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Area 315
Study 3
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Minnesota Department of Natural Resources
Division of Fish and Wildlife
Section of Fisheries

Stream Survey Report

Spring Brook
Report 2005

By

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General Information

Stream Name:	Spring Brook
Alternate Name:	Seven Springs Creek
Tributary Number:	M-71-007
Counties:	Stearns
Nearest Town:	Kimball
Source of flow:	Spring complex east of the City of Kimball
Waterway sequence:	Spring source /Spring Brook/Clearwater River/ Mississippi River
Stream Length:	0.7 miles from wetland complex to mouth
Gradient:	76 ft/mile
Sinuosity:	1.16
Classification:	Class I-b (Coldwater, brook trout)

Watershed Description

Watershed Name and Number

Major:	Mississippi River (1) – Clearwater River (17)
Minor:	Clearwater 17011
Watershed Area:	376.5 acres
Watershed Land Use:	Agricultural 48.2%, forest 29.5%, grassland/pasture 14.8% and water 5.3%.
Riparian Zone:	In the area containing trout the surrounding land is undeveloped and in private ownership. The land has been used for grazing and recreation. Although riparian vegetation is not all native, quality stands of vegetation are present with adequate coverage to protect the stream.

Introduction and Study Area

Spring Brook is a designated trout stream with a headwater located approximately three miles east of the City of Kimball in Stearns County, Minnesota (Figure 1). It was initially designated in 1950. Brook trout were stocked from 1950 through 1968 in an effort to establish a reproducing population. Prolific springs in several locations throughout the abrupt hillsides form the initial stream flow. The watershed extends nearly to the city of Kimball, although it only encompasses 376 acres (Figure 2). The estimated land uses (from 1991 data) include 48.2% agricultural, 29.5% forested and 14.8% grassland area (Table 1). While a significant portion of the land use is represented by agriculture, the stream has an effective watershed considerably smaller than the 376 acres due to the general lack of topographical drainage to the headwater areas.

An initial survey of Spring Brook was conducted in 1979 and other surveys were conducted in 1985 and 1994. During previous surveys, information was compiled on fish communities, physical and chemical characteristics, and invertebrate species composition and abundance. During 2005, a follow up survey including electrofishing, invertebrate species composition, temperature, watershed and geomorphic analysis were done to update fisheries and physical feature information on Spring Brook.

Spring Brook flows 0.7 miles (1.17 km) entirely through private property to the confluence with the Clearwater River (Figure 1). The stream drops 84 ft in less than one mile for an overall slope of 0.0076 or 76 ft/mile. The lower portion of the stream has been modified from its original pattern and profile through ditching and culvert placement in 1980, which was documented in the 1985 report. The upper portion of the stream from the springs to the lower valley is relatively high gradient (76 ft/mile) with soft, loamy soils. The lower portion of the stream proceeds through mostly wetland and marsh areas prior to entering the Clearwater River and Lake Lousia (Figure 3).

Within the lower portion of Spring Brook a series of excavations were done by the land owner in an effort to create ponds. A restoration order was implemented in 1980 to restore most of the function to the stream and remove two culverts. Since the restoration and after 1990, beaver became active and dammed the

channel in the area that was restored (Figure 4). For two years (1998,1999) the larger pond created by the beaver dam was used as a walleye rearing pond by a private fish dealer. The dam and beaver were removed in late 1999 and the area returned to a more natural state, although still modified from the original profile.

Geomorphology

Classification of the stream channel can give managers a better understanding of stream dynamics and processes. One method that has been employed is the use of measuring cross sections with respect to a measure of bank full stage or annual flushing flows. By using fluvial geomorphological concepts developed by Rosgen (1996), potential sources of erosion, deposition and sites for habitat improvement work can be identified for Spring Brook. Classification was performed at one location along Spring Brook in 2005 (Figure 4). The site was located upstream of the beaver pond activity area where the channel had flattened in profile but had not been altered by ditching or impoundment. Channel morphology (Figure 5) in this reach appeared relatively stable with higher quality riparian vegetation, including willow, alder and dogwood. The classification process estimated a flood prone width of 134 ft, an entrenchment ratio of 54.7, and a low width/depth ratio (2.1) (Table 2, Figure 6). The predominant substrate type (D-50) was coarse to very coarse sand with 85% of the particles as fines (Table 3). The station had a slope of 0.0011 and was best described by the E5 stream type (Figure 7). E channels are highly subject to vegetation alteration along the stream banks, but when intact provide ideal habitat for brook trout. The classified E channel area represented the best habitat visible in the area where brook trout had previously been sampled. Areas upstream had significant increases in gradient and decreases in habitat quality (Figure 5). Similarly, as the stream channel approached the spring sources, channel stability and water quality may prevent adequate survival of brook trout. Spring outflows tend to be high in nitrogen and low in oxygen. Since Spring Brook is a very short stream it may offer limited water quality suitable for trout close to the spring sources.

Temperature

A single temperature monitor was placed in the stream to assess conditions suitable for trout. The monitor

was anchored to the streambed and programmed to record temperature each hour to measure minimum, maximum and daily fluctuation during the period between 20 April through 1 November 2005 (Table 4). The single temperature monitor collected 4,848 hourly readings and most temperatures were less than 16°C (Figure 8). The values collected from Spring Brook during 2005 suggest that favorable water temperatures were present for brook trout (temperatures below 18°C) survival for the entire summer.

Biological

Electrofishing

Fish were sampled by using a Smith Root BP-15D backpack electrofisher with pulsed direct current. Electrofishing stations began at either a downstream block net or major physical feature (barrier) and proceeded upstream to a similar barrier. During 2005, all fish were identified and counted. A total of 15 Brook stickleback (10-20 mm) and one Central mudminnow (15 mm) were sampled in 575 seconds of electrofishing. Sampling took place on the main stem of Spring Brook and one major tributary (Figure 4). Additional spot sampling was performed in the excavated areas to check for the presence of fish, although no fish were found. In previous surveys (1979, 1985, 1994) brook trout were found in low abundance (28-32 fish each survey) near the former pond location (Figure 4); however, since 1997 no brook trout have been observed by the land owner and none were sampled in the 2005 survey.

The use of the beaver-impounded area as a walleye rearing pond likely extirpated the brook trout from Spring Brook. There was limited recruitment of brook trout based on previous survey results and the former pond encompassed an area where brook trout were once sampled. In 2005, the lack of brook trout, while not surprising, was not expected. Similar trout streams in the area (Thiel Creek, Fairhaven Creek) maintain consistent recruitment and high abundance of brook trout, however, they have larger watersheds, higher base flows and do not have walleye rearing ponds located in some of their best habitat. If a desire to reestablish brook trout within the Spring Brook watershed was considered a priority it is likely survival would be favorable based on temperature and habitat conditions found during the 2005 survey. If the land were public or easement obtained on the stream, it could be considered for channel realignment and

restoration. Since the stream is entirely on private property and easements seem unlikely, it is not recommended that DNR stocking of brook trout or channel restoration take place on Spring Brook at this time.

Invertebrate sampling

D-net samples were taken at a single location near the classification site and sampled substrate, woody debris and overhanging vegetation in the area. Eleven taxa were found in the sample (Table 5). The collection sample size was low and the species present suggest there may be more organic enrichment in Spring Brook than in other trout streams in Stearns County.

REFERENCES

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ACKNOWLEDGMENTS

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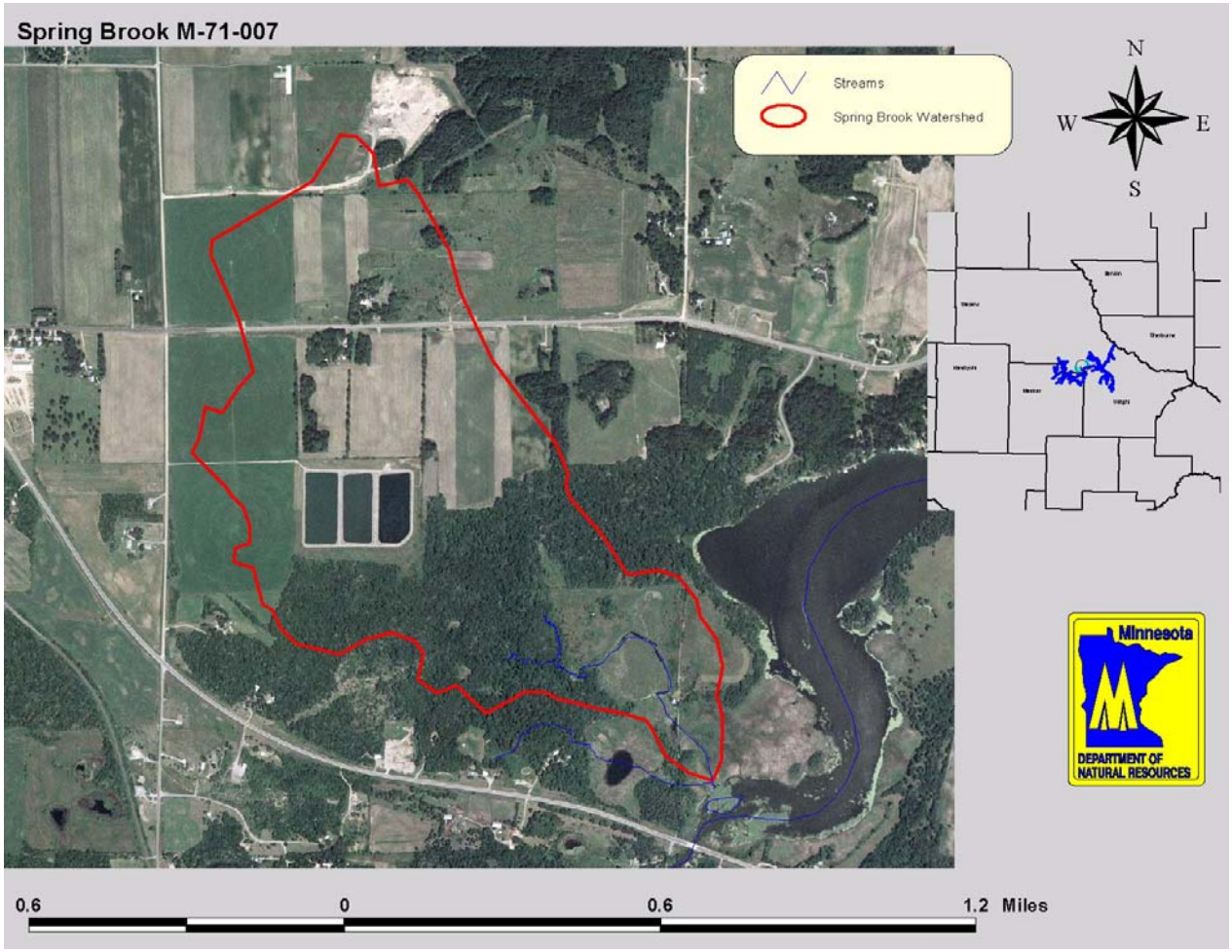

Figure 1. Location of Spring Brook, Minnesota.

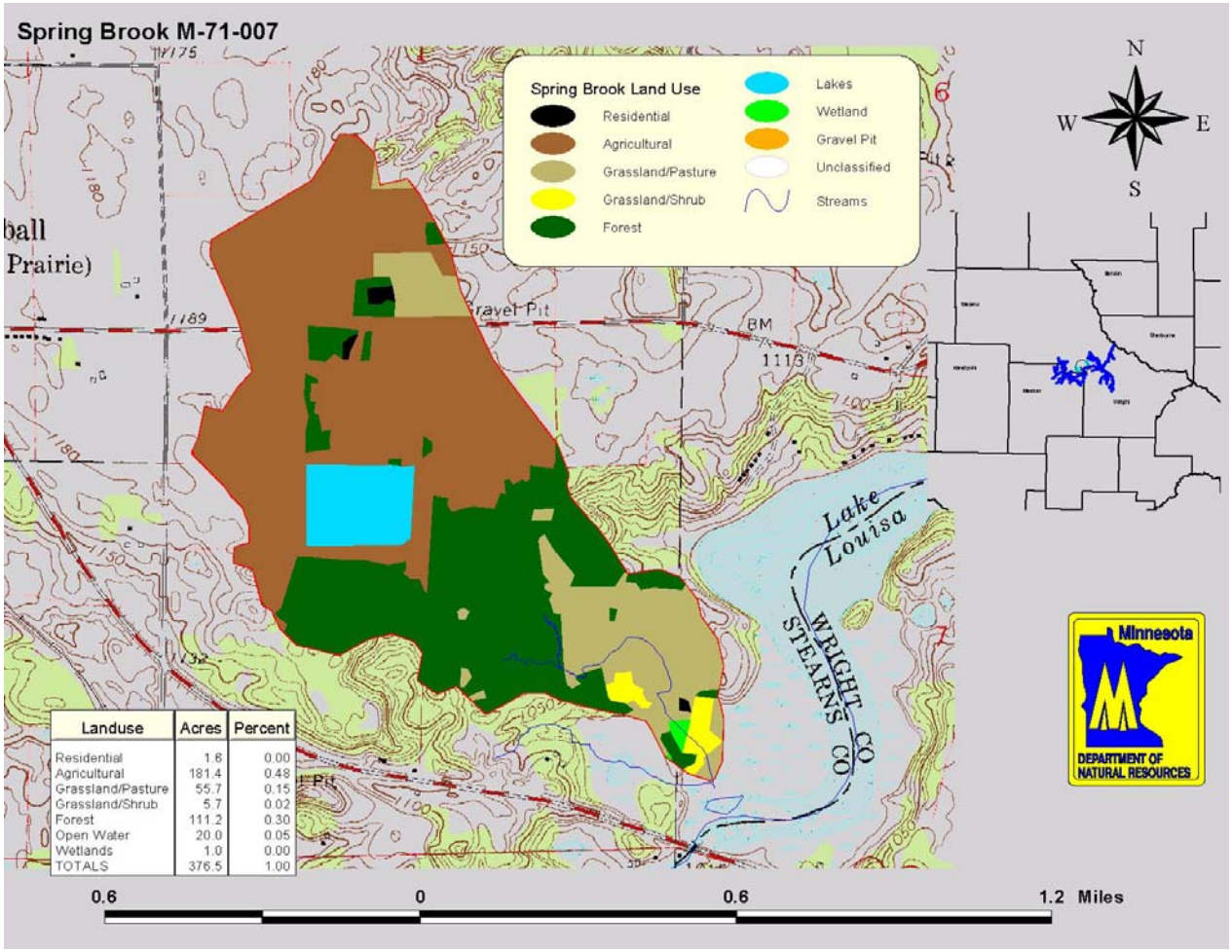

Figure 2. Estimated 1991 land use with in the Spring Brook (M-71-) major watershed.

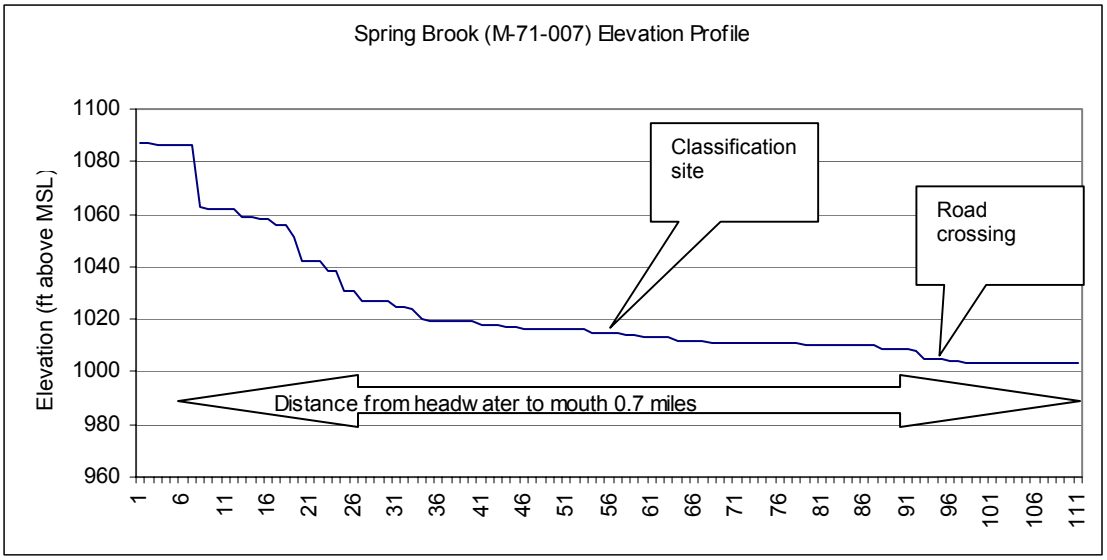

Figure 3. Elevation profile of Spring Brook near Kimball, MN 2005

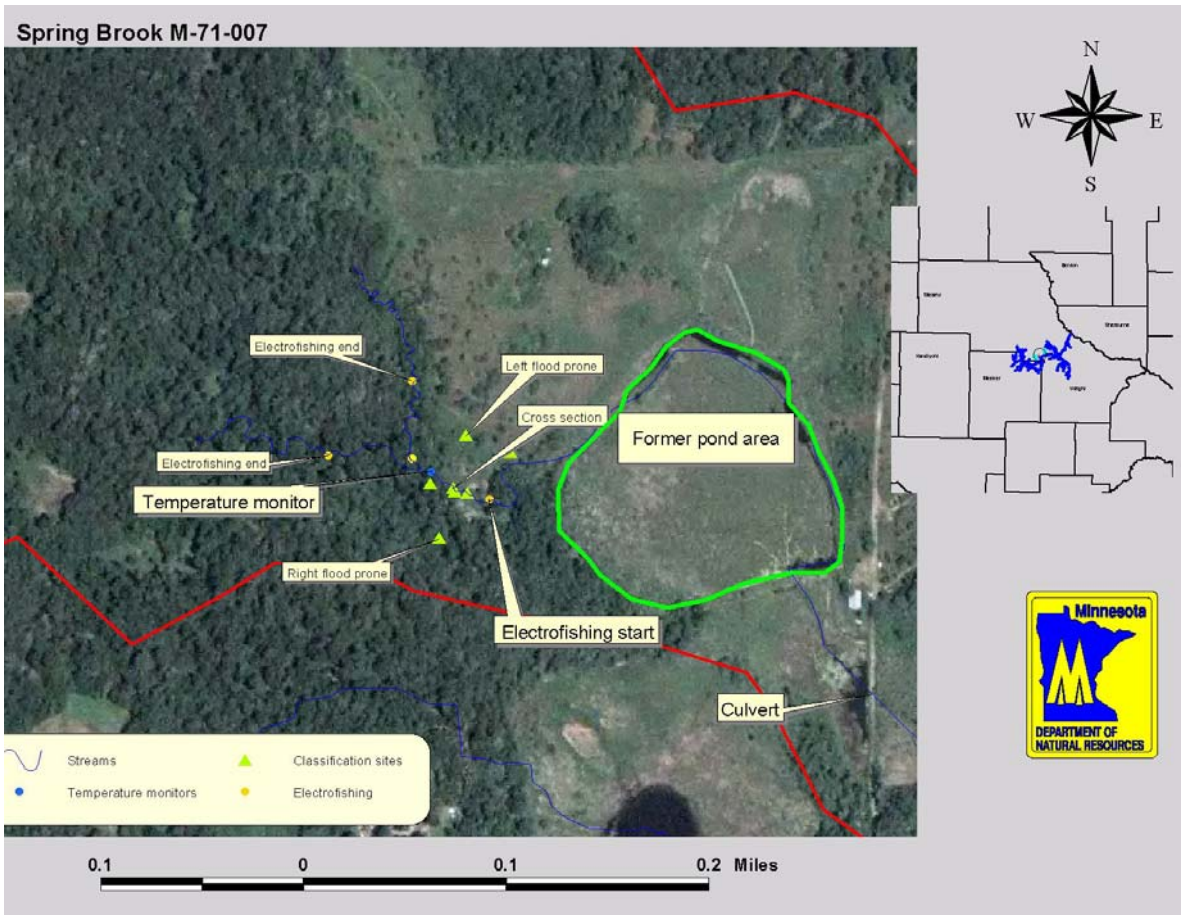

Figure 4. Location of electrofishing stations, temperature monitors, stage monitor and classification sites on Spring Brook during 2005.

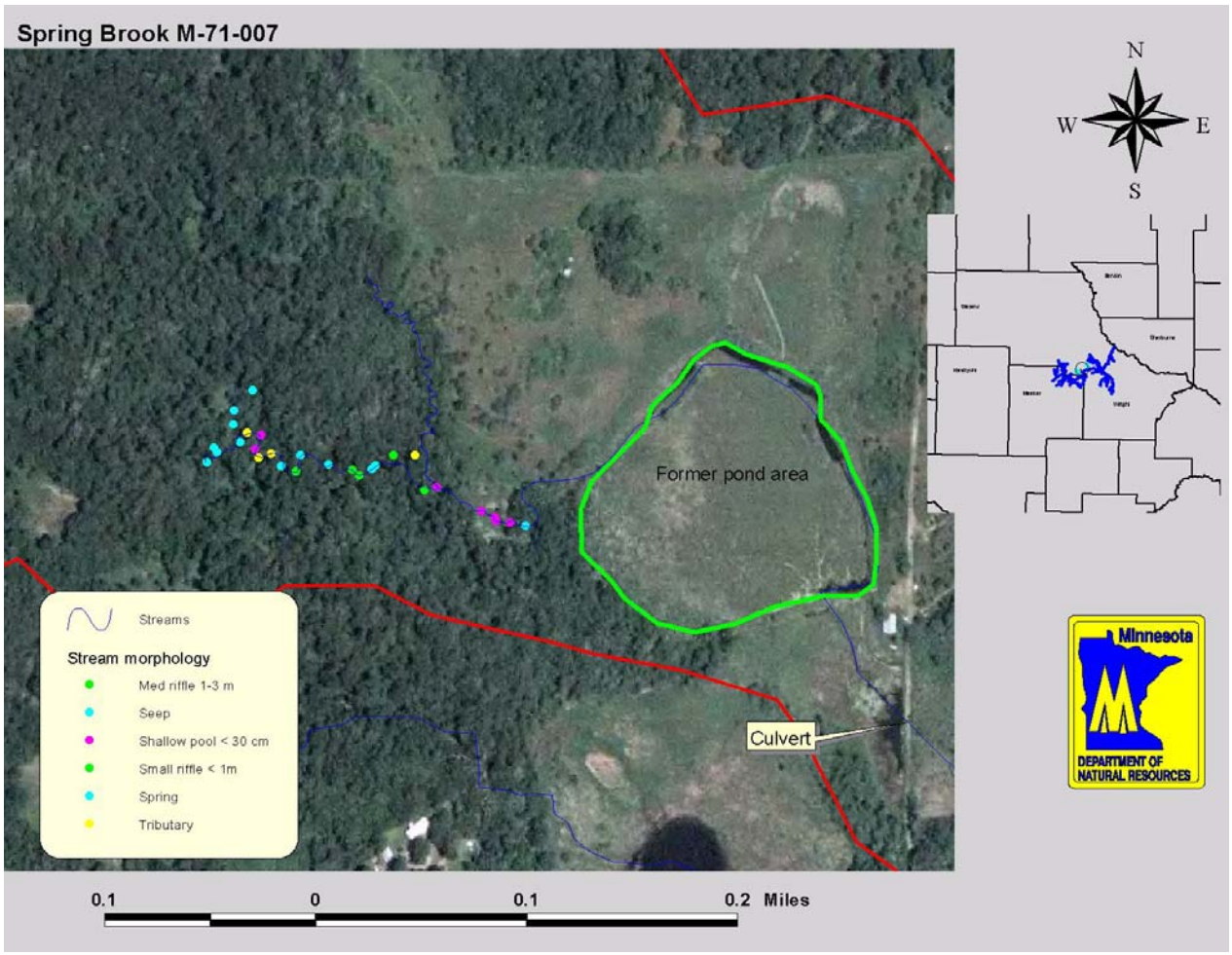

Figure 5. General morphology of selected site on Spring Brook 2005

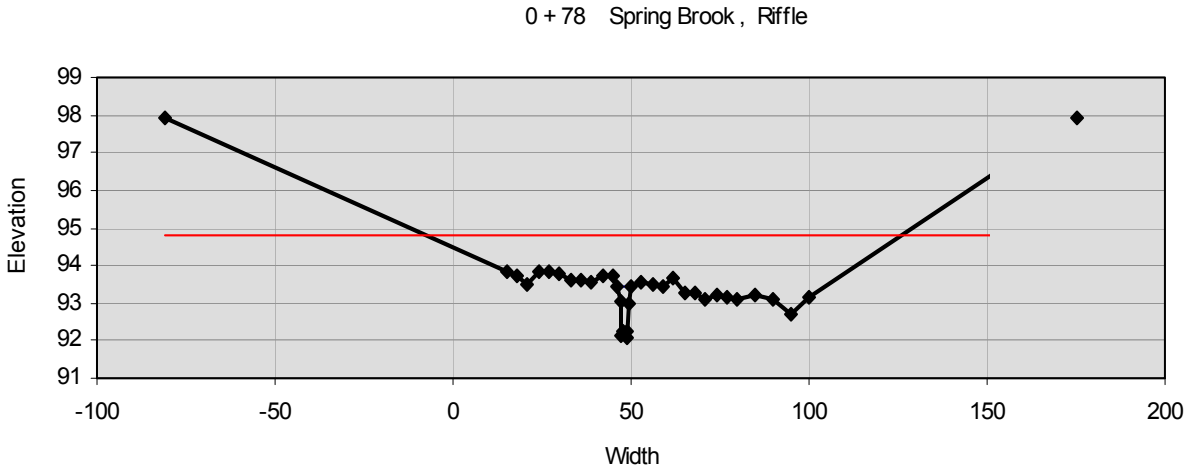

Figure 6. Classification site cross section dimensions Spring Brook (M-71-007) spring, 2005.

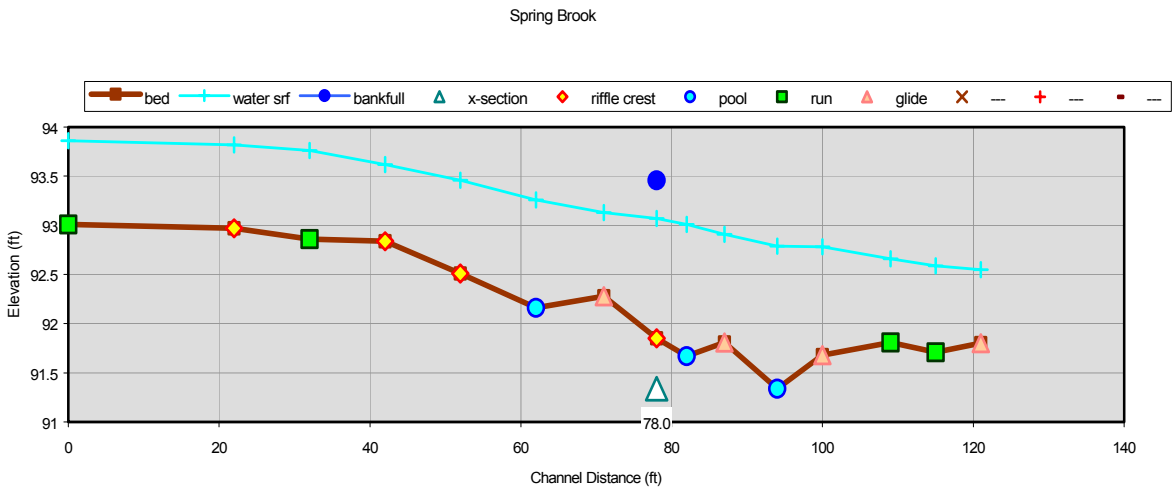

Figure 7. Longitudinal profile within the classification site, Spring Brook (M-71-007) spring, 2005.

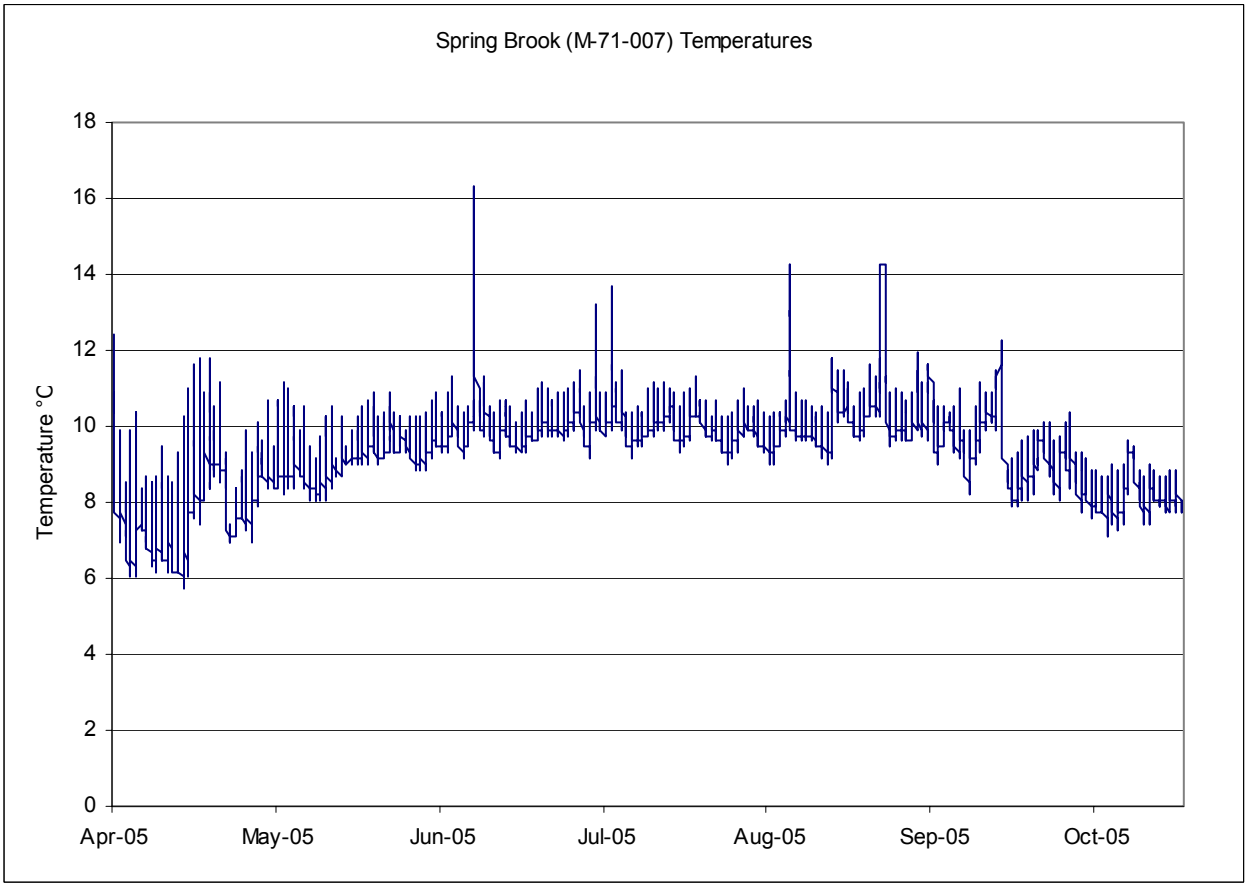

Figure 8. Mean daily temperatures (°C) recorded by remote Stow Away Tidbit monitor located in Spring Brook from 20 April through 1 November 2005.

Table 1. Spring Brook (M–74-4) major watershed estimated land use by acres and percent (1991 data).

Land use	Acres	Percent
Agricultural	181.4	48.2
Forest	111.2	29.5
Grassland/pasture	55.7	14.8
Open Water	20.0	5.3
Grassland/Shrub	5.7	1.5
Residential	1.6	0.4
Wetlands	1.0	0.3
Total	376.5	

Table 2. Results of stream classification for Spring Brook (M-71-007) spring, 2005.

Bankfull Dimensions		Flood Dimensions		Materials	
2.8	x-section area (ft.sq.)	134.0	W flood prone area (ft)	0.18	D50 Bed (mm)
2.5	width (ft)	54.7	entrenchment ratio	0.49	D84 Bed (mm)
1.2	mean depth (ft)	---	low bank height (ft)	26	threshold grain size (mm):
1.4	max depth (ft)	---	low bank height ratio		
3.7	wetted parimeter (ft)				
0.8	Hydrolic radi (ft)				
2.1	width-depth ratio				
Bankfull Flow		**Flow Resistance**		**Forces & Power**	
9.7	velocity (ft/s)	0.013	Manning's roughness	1.1	channel slope (%)
27.6	discharge rate (cfs)	0.02	D'Arcy-Weisbach fric.	0.52	shear stress (lb/sq.ft.)
1.96	Froude number	18.7	resistance factor u/u*	0.52	shear velocity (ft/s)
		719.9	relative roughness	7.7	unit strm power (lb/ft/s)

Table 3 . Pebble count information for the classification site on Spring Brook (M-71-007) spring, 2005.

Size (mm)		Size Distribution		Type	
D16	0.064	mean	0.2	silt/clay	15%
D35	0.13	dispersion	2.8	sand	85%
D50	0.18	skewness	-0.01	gravel	0%
D65	0.23			cobble	0%
D84	0.49			boulder	0%
D95	0.8				

Table 4. Spring Brook temperature values (^{0}C) recorded from between 20 April and 1 November 2005.

Parameter	Value
Min	5.7
Mean	9.5
Max	16.3
N	4,848
N>18	0
N>20	0
N>22	0

Table 5. Invertebrate identification and enumeration from D-net samples collected in a riffle area on Spring Brook, MN, 1 November 2005.

Taxa	Number
PLECOPTERA	
Paracapnia sp.	12
EPHEMEROPTERA	
Baetidae	
Baetis sp.	14
B. brunneicolor	13
TRICHOPTERA	
Limnephilidae	
Hesperophylax designatus	11
DIPTERA	
Tipulidae	
Dicranota sp.	1
Simuliidae	
Simulium sp.	1
Dixidae	
Dixa sp.	3
Chironomidae	6
CRUSTACEA	
Amphipoda	
Gammarus sp.	9

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Author	Date
Area Fisheries Supervisor	Date
Regional Fisheries Supervisor	Date