aql-protection of warm water aquatic life wbc-whole body contact recreation

and human health-fish consumption. btg-boating & canoeing

dws-drinking water supply ind-industrial

[1]**L2-**Major reservoirs

L3-Other lakes which are waters of the state. For effluent regulation purposes, publicly owned lakes are those for which a subtantial portion of the surrounding lands are publicly owned or managed.

P-Streams that maintain permanent flow even in drought periods.

C-Streams that may cease flow in dry periods but maintain permanent pools which support aquatic life.

Table Wq02. Stream reaches designated in Table E of the Rules of the Department of Natural Resources Division 20-Clean Water Commission Chapter 7-Water Quality (1996a) as "Outstanding State Resource Waters" within the North Fork Watershed.

Stream Name	Miles	Location	County
Bryant Creek	1.5	Bryant Creek Natural Area in Rippee Conserevation Area	Ozark/Douglas
Indian Creek	17.5	Mark Twain National Forest	Douglas/Howell
North Fork of the White River	5.5	Mark Twain National Forest	Ozark
Noblett Creek	5.0	Above Noblett Lake MarkTwain National Forest	Douglas/Howell
Spring Creek	17.0	Mark Twain National Forest	Douglas

Table Wq03. Selected water quality data for gage station #07057750 (Bryant Creek near Evans) for water years 1994-1997 (USGS 1994, USGS 1995, USGS 1996, MDNR 1996a, USGS 1997, USGS 1998a). Note: This table is not a final authority.

Parameter	**State Standard**			**Measurment**
	I	**V**	**VI**	**Min-Max**
Temperature (°F) (cool water fishery)	84.0 Max			36.5-80.6
pH	----------6.5-9.0---------			7.7-8.5
Oxygen, dissolved (mg/L) (cool water fishery)	5.0 Min			7.0-16.8
Coliform, fecal (colonies / 100 ml)			200	k2-4600
Streptococci, fecal (colonies / 100 ml)				k2-13,800
Alkalinity[1] (mg/L as $CaCO_3$)				112-229
Hardness (mg/L as $CaCO_3$)				180-220
Total Ammonia (mg/l as NH_3)	0.1-32.1[2]			<0.010-0.096
Phosophorus, Total[3] (mg/L as P)				<0.02-0.09

Manganese, dissolved (ug/L as Mn)				<1.9-10.0
Fluoride, dissolved (mg/L as F)		4		<0.1
Iron, dissolved (ug/L as Fe)	1000			<2-13

I Protection of aquatic life

III Drinking water supply

V Livestock and Wildlife Watering

VI Whole-body-contact recreation

VII Groundwater

k Non-ideal count of colonies (too large a sample, colonies merged)

1 State standard for alkalinity currently unavailable. The Environmental Protection Agency currently recommends a minimum of 20.0 mg/L (USEPA 1999)·

2 Based on maximum chronic and acute standards for cold-water fishery. Levels are pH and temperature dependent. For specific criteria at varying pH and temperatures consult Table B of the Rules of the Department of Natural Resources Division 20-Clean Water Commission Chapter 7-Water Quality.

3 State standard for phosphorus is currently unavailable. The Environmental Protection Agency currently recommends a maximum of 0.1mg/L for rivers (Christensen and Pope 1997).

Table Wq04. Selected water quality data for gage station #07057750 (North Fork River near Tecumseh) for water years 1994-1997 (USGS 1994, USGS 1995, USGS 1996, MDNR 1996a, USGS 1997, USGS 1998a). Note: This table is not a final authority.

Parameter	State Standard				Measurement
	I	IV	V	VI	Min-Max
Temperature (°F) (cold water fishery)	68.0 Max				42.8-72.5
pH	----------6.5-9.0----------				7.4-8.4
Oxygen, dissolved (mg/L) (cold water fishery)	6.0 Min				5.7-14.4
Coliform, fecal (colonies / 100 ml)				200	3.0-3200
Streptococci, fecal (colonies / 100 ml)					N/A
Alkalinity[1] (mg/L as $CaCO_3$)					N/A
Hardness (mg/L as $CaCO_3$)					N/A
Total Ammonia (mg/l as NH_3)	0.1-32.1[2]				<0.01-0.07
Phosophorus, Total[3] (mg/L as P)					<1.0-13.0

Manganese, dissolved (ug/L as Mn)					
Fluoride, dissolved (mg/L as F)			4		<0.1
Iron, dissolved (ug/L as Fe)	1000				<3.0-60.0

I Protection of aquatic life

IV Irrigation

V Livestock and Wildlife Watering

VI Whole-body-contact recreation

k Non-ideal count of colonies (too large a sample, colonies merged)

N/A Not Available

1 State standard for alkalinity currently unavailable. The Environmental Protection Agency currently recommends a minimum of 20.0 mg/L (USEPA 1999)·

2 Based on minimum chronic and acute standards for limited warm-water fishery. Levels are pH and temperature dependent. For specific criteria at varying pH and temperatures consult Table B of the Rules of the Department of Natural Resources Division 20-Clean Water Commission Chapter 7-Water Quality.

3 State standard for phosphorus is currently unavailable. The Environmental Protection Agency currently recommends a maximum of 0.1mg/L for rivers (Christensen and Pope 1997).

Table Wq05. Selected water quality data for gage station #07057475 (Double Spring near Dora) for water years 1994-1997 (USGS 1994, USGS 1995, USGS 1996, MDNR 1996a, USGS 1997, USGS 1998a). Note: This table is not a final authority.

Parameter	**State Standard**					**Measurment**
	I	**III**	**V**	**VI**	**VII**	**Min-Max**
Temperture (°F) (cold water fishery)	68.0 Max					51.8-57.2
pH	----------6.5-9.0----------					6.7-7.6
Oxygen, dissolved (mg/L) (cold water fishery)	6.0 Min					6.7-11.5
Coliform, fecal (colonies / 100 ml)				200		k1-k1010
Streptococci, fecal (colonies / 100 ml)						k1-k1100
Alkalinity[1] (mg/L as $CaCO_3$)						128-240
Hardness (mg/L as $CaCO_3$)						140-210
Total Ammonia (mg/l as NH_3)	0.1-32.1[2]					<0.010-0.036
Phosophorus, Total[3] (mg/L as P)						<0.02-0.09
Manganese, dissolved (ug/L as Mn)		50			50	<1-2

Fluoride, dissolved (mg/L as F)		4	4		4	<0.1
Iron, dissolved (ug/L as Fe)	1000	300			300	<1.0-14

I Protection of aquatic life

III Drinking water supply

V Livestock and Wildlife Watering

VI Whole-body-contact recreation

VII Groundwater

k Non-ideal count of colonies (too large a sample, colonies merged)

1 State standard for alkalinity currently unavailable. The Environmental Protection Agency currently recommends a minimum of 20.0 mg/L (USEPA 1999)·

2 Based on maximum chronic and acute standards for cold-water fishery. Levels are pH and temperature dependent. For specific criteria at varying pH and temperatures consult Table B of the Rules of the Department of Natural Resources Division 20-Clean Water Commission Chapter 7-Water Quality.

3 State standard for phosphorus is currently unavailable. The Environmental Protection Agency currently recommends a maximum of 0.1mg/L for rivers (Christensen and Pope 1997).

Table Wq06. Results of Pesticides National Synthesis Project water quality sampling for pesticide compounds within the North Fork Watershed (USGS 1999i and 1999j).

Station	Type	Pesticide Compound Detected
1	Surface	Atrazine; cis-Permithrin; Dieldrin; p,p'-DDE
2	Surface	Atrazine; Deethylatrazine; Metolachlor; p,p'-DDE; Thiobencarb
3	Ground Water	Non Detection
4	Ground Water	Non Detection
5	Ground Water	Non Detection
6	Ground Water	Non Detection

Table Wq07. NPDES permit sites within the North Fork Watershed in Missouri (MDNR 1998a).

Facility Name	Recieving Stream	Facility Type	County
Crystal Lake Fisheries	Hunter Cr.	Hatchery	Douglas
Ava Landfill	Trib. Hunter Cr.	Land Fill	Douglas
Journagan-Wllow Springs	Trib. Indian Cr.	Limestone Quarry	Howell
Red Dot Farm	Brixey Cr.	Animal Waste	Ozark
Rainbow Trout Ranch	Spring Cr.	Trout Hatchery	Ozark
Rainbow Trout Ranch	Spring Cr.	Motel	Ozark
Leo Journagan Const.	Trib North Fork R.	Limestone Quarry	Texas
Assoc. Milk Prod. Inc.	Trib. Bryant Cr.	Food	Wright
Norwood WWTP	Trib. Dry Cr.	Waste Water Treatment Plant	Wright

Note: This table is not a final authority. Data subject to change.

Table Wq08. Operations within the North Fork Watershed having 404 permits since 1995 (USACOE 1999).

Stream Name	Work Type	Permit Date	Linear Feet Affected
-	Culvert Construction	11 Oct 1995	
-	Utility Line	03 Feb 1995	
Bryant Cr.	Bank Stabilization	29 May 1997	250.00
Bryant Cr.	Bank Stabilization	29 May 1997	80.00
Bryant Cr.	Bank Stabilization	29 Apr 1997	
Bryant Cr.	Gravel Removal	23 Feb 1996	
Clifty Cr.	Gravel Removal	26 Mar 1998	
Clifty Cr.	Gravel Removal	06 Apr 1998	
Dry Cr.	None Given	01 Mar 1995	
E. Prong Fox Cr.	Culverts	23 Oct 1997	45.00
Fox Cr.	Gravel Removal	25 Mar 1998	
Fox Cr.	Gravel Removal	08 Apr 1998	
Fox Cr.	Gravel Removal	03 May 1995	
Hunter Cr.	Bridge Repair	08 May 1997	100.00
Lick Cr.	Sand/Gravel Removal	10 Dec 1997	

Lick Cr.	Sand/Gravel Removal	06 May 1997	
Lick Cr.	None Given	30 Sep 1996	
North Fork R.	Gravel Removal	02 Oct 1996	
North Fork R./ Indian Cr.	Gravel Removal	22 Mar 1995	
North Fork R.	Gravel Removal	14 Jul 1995	
North Fork R.	Bridge Replacement	25 Nov 1998	40.00

Note: This table is not presented as a final authority. Status of permits subject to change.

Table Wq07. Operations within the North Fork Watershed having 404 permits since (continued) 1995 (USACOE 1999).

Stream Name	Work Type	Permit Date	Linear Feet Affected
North Fork R.	Bridge Repair	28 Apr 1997	
North Fork R.	Bridge Construction	27 Nov 1998	40.00
Prairie Hl.	Bridge	29 Jun 1995	
Prairie Hl.	Bridge	15 Sep 1995	
Spring Cr.	Gravel Removal	13 Nov 1997	
Spring Cr.	Boat Ramp	05 May 1995	
Spring Cr.	Boat Ramp	23 May 1996	

Note: This table is not presented as a final authority. Status of permits subject to change.

Wq09. 1997 Livestock numbers for counties intersected by the North Fork Watershed (MASS 1999). State ranking (of 114 counties) is given in parentheses.

County	% of County in Watershed	Cattle	Hogs
Douglas	66.7%	63,500 (16)	1,200 (100)
Howell	35.0%	95,500 (4)	10,000 (62)
Ozark	56.8%	57,000 (24)	4,000 (83)
Texas	3.1%	102,000 (3)	2,100 (91)
Webster	<1%	75,000 (10)	24,000 (33)
Wright	8.1%	78,000 (8)	6,000 (75)

Table Wq10. Fish kill and water pollution investigations conducted within North Fork Watershed from 1990-1998 (MDC 1991-1995; MDNR 1999d; and MDC 1999a).

Date	Stream	Facility Ownership	Fish Kill	Description
04/01/90	**Trib. to Brush Cr.**	Private	No	Animal waste solids in stream.
7/93, 8/94	**Trib. to Fox Cr.**	Private	No	Solids in Spring Branch.
4/92	**Trib. to S. Bridges Cr.**	Private	No	Turbidity, manure solids deposited in spring branch.
7/93	**Fox Cr.**	Private	No	Septic tank effluent surfacing, discharges to spring.
8/29/94	**Brixey Cr.**	Private	Yes	Agricultural: hog manure.
11/14/94	**North Fork R.**	N/A	No	Transportation: brewers grain.
4/91, 11/93, 4/95	**Trib. Dry Cr.**	Municipal	No	Bloodworms, excess algae, poor effluent.
5/28/98	**North Fork R.**	N/A	No	Excessive turbidity and Sedimentation.

Table Wq11. Water use within the North Fork Watershed in 1995 based on withdrawals in millions of gallons per day (USGS 1998b).

Use	Ground Water	Surface Water	Total
Public Supply (Total)	**3.41**	-	**3.41**
Domestic (delivered)	-	-	0.62
Commercial (delivered)	-	-	0.14
Industrial (delivered)	-	-	0.06
Self Supplied (Total)	**1.38**	**1.71**	**3.11**
Domestic	0.89	-	0.89
Commercial	0.01	-	0.01
Industrial	0.02	-	0.02
Livestock	0.45	1.31	1.76
Irrigation	0.03	0.4	0.43
Total	**4.81**	**1.71**	**6.52**

Table Wq12. Major water users within the North Fork Watershed (MDNR 1997).

Owner	Source	No.of Intakes	Total Gallons Pumped in 1997	Acres Irrigated
Fairview R-XI School	Ground Water	1	1,252,800	0
City of Gainesville	Ground Water	4	52,632,300	0
Pwsd #1 Howell Co	Ground Water	1	25,816,500	0
Private	Lick Creek	2	60,480,000	140
	North Fork River	2	96,000,000	110
Private	Ground Water	1	968,300	0
Private	Bryant Creek	2	0	0
	Brush Creek	2	0	0
Total	-	**15**	**237,149,900**	**250**