

Final Report

**Mussel Survey of the Mountain Fork River**

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By

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## **Survey of the Mussels of the Mountain Fork River**

This report presents the results of an intensive survey of the freshwater mussel (Mollusca, Bivalvia, Unionidae) fauna of the Mountain Fork River, Oklahoma and Arkansas. Field work was performed by Caryn C. Vaughn, Daniel Spooner, Melissa Moore, and Chad Kolkman, Oklahoma Biological Survey, University of Oklahoma, and Adam Richardson, Southwestern Oklahoma State University, under the direction of Vaughn.

### **Methods**

We traversed the majority of the Mountain Fork River by canoe, from the upper reaches (Camp Pioneer, Arkansas) to directly above where the river enters Broken Bow Reservoir (The Narrows, Oklahoma) (Figure 1). Reconnaissance snorkel searches were performed in areas where dead shell material was observed and/or where habitat appeared favorable for mussels (Vaughn et al. 1997, Vaughn and Taylor 1999). When live mussels were found, we used snorkeling, assisted by SCUBA where necessary, to determine the boundaries of the mussel bed, and then performed a timed search of the area of mussel concentration. In addition, quadrat sampling was conducted where mussels were abundant enough for this technique to be effective (Vaughn et al. 1997).

Timed searches were conducted by systematically snorkeling over the mussel bed for a given amount of time and locating mussels both visually and by feel. When a patch of mussels was detected, the surveyor also dug into the substratum for any buried mussels. A timed search is the most common technique for collecting information on mussel abundance, and is the only technique that can reliably be used to obtain estimates of total species richness and locate rare species (Kovalak et al. 1986, Cawley 1993, Vaughn et al. 1997).

Where mussel abundance allowed, quadrat sampling was performed prior to timed searches to obtain estimates of mussel density. Quadrats were 0.25 m<sup>2</sup> PVC pipe squares. We sampled 15 quadrats for each mussel bed sampled in this way, and used a stratified random sampling protocol to encompass all microhabitats within the mussel

bed. This method has been shown to yield density estimates with a mean confidence level of 97% (Vaughn et al. 1997).

For both timed searches and quadrat sampling, SCUBA was used in areas deeper than 75 cm. Mussels were placed in bags and brought to shore where they were identified, their total length measured, and returned to the mussel bed alive after all sampling was completed. Voucher specimens for unknown individuals and each representative species were collected and deposited in the Oklahoma Biological Survey mussel collection.

## Results

Mussels occurred throughout the Mountain Fork River where appropriate habitat was available. We systematically surveyed 23 sites on the river between Camp Pioneer and the Narrows (Figure 1, Appendix 1). Live mussels occurred at 21 of these sites (Appendix 1). Nineteen species of freshwater mussels (family Unionidae) were found, as well as the exotic Asian clam (*Corbicula fluminea*, family Corbiculidae). Total mussel abundance (mussels observed/hour) ranged from 0 to 312 with a mean of 40 +/-84 individuals per site (Figure 2). Mussel species richness per site ranged from 0 to 16 (Figure 4), with a mean of 6 +/- 4. Overall mussel species richness and abundance are lower in the Mountain Fork River than in larger, lower gradient rivers in the region such as the Kiamichi River (Vaughn and Pyron 1995, Vaughn et al. 1996) or the lower Little River (Vaughn and Taylor 1999). This would be expected because mussels prefer stable sand-gravel mixtures (McMahon 1991), and the substrate in the Mountain Fork River is dominated by large cobble and boulders. At most sites containing mussels, the mussels occurred in pockets of sand and gravel wedged between the boulders. Where extensive areas of gravel were available, such as at sites 9 and 4, (see Appendix 1 for descriptions), mussels were abundant and species richness was high. This distribution and abundance pattern is very similar to that found for mussels in the Glover River (Vaughn 1996), which has a similar gradient and dominant substrate type.

The mussel fauna in the Mountain Fork River is dominated by the three-ridge, *Amblema plicata* (G5S3), and the pigtoe, *Fusconaia flava* (G5S4) (Figure 2 and 3). These two species are also abundant in other streams in southeastern Oklahoma and

western Arkansas (Vaughn et al. 1996, Vaughn and Taylor 1999). The Interior Highland endemic the Ouachita kidneyshell, *Ptychobranthus occidentalis* (G3G4S2), appears to be thriving in the Mountain Fork River (Figure 2 and 3). This species is also very abundant in Glover River (Vaughn 1996), which is physically very similar to the Mountain Fork River. The Ouachita endemic mussels, the Ouachita creekshell, *Villosa arkansasensis* (G2S1S2) and the Southern hickorynut, *Obovaria jacksoniana* (G1G2S), are also doing well in the Mountain Fork River. The abundance of an edge-of-range species, the fluted shell, *Lasmigona costata* (G5S1), is also higher than most Oklahoma rivers and on par with the Glover River (Vaughn 1996). Another edge-of-range species, the rainbow, *Villosa iris* (G4S1) occurred at three sites (Figure 3). No federally endangered or threatened mussel species were found in the Mountain Fork River. The river does not contain appropriate habitat for the Ouachita Rock Pocketbook, *Arkansia wheeleri* (Vaughn and Pyron 1995).

Table 1. Mussel species found alive in the Mountain Fork River. Rarity rankings are defined in Table 2.

<b>Current species name</b>	<b>Historical name</b>	<b>Common name &amp; rank</b>
<i>Actinonaias ligamentina</i> (Lamarck, 1819)	<i>Lampsilis ligamentina</i> <i>gibba</i>	Mucket G5S3
<i>Amblema plicata plicata</i> (Say, 1817)	<i>Quadrula plicata</i> <i>Quadrula undulata</i>	Three ridge G5S3
<i>Corbicula fluminea</i> (Muller, 1774)		Asian clam G5S5
<i>Fuscania flava</i> (Rafinesque, 1820)	<i>Quadrula rubiginosa</i>	Pigtoe G5S4
<i>Lampsilis cardium</i> (Rafinesque, 1820)	<i>Lampsilis ventricosa</i>	Plain Pocketbook G4S4
<i>Lampsilis siloquoidea</i> (Barnes, 1827)	<i>Lampsilis radiata</i>	Fatmucket G4S2
<i>Lampsilis teres</i> (Rafinesque, 1820)	<i>Elliptio teres</i>	Yellow sandshell G5S5
<i>Lasmigona costata</i> (Rafinesque, 1820)	<i>Alasmidonta costata</i>	Flutedshell G5S1
<i>Leptodea fragilis</i> (Rafinesque, 1820)	<i>Unio fragilis</i>	Fragile papershell G5S4
<i>Ligumia subrostrata</i> (Say, 1831)	<i>Unio subrostrata</i>	Pondmussel G4S4
<i>Obovaria jacksoniana</i> (Frierson, 1812)	<i>Unio castaneus</i>	Southern Hickorynut G1G2S2
<i>Ptychobranhus occidentalis</i> (Conrad, 1836)	<i>Ptychobranhus</i> <i>clientonense</i>	Ouachita kidneyshell G3G4S2
<i>Quadrula pustulosa pustulosa</i> (Conrad, 1835)	<i>Quadrula pustulosa</i>	Pimpleback G5S4

<b>Current species name</b>	<b>Historical name</b>	<b>Common name &amp; rank</b>
<i>Strophitus undulatus</i> (Say, 1817)	<i>Strophitus edentulus</i>	Creepers G5S3
<i>Toxolasma parvus</i> (Barnes, 1823)	<i>Unio parvus</i>	Lilliput G4S4
<i>Toxolasma texasensis</i> (I. Lea, 1857)	<i>Unio texiensis</i>	Texas lilliput G4S1
<i>Tritogonia verrucosa</i> (Rafinesque, 1820)	<i>Tritogonia tuberculata</i>	Pistolgrip G4S4
<i>Truncilla donaciformis</i> (Lea, 1828)	<i>Unio donaciformis</i>	Fawnsfoot G5S5
<i>Villosa arkansasensis</i> (I. Lea, 1862)		Ouachita creekshell G2S1S2
<i>Villosa iris</i> (I. Lea, 1829)	<i>Unio iris</i>	Rainbow G4S1
<i>Villosa lienosa</i> (Conrad, 1834)	<i>Lampsilis lienosa</i>	Little spectaclecase G5S2

Table 2. Natural Heritage Rarity Rankings

ONHI gives species and natural communities occurring in Oklahoma two ranks: a global (G) rank reflecting its rarity throughout the world, and, a state (S) rank reflecting its rarity within Oklahoma. Taken together these ranks serve as an index of biological status, but the ranks are subject to change with new information. *Natural Heritage Rarity Rankings have no regulatory stature: they are intended for information only.*

### GLOBAL RANK

- G1 Critically imperiled globally because extreme rarity (5 or fewer occurrences or very few remaining individuals or acres) or because of some factor of its biology making it especially vulnerable to extinction.
- G2 Imperiled globally because of its rarity (6 to 20 occurrences or few remaining individuals or acres) or because of other factors demonstrably making it vulnerable to extinction throughout its range.
- G3 Either very rare and local throughout its range or found locally (even abundantly at some of its locations) in a restricted range, or because of other factors making it vulnerable to extinction throughout its range; in the range of 21-100 occurrences.
- G4 Apparently secure globally, though it may be quite rare in parts of its range, especially at the periphery.
- G5 Demonstrably secure globally though it may be quite rare in parts of its range, especially at the periphery.
- GH Historically known, with the expectation that it may be rediscovered.
- GX Believed to be extinct.
- GU Not yet ranked.

### STATE RANK

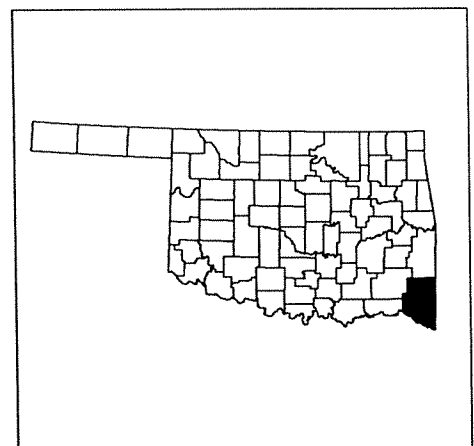
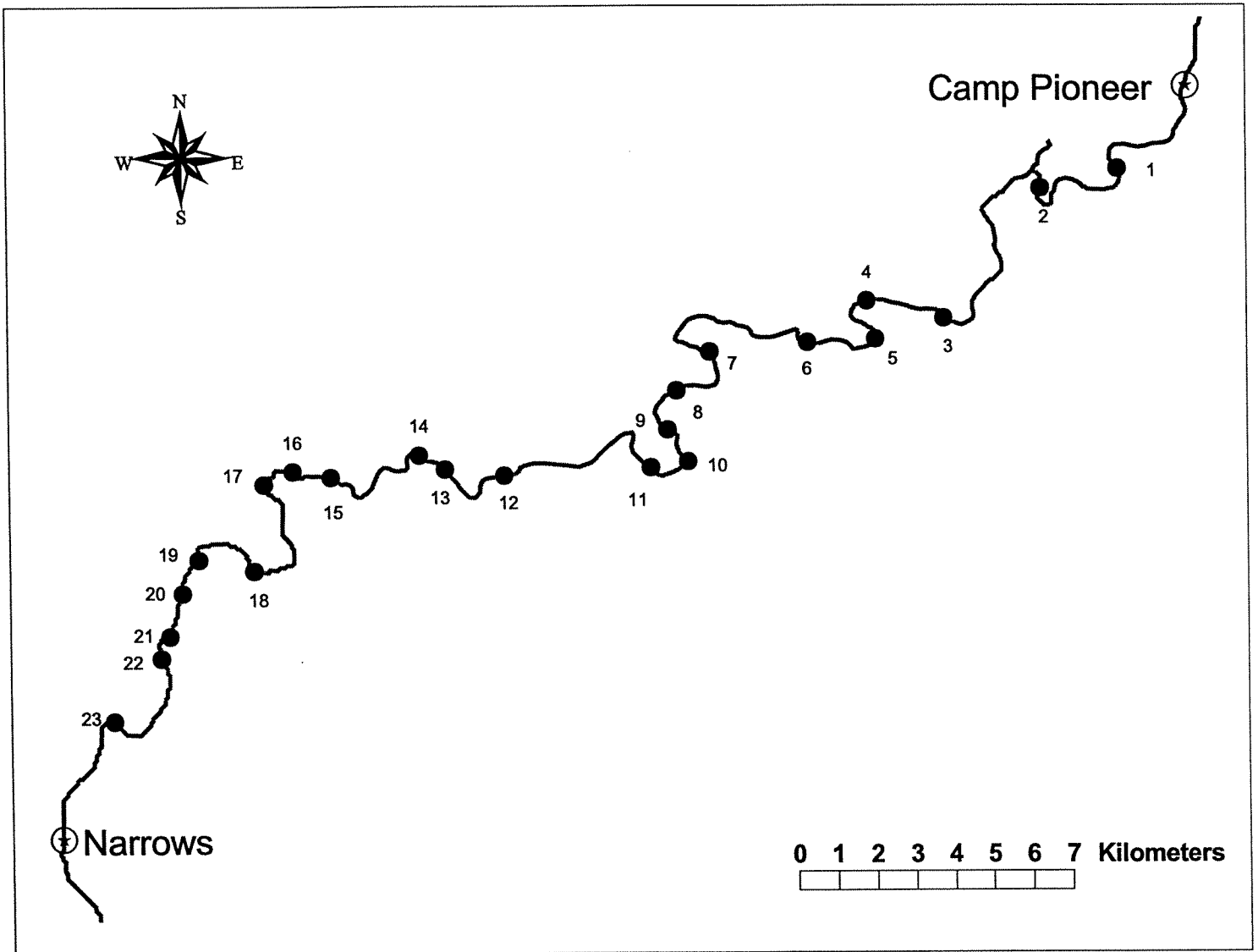
- S1 Critically imperiled in Oklahoma because of extreme rarity (5 or fewer occurrences or very few remaining individuals or acres) or because of some factor of its biology making it especially vulnerable to extinction.
- S2 Imperiled in Oklahoma because of extreme rarity (6 to 20 occurrences or few remaining individuals or acres) or because of other factors making it very vulnerable to extinction throughout its range.
- S3 Rare and local in Oklahoma (though it may be abundant at some of its locations); in the range of 21-100 occurrences.
- S4 Apparently secure in Oklahoma.
- S5 Demonstrably secure in Oklahoma.
- SA Accidental in Oklahoma.
- SH Historically known from Oklahoma, but possibly extirpated; not seen in the last 15 years.
- SR Reported in Oklahoma but not documented.
- SRF Falsely reported in Oklahoma.
- S#M\* Migratory.
- S#N Non-breeding in Oklahoma.
- S#B Breeding in Oklahoma.

### Literature Cited

- Cawley, E.T. 1993. Sampling adequacy in population studies of freshwater mussels. Pages 168-172 in K.S. Cummings, A.C. Buchanan and L.M. Koch (eds), Conservation and Management of Freshwater Mussels. Proceedings of a UMRCC symposium, 12-14 October 1992, St. Louis, Missouri. Upper Mississippi River Conservation Committee, Rock Island, Illinois. 189 pp.
- Kovalak, W.P., S.D. Dennis, and J.M. Bates. 1986. Sampling effort required to find rare species of freshwater mussels. Pages 46-59 in, B.G. Isom (ed), Rationale for Sampling and Interpretation of Ecological Data in the Assessment of Freshwater Ecosystems. American Society for Testing and Material, Special Technical Publication No.894.
- McMahon, R.F. 1991. Mollusca: Bivalvia. Pages 315-390 in, J.H. Thorp and A.P. Covich (eds), Ecology and Classification of North American Freshwater Invertebrates. Academic Press, Inc. New York.
- Vaughn, C.C. and M. Pyron. 1995. Population ecology of the endangered Ouachita Rock Pocketbook mussel, *Arkansia wheeleri* (Bivalvia: Unionidae), in the Kiamichi River, Oklahoma. American Malacological Bulletin 11:145-151.
- Vaughn, C.C. 1996. Glover River mussel survey. Final report to the USDA Forest Service.
- Vaughn, C.C., C.M. Mather, M. Pyron, P. Mehlhop, and E.K. Miller. 1996. The current and historical mussel fauna of the Kiamichi River, Oklahoma. Southwestern Naturalist 41:325-328.
- Vaughn, C.C., C.M. Taylor and K J. Eberhard. 1997. A comparison of the effectiveness of timed searches vs. quadrat sampling in mussel surveys . Pages 157-162, in Cummings, K.S., A.C. Buchanan, C.A. Mayer and T.J. Naimo (eds), Conservation and Management of Freshwater Mussels II: Initiatives for the Future. Proceedings of a UMRCC symposium, 16-18 October 1995, St. Louis, Missouri. Upper Mississippi River Conservation Committee, Rock Island, Illinois.
- Vaughn, C.C. and C.M. Taylor. 1999. Impoundments and the decline of freshwater mussels: a case study of an extinction gradient. Conservation Biology 13:912-920.



**Figure 1. Mountain Fork site map.**



**Locator Map**

Figure 2. Percent mussel abundance by species in the Mt. Fork River.

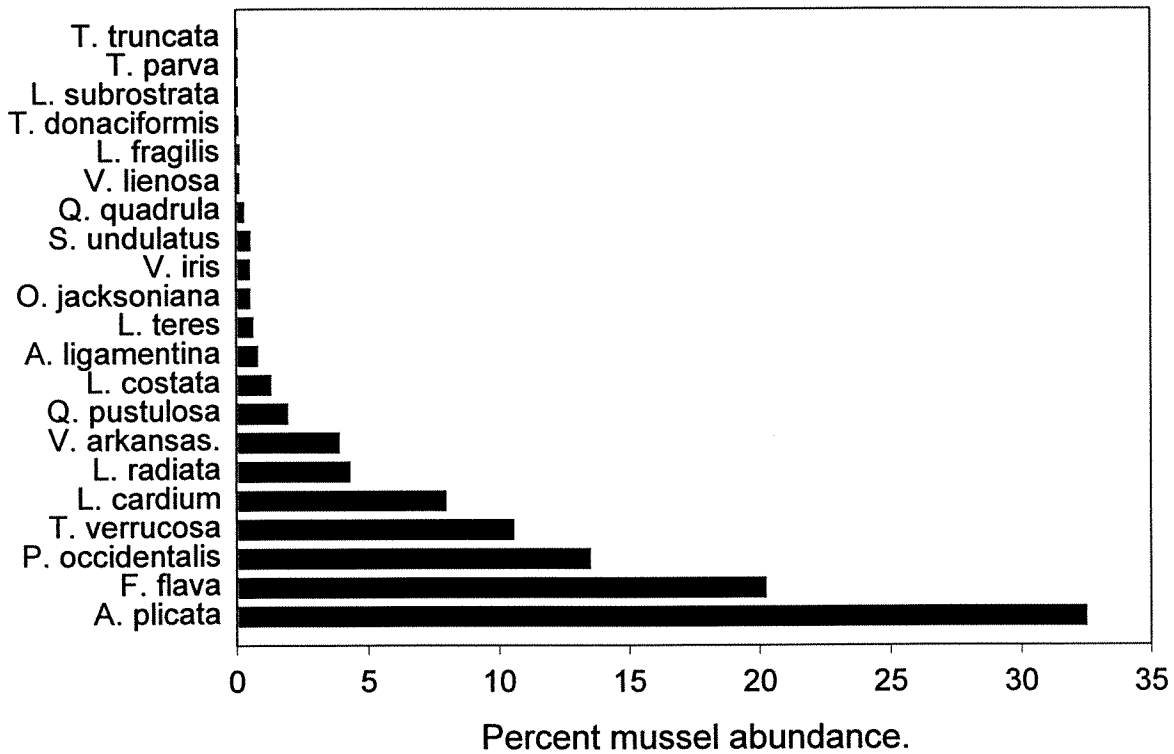


Figure 3. Number of sites occupied by individual mussel species.

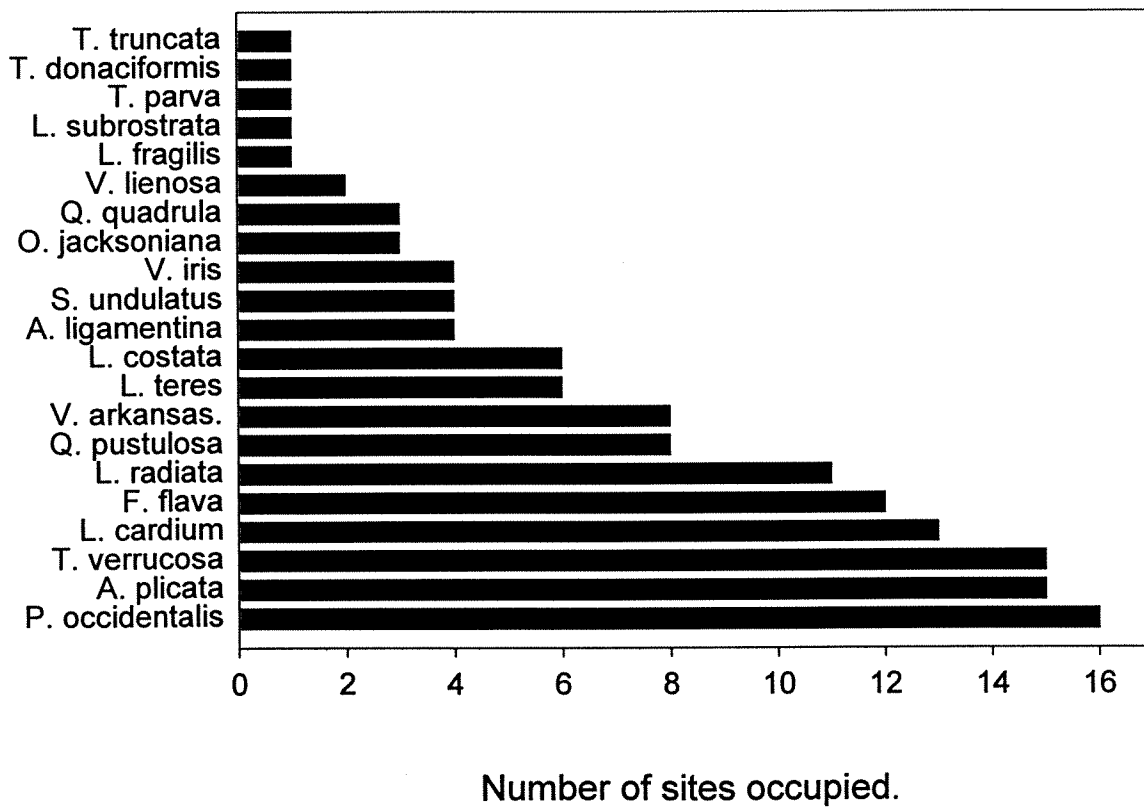


Figure 4. Species richness by site.

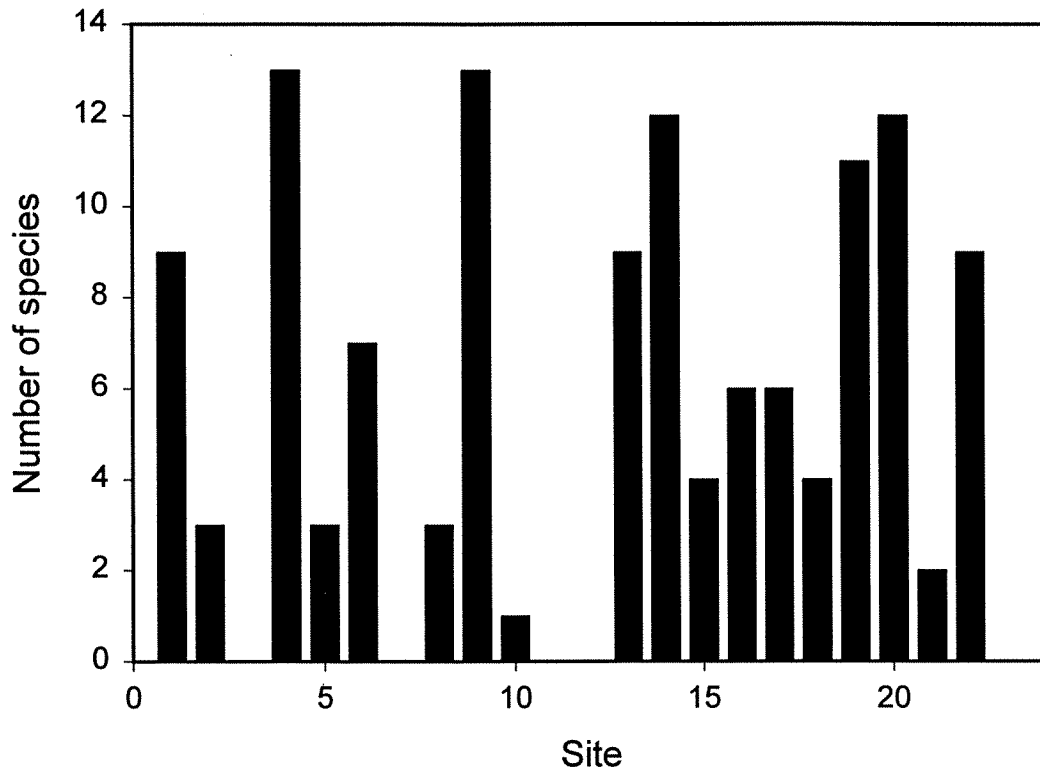
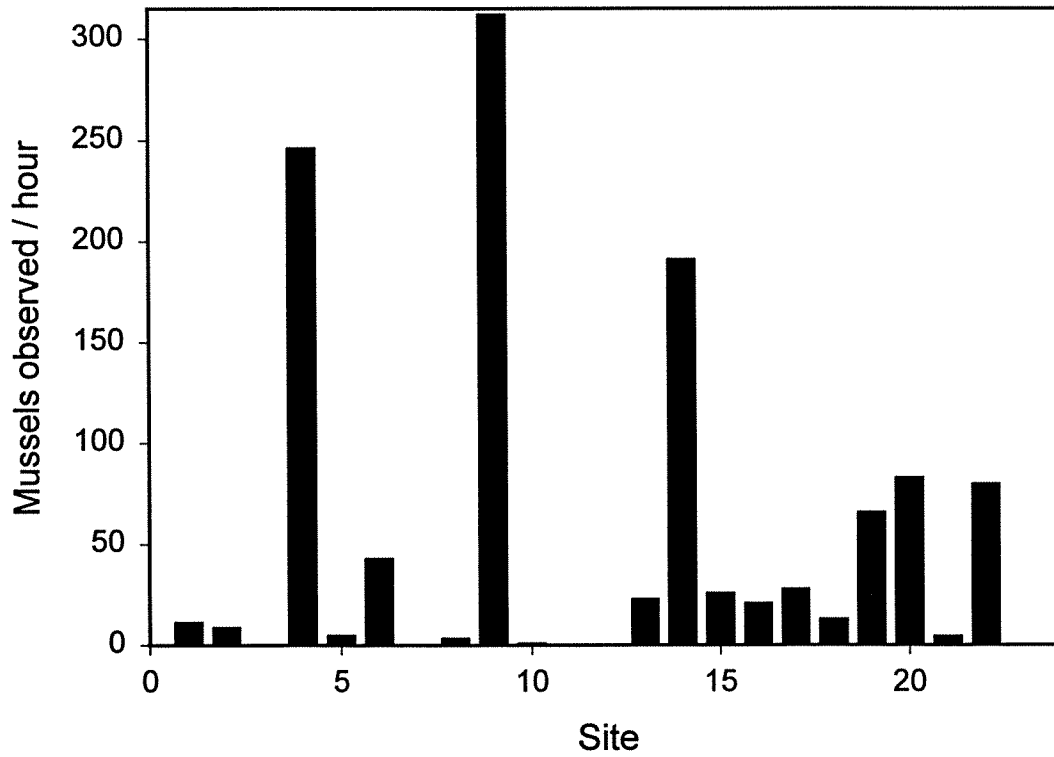


Figure 5. Mussel abundance by site.

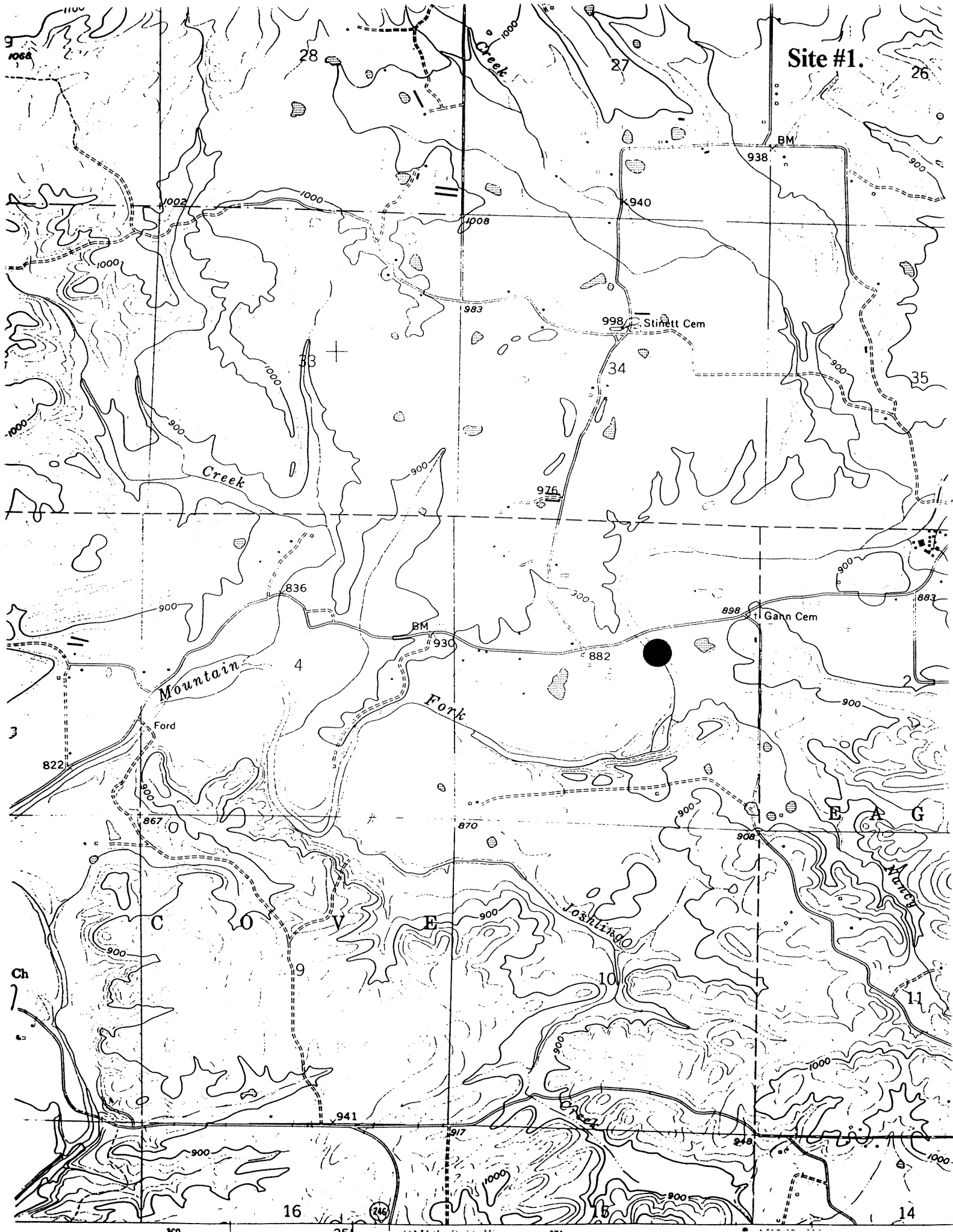


Appendix 1.  
Description of individual sites.

Site number: 1  
Fcode: F99VAU27  
Date: 8 August 1999  
County: Polk, AR  
Stream: Mountain Fork  
Quad name: Zafra

This site contained two separate mussel beds. The first bed was just above and within the riffle area. There was a cobble shore lined with water willow. The eastern shore contained pasture with very few trees. The second bed was downstream as the river turned. It consisted of many little backwater habitats similar to oxbow formations. The substrate was highly variable with cobble as well and sandy/ silt sediment. There was a lot of water willow at this site.

Species	Relative abundance (%)
<i>Ptychobranchnus occidentalis</i>	8.7
<i>Lampsilis cardium</i>	21.7
<i>Lampsilis teres</i>	8.7
<i>Tritigonia verrucosa</i>	8.7
<i>Strophitus undulatus</i>	8.7
<i>Villosa arkansasensis</i>	4.3
<i>Lampsilis siloquoidea</i>	26.1
<i>Fusconaia flava</i>	8.7
<i>Villosa lienosa</i>	4.3



Site #1.

Gahn Cem

Stinett Cem

Mountain Fork

Joshindo Creek

Ch

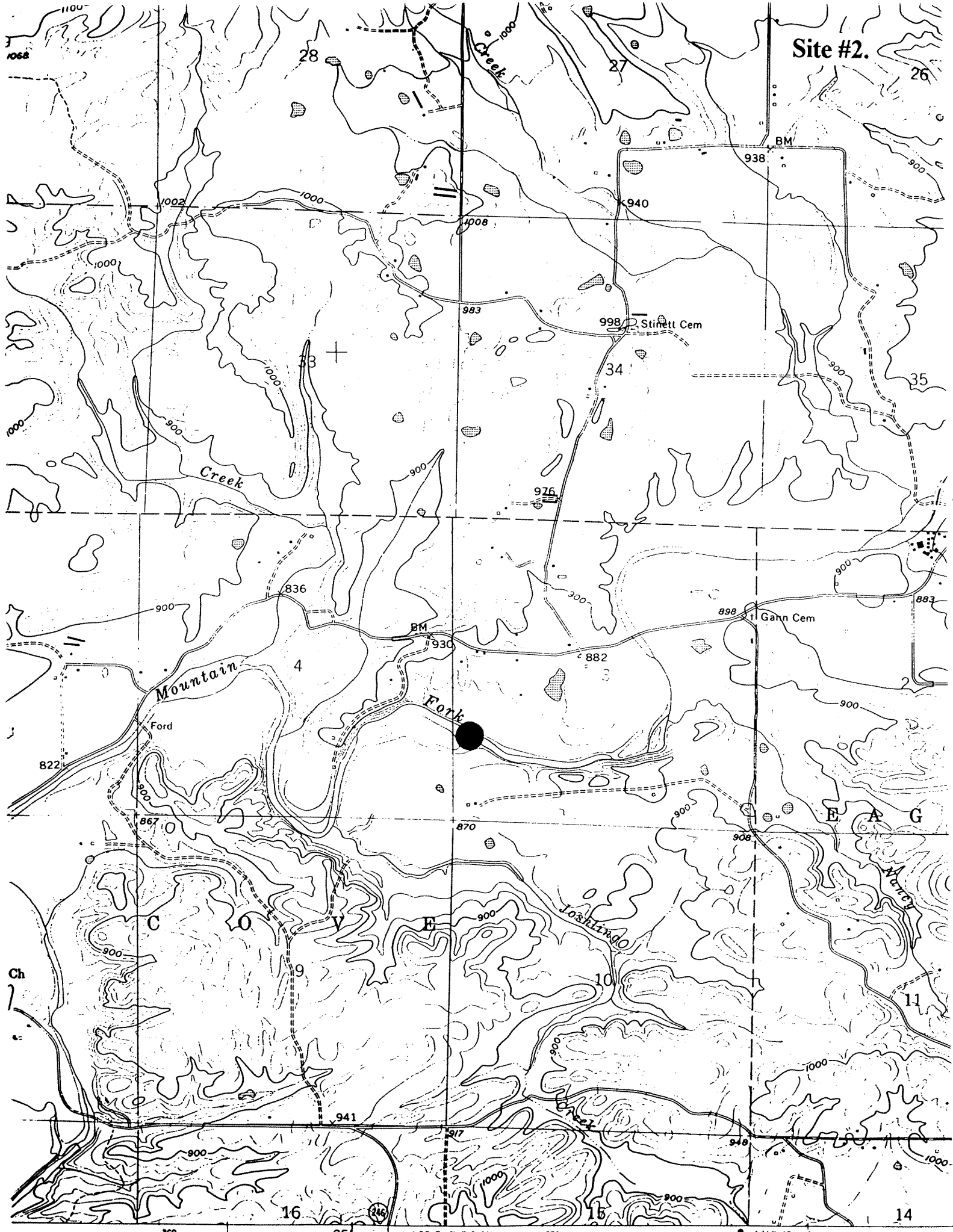
E A G

Site number: 2  
Fcode: F99VAU28  
Date: 8 August 1999  
County: Polk, AR  
Stream: Mountain Fork  
Quad name: Zafra

This site consisted of many fluvial deposits along with water willow. Mussels were sporadic and did not occur in a bed, although there was a concentration just below the creek outlet.

Species	Relative abundance (%)
<i>Amblema plicata</i>	44.4
<i>Tritigonia verrucosa</i>	44.4
<i>Fusconaia flava</i>	11.1

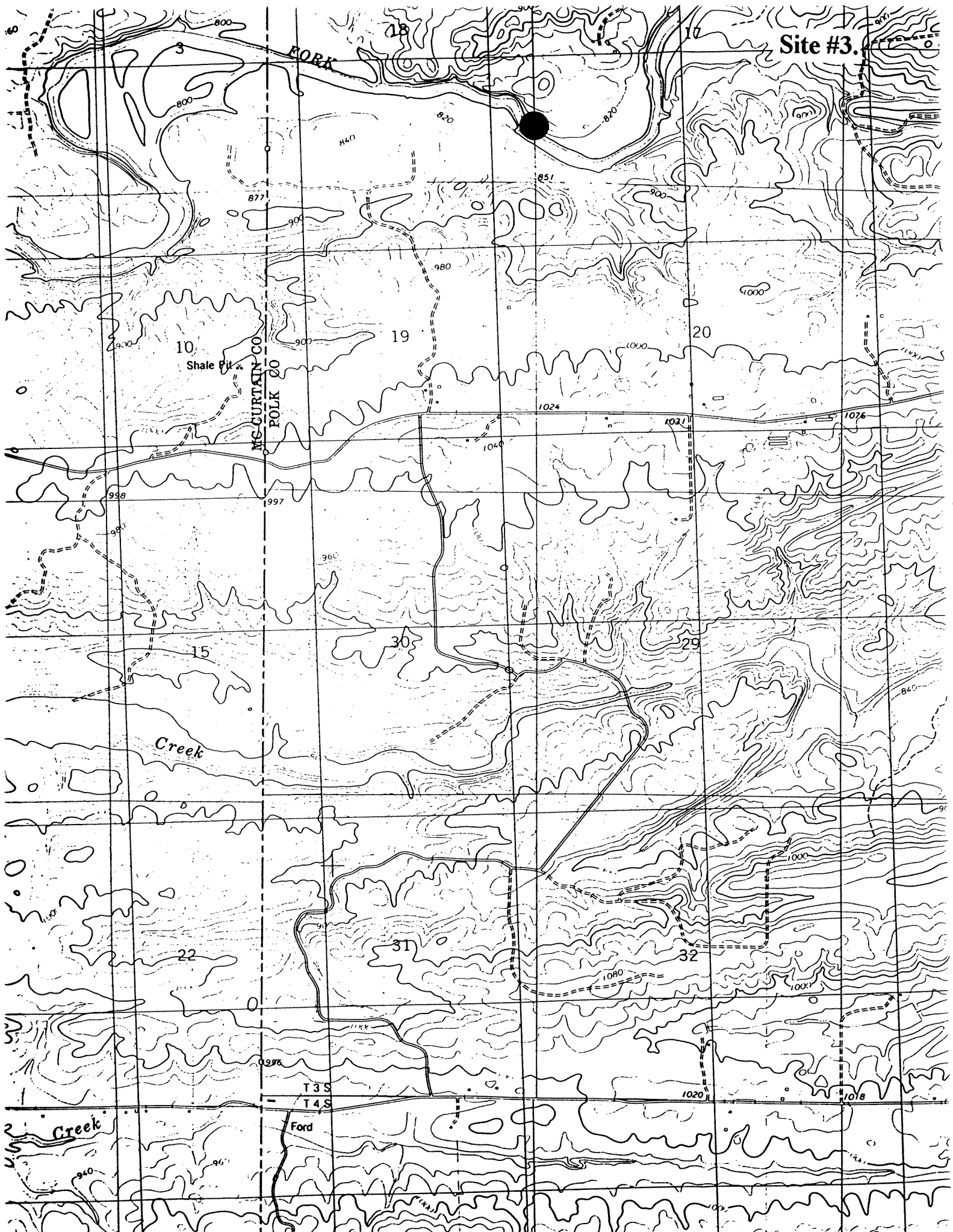
Site #2.





Site number: 3  
Fcode: F99VAU01  
Date: 8 June 1999  
County: Polk, AR  
Stream: Mt. Fork  
Quad name: Cove

The site contained a gravel bar surrounded by water willow. Flow was typical of a riffle area. Tadpoles and crayfish were abundant. No mussels were found.



Site #3.

POLK

10  
Shale Pit

McCURTAIN CO  
POLK CO

Creek

Creek

T 3 S  
T 4 S

Ford

18

17

10

19

20

15

30

29

22

31

32

997

851

958

960

1000

997

1024

1021

1026

1000

1080

1000

1020

1018

2

5

8

11

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17

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32

35

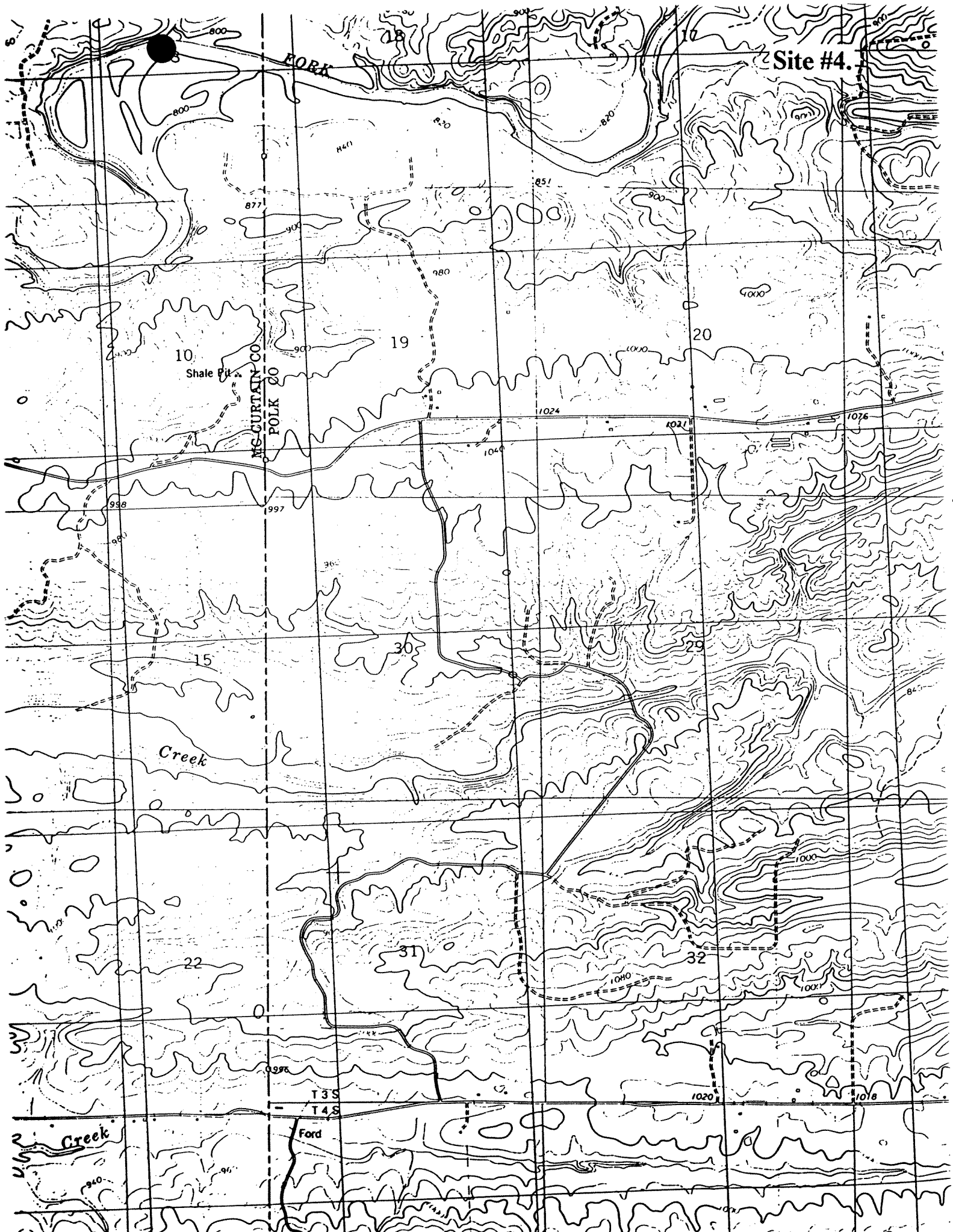
38

41

Site number: 4  
 Fcode: F97VAU28  
 Date: 8 July 1997  
 County: McCurtain, OK  
 Stream: Mountain Fork  
 Quad name: Cove

This site had a relatively low flow. Cow Creek entered on the right hand side of the river. There were many little water willow islands and water willow was abundant on shore. Upstream (above Cow Creek), there was a backwater area containing mussels. On the east side of the bank, there was a pasture and very little riparian vegetation. The west bank was well vegetated. The substrate at this site was very silty with abundant organic matter. The introduced Asian clam (*Corbicula fluminea*) was found at this site.

Species	Relative abundance (%)
<i>Fusconaia flava</i>	52.3
<i>Amblema plicata</i>	17.9
<i>Ptychobranhus occidentalis</i>	8.8
<i>Lampsilis cardium</i>	5.8
<i>Lampsilis siloquoidea</i>	5.2
<i>Villosa arkansasensis</i>	3.9
<i>Tritigonia verrucosa</i>	2.3
<i>Lampsilis teres</i>	1.0
<i>Strophitus undulatus</i>	1.0
<i>Villosa iris</i>	0.6
<i>Leptodea fragilis</i>	0.6
<i>Lasmigona costata</i>	0.3
<i>Ligumia subrostrata</i>	0.3



Site #4.

RORK

Shale Pit

Creek

Creek

Ford

MC CURTAIN CO  
POLK CO

T3S  
T4S

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980

1024

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996

1020

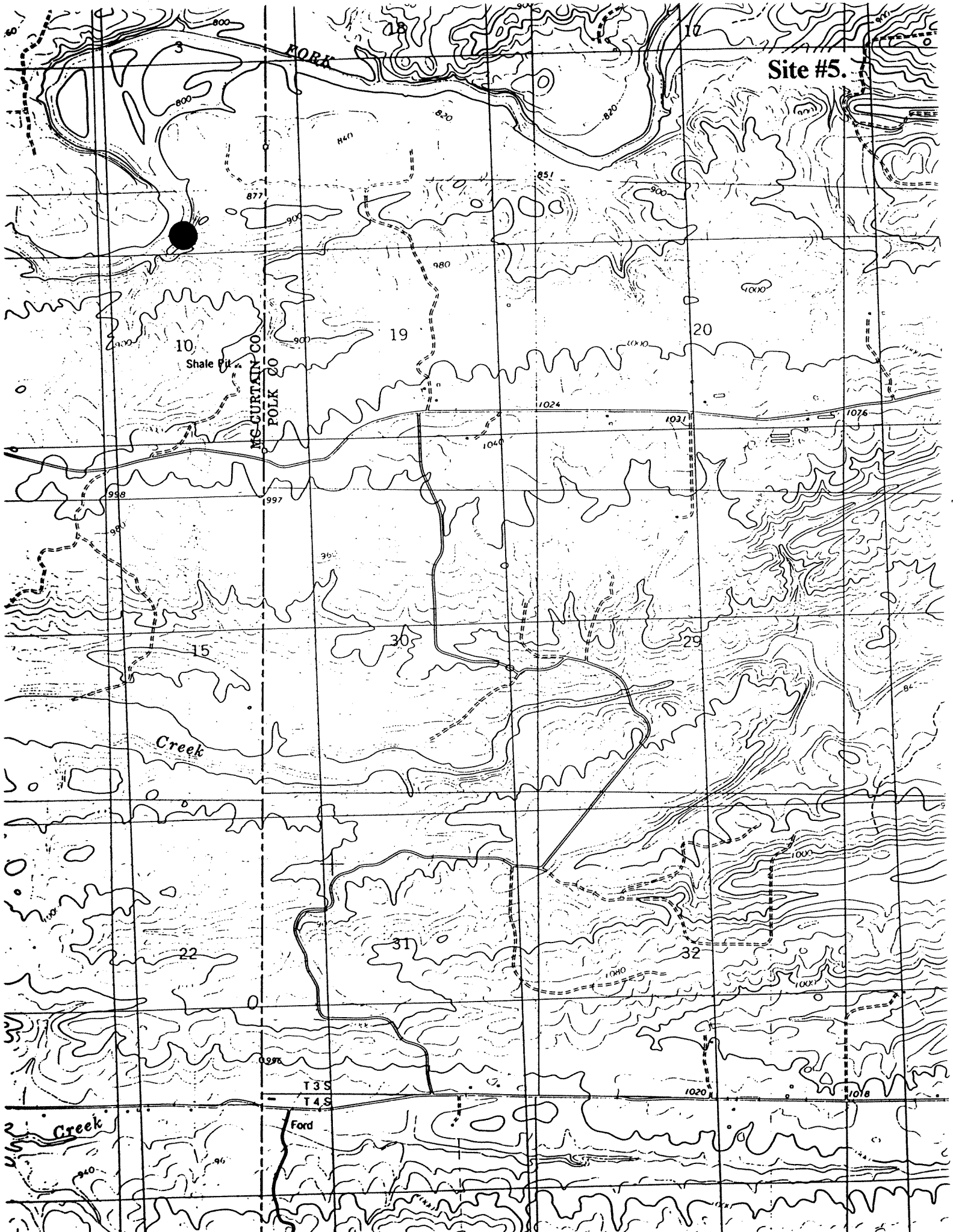
1018

940

960

Site number: 5  
Fcode: F99VAU02  
Date: 8 June 1999  
County: McCurtain, OK  
Stream: Mountain Fork  
Quad name: Cove

Species	Relative abundance (%)
<i>Amblema plicata</i>	40
<i>Ptychobranchnus occidentalis</i>	40
<i>Actinonaias ligamentina</i>	20



Site #5.

FORK

Shale Pt.

Creek

Creek

Ford

MC CURTAIN CO  
POLK CO

T3S  
T4S

10

19

20

15

30

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32

33

34

35

36

37

38

800

820

820

877

980

851

900

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998

997

1040

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1037

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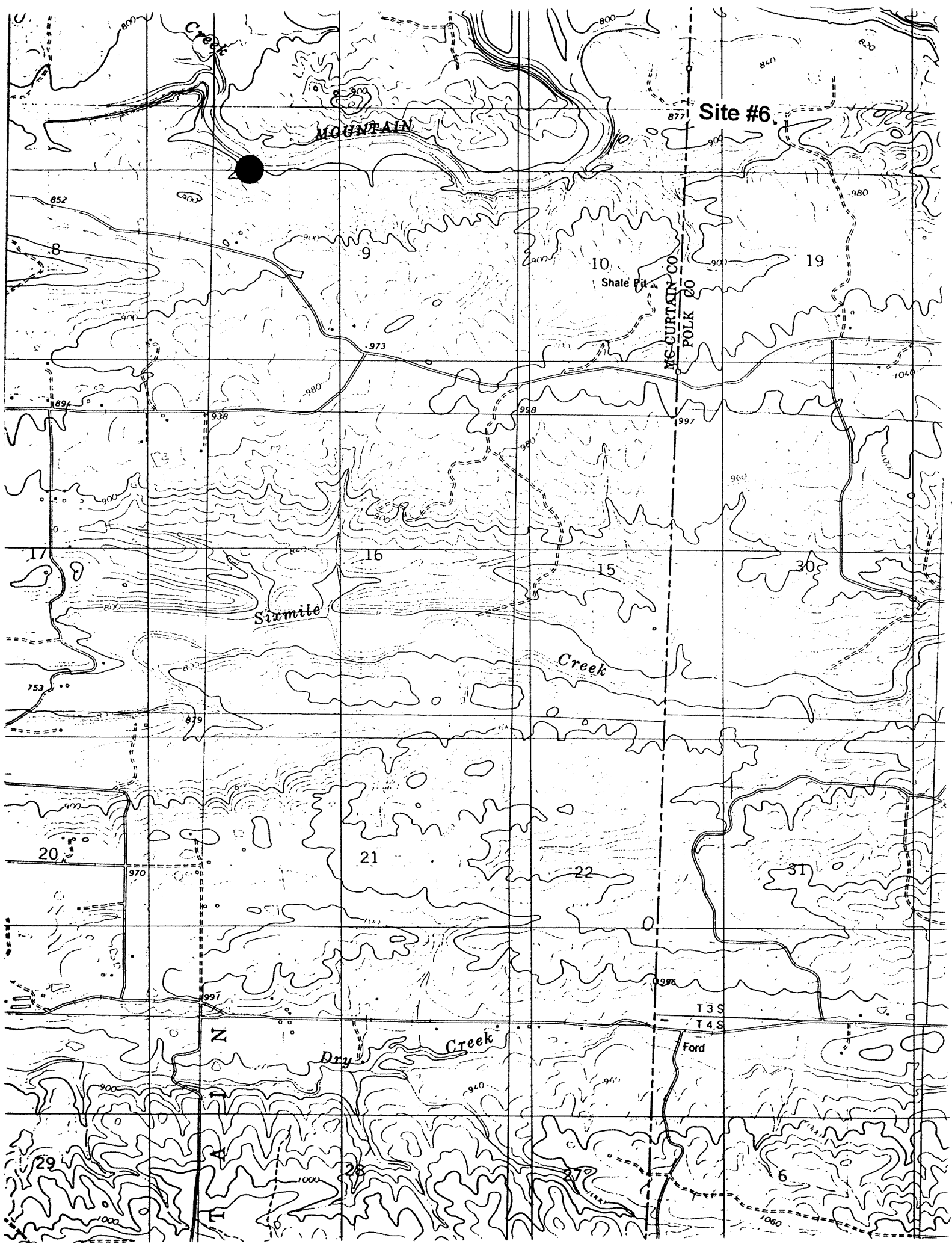
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940

Site number: 6  
Fcode: F99VAU03  
Date: 8 June 1999  
County: McCurtain, OK  
Stream: Mountain Fork  
Quad name: Cove

The river at this site split around an island of water willow. Mussels occurred in a bed on the east side of the river, in a sandy backwater area. The introduced Asian clam (*Corbicula fluminea*) was found at this site.

Species	Relative abundance (%)
<i>Amblema plicata</i>	59.3
<i>Fusconaia flava</i>	11.1
<i>Tritogonia verrucosa</i>	11.1
<i>Obovaria jacksoniana</i>	5.6
<i>Lampsilis teres</i>	3.7
<i>Actinonaias ligamentina</i>	1.9
<i>Lampsilis siliquoidea</i>	1.9





Site number: 7

Fcode: F97VAU29

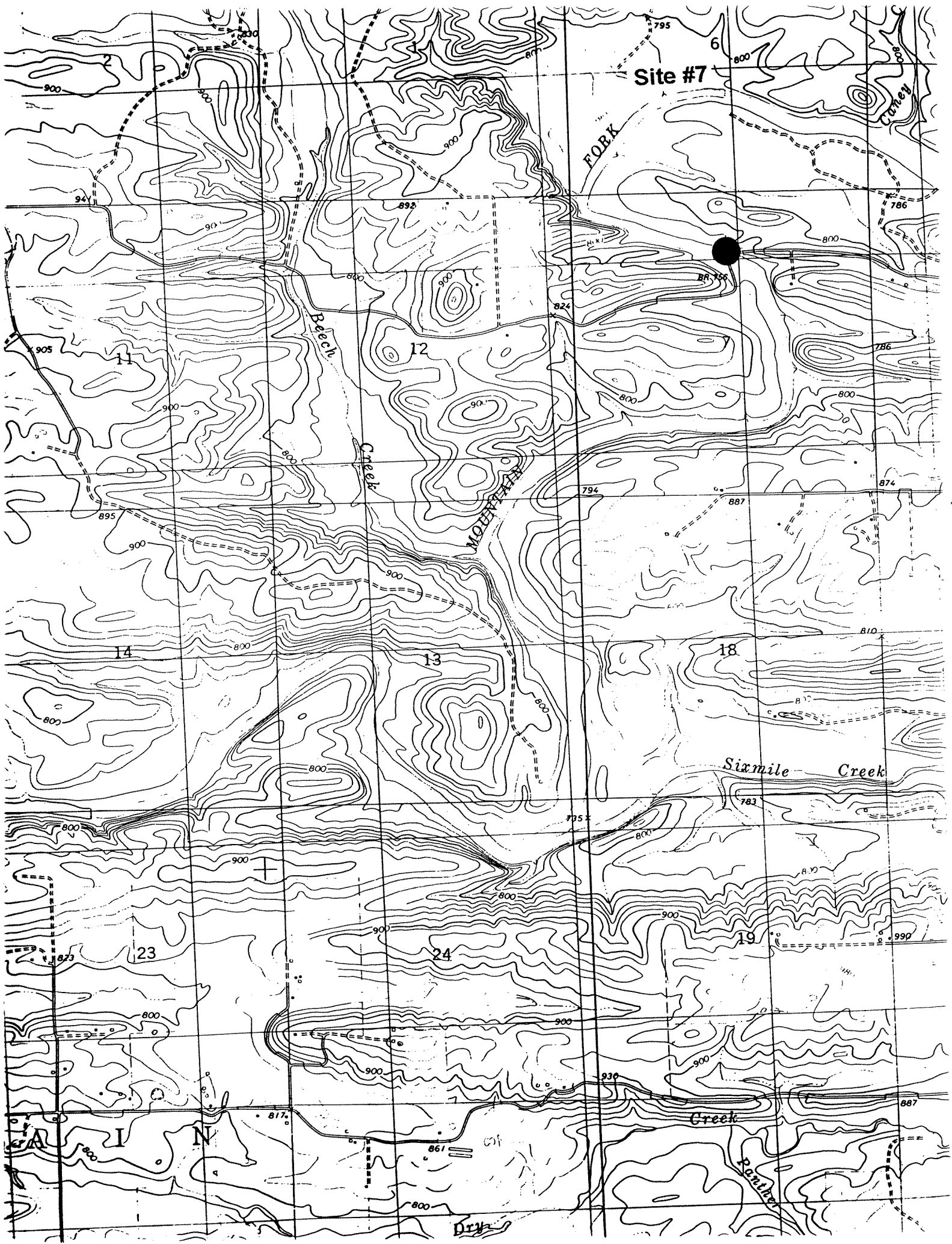
Date: 9 July 1997

County: McCurtain, OK

Stream: Mountain Fork

Quad name: Watson

This site was an old mussel bed directly downstream from a low water bridge. There were a few live mussels and many dead shells.



Site #7

FORK

Beech Creek

FORK MOUNTAIN

Sixmile Creek

Creek

Panther

IRON

Dry

Site number: 8  
Fcode: F97VAU30  
Date: 9 July 1997  
County: McCurtain, OK  
Stream: Mountain Fork  
Quad name: Watson

This site was downstream from a large riffle area.

Species	Relative abundance (%)
<i>Ptychobranhus occidentalis</i>	33.3
<i>Quadrula pustulosa</i>	33.3
<i>Truncilla donaciformis</i>	33.3



Site #8

FORK

Beech Creek

MOUNTAIN

Sixmile Creek

Creek

11

12

13

14

18

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24

19

DRY

Site number: 9  
 Fcode: F97VAU31  
 Date: 9 July 1997  
 County: McCurtain, OK  
 Stream: Mountain Fork  
 Quad name: Watson

This site was located just above a riffle area and beside a backwater area. A gravel peninsula separated the backwater from the riffle. The mussel bed consisted of a cobble substrate overlying sand. The introduced Asian clam (*Corbicula fluminea*) was found at this site.

Species	Relative abundance (%)
<i>Amblema plicata</i>	50.8
<i>Fusconaia flava</i>	10.8
<i>Ptychobranhus occidentalis</i>	8.6
<i>Villosa arkansasensis</i>	8.2
<i>Tritigonia verrucosa</i>	7.8
<i>Lampsilis cardium</i>	6.7
<i>Lampsilis siloquoidea</i>	4.5
<i>Lasmigona costata</i>	2.1
<i>Quadrula pustulosa</i>	0.8
<i>Obovaria jacksoniana</i>	0.6
<i>Strophitus undulatus</i>	0.6
<i>Villosa iris</i>	0.5
<i>Toxalosma parva</i>	0.2



Site #9

18

13

14

11

12

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24

19

DRY

Site number: 9  
Fcode: F99VAU04  
Date: 9 June 1999  
County: McCurtain, OK  
Stream: Mountain Fork  
Quad name: Watson

This site was located ~ 1 mile downstream from Beech Creek. There was a low water bridge, just past the mouth of the Beech Creek. In this reach the river changed from a slow flowing pool to a narrowing, faster stretch of river with a backwater to the west. The island between the backwater area and main channel consisted of a gravel bar with water willow. The riffle containing the mussel bed consisted of cobble/gravel substrate with some fallen logs. The introduced Asian clam (*Corbicula fluminea*) was found at this site.

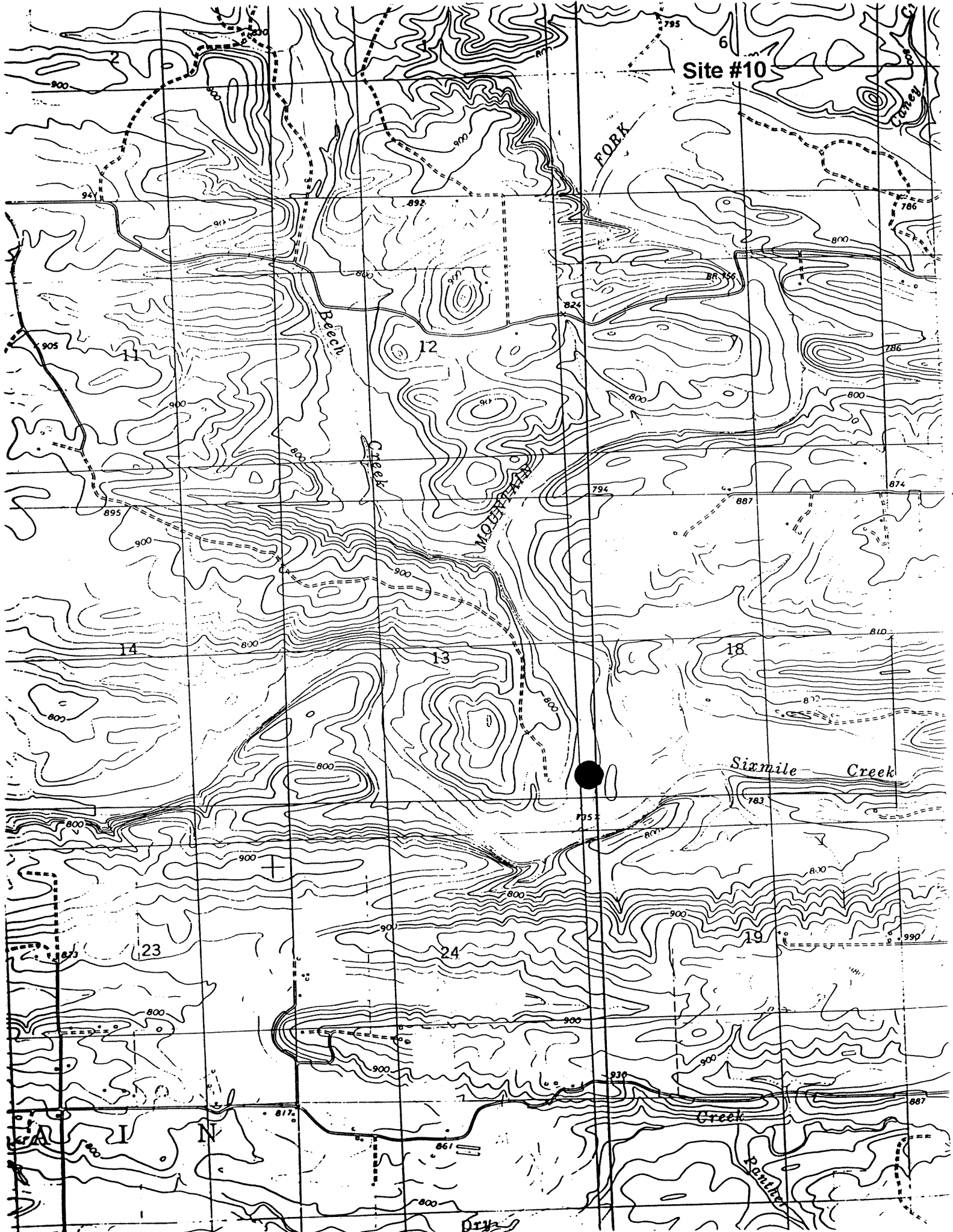




Site number: 10  
Fcode: F99VAU05  
Date: 9 June 1999  
County: McCurtain, OK  
Stream: Mountain Fork  
Quad name: Watson

This site was located between the mouth of an intermittent stream and Six Mile Creek.  
The introduced Asian clam (*Corbicula fluminea*) was found at this site.

Species	Relative abundance (%)
<i>Ptychobranchnus occidentalis</i>	100



Site #10

6

FOBK

Poultney  
Creek

12

18

Sixmile Creek

14

13

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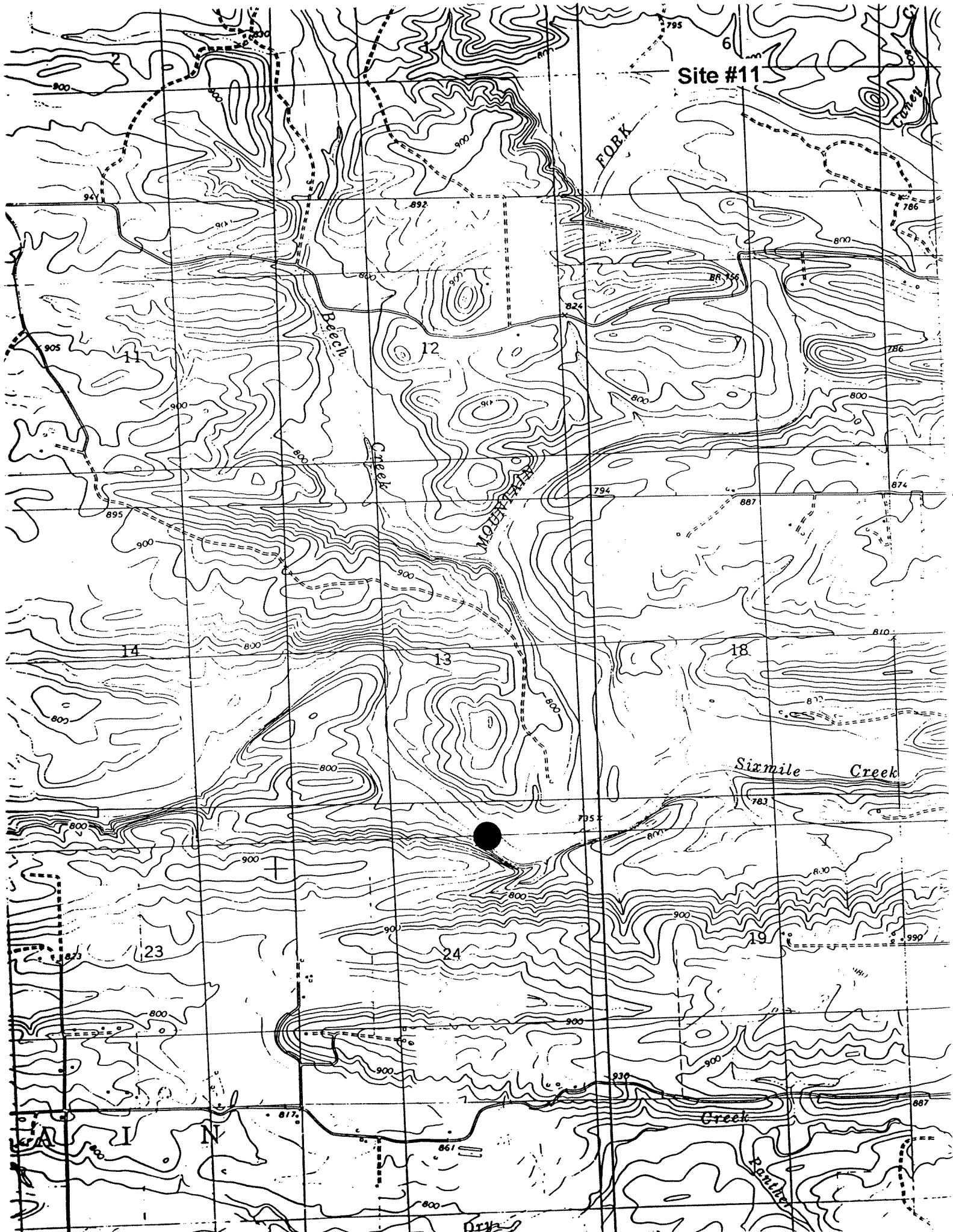
Creek

Poultney  
Creek

Dry

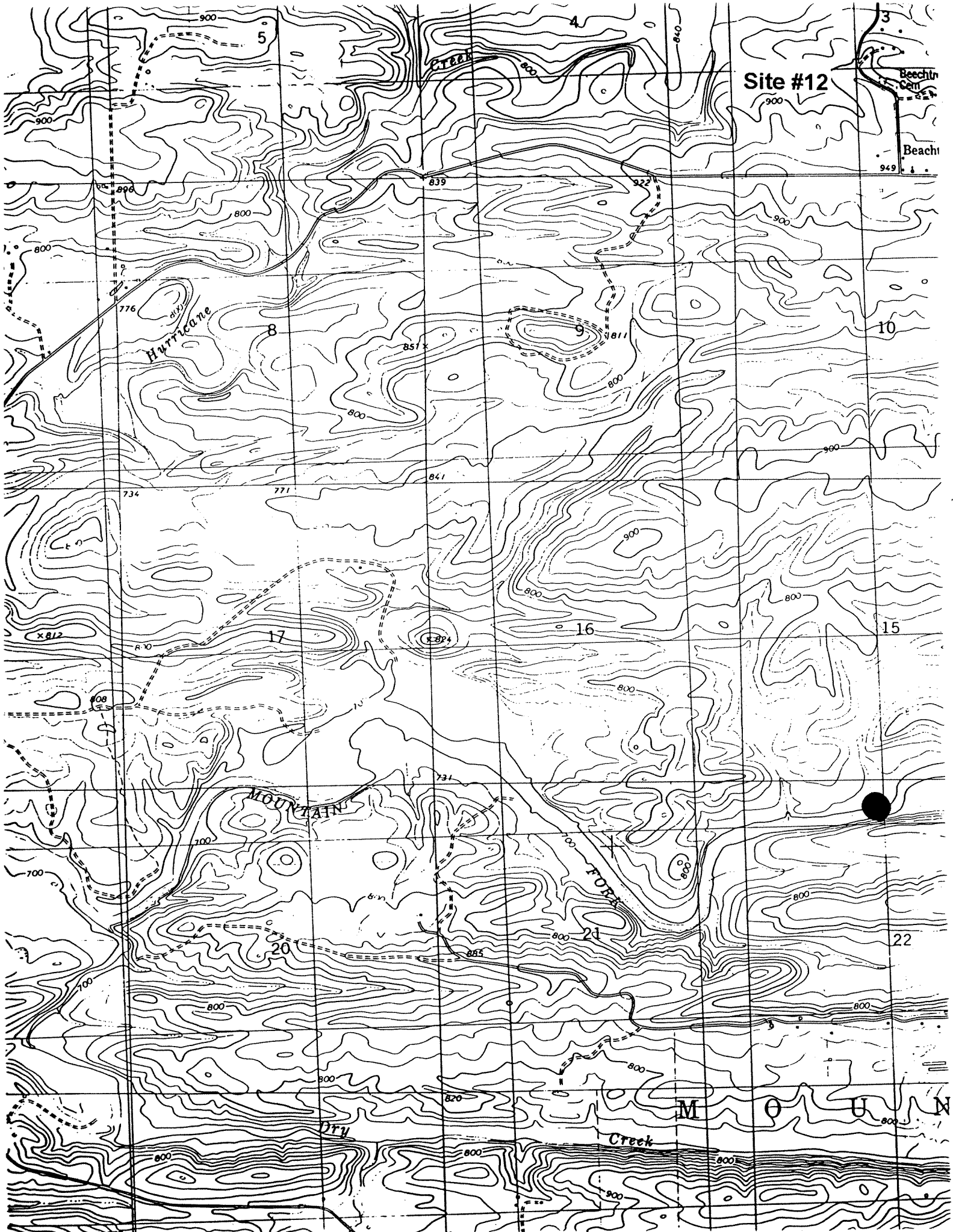
Site number: 11  
Fcode: F99VAU06  
Date: June 9 1999  
County: McCurtain, OK  
Stream: Mountain Fork  
Quad name: Watson

A snorkel search was performed on this area. We found water striders, crayfish, and leeches, but no mussels.



Site number: 12  
Fcode: F99VAU07  
Date: 9 June 1999  
County: McCurtain, OK  
Stream: Mountain Fork  
Quad name: Watson

This site consisted of many gravel shoals with patches of water willow. No mussels found.



Site #12

Beechtr  
Cen  
Beach  
949

Hurricane

MOUNTAIN

M O U N T A I N

DRY

Creek

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15

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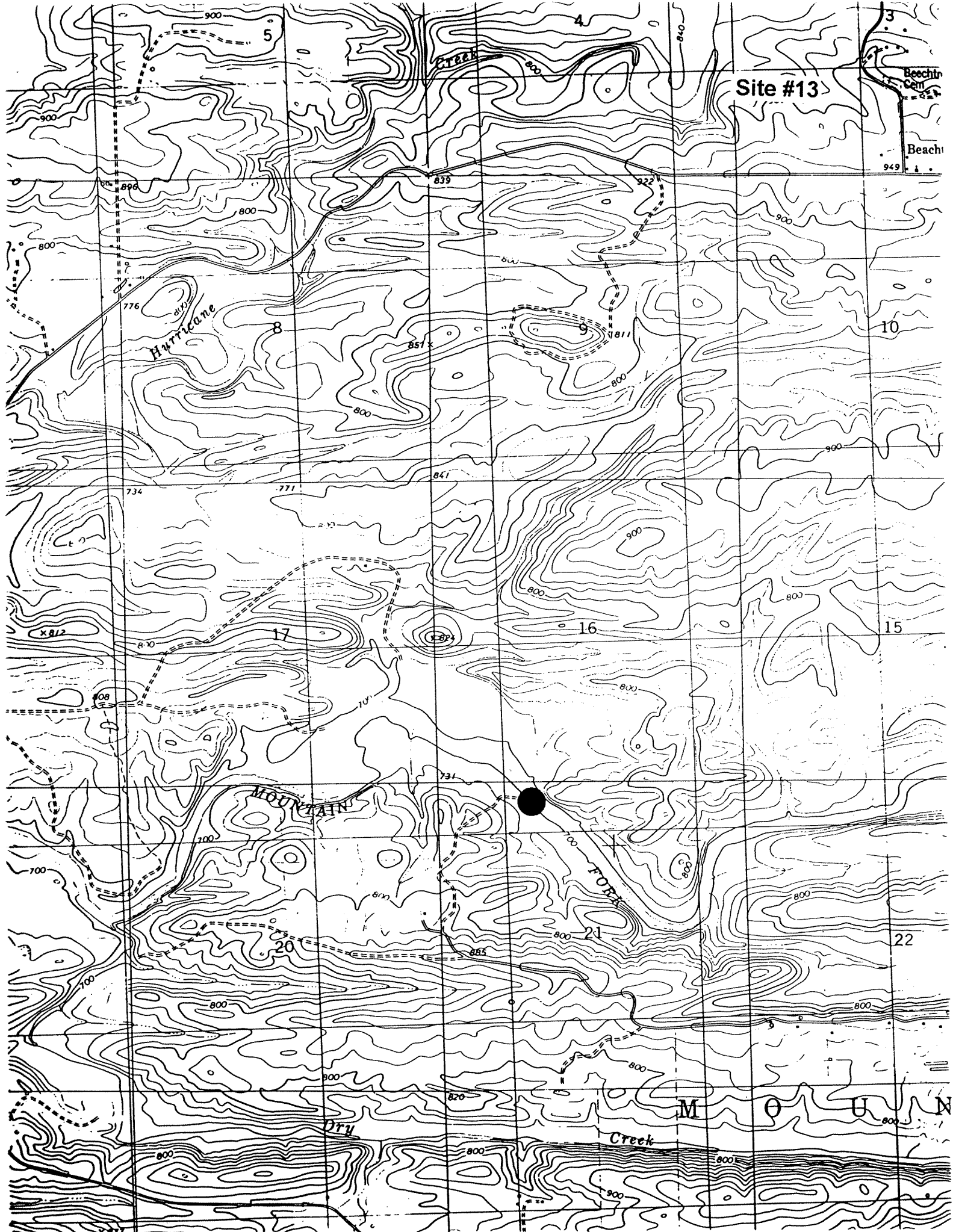
800

817

Site number: 13  
Fcode: F99VAU08  
Date: 9 June 1999  
County: McCurtain, OK  
Stream: Mountain Fork  
Quad name: Watson

This site contained a gravel shoal on the eastern side of the stream. The eastern side consisted of a low, eroded streambank. On the western side of the river, there was abundant emergent vegetation. Mussels were primarily found within a bed in the gravel shoal on the west bank. The introduced Asian clam (*Corbicula fluminea*) was found at this site.

Species	Relative abundance (%)
<i>Fusconaia flava</i>	26.1
<i>Tritigonia verrucosa</i>	21.7
<i>Amblema plicata</i>	17.4
<i>Ptychobranhus occidentalis</i>	13.0
<i>Villosa arkansasensis</i>	4.3
<i>Lampsilis cardium</i>	4.3
<i>Lampsilis siloquoidea</i>	4.3
<i>Lasmigona costata</i>	4.3
<i>Quadrula pustulosa</i>	4.3



Site #13

Beechin  
Creek  
Beach  
949

HURRICANE

MOUNTAIN

Creek

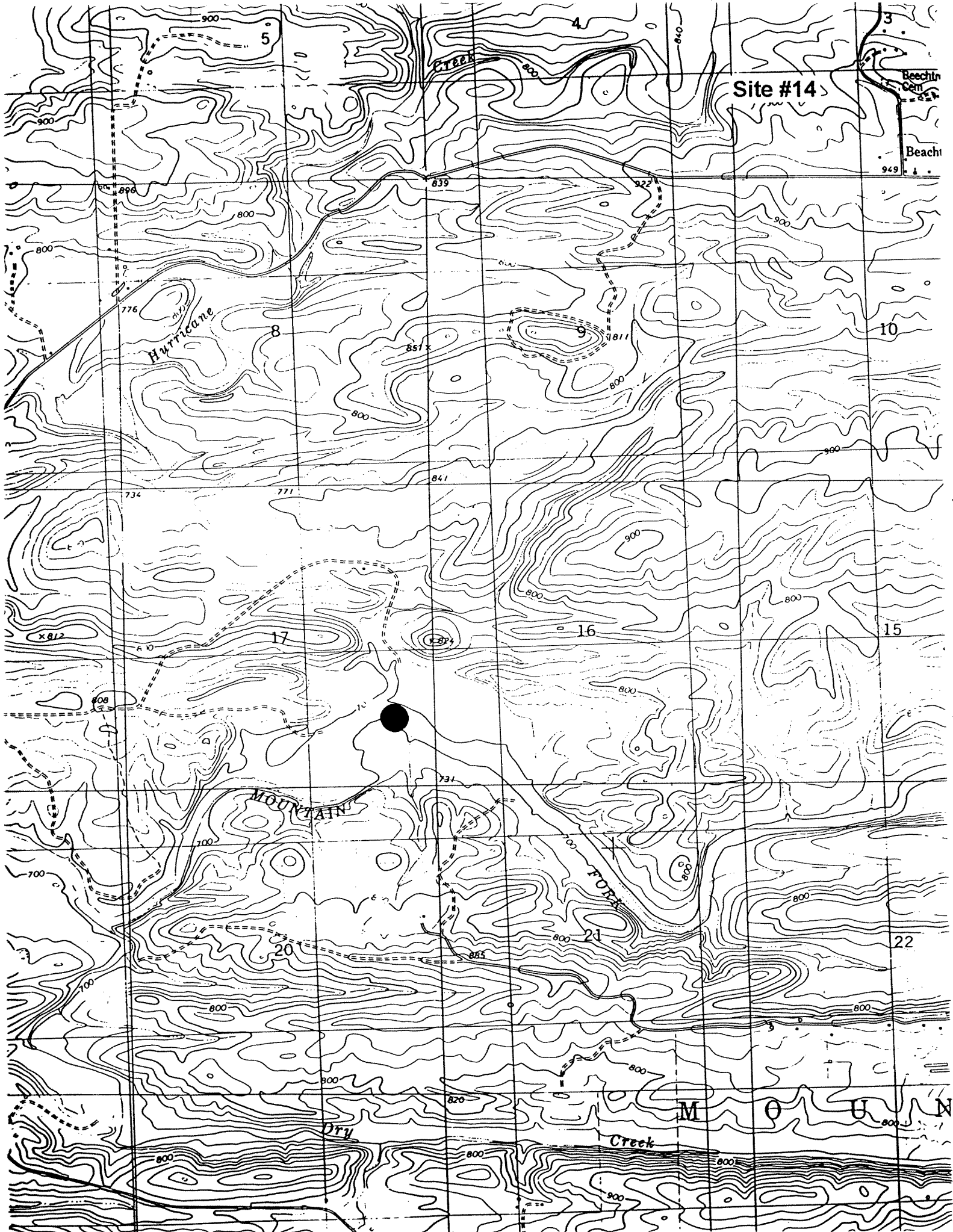
M O U N T A I N



Site number: 14  
Fcode: F97VAU32  
Date: 10 July 1997  
County: McCurtain, OK  
Stream: Mountain Fork  
Quad name: Watson

This site was located where the river narrowed and formed many small backwater areas. The substrate was silty and the mussels appeared to be in poor condition.

Species	Relative abundance (%)
<i>Fusconaia flava</i>	31.1
<i>Ptychobranchnus occidentalis</i>	20.2
<i>Amblema plicata</i>	19.8
<i>Tritigonia verrucosa</i>	8.4
<i>Lampsilis siloquoidea</i>	6.7
<i>Lampsilis cardium</i>	5.1
<i>Quadrula pustulosa</i>	4.1
<i>Villosa arkansasensis</i>	2.2
<i>Obovaria jacksoniana</i>	1.0
<i>Lasmigona costata</i>	0.7
<i>Strophitus undulatus</i>	0.5
<i>Truncilla truncata</i>	0.2



Site #14

HURRICANE

MOUNTAIN

DRIY

Creek

Beechin Cem  
Beach  
949

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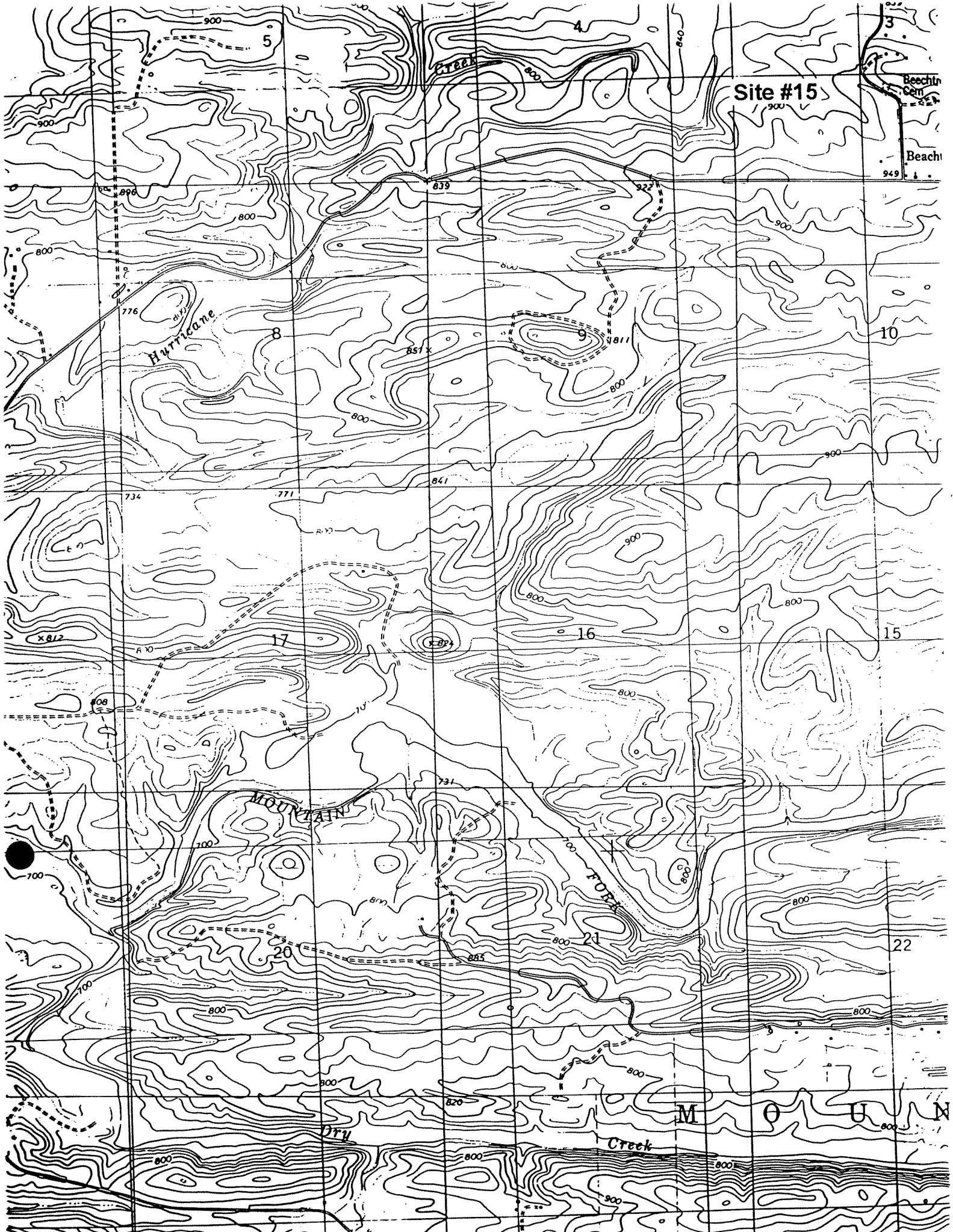
22

M O U N T A I N

Site number: 15  
Fcode: F97VAU33  
Date: 10 July 1997  
County: McCurtain, OK  
Stream: Mountain Fork  
Quad name: Watson

This site consisted of a riffle/ run area surrounding a peninsula. Mussels were found above the first riffle and in the run. The substrate was predominately cobble.

Species	Relative abundance (%)
<i>Ptychobranchus occidentalis</i>	38.5
<i>Lampsilis cardium</i>	38.5
<i>Lasmigona costata</i>	15.4
<i>Tritigonia verrucosa</i>	7.7



Site #15

Beechin  
Cem  
Beach  
949



700

M O U N T A I N

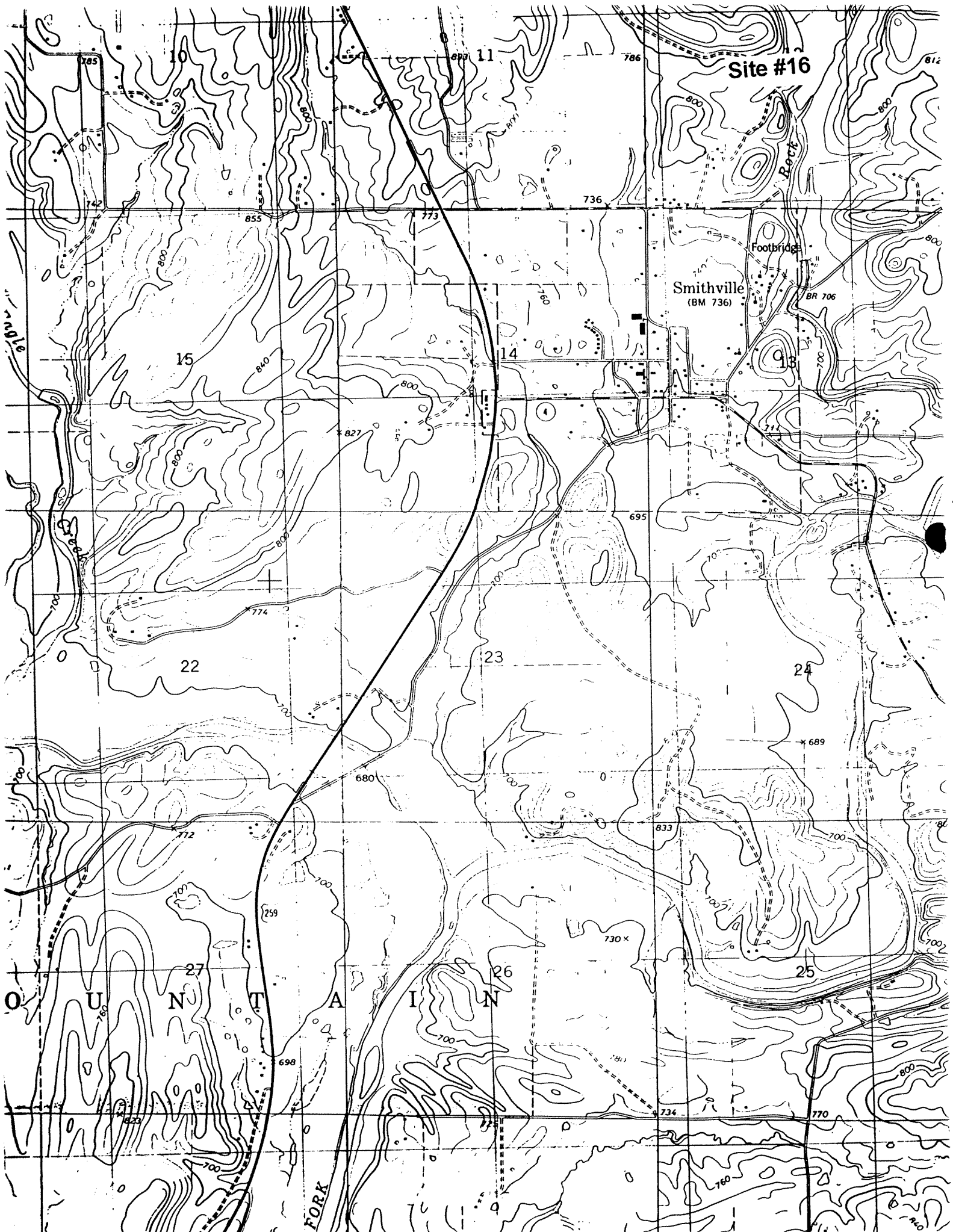
Creek

800 800 800 900

Site number: 16  
Fcode: F97VAU34  
Date: 10 July 1997  
County: McCurtain, OK  
Stream: Mountain Fork  
Quad name: Smithville

This site was directly above the bend where Rock Creek enters the river. This site contained a braided area consisting of very shallow cobble riffles. There was a lot of water willow. Mussels were found above and directly below the riffle.

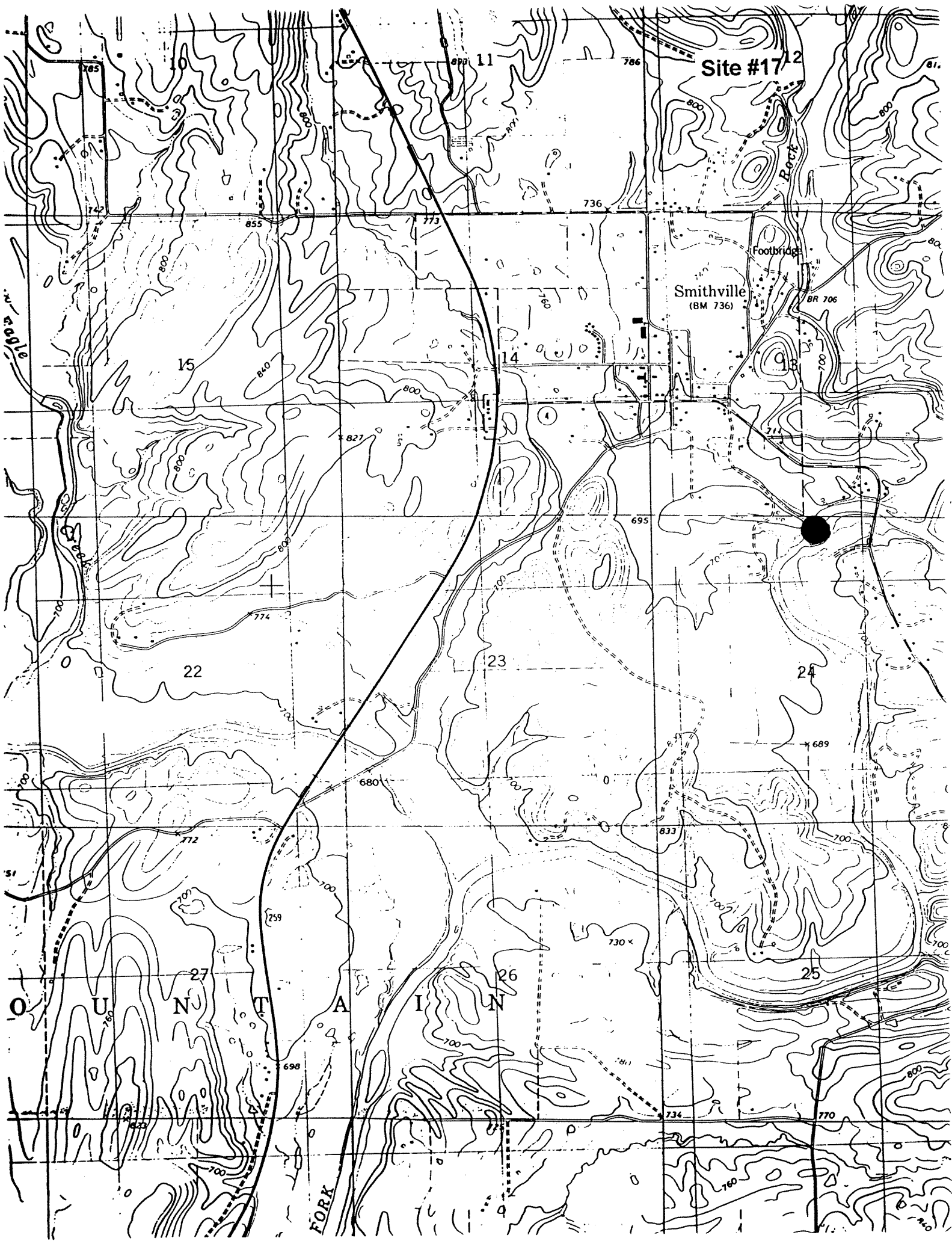
Species	Relative abundance (%)
<i>Tritigonia verrucosa</i>	33.3
<i>Ptychobranchnus occidentalis</i>	28.6
<i>Lampsilis cardium</i>	19.0
<i>Fusconaia flava</i>	9.5
<i>Amblema plicata</i>	4.8
<i>Lampsilis teres</i>	4.8



Site number: 17  
Fcode: F97VAU35  
Date: 11 July 1997  
County: McCurtain, OK  
Stream: Mountain Fork  
Quad name: Smithville

This site consisted of a splitting of the river around a water willow island. Mussels were found in the western channel.

Species	Relative abundance (%)
<i>Tritigonia verrucosa</i>	50
<i>Amblema plicata</i>	14.3
<i>Ptychobranhus occidentalis</i>	14.3
<i>Villosa arkansasensis</i>	7.1
<i>Lampsilis cardium</i>	7.1
<i>Villosa iris</i>	7.1

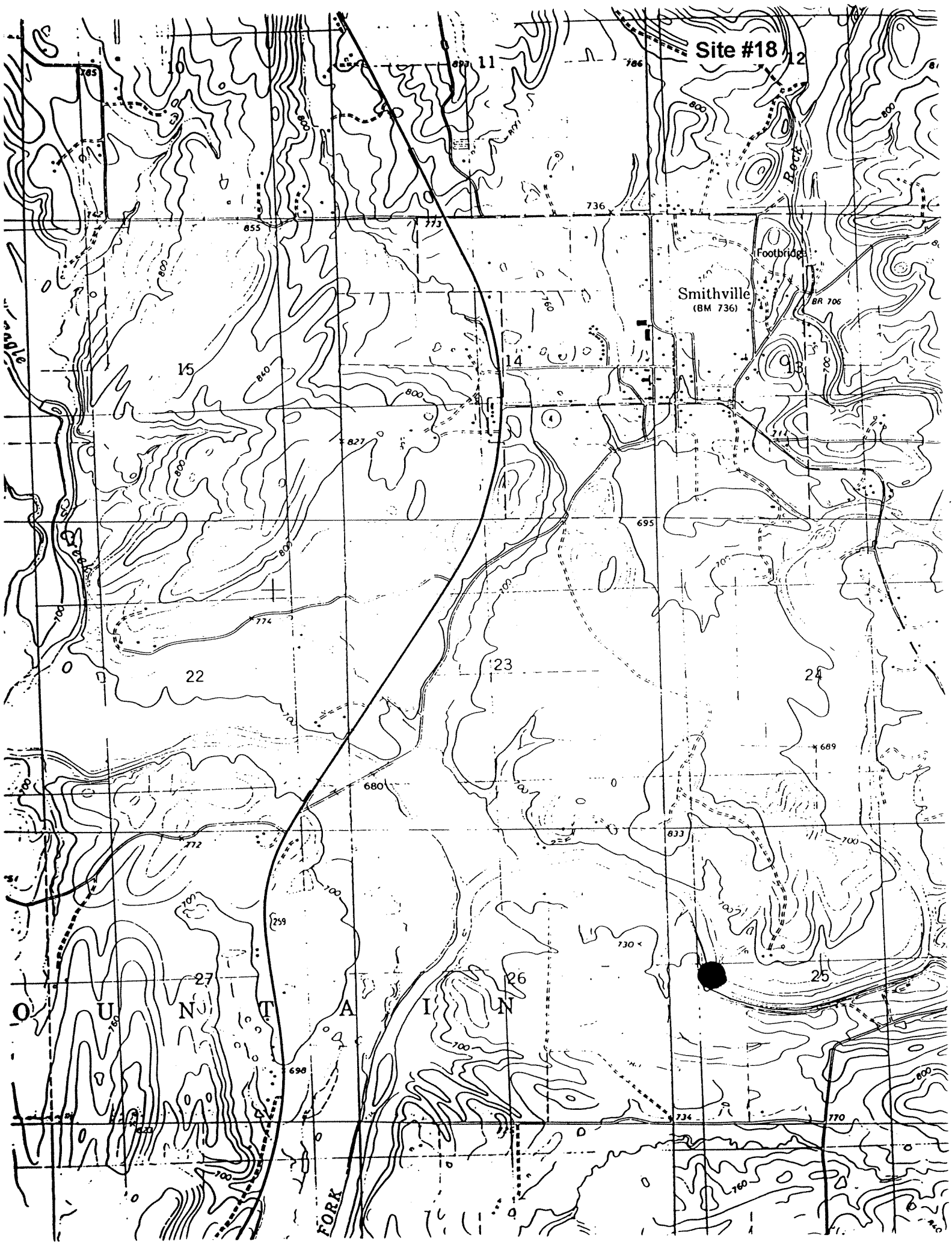




Site number: 18  
Fcode: F97VAU36  
Date: 11 July 1997  
County: McCurtain, OK  
Stream: Mountain Fork  
Quad name: Smithville

This site consisted of gravel overlying a bedrock substrate. There were sparse mussels in the gravel pockets between some boulders.

Species	Relative abundance (%)
<i>Lampsilis siloquoidea</i>	7.7
<i>Amblema plicata</i>	38.5
<i>Tritigonia verrucosa</i>	38.5
<i>Lampsilis cardium</i>	15.4



Site #18

Smithville  
(BM 736)

FORK

Footbridge

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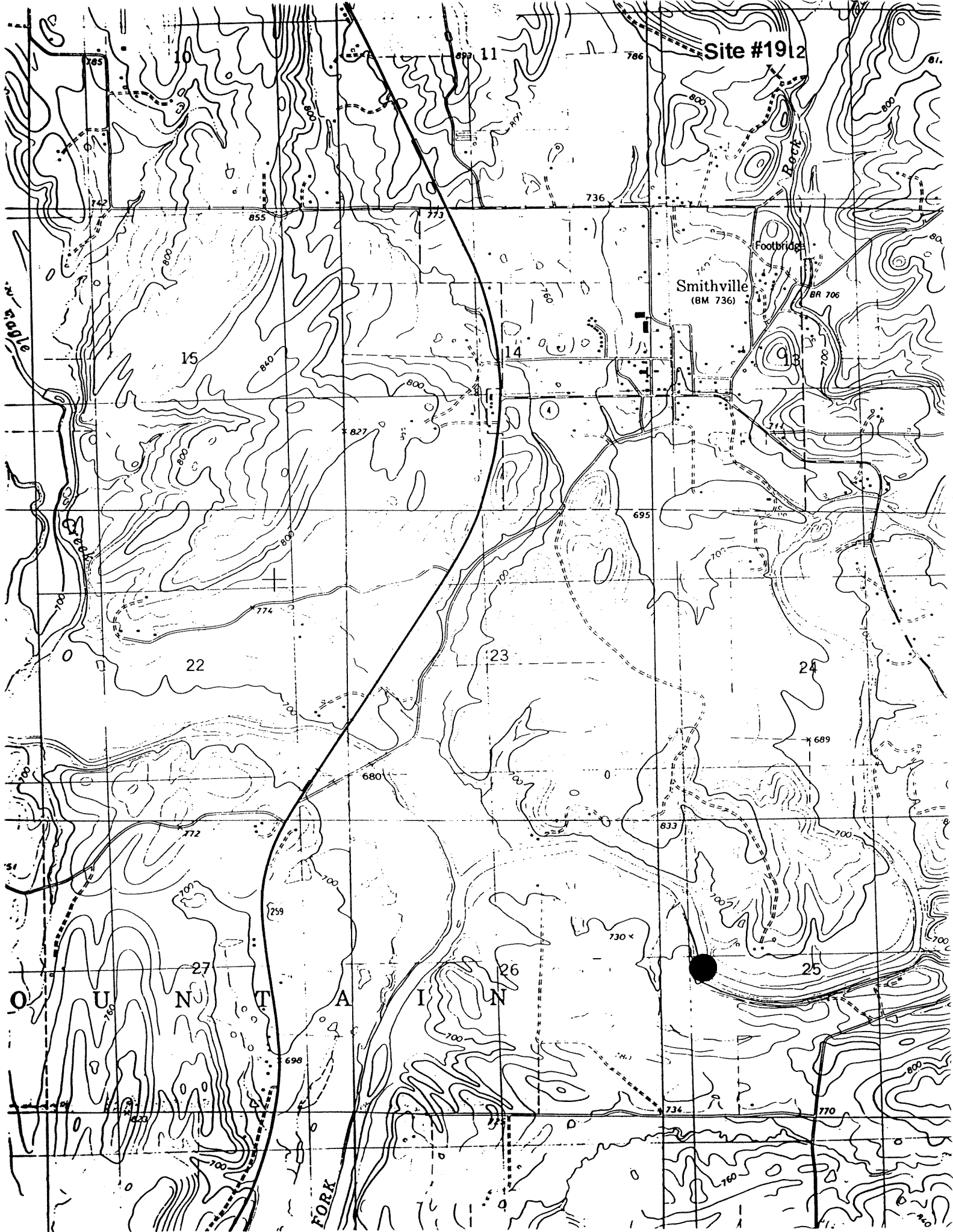
11

12

Site number: 19  
Fcode: F99VAU29  
Date: 9 August 1999  
County: McCurtain, OK  
Stream: Mountain Fork  
Quad name: Smithville

This site was the first riffle just below the outlet of Eagle Fork Creek. This site consisted of a riffle section below the outlet of the Eagle Fork and had a backwater area on the west side of the river. The substrate was dominately a cobble/gravel and was surrounded by water willow. The mussels occurred in a bed just above the riffle and extended down through the riffle.

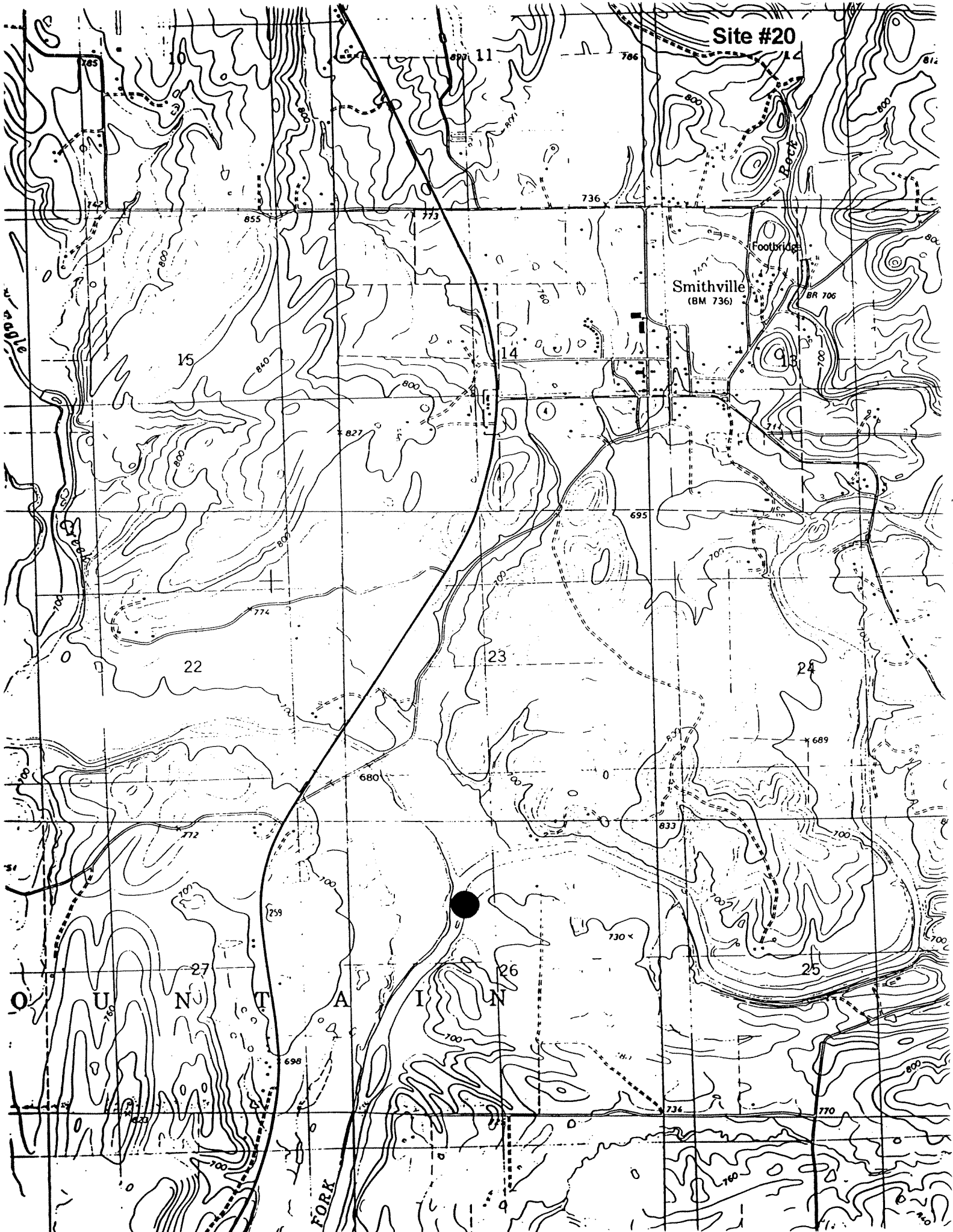
Species	Relative abundance (%)
<i>Amblema plicata</i>	56.1
<i>Lampsilis cardium</i>	12.1
<i>Tritigonia verrucosa</i>	10.6
<i>Ptychobranhus occidentalis</i>	6.1
<i>Fusconaia flava</i>	3.0
<i>Lasmigona costata</i>	3.0
<i>Actinonaias ligamentina</i>	3.0
<i>Lampsilis siloquoidea</i>	1.5
<i>Lampsilis teres</i>	1.5
<i>Quadrula pustulosa</i>	1.5
<i>Quadrula quadrula</i>	1.5



Site number: 20  
Fcode: F97VAU27  
Date: 7 July 1997  
County: McCurtain, OK  
Stream: Mountain Fork  
Quad name: Smithville

This site had an island/ gravel bar. The west bank was vegetated with water willow. On the east bank, there was a very thin patch of riparian vegetation with a rather steep slope. Cattle could be heard directly upstream. This site was relatively close to the highway and cars could be heard. The introduced Asian clam (*Corbicula fluminea*) was found at this site.

Species	Relative abundance (%)
<i>Lampsilis siloquoidea</i>	26.1
<i>Lampsilis cardium</i>	21.7
<i>Ptychobranhus occidentalis</i>	8.7
<i>Fusconaia flava</i>	8.7
<i>Tritigonia verrucosa</i>	8.7
<i>Lampsilis teres</i>	8.7
<i>Strophitus undulatus</i>	8.7
<i>Villosa arkansasensis</i>	4.3
<i>Villosa lienosa</i>	4.3



Site #20

Smithville  
(BM 736)

Footbridge

BR 706

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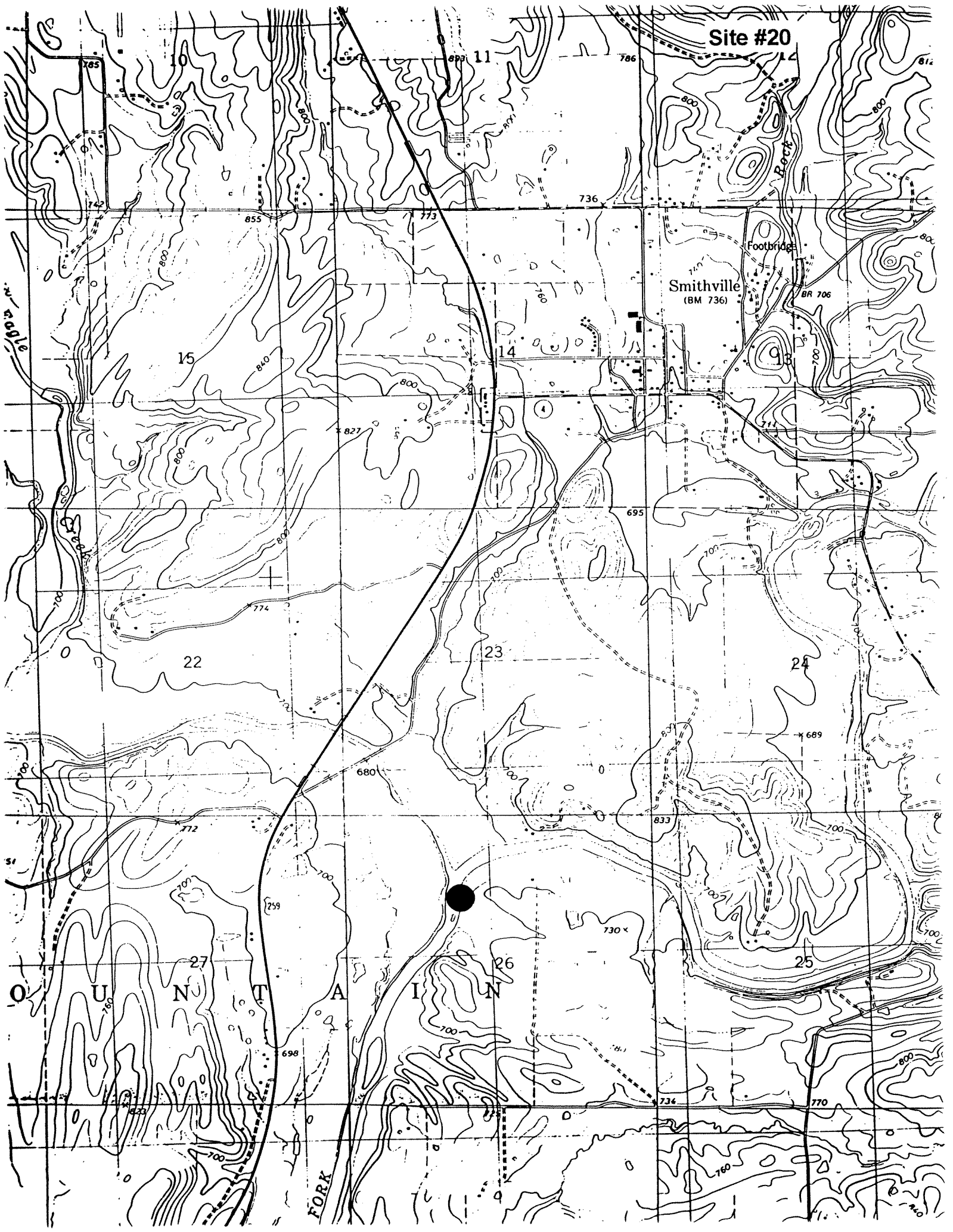
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FORK

Site number: 20  
Fcode: F99VAU30  
Date: 9 August 1999  
County: McCurtain, OK  
Stream: Mountain Fork  
Quad name: Smithville

This site was located on the first large island below the Eagle Fork Creek outlet. There was another bed located just around the bend. This second bed was located under a fallen sycamore tree that was perpendicular to the river. On the west side of the riverbed was a field with fallen trees and eroding shoreline. The introduced Asian clam (*Corbicula fluminea*) was found at this site.

Species	Relative abundance (%)
<i>Ptychobranchnus occidentalis</i>	22.9
<i>Amblema plicata</i>	22.3
<i>Tritigonia verrucosa</i>	16.9
<i>Lampsilis cardium</i>	14.4
<i>Fusconaia flava</i>	10.8
<i>Quadrula pustulosa</i>	7.2
<i>Lampsilis siloquoidea</i>	3.0
<i>Quadrula quadrula</i>	1.8
<i>Lampsilis teres</i>	0.6

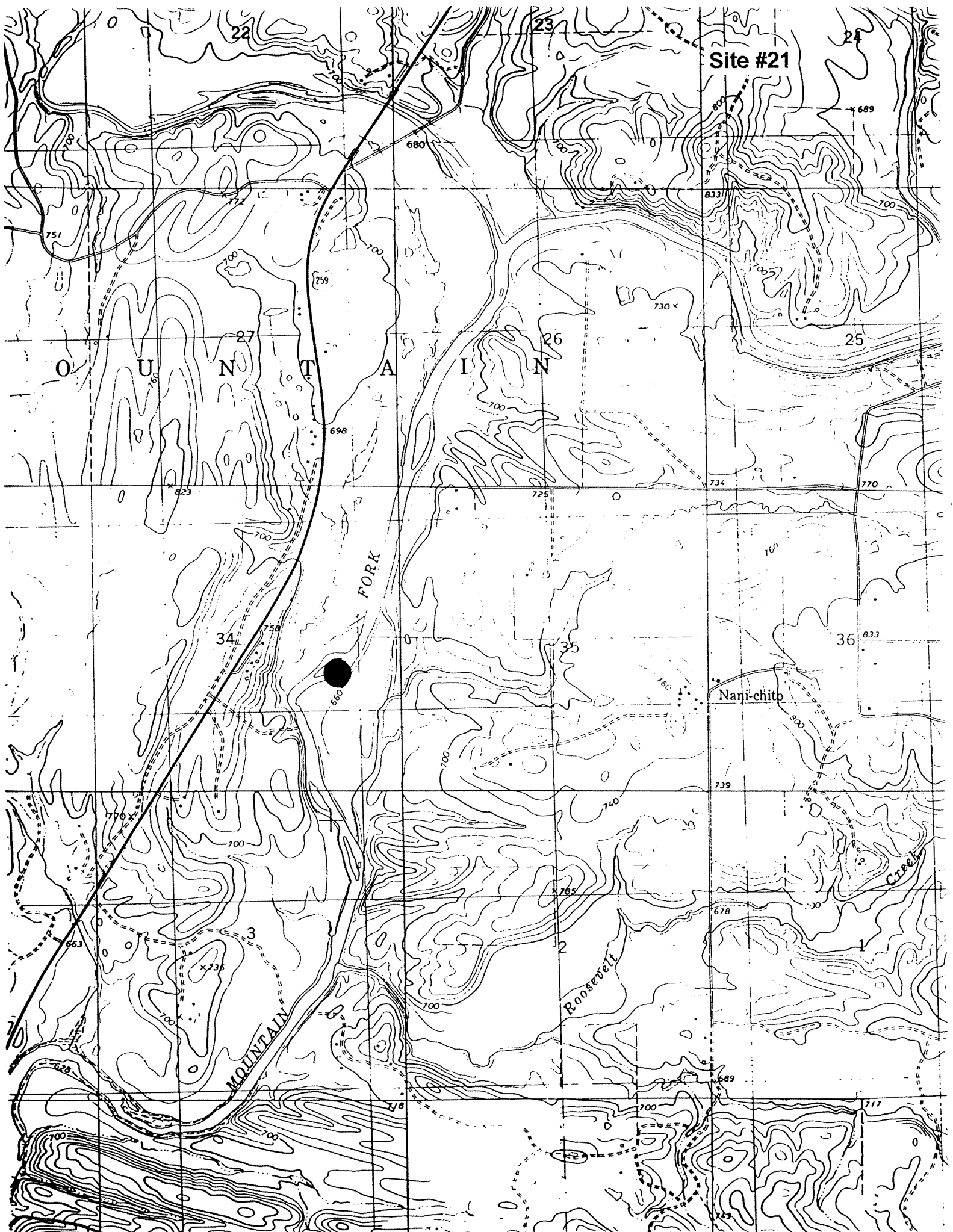




Site number: 21  
Fcode: F99VAU31  
Date: 8 August 1999  
County: McCurtain, OK  
Stream: Mountain Fork  
Quad name: Smithville

The river at this site split around a water willow/ gravel island. There were boulders, and bedrock in the streambed.

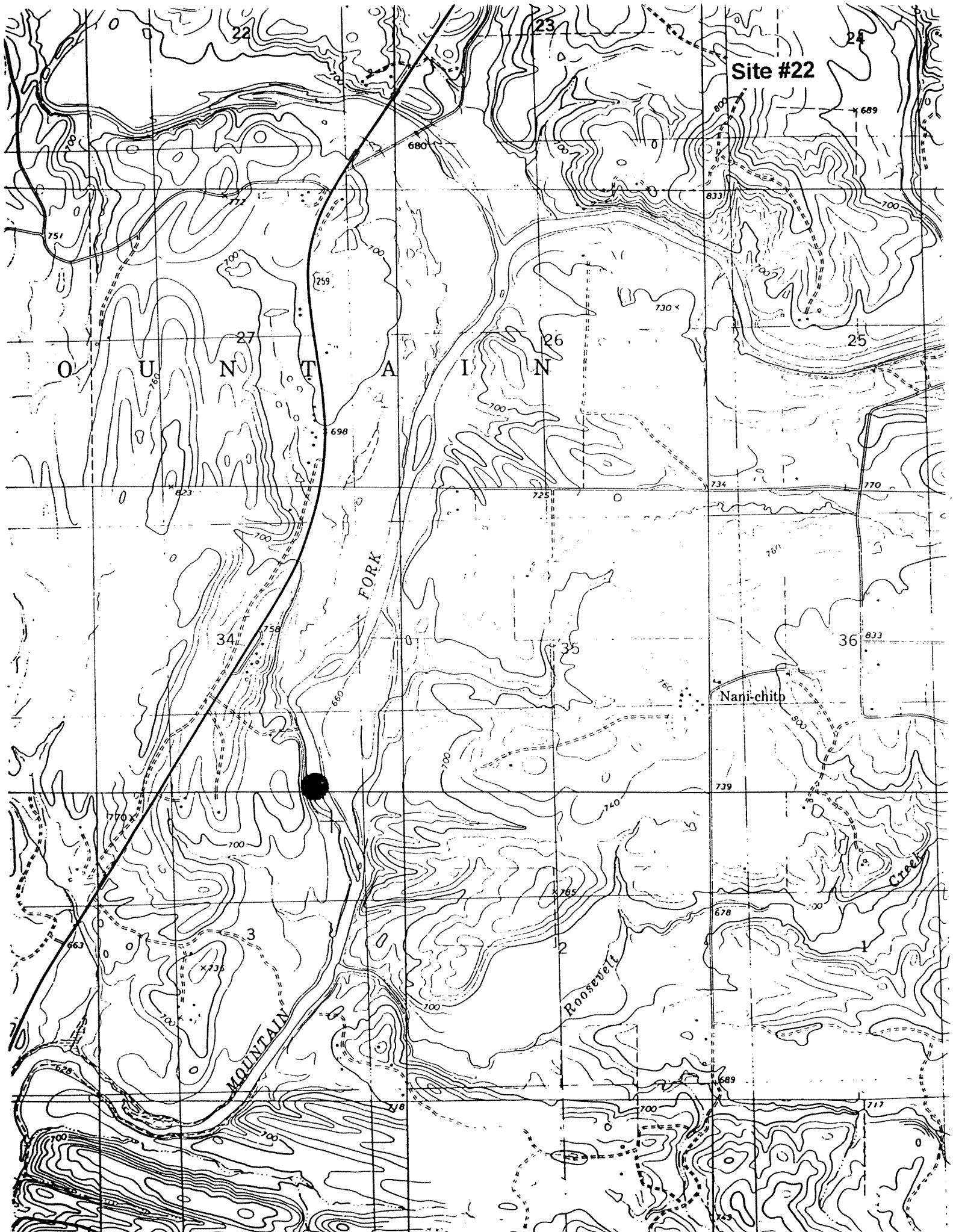
Species	Relative abundance (%)
<i>Ptychobranchnus occidentalis</i>	66.7
<i>Amblema plicata</i>	33.3



Site number: 22  
Fcode: F99VAU32  
Date: 8 August 1999  
County: McCurtain, OK  
Stream: Mountain Fork  
Quad name: Smithville

The river at this site split around a large water willow island. The mussel bed was located on the west branch of the split, just above the riffles. The substrate was cobble/gravel in nature.

Species	Relative abundance (%)
<i>Amblema plicata</i>	62.5
<i>Tritigonia verrucosa</i>	16.3
<i>Ptychobranchnus occidentalis</i>	6.3
<i>Lampsilis cardium</i>	5.0
<i>Fusconaia flava</i>	3.8
<i>Quadrula pustulosa</i>	2.5
<i>Lampsilis siloquoidea</i>	1.3
<i>Quadrula quadrula</i>	1.3
<i>Villosa iris</i>	1.3



Site number: 23  
Fcode: F99VAU37  
Date: 9 August 1999  
County: McCurtain, OK  
Stream: Mountain Fork  
Quad name: Smithville

This site was located at mouth of a creek. One *Amblema plicata* and one *Tritigonia verrucosa* found, however no time search was performed at this site.

