

Topeka Shiner Monitoring in Minnesota: 2014

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ABSTRACT

In response to a range-wide decline in abundance and distribution, the Topeka shiner (*Notropis topeka*) was designated as a federally endangered species in 1999. In 2004, the Minnesota Department of Natural Resources began a presence/absence survey effort to monitor Minnesota populations of Topeka Shiners at randomly selected sites within the federally designated critical habitat for the species. Averaged over the first seven years of monitoring from 2004-2010, Topeka shiners were present at 76.4% of randomly selected reaches of streams. Monitoring surveys conducted in 2012, and 2013 fell below the overall average at 40% and 30% respectively. Herein, results are presented for Topeka shiner monitoring surveys conducted in 2014 in which Topeka shiners were found at 45% of randomly selected segments. Results from this and previous sampling efforts are indicative of a decline in Minnesota populations of Topeka shiners. Expanded monitoring and survey efforts are recommended.

INTRODUCTION

The Topeka shiner (*Notropis topeka*) was historically widespread and abundant in low order streams throughout the central plains region of the United States. Over the last several decades, it has exhibited widespread decline across much of its range and is estimated to occur in only 10 percent of its historic geographic distribution (Tabor 2002). Although no single factor has been identified as the causative agent in the rapid decline of this species, habitat loss resulting from the nearly wholesale conversion of the landscape for agricultural purposes has been implicated by several researchers (Pflieger 1997; Eddy and Underhill 1974; Gelwicks and Brunderman 1996; Berg et al. 2004). The combined effects of ecosystem alteration have led to a decrease in base flows, elevated sedimentation, increased turbidity, higher water temperatures, and loss of aquatic vegetation; all of these factors contribute to the degradation and loss of the Topeka shiner's preferred habitat (Tabor 1993). In response to the rapid and dramatic decline in abundance and distribution, the U.S. Fish and Wildlife Service designated the species as endangered under the Endangered Species Act of 1973 (Tabor 1998).

Surveys conducted during the late 1990s indicated that Minnesota harbored viable populations of Topeka shiners throughout its distribution in the state, and that compared with previous survey efforts in the 1970s and 80s, these populations appeared to be stable (Dahle 2001; Hatch 2001). These findings were in sharp contrast to survey efforts in other portions of the Topeka shiner's historic range, where they were sampled at only 17% of historic localities in Kansas (Tabor 1998) and 15% of historic localities in Missouri (Gelwicks and Brunderman 1996). This discrepancy between presence/absence at historic sites in Minnesota versus other

regions within the species' range led Dahle (2001) to conclude that "Minnesota populations may represent the largest and most stable population remaining in the species' range."

In 2004, the Minnesota Department of Natural Resources began a program to monitor populations of Topeka shiners within the state. A protocol was established (Ceas and Anderson 2004) to conduct a presence/absence survey of Topeka shiners at twenty randomly selected reaches of stream from within the federally-designated critical habitat in the Big Sioux and Rock River drainages in southwestern MN. Surveys were conducted annually from 2004 to 2010 and Topeka shiners were found at an average of 76.4% of sites over the seven year period (Ceas and Anderson 2004; Ceas and Monstad 2005, 2006; Ceas and Plain 2007; Ceas and Larson 2008, 2009, 2010). These values ranged from Topeka shiners present at 90% of the 20 randomly-selected reaches of streams in 2006, to 60% of sites in 2010. Although the annual percentage of sites where Topeka shiners were present was relatively stable for the first six years of monitoring (Figure 1), surveyors began to note a marked decline in relative abundance of the species as well as a decline in the number of sites where the species was present (Ceas and Larson 2009, 2010). In 2012 and 2013, this negative trend continued where Topeka shiners were only found at 40% and 30% of randomly selected segments, respectively (Nagle and Larson, 2013). Results from monitoring surveys conducted in 2014 are detailed in this report and are consistent with a decline in the prevalence of Topeka shiners in Minnesota.

METHODS

Methods for 2014 Topeka shiner monitoring follow Ceas and Anderson (2004) and are reproduced below with updated information.

Selection of Stream Segments

For each year of Topeka shiner monitoring, 20 one-mile reaches of stream were selected at random from the federally designated Topeka shiner critical habitat within Minnesota, employing an ArcView extension program developed by MN DNR (Appendix A, Map 1).

Landowner Contact

When possible, stream segments were accessed at public rights-of-way at bridge crossings. However, given that many of the randomly-selected stream segments occur on privately-owned lands, permission was obtained from landowners to access those reaches of stream. Contact information for landowners was provided to the DNR by the County Auditor's offices of Pipestone, Lincoln, Murray, and Nobles counties. Landowner contact information for Rock County was accessed online at <http://rock.houstoneng.com>. Landowners received a notice in the mail requesting access to the property to conduct aquatic surveys, and when possible were also contacted by telephone.

Selection and Reconnaissance of Sampling Sites

Based on habitat preferences characterized in the literature (Minckley and Cross 1959; Bailey and Allum 1962; Pflieger 1997; Berg et al. 2004; Eddy and Underhill 1974; Dahle 2001; Hatch 2001), sample sites were identified within each randomly-selected reach of stream using aerial photography viewed in ArcGIS ver 10.1. At each sample segment, a brief reconnaissance was conducted to prioritize sampling at potential Topeka shiner habitat.

Basic habitat descriptions and locality information for each of the twenty stream segments sampled in 2014 are presented in Table 1 of Appendix B. Lists of fish species captured along each of the sample segments are presented in Table 2.

Fish Sampling

Presence/absence surveys were conducted for Topeka shiners using 15' x 5' x 1/8" pole seines from May 19th to 22nd, 2014. Sampling efforts were focused on low-flow areas along the main channel boundary (MCB), backwaters, and off-channel ponds and oxbows. Seines were dragged along unobstructed reaches of substrate, and set-kicks were performed in vegetation or undercut banks. Due to substantial habitat and stream character heterogeneity across randomly selected sample segments, sampling efforts were not standardized between segments. Stream segments were sampled until either Topeka shiners were captured, or all suitable Topeka shiner habitat within the segment had been sampled. In the absence of Topeka shiners or suitable habitat, a minimum of ten sites were sampled within each segment.

The monitoring effort focuses on presence/absence of Topeka shiners and no methodologies were employed to quantify population size or numbers of individuals within the sample reaches. However, within segments where Topeka shiners were sampled, a qualitative assessment of relative abundance was made based on the professional judgment of the surveyor

(Ceas and Larson 2010). While these assessments are inherently subjective by nature, they are intended to provide a coarse characterization of Topeka shiner relative abundance at sites where they are present. Sites where Topeka shiners were sampled were categorized as either ‘abundant’ (Topeka shiner is most numerous species present, or >10 individuals collected in the initial seine haul at capture site), ‘common’ (Topeka shiner individuals appear in low numbers relative to other species, or 5-10 individuals captured in the initial seine haul), or ‘present’ (<5 individuals captured after substantial sampling effort).

RESULTS

2014 Monitoring Surveys

Topeka shiners were collected at nine of the 20 one-mile stream segments: 181, 184, 188, 189, 190, 191, 192, 193, and 194 (Appendix A, Map 2). See Figure 1 for yearly totals of segments with Topeka shiners from 2004-2013. In all instances, Topeka shiners were captured in areas of low flow, pool, or backwater habitat; no individuals were captured in free-flowing reaches of stream. Segments 192, 193, and 194 were the only reaches of stream where Topeka shiners were captured at the first sample site. Habitat and voucher photographs for 2014 stream segments are presented in Appendix C.

Although Topeka shiners were collected at slightly more sites than the previous two years of monitoring surveys, very few Topeka shiners were collected in 2014 relative to surveys conducted from 2004-2009. Of the sites where Topeka shiners were captured, only two yielded shiners in high numbers. Few individuals were captured at the remaining seven sites where the species was found: nine individuals were collected at one segment after substantial sampling

effort, and few ($n < 5$) individuals were found at the six other segments where the species was present.

Four sample segments contained off-channel pond habitat (segments 182, 184, 186, and 198), but Topeka shiners were not found in any of them. The off-channel ponds along segment 182 (trib. to Willow Creek) were dominated by cattail and mats of filamentous algae and contained a few individuals of Iowa darters (*Etheostoma exile*), and no Topeka shiners were captured. The ponds along segment 184 (Pipestone Creek) contained drainage from a nearby feedlot; over 0.75 m of sludge/cattle waste was accumulated in the pond nearest Hwy 30. Only fathead minnows (*Pimephales promelas*) were sampled in these ponds. No fish were captured in the off-channel ponds along segment 186 (trib. to Rock River), which was an intermittent stream that was nearly dry at the time of sampling. The artificial pond along a ditched reach of segment 198 contained only fathead minnows (*Pimephales promelas*).

A total of 26 fish species were collected during the 2014 surveys. Plains topminnow, a Threatened species in MN, was collected in four segments (sites: 187-6, 190-3, 190-7, 195-10, and 199-7). A complete list of fish species collected in each segment is presented in Table 2.

DISCUSSION

Monitoring surveys conducted in 2014 found Topeka shiners at 45% of the randomly-selected sites (Figure 1). While absence at some sites may be attributable to distributional and geomorphic factors associated with randomly selected sites falling outside of preferred habitats, the near absence of Topeka shiners in areas with historically strong populations is of particular concern.

2014 Absence localities

As mentioned above, the randomized segment selection process may result in some segments falling on reaches of stream that are less likely to contain Topeka shiners. The following section describes segments of streams that did not contain Topeka shiners, but exhibited suitable habitat and/or contained historic records of the species from previous MN DNR monitoring surveys (2004-2010). Refer to Table 1 for basic habitat descriptions and coordinates of sample sites within each segment. Refer to Appendix C for habitat photographs of the segments described below.

Segment 187 (Unnamed tributary to Rock River, Rock River) exhibited suitable Topeka shiner habitat in pooled areas along the stream reach, a scour pool downstream of a culvert, and backwater areas along the main stem of the Rock River. A backwater along a gravel bar that contained Topeka shiners in 2012 surveys (site 148-4, 2012; site 187-8, 2014) was thoroughly sampled; no Topeka shiners were present. The backwaters along the Rock River contained much more filamentous algae than they did in the 2012 visit.

Segment 198 (Elk Creek) exhibited some suitable Topeka shiner habitat in pooled areas along bends in the stream, however the deeply-incised channel with severely eroded, steep banks throughout much of the reach did not provide an abundance of off-channel habitat. The southern portion of the segment was channelized and exhibited no suitable habitat. The segment is mentioned here because in previous monitoring surveys (2004-2013), Topeka shiners were present at > 91% (11/12) of sites samples within this watershed. The only other segment in this watershed (155, 2012) in which the species was not captured had been channelized as well.

Segment 200 (Little Rock River) exhibited ideal habitat throughout much of the reach in that it is a very clear, low gradient stream with ample pooled and low flow areas along the reach.

Sites in the nearby and very similar tributary, Little Rock Creek, harbor the shiners in abundance (Nagle 2014).

The remaining segments of stream that did not contain Topeka shiners either occurred in regions that have not historically exhibited large populations (segment 182), and/or the present character of the stream did not offer suitable habitat (segments 183, 185, 186), or the segment exhibited signs of substantial alterations to the stream in the form of drainage tiles, channelization, or bank modifications. Segments 196 and 197 (Rock River) and 195 and 199 (Champepadan Creek) were similar segments in that they were larger streams that exhibited sparse off-channel and low flow areas along the channel that were isolated by long intervening reaches of free flowing stream at time of sampling.

Plains Topminnow

Plains topminnow (*Fundulus sciadicus*) is a Threatened Species in Minnesota. Although survey efforts specifically targeted Topeka shiners, survey efforts were focused on backwaters, low-flow areas, and pool habitats, which is also the preferred habitat of the plains topminnow (Pflieger 1997). Despite intense survey effort in suitable plains topminnow habitat, the species was documented at only 3/10 segments sampled within their distribution in 2012 and at 1/12 segments in 2013. Surveys conducted in 2014 sampled the species at 4/13 segments within the species' distribution. The low number of segments where the species was documented and scarcity of individuals suggest that this taxon is in need of additional protection and management.

Conclusions

The protocol employed in Minnesota's Topeka shiner monitoring effort was designed to detect changes in the species' presence within the state (Ceas and Anderson 2004). Data collected over the past ten years of monitoring provide detailed documentation of a shift in the prevalence of Topeka shiners in Minnesota. In the five year period from the onset of monitoring in 2004 to 2008, Topeka shiners were present at an average of 80% of sites. The next four cycles of monitoring reported an annual drop in the number of sites where the species was present, falling steadily from 80% of sites in 2008, to a to-date low of 30% of sites in 2013 (Ceas and Larson 2008, 2009, 2010; Nagle and Larson 2013) (Figure 1). Not only did surveys conducted during this period demonstrate a decrease in the number of sites where the species is present, but also showed a distinct decline in the qualitative assessments of relative abundance. Ceas and Larson (2008) ranked 11 of the sites where shiners were present as 'common' or 'abundant', and this value fell to two sites by 2010 (Figure 2). While Topeka shiners were documented at a greater number of randomly selected reaches (45%) in 2014 than the previous two years of monitoring, this value is still well below the overall average and far below the values observed in the first few years of monitoring. The downward trend in distribution and abundance of Topeka shiners noted by Ceas and Larson (2010) is reinforced by recent survey efforts presented here and by Nagle and Larson (2013); surveys conducted in 2012, 2013 and 2014 exhibit still lower numbers of sites where Topeka shiners were present. These findings are further bolstered by a recent study in Iowa that demonstrates a similar pattern; surveys conducted in Iowa during 2010-2011 only collected Topeka shiners 43% of sites where the species was present in 1997-2000 (Bakevich 2013).

Although sampling effort is not standardized among sample segments, a general trend of increased sample effort is observed throughout the monitoring. Averaged over the period from 2004 to 2009, Topeka shiners were collected at the first sample site at over ten of the segments. This value dropped to six segments in 2010 and to two segments in 2012, 2013 and 2014. This trend of greater sampling effort yielding fewer and fewer individuals is further indication of a decline in Minnesota populations of Topeka shiners.

Having detected what appeared to be a significant decline in Minnesota populations of Topeka shiners, Nagle and Larson (2013) recommended that a larger survey effort be implemented to evaluate shiner populations at historic localities from this monitoring program and other studies, as well as continuing to monitor sites at randomly-selected localities. In 2013 additional surveys were conducted to revisit localities that were demonstrated to harbor large numbers of individuals in previous surveys (Nagle 2014). These revisits found the species to be present at only 64% of known localities and, in most cases, far fewer in numbers than documented in the initial visits. The present, and other recent studies indicate that not only are Minnesota populations no longer as stable as indicated by studies conducted in the late 1990s and early 2000s, but that a rapid decline is evident. Continued monitoring effort and further study are recommended to identify stream stressors and factors that contribute to habitat loss and population decline.

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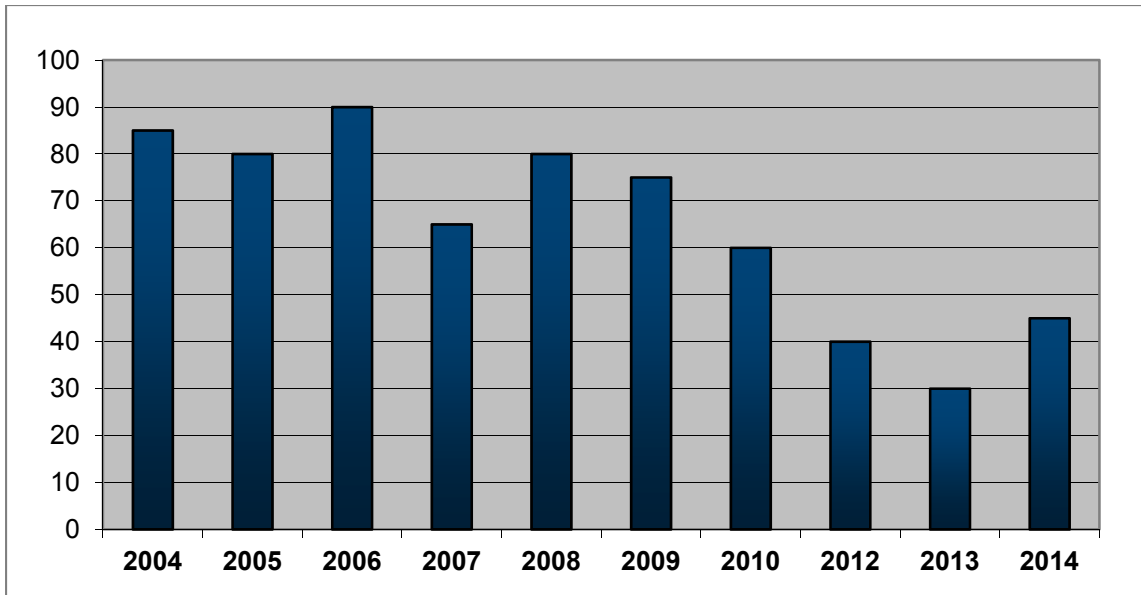


Figure 1: Percentage of randomly selected stream segments where Topeka shiners were captured, 2004-2014.

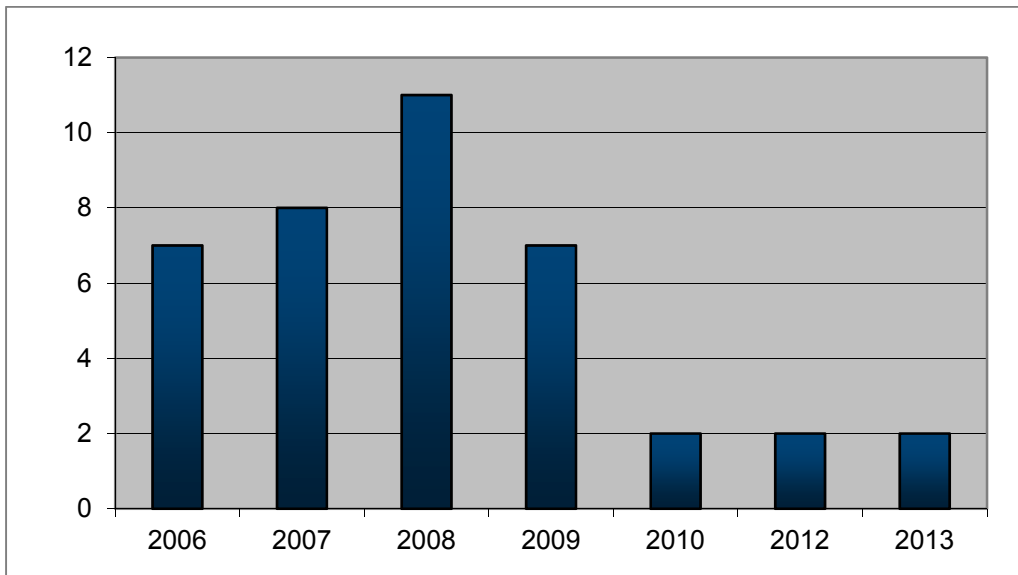


Figure 2: Number of sites where Topeka shiners were considered 'common' or 'abundant': 2006-2013.

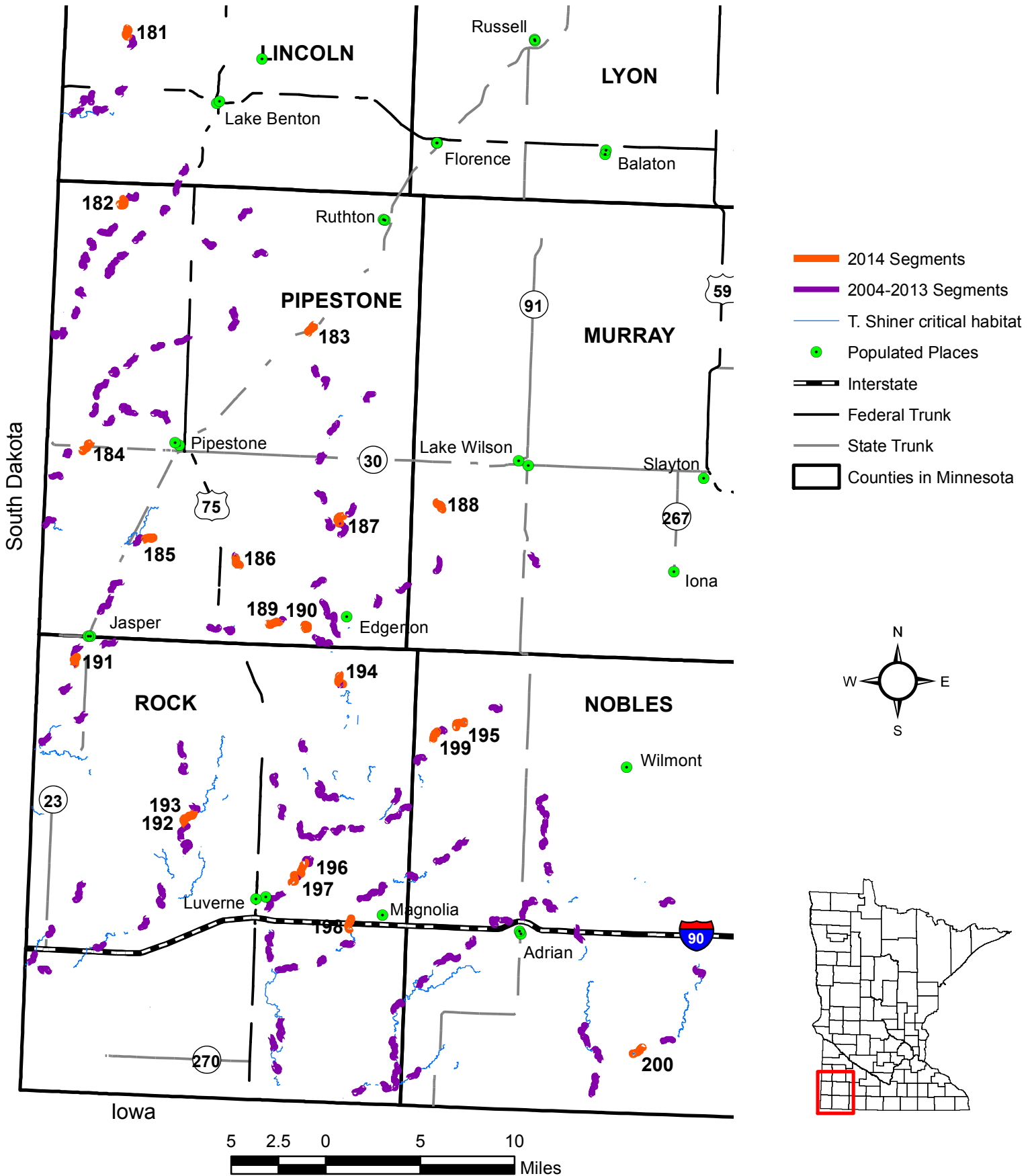
Appendix A- Maps of Stream Segments

Map 1. Overview of 200 one-mile stream segments sampled during 2004-2014.

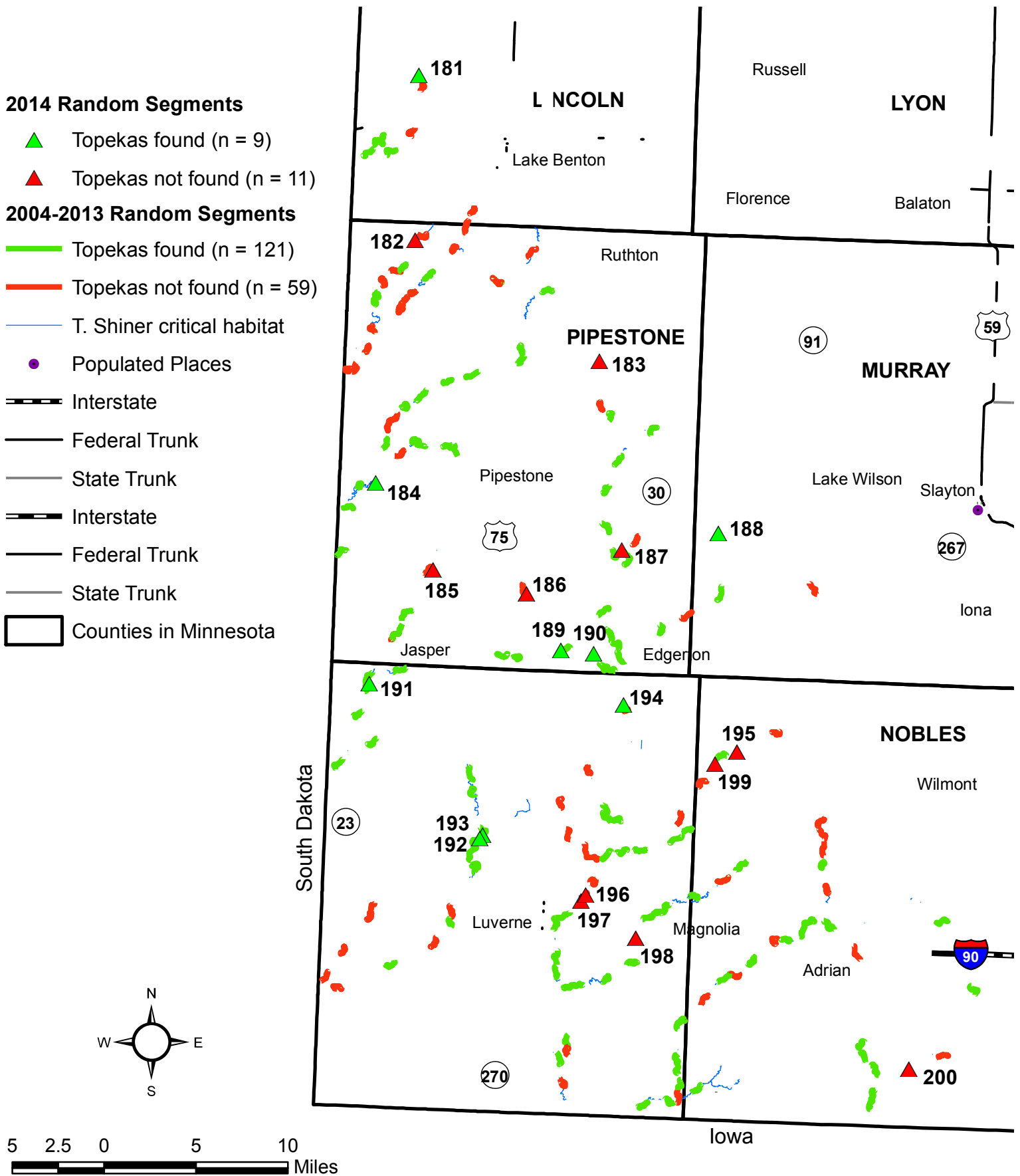
Map 2. Presence/absence of Topeka shiners at segments sampled during 2004-2014.

Maps 3-22. Aerial views of the 40 sample segments that were sampled in 2014.

Map 1: Overview of Random Segments 2004-2014



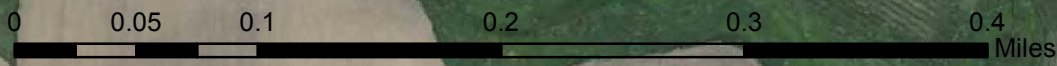
Map 2: Overview of segments where Topeka Shiners were found 2004-2014

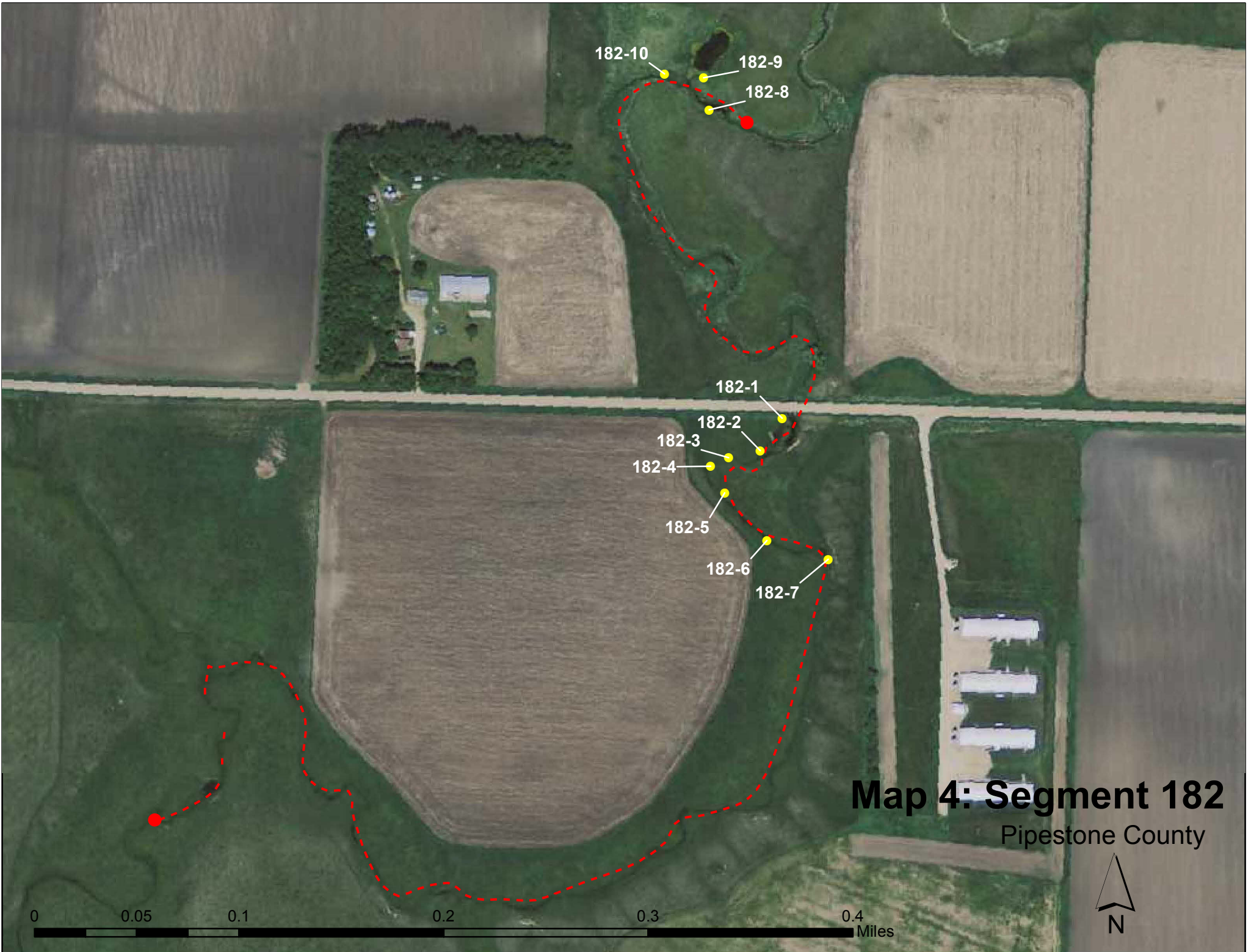




Map 3: Segment 181

Lincoln County





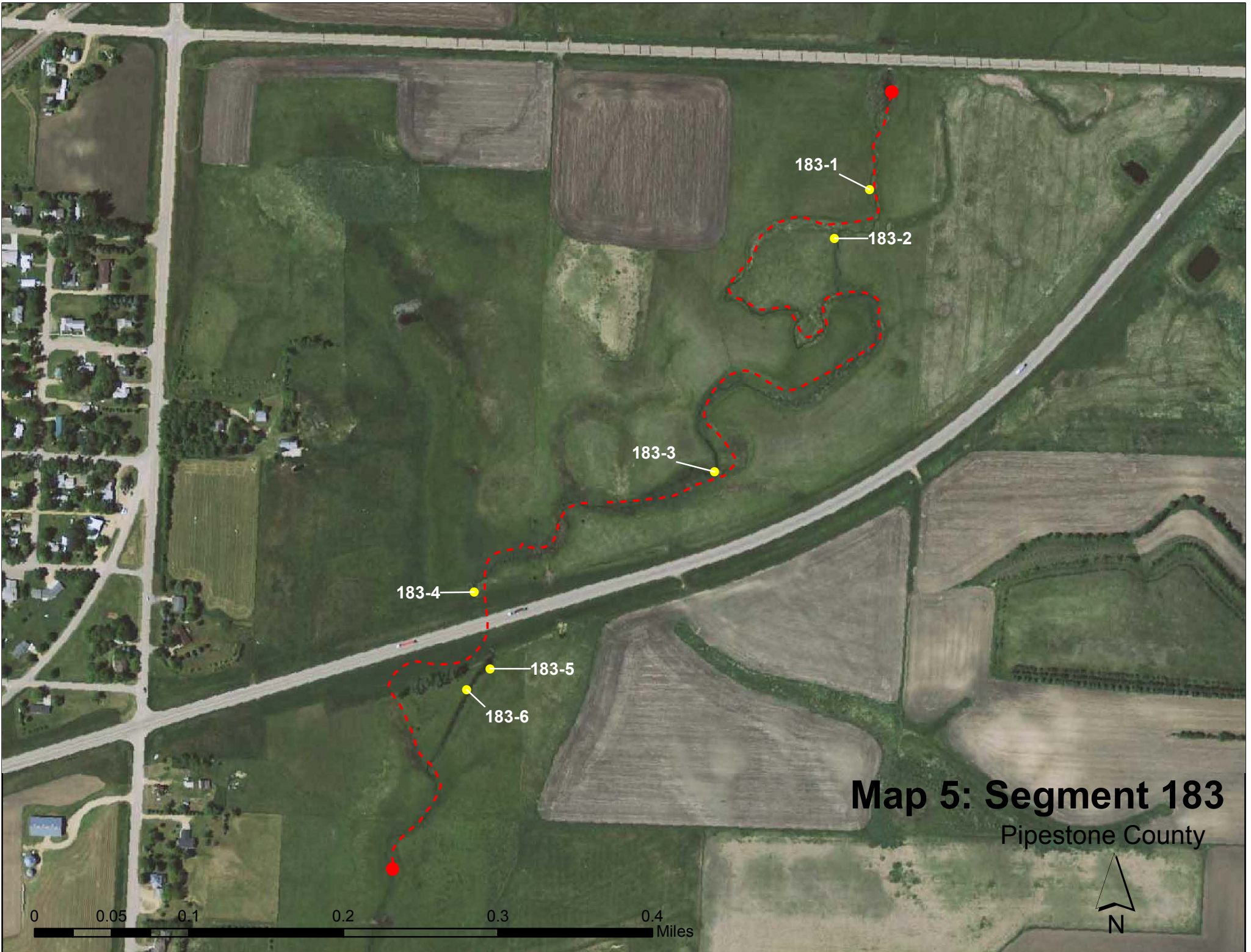
182-10
182-9
182-8

182-1
182-2
182-3
182-4
182-5
182-6
182-7

Map 4: Segment 182
Pipestone County

0 0.05 0.1 0.2 0.3 0.4 Miles



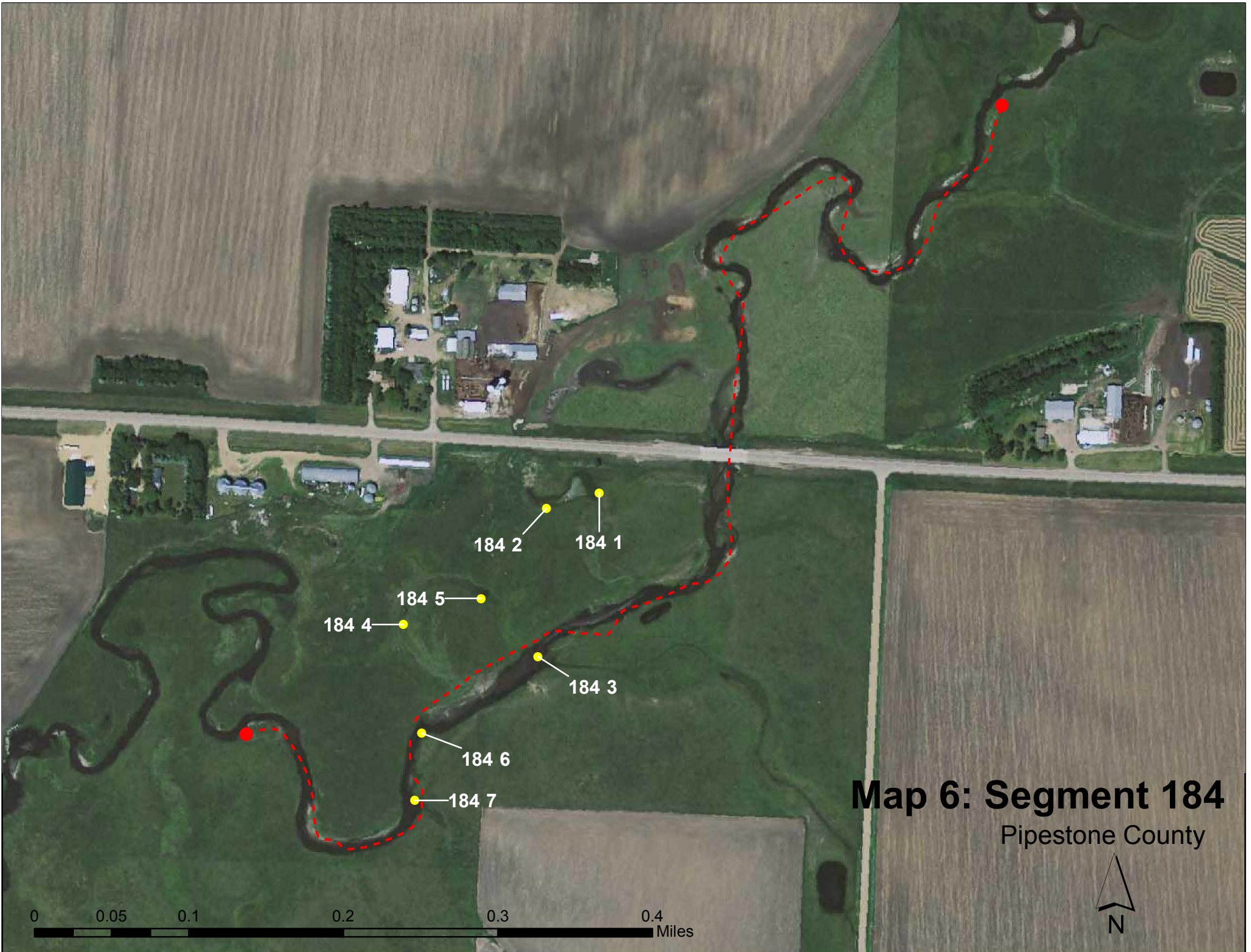


Map 5: Segment 183

Pipestone County

0 0.05 0.1 0.2 0.3 0.4 Miles



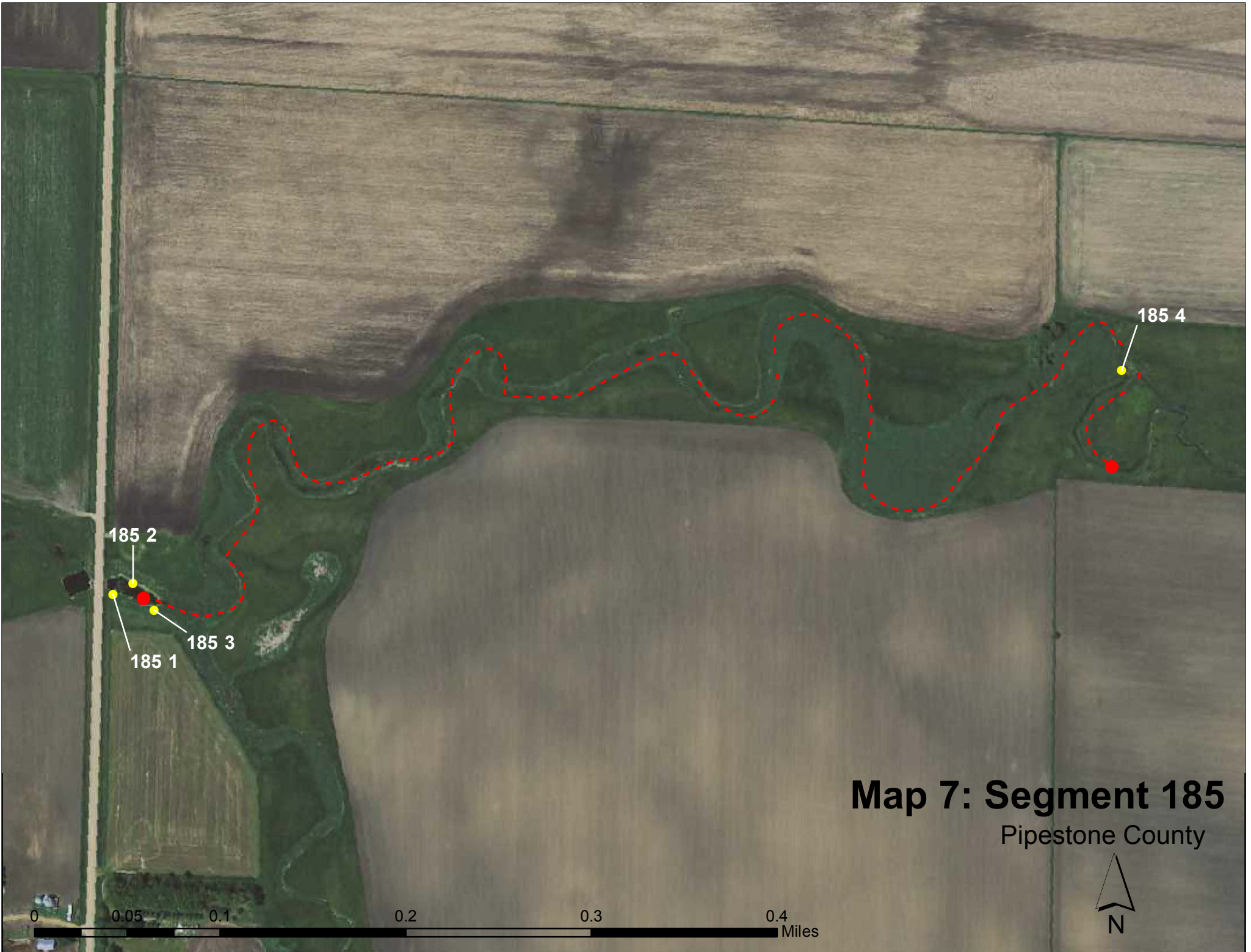


Map 6: Segment 184

Pipestone County



0 0.05 0.1 0.2 0.3 0.4 Miles



185 2

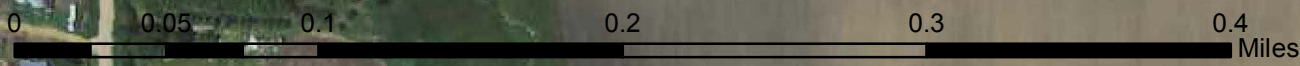
185 4

185 1

185 3

Map 7: Segment 185

Pipestone County





186-3

186-2

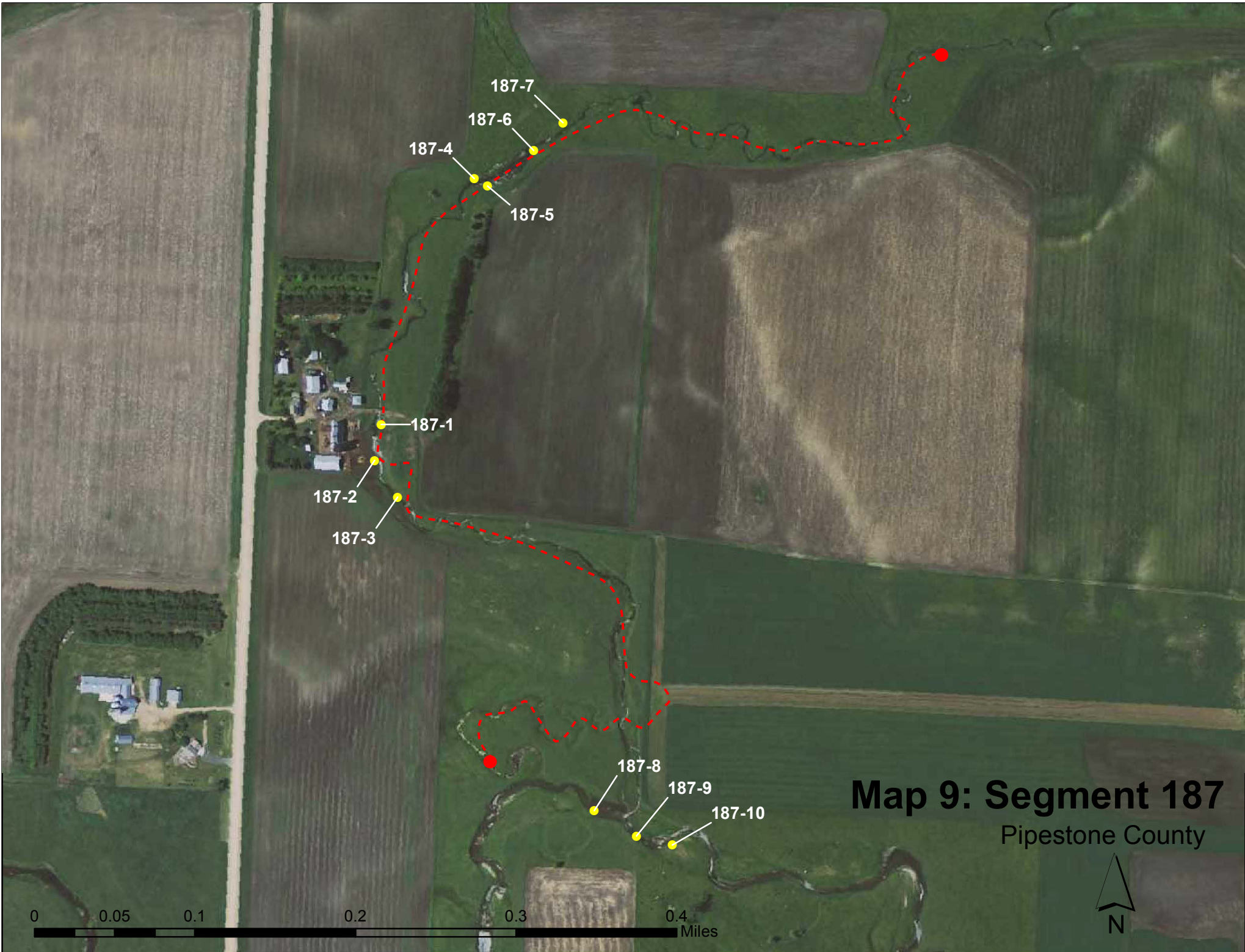
186-1

Map 8: Segment 186

Pipestone County

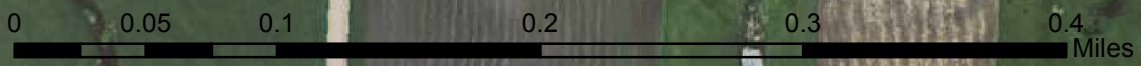
0 0.05 0.1 0.2 0.3 0.4 Miles

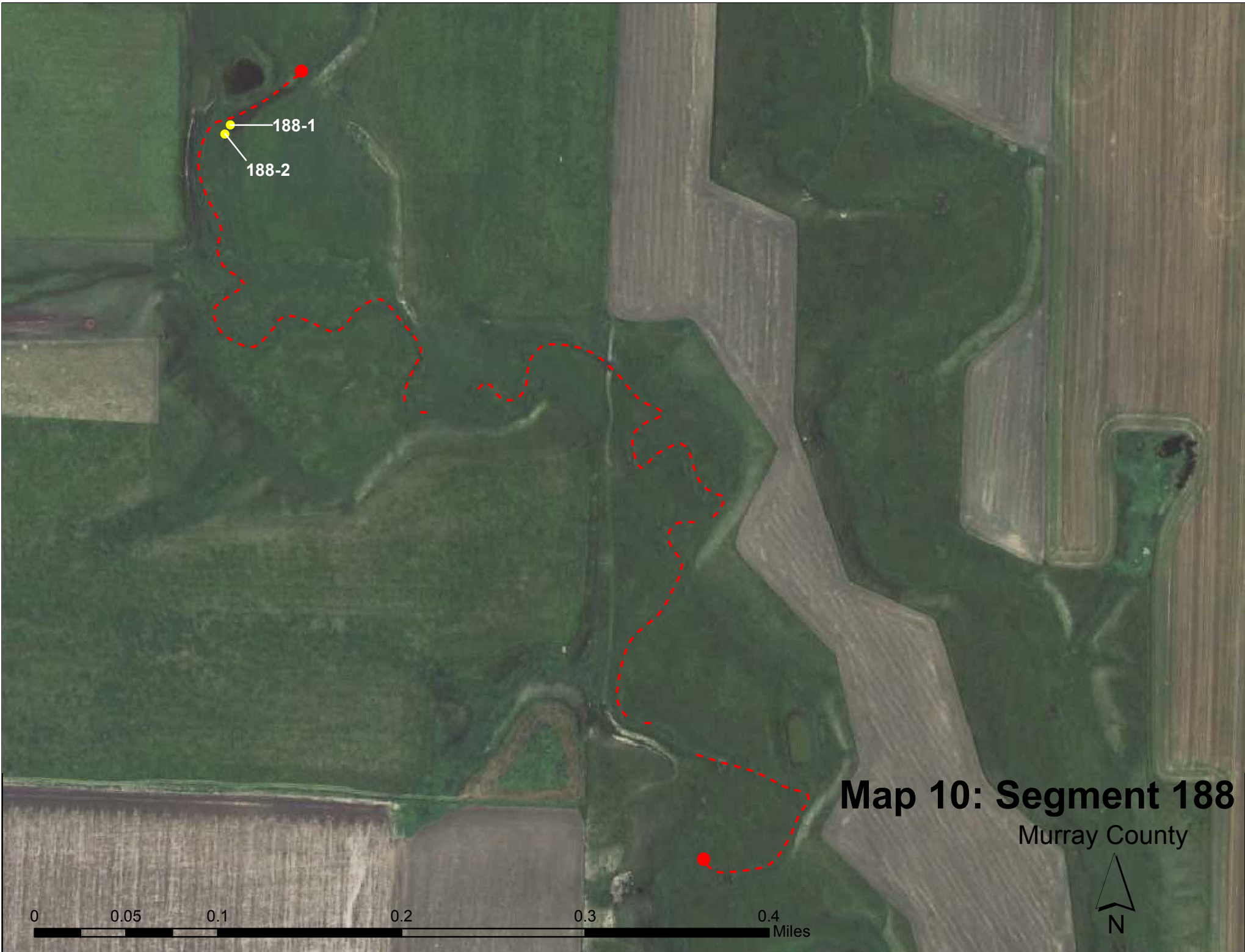




Map 9: Segment 187

Pipestone County



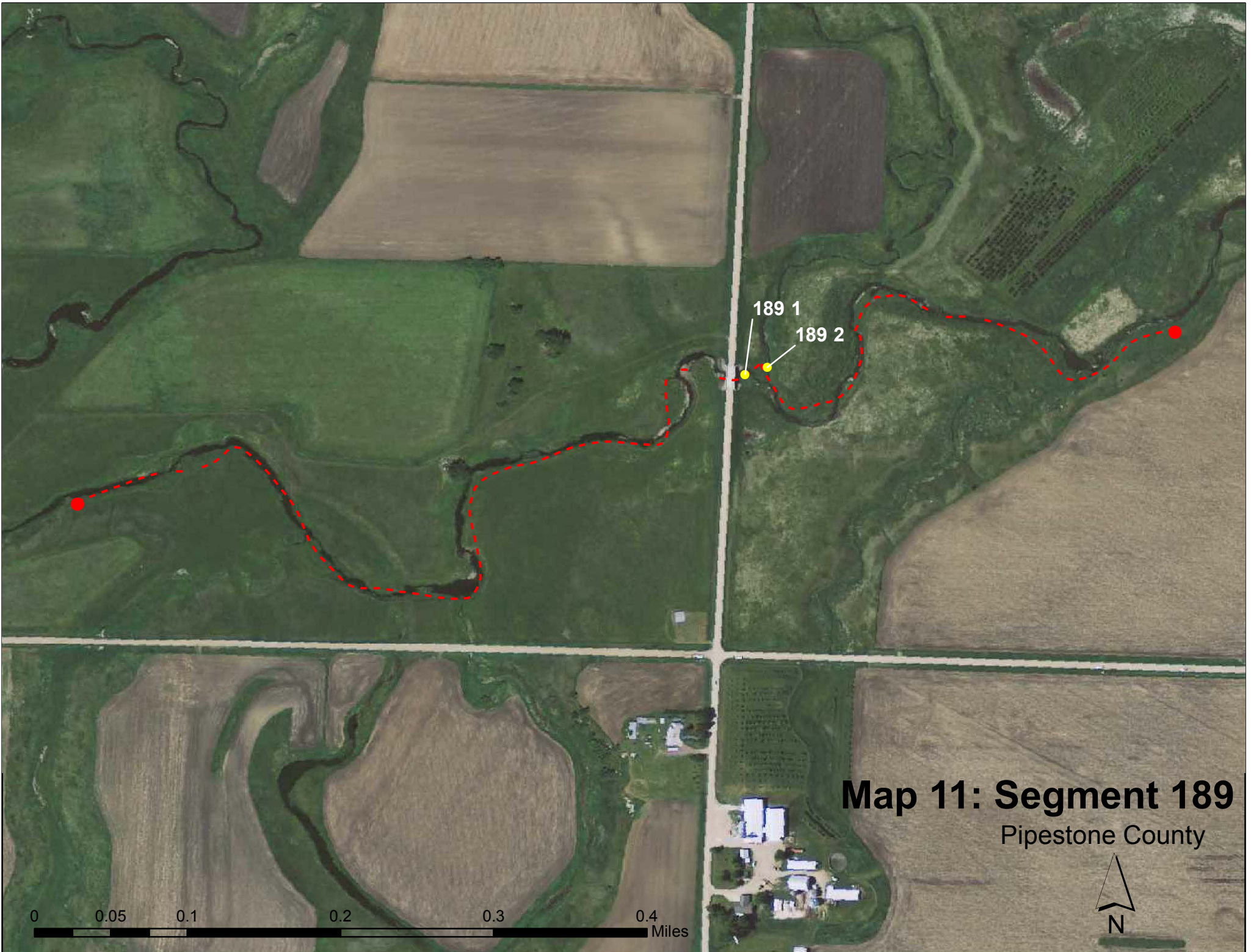


188-1
188-2

Map 10: Segment 188
Murray County

0 0.05 0.1 0.2 0.3 0.4 Miles





189 1
189 2

Map 11: Segment 189
Pipestone County

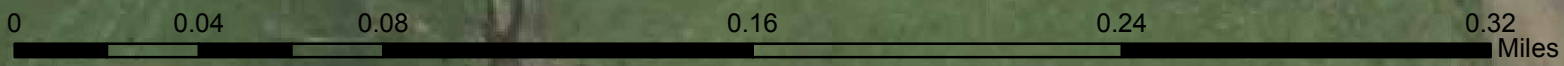
0 0.05 0.1 0.2 0.3 0.4 Miles

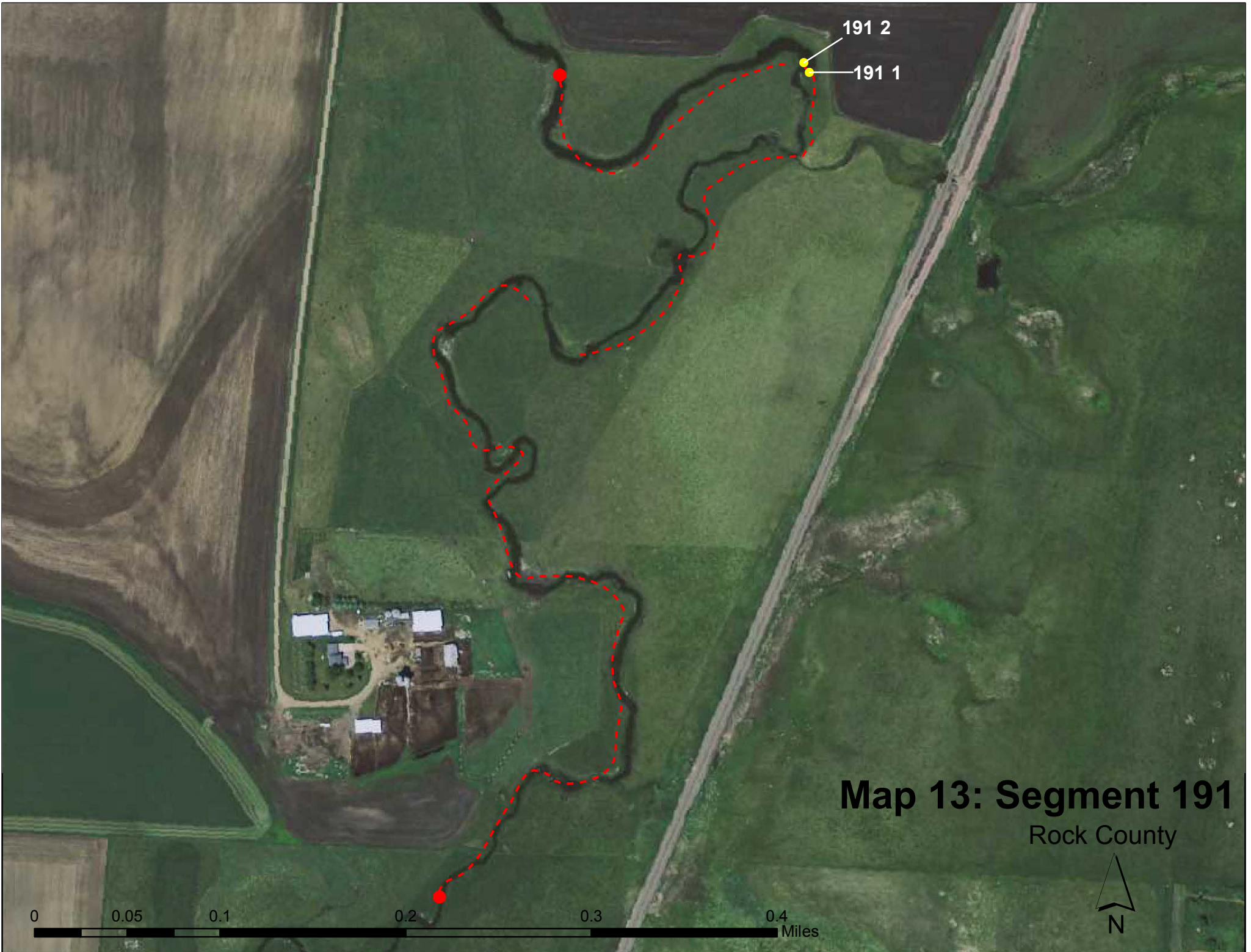




Map 12: Segment 190

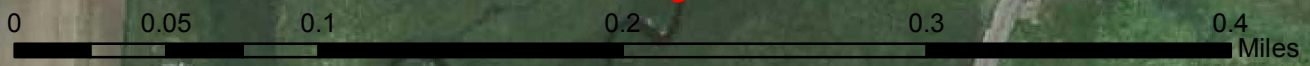
Pipestone County

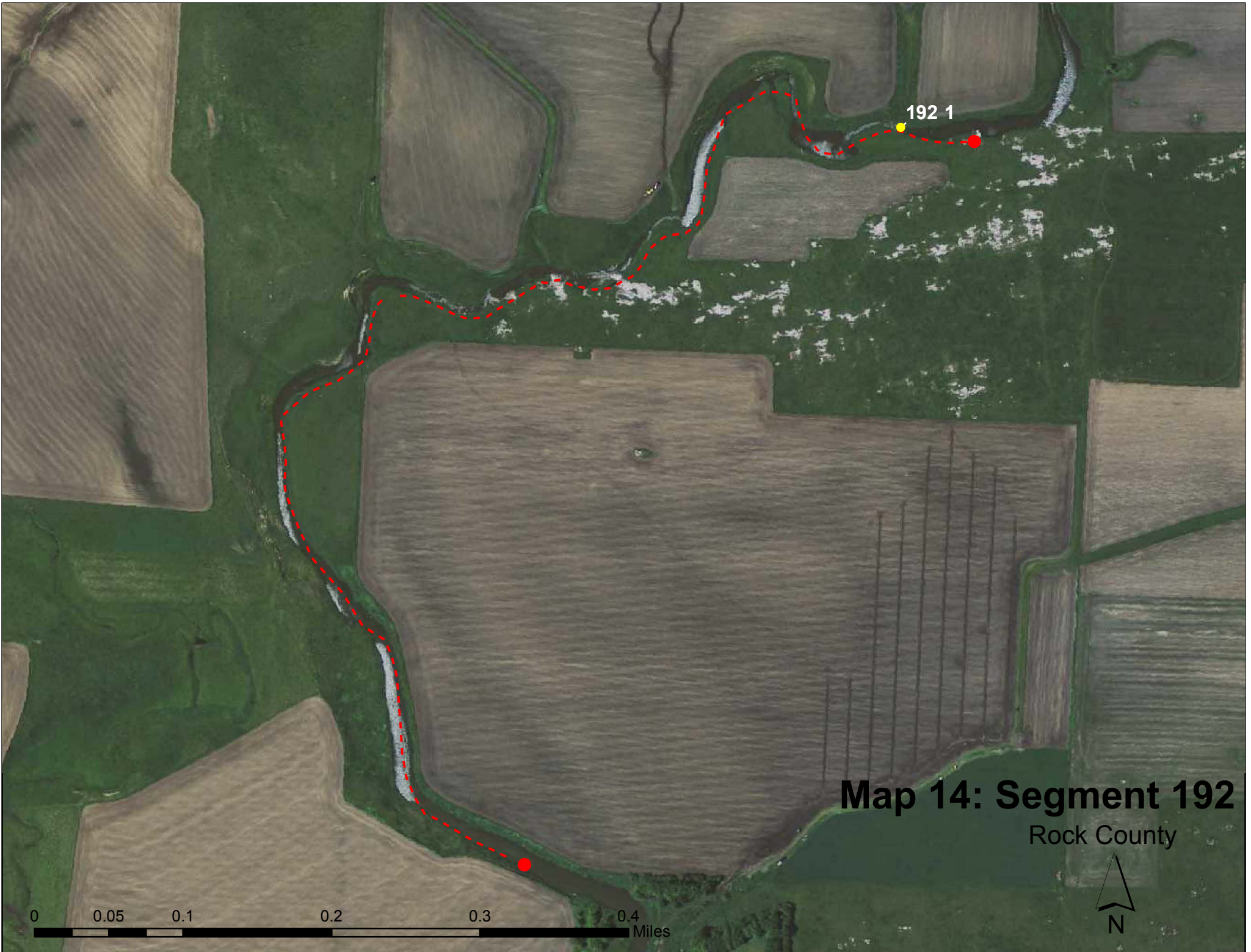




Map 13: Segment 191

Rock County

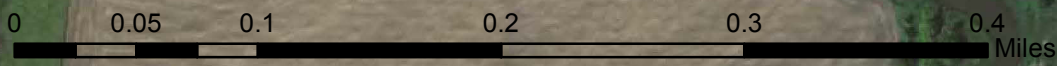


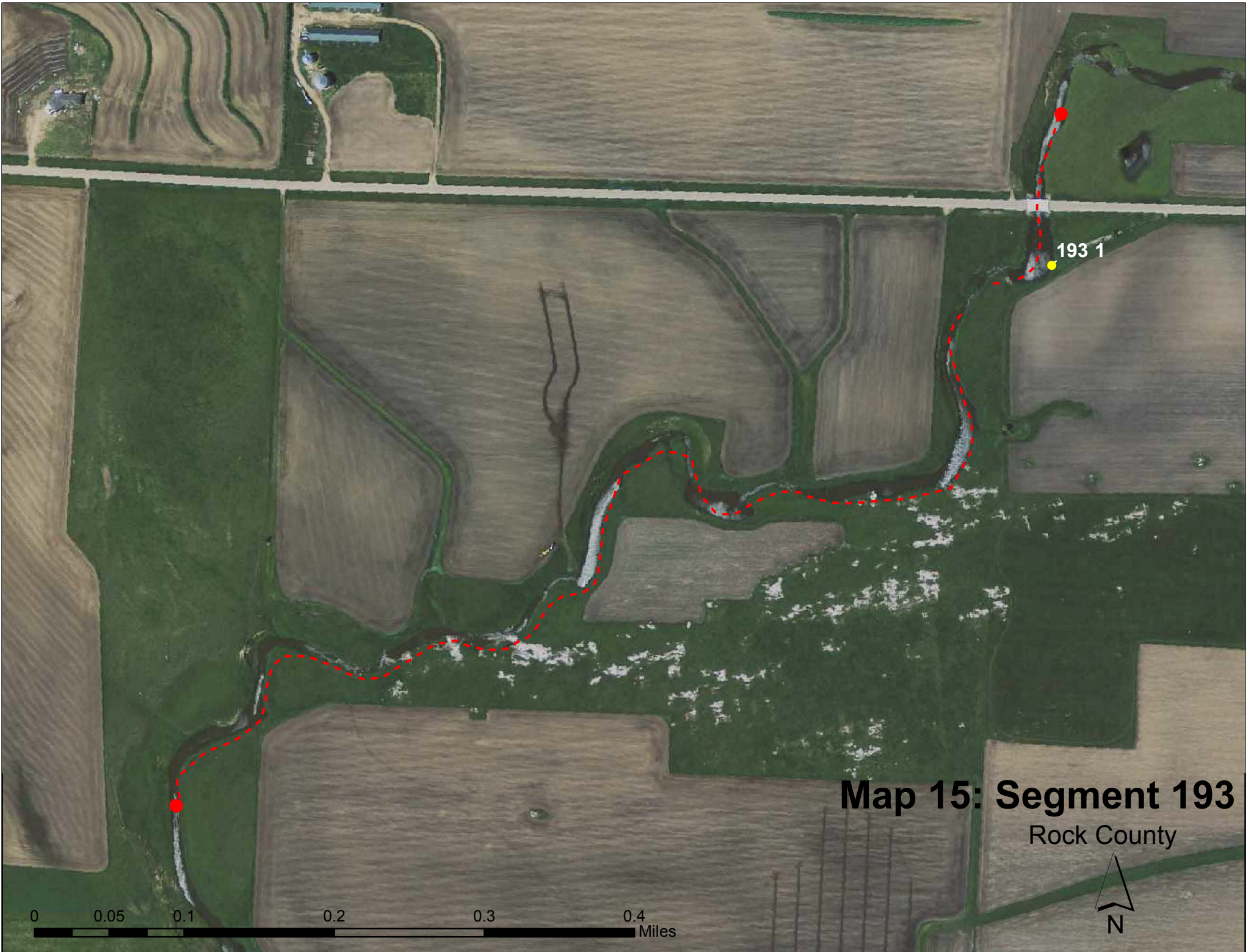


192 1

Map 14: Segment 192

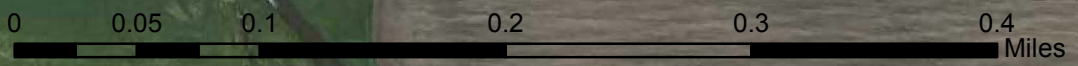
Rock County





Map 15: Segment 193

Rock County

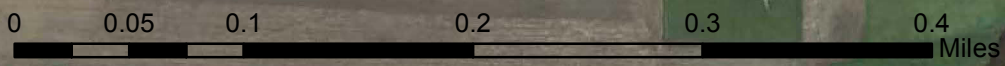


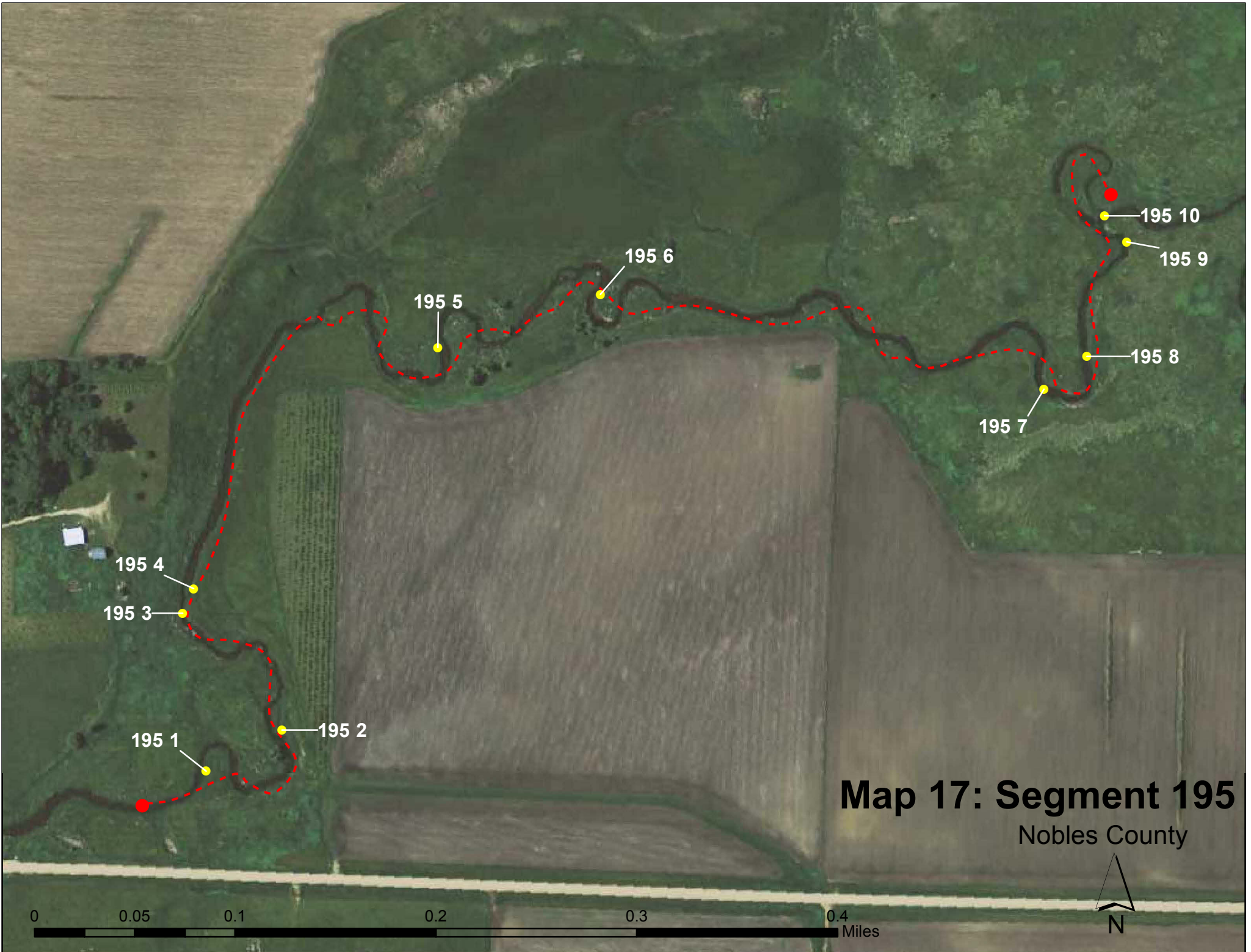


194 1

Map 16: Segment 194

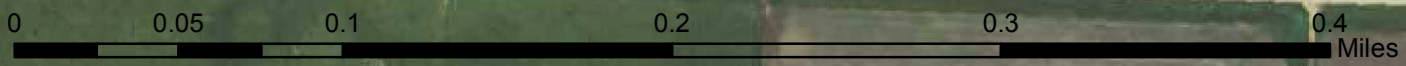
Rock County

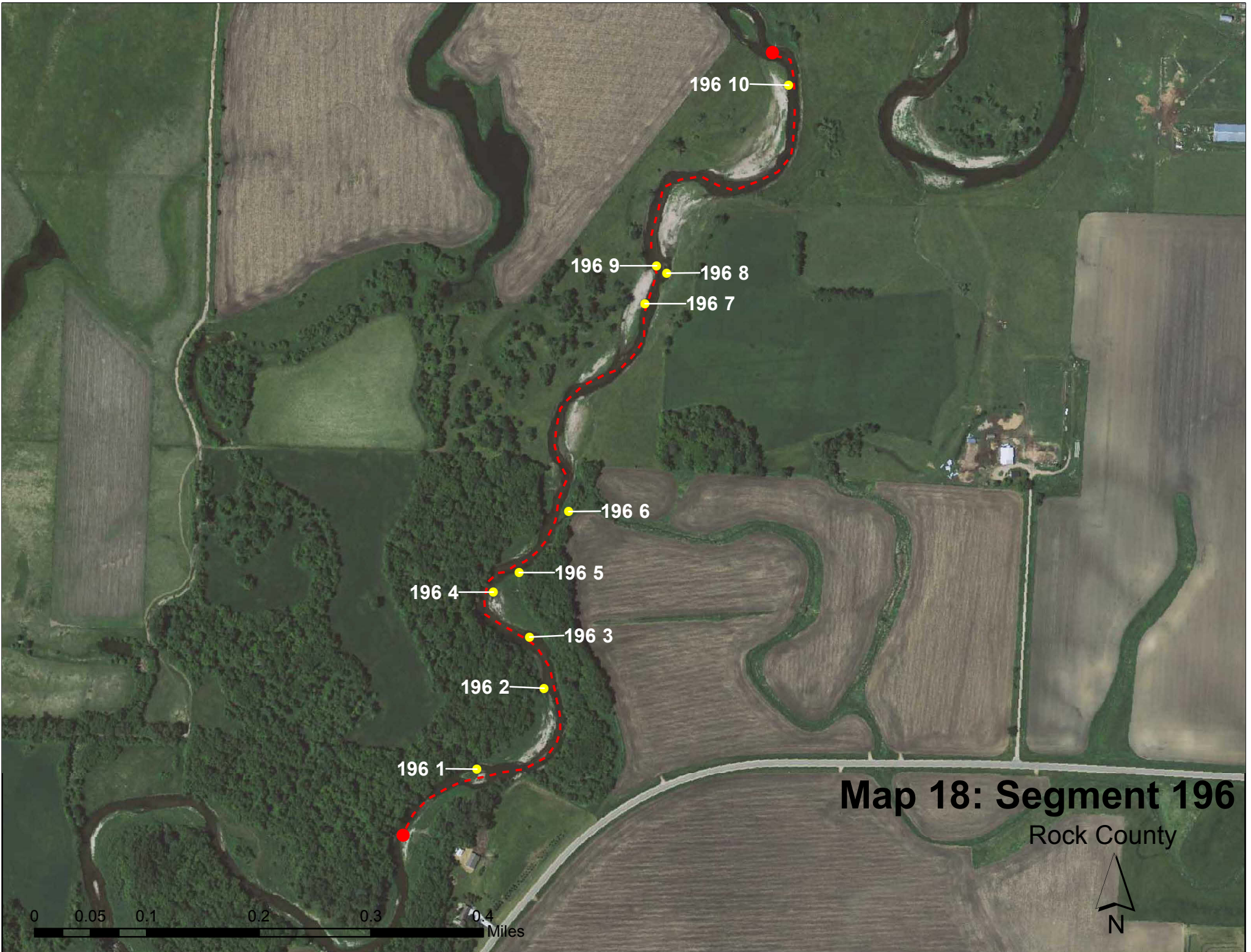




Map 17: Segment 195

Nobles County





Map 18: Segment 196

Rock County

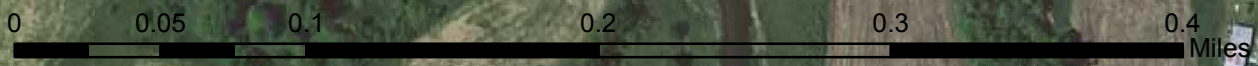


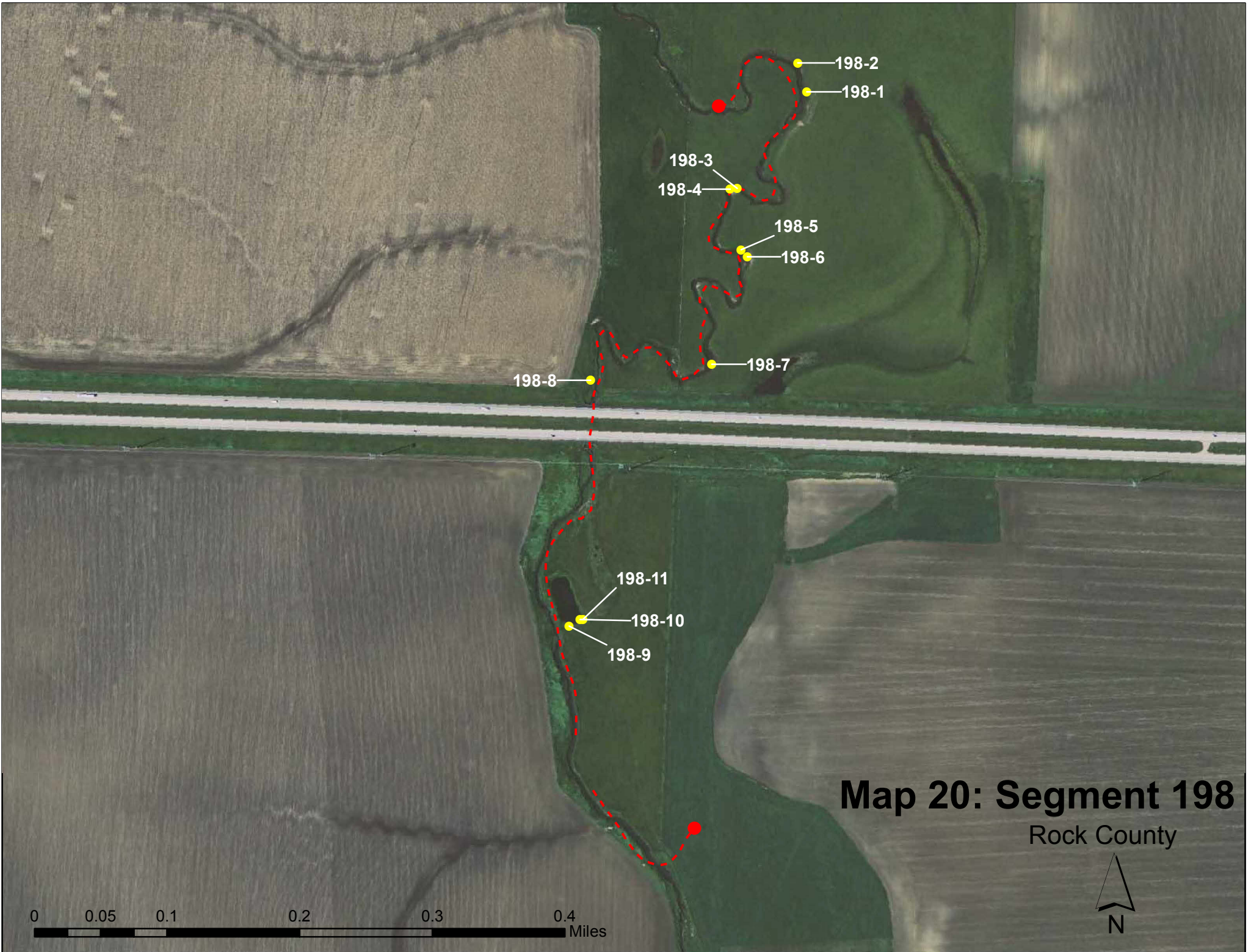
0 0.05 0.1 0.2 0.3 0.4 Miles



Map 19: Segment 197

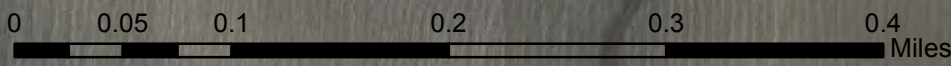
Rock County

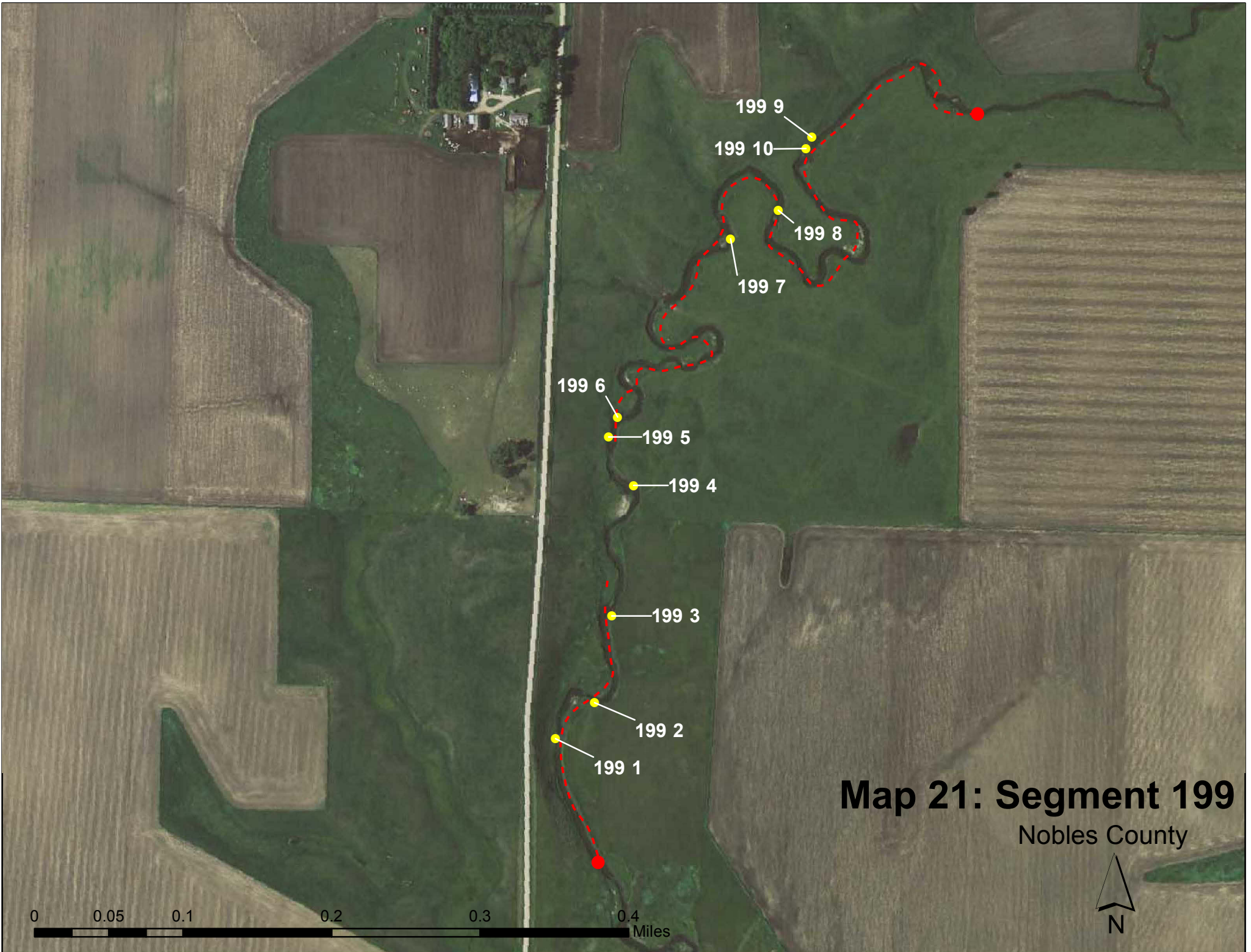




Map 20: Segment 198

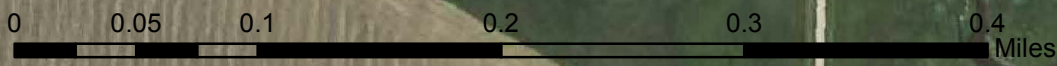
Rock County

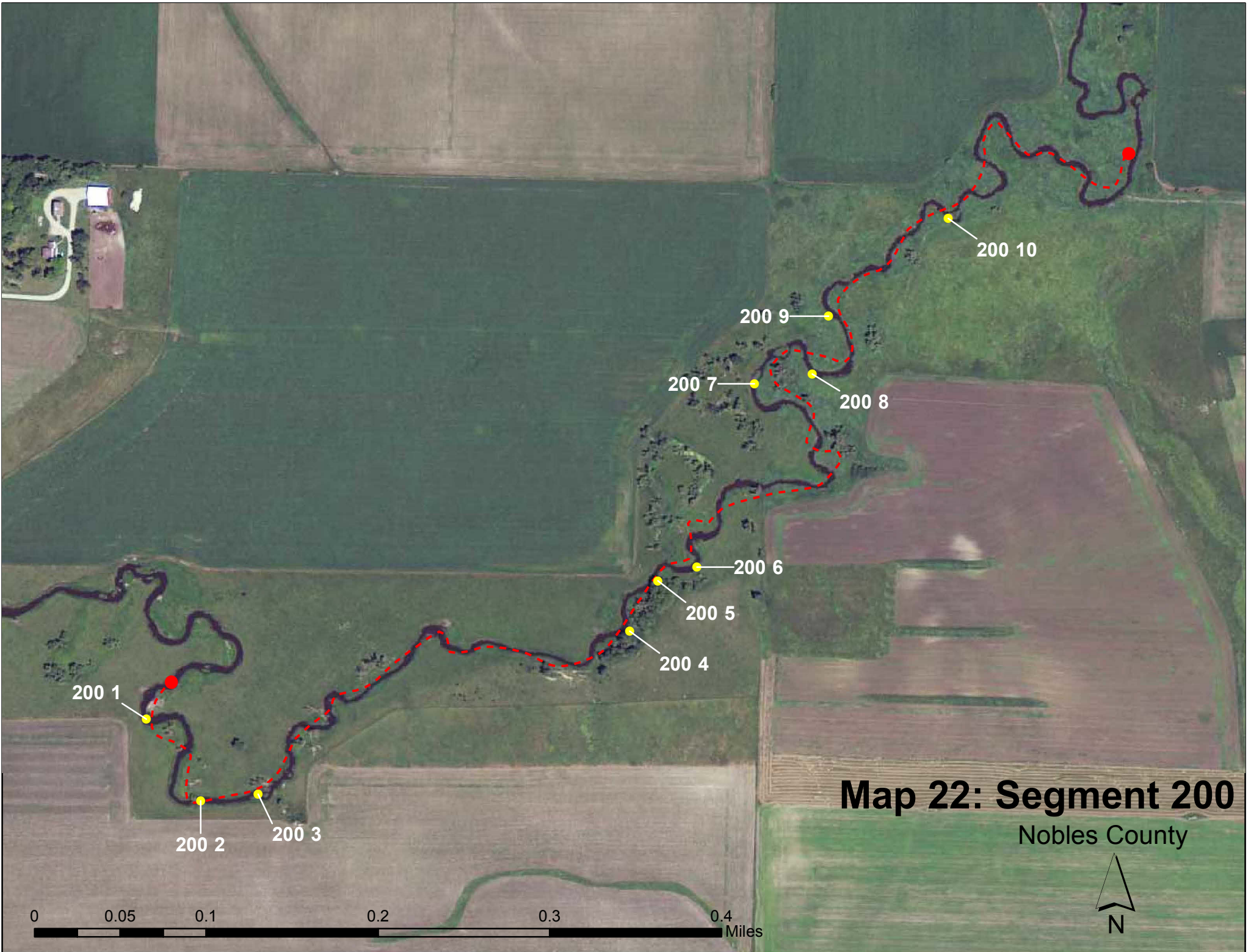




Map 21: Segment 199

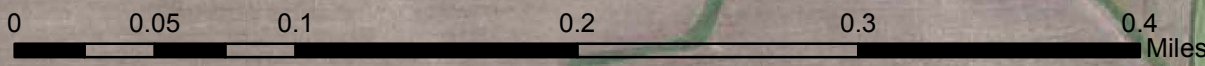
Nobles County





Map 22: Segment 200

Nobles County



Appendix B – Tables 1 & 2.

Table 1. 2014 Segments, Sample Sites, and Topeka Shiner Presence/Absence.

Table 2. List of Fish Species Collected at Segments 181-200, 2014.

Table 1. Locations of the twenty stream Segments (sites 181-200) sampled in 2014, corresponding sampling sites within each segment, and a brief habitat description for each site from which Topeka shiners were collected. Included are a "Common Location" descriptor (approximate mileage & direction to nearest town/highways), the Township/Range for the 20 Segments, and UTM coordinates for each sampling site. Habitat type is an approximate characterization of the specific sample site within the sample reach: pooled areas along the stream channel ('pool'); low-flow reaches of stream and backwater habitats along the main channel boundary ('in-channel/MCB'); ponds adjacent to the sample reach that are not connected to the main channel of the stream ('pool, off-channel'). Widths are estimated mean stream width in meters (m).

Segment **Stream Name & Common Location**

County	T	R	Section(s)	Township Name	Site Number	Habitat Type	Latitude	Longitude
181	<u>Medary Creek</u> at Co Rd 13, 3.5 mi N, 5 mi W Lake Benton							
Lincoln	110	46	21, 28	Drammen	181-1	pool	44.312846	-96.386377
					181-2	in-channel/MCB	44.312957	-96.385924
					181-3	pool	44.313220	-96.385078
Habitat Description: very narrow (< 1m) flowing headwater stream. May be intermittent. Rooted aquatic macrophytes in channel. Large scour pool below culvert. Entire reach upstream of CR 8 is heavily trampled, in pasture.								
<u>Topeka shiner: present: single Topeka shiner collected in small (2m x 5m), shallow (0.5 m) pooled area with ~100 <i>P. promelas</i></u>								
Substrate = sand/gravel mixture in channel. Silted in off-flow areas. Some boulders.								

(Table 1 continued on next page)

Table 1. Continued.

Segment **Stream Name & Common Location**

County	T	R	Section(s)	Township Name	Site Number	Habitat Type	Latitude	Longitude
<u>182</u> <u>Willow Creek</u> at Co Rd 275, 1 mi N, 5.5 mi S, 5 mi W Lake Benton								
Pipestone	108	46	4, 9	Altona	182-1	pool	44.183127	-96.381676
					182-2	pool	44.182892	-96.381878
					182-3	in-channel/MCB	44.182833	-96.382184
					182-4	in-channel/MCB	44.182766	-96.382358
					182-5	in-channel/MCB	44.182582	-96.382207
					182-6	in-channel/MCB	44.182257	-96.381774
					182-7	in-channel/MCB	44.182143	-96.381165
					182-8	in-channel/MCB	44.185286	-96.382516
					182-9	pool/off-channel	44.185513	-96.382584
					182-10	in-channel/MCB	44.185529	-96.382970
<p>Habitat Description: narrow (1-2 m) headwater stream. Sampled scour pool downstream of 231st St. and off channel pond upstream of road. Entire reach downstream of road is heavily trampled, in pasture. Filamentous algae abundant.</p> <p>No Topeka shiners captured.</p> <p>Substrate = silt, gravel, sand</p>								
<u>183</u> <u>Rock River</u> at Hwy 23, 0.5 mi E Holland								
Pipestone	107	44	7	Rock	183-1	in-channel/MCB	44.094157	-96.175406
					183-2	in-channel/MCB	44.093685	-96.175838
					183-3	in-channel/MCB	44.091456	-96.177282
					183-4	in-channel/MCB	44.090241	-96.180345
					183-5	in-channel/MCB	44.089531	-96.180096
					183-6	in-channel/MCB	44.089324	-96.180390

Table 1. Continued.

Habitat Description: small (< 1m) headwater, meanders through swampy wetland. No defined channel through much of reach, cattail throughout. Beaver dam just N (upstream) of MN 23, no fish sampled upstream of the dam (sites 1-4). Reach appears to have been channelized S of road.

No Topeka shiners captured.

Substrate = muck, silt.

Segment Stream Name & Common Location

County	T	R	Section(s)	Township Name	Site Number	Habitat Type	Latitude	Longitude
184 <u>Pipestone Creek</u> <u>at Hwy 30, 4.5 mi W Pipestone</u>								
Pipestone	106	46	7, 8, 18	Sweet	184-1	pool, off-channel	43.994173	-96.411813
					184-2	pool, off-channel	43.994006	-96.412488
					184-3	pool, off-channel	43.992613	-96.412524
					184-4	pool, off-channel	43.992863	-96.414285
					184-5	in-channel/MCB	43.993138	-96.413287
					184-6	in-channel/MCB	43.991852	-96.413986
					184-7	pool	43.991221	-96.414043
<p>Habitat Description: 6m wide slowly flowing stream. High, severely eroded banks throughout reach. Entire reach is trampled, in pasture. No riparian vegetation. Evidence of recent fish kill; reach strewn with mostly decomposed carp. Landowner estimated it occurred in March. Feed lot drains to off channel ponds (sites 1-4). > 0.75 m of sludge in ponds. <u>Topeka Shiner, present: Three individuals captured in two seine hauls in a small backwater along pooled area in bend.</u></p> <p>Substrate = silt, gravel, muck</p>								
185 <u>Tributary, Split Rock Creek</u> <u>1.5 mi N, 1.5 mi E Ihlen</u>								
Pipestone	105	46	2	Eden	185-1	pool	43.924897	-96.347237
					185-2	pool	43.924991	-96.347026
					185-3	pool	43.924788	-96.346786
					185-4	wetland	43.926960	-96.336458

Table 1. Continued.

Habitat Description: very small (< 1m), wetland influenced headwater. Most of segment is a narrow cattail wetland with no distinct channel. Seined in scour pool below culvert. Pool choked with filamentous algae. Very few fish (n=2). No Topeka shiners captured.
Substrate = muck

Segment Stream Name & Common Location

County	T	R	Section(s)	Township Name	Site Number	Habitat Type	Latitude	Longitude
186	<u>Tributary, Poplar Creek</u> 1.5 mi N Trosky							
Pipestone	105	45	9, 10, 16	Elmer	186-1	in-channel/MCB	43.909130	-96.244720
					186-2	in-channel/MCB	43.909288	-96.244972
					186-3	pool/off-channel	43.909984	-96.246370
<p>Habitat Description: Tiny (< 1m) intermittent stream. Terrestrial grass growing throughout barely defined channel. Landowner states that this reach is usually dry. Sampled pool at culvert and dugout ponds. Single <i>P. promelas</i> collected. No Topeka shiners captured. Substrate = muck, silt</p>								
187	<u>Tributary, Rock River</u> 2.5 mi E, 1 mi S Hatfield							
Pipestone	106	44	33	Burke	187-1	pool	43.946264	-96.142722
					187-2	pool	43.945937	-96.142787
					187-3	in-channel/MCB	43.945612	-96.142479
					187-4	in-channel/MCB	43.948511	-96.141674
					187-5	pool	43.948449	-96.141507
					187-6	pool	43.948785	-96.140946
					187-7	pool	43.949046	-96.140597
					187-8	pool	43.942854	-96.139877
					187-9	in-channel/MCB	43.942641	-96.139339
					187-10	in-channel/MCB	43.942573	-96.138888

Table 1. Continued.

Habitat Description: Narrow (2m) free flowing stream with some riffles and pools. Low flow areas exhibit deep silt and muck (> .75 m) over gravel. Nearly entire reach is pasture. Banks eroded, trampled.

No Topeka shiners captured.

Substrate = gravel, and in channel. Silt, muck in pools.

Segment Stream Name & Common Location

County	T	R	Section(s)	Township Name	Site Number	Habitat Type	Latitude	Longitude
188	<u>North Branch Chanarambie Creek</u> 4 mi W, 2.5 mi S Lake Wilson							
Pipestone	106	43	29	Chanarambie	188-1	pool	43.962429	-96.038055
					188-2	pool	43.962360	-96.038112

Habitat Description: very narrow (< 1m), swiftly flowing headwater stream with hard substrate in channel. May be intermittent.

Topeka shiner: present, one individual captured in a deeply silted, shallow pool with > 200 *P. promelas*.

Substrate = sand, gravel in channel. Deep silt and muck over sand in pool.

189	<u>Poplar Creek</u> 4 mi W, 0.5 mi S Edgerton							
Pipestone	105	45	25, 26	Elmer	189-1	pool	43.865786	-96.204859
					189-2	pool	43.865860	-96.204570

Habitat Description: 4 m wide gently flowing stream. Pooled area at bridge (2013 Topeka shiner capture site) completely choked with thick mats of filamentous algae. Algae not present at time of 2013 visit.

Topeka shiner: abundant; 137 individuals captured in a single seine haul in pooled area at confluence with unnamed trib.

Clean sand-gravel substrate. *Campostoma* actively spawning over two nests present at capture site.

Substrate = Gravel, sand, muck.

Table 1. Continued.

Segment **Stream Name & Common Location**

County	T	R	Section(s)	Township Name	Site Number	Habitat Type	Latitude	Longitude
<u>190</u>	<u>Poplar Creek</u> <u>2 mi W, 0.5 mi S Edgerton</u>							
Pipestone	105	44	30, 31	Osborne	190-1	pool	43.864539	-96.173317
					190-2	pool	43.864398	-96.173393
					190-3	pool	43.863657	-96.174217
					190-4	pool	43.863613	-96.174442
					190-5	in-channel/MCB	43.865311	-96.172721
					190-6	in-channel/MCB	43.864533	-96.171724
					190-7	in-channel/MCB	43.863797	-96.169056

Habitat Description: 5-6m wide, gently flowing stream with high, eroded banks. Reach is in pasture, banks trampled in places. Low flow, and off channel habitats present along meanders. Low flow areas choked with filamentous algae.
Topeka shiner: present; nine individuals captured over clean gravel/sand in small pooled area upstream of a natural rock dam.

Substrate = sand, gravel, silt

191 **Split Rock Creek** 1 mi W, 1.5 mi S Jasper

Rock	104	46	7	Rose Dell	191-1	pool	43.833574	-96.411754
	104	47	12		191-2	pool	43.833648	-96.411817

Habitat Description: 5-6 m wide slowly flowing stream with high, eroded banks. Entire reach is in pasture, banks trampled in areas.

Topeka shiner: present, two individuals captured in a pooled area at bend in stream.

Substrate = gravel, sand, silt

Table 1. Continued.

Segment **Stream Name & Common Location**

	County	T	R	Section(s)	Township Name	Site Number	Habitat Type	Latitude	Longitude
<u>192</u>	<u>Beaver Creek</u> 4 mi N, 4 mi W Luverne								
	Rock	103	45	19	Mound	192-1	pool	43.715463	-96.285019
		103	46	24					
	Habitat Description: Stream is a series of silted, boulder strewn pools. No discernible flow.								
	<u>Topeka shiner: abundant, three individuals captured by simply dipping the seine. Site is just downstream of a locality with abundant Topeka shiners in 2012 and 2014 (this survey).</u>								
	Substrate = Silt, sand, boulders								
<u>193</u>	<u>Beaver Creek</u> 4 mi N, 3.5 mi W Luverne								
	Rock	103	45	18, 19	Mound	193-1	pool	43.717730	-96.281719
		103	46	24					
	Habitat Description: stream is a series of deeply silted pools with boulders and no perceptible flow. Water very turbid.								
	<u>Topeka shiner: abundant, >100 individuals captured in a single seine haul.</u>								
	Substrate = deep silt, boulders								
<u>194</u>	<u>Rock River</u> 3 mi S Edgerton								
	Rock	104	44	8, 9	Battle Plain	194-1	in-channel/MCB	43.824334	-96.134483
	Habitat Description: Wide (10m) flowing stream with high, severely eroded banks. Some pools and backwaters present.								
	<u>Topeka shiner: present, three individuals captured in a single seine haul over sand/gravel in a low flow area along MCB.</u>								
	Substrate = sand, gravel, silt, muck on margins								

Table 1. Continued.

Segment Stream Name & Common Location

County	T	R	Section(s)	Township Name	Site Number	Habitat Type	Latitude	Longitude
<u>195</u>	<u>Champepadan Creek</u> 3 mi N, 3 mi W Lismore							
Nobles	104	43	21	Leota	195-1	in-channel/MCB	43.790938	-96.009232
					195-2	in-channel/MCB	43.791258	-96.008486
					195-3	in-channel/MCB	43.792081	-96.009524
					195-4	in-channel/MCB	43.792262	-96.009424
					195-5	in-channel/MCB	43.794082	-96.007059
					195-6	in-channel/MCB	43.794512	-96.005445
					195-7	in-channel/MCB	43.793939	-96.000955
					195-8	in-channel/MCB	43.794187	-96.000535
					195-9	in-channel/MCB	43.795033	-96.000178
					195-10	in-channel/MCB	43.795217	-96.000409

Habitat Description: 4-5m wide slowly flowing stream with developed meander. Little OCH present. Seined low flow areas along MCB.

No Topeka shiners captured.

Substrate = sand, silt, muck

Table 1. Continued.

Segment Stream Name & Common Location

	County	T	R	Section(s)	Township Name	Site Number	Habitat Type	Latitude	Longitude
<u>196</u>	<u>Rock River</u>	<u>1.5 mi N, 2 mi E Luverne</u>							
	Rock	102	44	6	Vienna, Magnolia	196-1	in-channel/MCB	43.673984	-96.167511
		103	44	31		196-2	in-channel/MCB	43.675059	-96.166367
						196-3	in-channel/MCB	43.675712	-96.166658
						196-4	in-channel/MCB	43.676273	-96.167338
						196-5	in-channel/MCB	43.676536	-96.166888
						196-6	in-channel/MCB	43.677351	-96.166052
						196-7	in-channel/MCB	43.680067	-96.164834
						196-8	in-channel/MCB	43.680470	-96.164466
						196-9	in-channel/MCB	43.680562	-96.164654
						196-10	in-channel/MCB	43.682955	-96.162431

Habitat Description: 10 m wide meandering stream with some braiding and sparse, small back waters along MCB.

Bank erosion severe in places. Much of the segment is pasture. Does not appear to contain ideal habitat.

No Topeka shiners captured.

Substrate = gravel, sand, silt

Table 1. Continued.

Segment Stream Name & Common Location

	County	T	R	Section(s)	Township Name	Site Number	Habitat Type	Latitude	Longitude
<u>197</u>	<u>Rock River</u>	<u>1 mi N, 2 mi E Luverne</u>							
	Rock	102	44	6	Luverne, Magnolia	197-1	pool	43.669016	-96.172468
		102	45	1		197-2	pool	43.670836	-96.172981
						197-3	pool	43.671619	-96.173906
						197-4	pool	43.672179	-96.174081
						197-5	pool	43.671848	-96.170494
						197-6	pool	43.668197	-96.174069
						197-7	pool	43.668354	-96.174072
						197-8	in-channel/MCB	43.667998	-96.175975
						197-9	in-channel/MCB	43.667359	-96.176368
						197-10	in-channel/MCB	43.667195	-96.176288

Habitat Description: 10 m wide meandering stream with intact riparian buffer. Channel braided in places. OCH sparse.

Seined along channel margins and low flow areas.

No Topeka shiners captured.

Substrate = gravel, sand, silt

Table 1. Continued.

Segment Stream Name & Common Location

County	T	R	Section(s)	Township Name	Site Number	Habitat Type	Latitude	Longitude
198	<u>Elk Creek</u> 1.5 mi W, 0.5 mi S Magnolia							
Rock	102	44	15, 16	Magnolia	198-1	pool	43.641437	-96.111579
					198-2	pool	43.641748	-96.111733
					198-3	in-channel/MCB	43.640354	-96.112569
					198-4	in-channel/MCB	43.640343	-96.112675
					198-5	in-channel/MCB	43.639686	-96.112480
					198-6	in-channel/MCB	43.639615	-96.112383
					198-7	pool	43.638427	-96.112854
					198-8	in-channel/MCB	43.638202	-96.114663
					198-9	pool/ off-channel	43.635510	-96.114852
					198-10	pool/ off-channel	43.635587	-96.114688
					198-11	pool/ off-channel	43.635591	-96.114648

Habitat Description: 5-6 m wide meandering stream with high, steep, heavily trampled banks. Sampled pooled areas in bends. Stream appears channelized S of I-90, no suitable habitat. Sampled dugout pond along ditched reach.

No Topeka shiners captured.

Substrate = sand, silt, gravel

Table 1. Continued.

Segment Stream Name & Common Location

County	T	R	Section(s)	Township Name	Site Number	Habitat Type	Latitude	Longitude
<u>199</u>	<u>Champepadan Creek</u> <u>2 mi N, 2 mi E Kenneth</u>							
Nobles	104	43	29	Leota	199-1	in-channel/MCB	43.780675	-96.032967
					199-2	in-channel/MCB	43.781039	-96.032460
					199-3	in-channel/MCB	43.781894	-96.032269
					199-4	in-channel/MCB	43.783172	-96.032042
					199-5	in-channel/MCB	43.783634	-96.032398
					199-6	in-channel/MCB	43.783834	-96.032289
					199-7	in-channel/MCB	43.785608	-96.030861
					199-8	in-channel/MCB	43.785902	-96.030230
					199-9	in-channel/MCB	43.786627	-96.029813
					199-10	in-channel/MCB	43.786514	-96.029887

Habitat Description: Deeply incised stream (9 m wide) with steep, eroded banks. Little OCH present.

Sampled pools at bends and small backwaters. Current slow.

No Topeka shiners captured.

Substrate = sand, silt, gravel

Table 1. Contined

Segment Stream Name & Common Location

County	T	R	Section(s)	Township Name	Site Number	Habitat Type	Latitude	Longitude
<u>200</u>	<u>Little Rock River</u> 5 mi S Rushmore							
Nobles	101	41	18	Ransom	200-1	pool	43.546056	-95.810880
					200-2	pool	43.545385	-95.810222
					200-3	pool	43.545455	-95.809557
					200-4	in-channel/MCB	43.546936	-95.805315
					200-5	in-channel/MCB	43.547370	-95.805009
					200-6	pool	43.547496	-95.804560
					200-7	in-channel/MCB	43.549057	-95.803965
					200-8	in-channel/MCB	43.549157	-95.803300
					200-9	in-channel/MCB	43.549647	-95.803131
					200-10	in-channel/MCB	43.550506	-95.801785
<p>Habitat Description: 6m wide meandering stream with high banks. Very low gradient, almost no flow. Much of W half of segment was pool habitat. E half narrower and more silted.</p> <p>No Topeka shiners captured.</p> <p>Substrate = gravel, sand, silt, muck</p>								

Appendix C- Habitat and Voucher Photographs

Habitat photographs for segments in which no Topeka shiners were captured are representative of the habitat along the one-mile reach of stream. Habitat photographs from segments where Topeka shiners were present represent the specific site where they were collected. Voucher photographs are presented for each of the sites where Topeka shiners were collected.

Site 181-1, Pipestone Creek: habitat photo.



Site 181-1, Pipestone Creek: voucher photo.



Segment 182, Willow Creek: no Topeka shiners captured.



Segment 183, Rock River: no Topeka shiners captured.



Site 184-7, Pipestone Creek: habitat photo.



Site 184-7, Pipestone Creek: voucher photo.



Segment 185, Trib. to Split Rock Creek: no Topeka shiners captured.



Segment 186, Trib. to Poplar Creek: no Topeka shiners captured..



Segment 187, Trib. to Rock River: no Topeka shiners captured..



Site 188-2, Rock River: habitat photo.



Site 188-2, Rock River: voucher photo.



Site 189-2, Poplar Creek: habitat photo.



Site 189-2, Poplar Creek: voucher photo.



Segment 190-7, Poplar Creek: habitat photo.



Site 190-7, Poplar Creek: voucher photo.



Site 191-2, Poplar Creek: habitat photo.



Site 191-2, Poplar Creek: voucher photo.



Site 192-1, Beaver Creek: habitat photo.



Site 192-1, Beaver Creek: voucher photo.



Site 193-1, Beaver Creek: habitat photo.



Site 193-1, Beaver Creek: voucher photo.



Site 194-1, Rock River: habitat photo.



Site 194-1, Rock River: voucher photo.



Segment 195, Champepadan Creek: no Topeka shiners captured..



Segment 196, Rock River: no Topeka shiners captured..



Segment 197, Rock River: no Topeka shiners captured..



Segment 198, Rock River: no Topeka shiners captured..



Segment 199, Champepadan Creek: no habitat photo.

Segment 200, Little Rock River: no Topeka shiners captured.

