A Survey of Franklin's Ground Squirrel (*Spermophilus franklinii*) in East-Central Illinois

Center for Biodiversity Technical Report 1998 (11)

6 July 1998

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Franklin's ground squirrel, *Spermophilus franklinii* (Sabine, 1822), is one of the larger members of the genus *Spermophilus* occurring in North America (Hall 1981). It is primarily an inhabitant of the northern Great Plains from east-central Alberta and southern Saskatchewan to Kansas and Missouri, but its range extends eastward through northern and central Illinois to northwestern Indiana (Hall 1981). It is a considered a characteristic species of tallgrass and mid-grass prairie (Jones et al. 1983, 1985). Prairie covered 60% of Illinois (mainly in the northern two-thirds of the state) at the time of European settlement, but more than 99% of the native prairie has been lost to agriculture and urbanization (Robertson and Schwartz 1994). Although there are historical records of Franklin's ground squirrel from numerous locations in northern and central Illinois (Hoffmeister 1989), recent information about its distribution and abundance in the state is limited (Lewis and Rongstad 1992). Some biologists have speculated that this species is becoming increasingly uncommon in the eastern portion of its range (Lewis and Rongstad 1992) and Johnson and Choromanski-Norris (1992) found that its range in Indiana has receded westward. Accordingly, Franklin's ground squirrel is listed as an endangered species in Indiana (Indiana Department of Natural Resources 1993) and is considered a species of special concern in Wisconsin (Wisconsin Department of Natural Resources 1993). A live-trapping survey was conducted during spring 1998 to investigate the current distribution and abundance of Franklin's ground squirrel in three counties (Champaign, Piatt, and Vermilion) in east-central Illinois for which there are historical records of this species.

Natural History of Franklin's Ground Squirrel

Although Franklin's ground squirrel (also called the gray gopher or prairie squirrel) is a characteristic species of tallgrass and mid-grass prairie regions, it does not inhabit only the open prairie. It occupies the ecotone between woodlands and grasslands, forest openings, thickets, aspen parklands, and marsh and bog borders (Sowls 1948, Jackson 1961, Jones et al. 1983, Sargeant et al. 1993). The most important habitat requirement for this species is a tall, dense vegetative cover of grasses, forbs, shrubs, and even small trees (Jackson 1961, Choromanski-Norris and Sargeant 1982, Jones et al. 1983). Franklin's ground squirrel avoids the short grass of closely grazed pastures or mowed areas such as golf courses, cemeteries, and lawns -- unlike the smaller thirteen-lined ground squirrel (*Spermophilus tridecemlineatus*) whose range it overlaps (Wood 1910, Jackson 1961, Hoffmeister 1989). In intensively agricultural regions suitable habitat for Franklin's ground squirrels occurs in fencerows, old fields, roadsides (if not mowed frequently), prairie cemeteries, ditch banks, and railroad rights-of-way (Jackson 1961, Mumford and Whitaker 1982, Jones et al. 1985, Masulis and Wells 1988, Hoffmeister 1989). Railroad embankments are considered especially important as habitat for this species because there may be few other places with dense, relatively undisturbed vegetative cover available (Mumford and Whitaker 1982, Jones et al. 1983, Hoffmeister 1989).

Franklin's ground squirrels use burrows year-round and the availability of suitable sites for burrowing is a limiting factor (Hoffmeister 1989). Burrows must be sufficiently insulated to remain cool during summer and above freezing during winter and well-drained to avoid flooding; they often are located on steep slopes (Haberman and Fleharty 1971, Jones et al. 1983, Hoffmeister 1989). A burrow consists of an extensive set of tunnels and includes a nest lined with grass and food storage chambers (Haberman and Fleharty 1971, Jones et al. 1983). Burrows were consistently 43 cm deep in Nebraska (Haberman and Fleharty 1971), but they also have been reported to be 0.9 to 2.4 m deep (Jackson 1961, Jones et al. 1983). One to four burrow entrances, about 8 cm in diameter, are concealed in tall vegetation and are sometimes bordered by a mound of soil (Jackson 1961, Haberman and Fleharty 1971, Van Petten and Schramm 1972, Mumford and Whitaker 1982, Jones et al. 1983). Runways through the vegetation often lead from burrow entrances to foraging areas (Jackson 1961, Mumford and Whitaker 1982, Hoffmeister 1989).

Being true hibernators Franklin's ground squirrels are active less than half of the year. They typically emerge from hibernation during April, with the males appearing first (Sowls 1948, Jackson 1961, Murie 1973, Mumford and Whitaker 1982, Jones et al. 1983, Choromanski-Norris et al. 1986, Hoffmeister 1989). In North Dakota females emerged approximately two weeks later than males (Choromanski-Norris et al. 1986). Breeding occurs shortly after the females emerge and females give birth to a single litter from late May to mid-June (Sowls 1948, Iverson and Turner 1972, Choromanski-Norris et al. 1986). Litters typically consist of six to nine pups, but can include as many as 13 (Jones et al. 1983). Juveniles began to appear aboveground during late June in North Dakota (Choromanski-Norris et al. 1986) and Alberta (Murie 1973). Adults may enter hibernation as early as July, with males immerging before females (Murie 1973, Choromanski-Norris et al. 1986). Aboveground activity of adults ceased in August or September in North Dakota (Choromanski-Norris et al. 1986) and Manitoba (Iverson and Turner 1972). Young of the year remained active until late September or early October in Manitoba (Iverson and Turner 1972) and have been collected in Illinois as late as mid-November (Hoffmeister 1989).

Franklin's ground squirrels are strictly diurnal. They emerged from their burrows between 0600 and 0900 h, remained active throughout most of the day, and retired between 1900 and 2100 h in North Dakota (Choromanski-Norris et al. 1989). Franklin's ground squirrels at an Illinois prairie were sighted between 0730 and 1930 h (Van Petten and Schramm 1972), while radio-collared individuals emerged between 0900 and 1000 h and went underground at about 2000 h (Krohne et al. 1973). Sowls (1948) estimated that Franklin's ground squirrels spend less than 10% of their lives aboveground. Haberman and Fleharty (1971) found that, except for rain, weather conditions had little effect on activity, but Sowls (1948) concluded that rain, wind, or low temperatures would keep squirrels in their burrows. In an Illinois prairie radio-collared Franklin's ground squirrels displayed maximum activity on warm, sunny days with little or no wind; on rainy or overcast days they remained near their burrows (Krohne et al. 1973).

Ground squirrels are omnivores and Franklin's ground squirrel may be the most carnivorous member of the group (Jones et al. 1985). Its diet includes green vegetation, roots, seeds, fruit, insects and insect larvae, amphibians, bird eggs, nestling birds, young mice and rabbits, and carrion (Sowls 1948, Iverson and Turner 1972, Mumford and Whitaker 1982, Hoffmeister 1989). Franklin's ground squirrels feed heavily on vegetation during spring, but their consumption of animal food peaks in mid-summer while seeds and fruits become important during late summer (Jones et al. 1983). This species can be a significant predator on duck eggs in the prairie pothole region (Sowls 1948, Sargeant et al. 1987) and can also cause crop damage (Jackson 1961). Predators of Franklin's ground squirrels include the badger (*Taxidea taxus*), coyote (*Canis latrans*), red fox (*Vulpes vulpes*), mink (*Mustela vison*), long-tailed weasel (*Mustela frenata*), striped skunk (*Mephitis mephitis*), hawks, and snakes (Sowls 1948, Jackson 1961, Jones et al. 1983).

Populations of Franklin's ground squirrels fluctuate greatly from year to year. In Manitoba their populations appeared to reach peak densities at intervals of four to six years (Sowls 1948). Erlien and Tester (1984), however, found an apparent ten-year cycle for Franklin's ground squirrel numbers in northwestern Minnesota; they speculated that this cycle was related to predator shifts during low phases of the snowshoe hare (*Lepus americanus*) cycle. In Alberta there were 1.3 to 2.5 adults/ha and the maximum density of adults and juveniles was 5/ha (Murie 1973), but densities sometimes are said to reach 15 to 20/ha (Jackson 1961, Jones et al. 1983).

Despite the brevity of their active season Franklin's ground squirrels are somewhat nomadic, shifting their ranges several times (Jackson 1961, Krohne et al. 1973, Jones et al. 1983). The daily movements and home ranges of males were larger than those of females in North Dakota (Choromanski-Norris et al. 1989). The mean daily distances traveled were 213 m and 153 m for males and females, respectively; movements of females were reduced during gestation and the

movements of both sexes decreased during the two weeks prior to immergence (Choromanski-Norris et al. 1989). The mean annual home range of males was 24.6 ha whereas the mean for females was only 8.7 ha (Choromanski-Norris et al. 1989). This study also revealed that annual home ranges of individuals overlapped both within and between sexes. This is consistent with the observation that although not as social as other ground squirrels, Franklin's ground squirrels live in small colonies (Jones et al. 1983).

Overwinter survival varied from 20% to 60% in Manitoba (Iverson and Turner 1972) and from 33% to 42% in Alberta (Murie 1973). In Minnesota mean length of life for both sexes combined was 0.74 year, but females displayed higher survival rates (Erlien and Tester 1984). Unlike some other species of ground squirrels which have a greater proportion of females, the sex ratio of adult and juvenile Franklin's ground squirrels has been found to be approximately 1:1 (Iverson and Turner 1972, Murie 1973, Erlien and Tester 1984).

Illinois Distribution of Franklin's Ground Squirrel

Cory (1912) thought that Franklin's ground squirrels were more local in distribution and less common than thirteen-lined ground squirrels in Illinois. He stated that the range of Franklin's ground squirrel included at least the northern two-thirds of Illinois and cited Vernon Bailey (1893: Bulletin U.S. Department of Agriculture, Division of Ornithology and Mammalogy 4:1-69) as giving St. Clair County as the species' southern limit in the state. Necker and Hatfield (1941) listed records for 17 Illinois counties, the southernmost being St. Clair County. Sixty-nine percent of the locations in their list are in northeastern or east-central Illinois.

Not knowing the basis for Bailey's St. Clair County record, Hoffmeister (1989) did not include it in his description of the species' range in Illinois. Hoffmeister (1989) examined 86 specimens from 21 Illinois counties and included Necker and Hatfield's (1941) records for four additional counties (Figure 1). Four of the other counties (Adams, Ford, Marshall, and Winnebago) listed by Necker and Hatfield (1941) were not included by Hoffmeister (1989), presumably because they were not based on vouchered specimens. The southernmost Franklin's ground squirrel specimens reported by Hoffmeister (1989) were from Macoupin and Coles counties. There is only a single specimen from northwestern Illinois (Carroll County) and specimens are known from only one county (Hancock) in the far western portion of the state (Hoffmeister 1989). The latter specimens were prepared by taxidermist C.K. Worthen of Warsaw who worked during the late 1800's and early 1900's. Nearly every specimen that Worthen prepared is labeled "Warsaw" so it is possible that some were not actually collected at that location (Hoffmeister 1989).

In 1986 Lewis and Rongstad (1992) surveyed wildlife managers, natural heritage biologists, and naturalists at state parks, state recreation areas, and forest preserve districts in Illinois, asking them to report any recent (within ten years) sightings of Franklin's ground squirrel. The species was reported from 22 locations in 16 counties, with the southernmost observation in Fayette County. No sightings were reported in northwestern Illinois and there were reports for only two counties in western Illinois (Henderson and Greene). Lewis and Rongstad (1992) concluded that Franklin's ground squirrel has a relatively stable range in Illinois. Sightings in Fayette and Cumberland counties were south of Hoffmeister's (1989) records, but the species now seemed to be absent from northwestern Illinois. Many of the biologists who responded to Lewis and Rongstad's (1992) survey thought that Franklin's ground squirrel had declined in recent years.

There are more specimens of Franklin's ground squirrel from Champaign County than any other county in Illinois, but only three from Piatt and Vermilion counties (Table 1; Hoffmeister 1989). Several squirrels were live-trapped at the University of Illinois' ecological research areas (Phillips Tract and Trelease Prairie) approximately 6 km northeast of Urbana during the early and mid-1970's, although none have been caught there since (Dr. Lowell L. Getz, pers. comm.). In

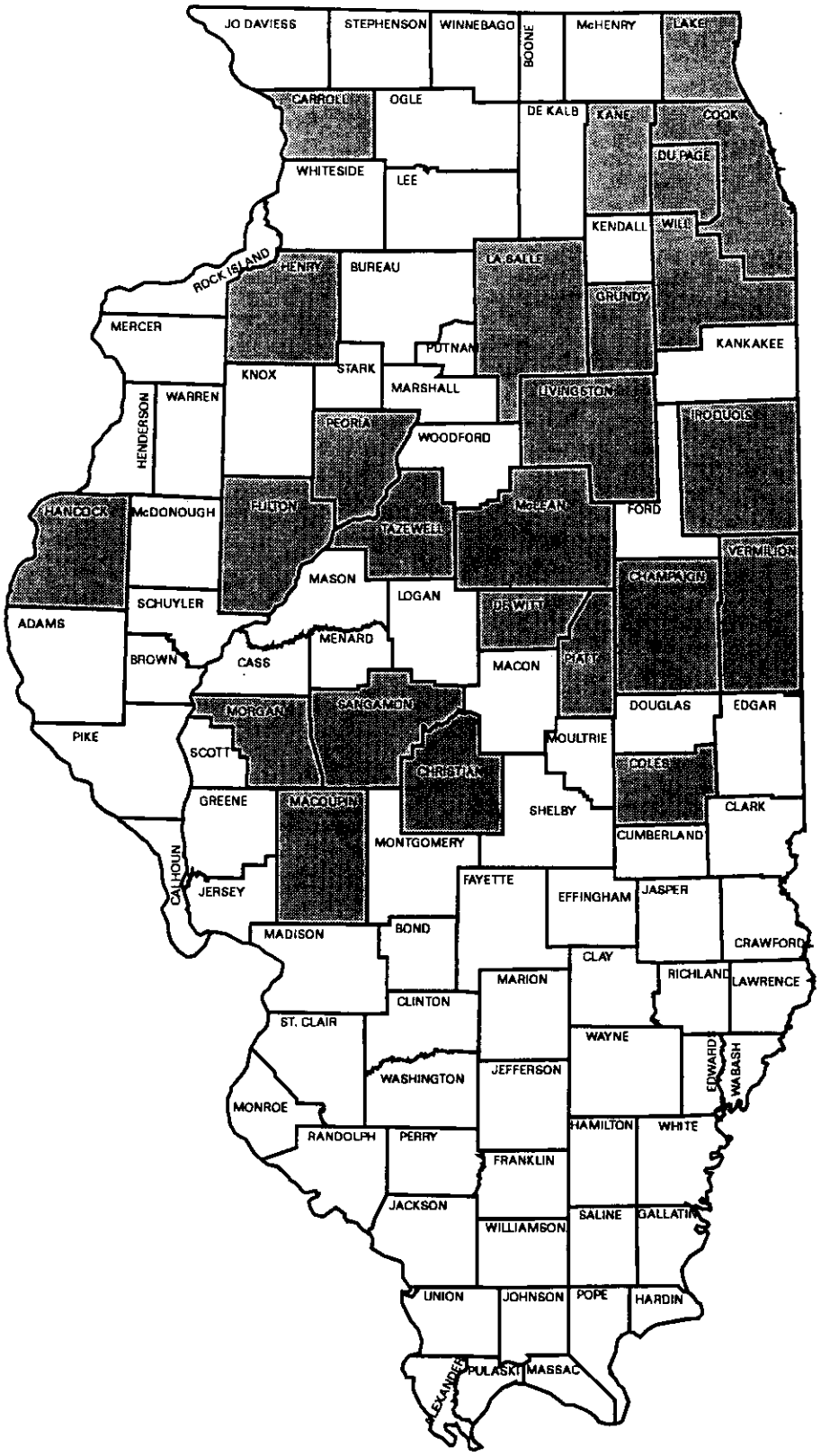

Figure 1. Distribution records for Franklin's ground squirrel in Illinois (Hoffmeister 1989)

addition, one squirrel was caught along the railroad embankment between Seymour and White Heath (probably in Champaign County) during the late 1960's or early 1970's (David Monk, Educational Resources in Environmental Science, pers. comm.) and two or three squirrels were live-trapped south of Champaign along the Illinois Central Railroad during the early 1980's (Dr. Barbara A. Frase, pers. comm.). Lewis and Rongstad (1992) reported two recent sightings in central Champaign County. Mark Pittman (Vermilion County Conservation District, pers. comm.) saw a road-killed Franklin's ground squirrel on Henning Road approximately 0.8 km south of the entrance to Kennekuk County Park in the early 1970's, while Lewis and Rongstad (1992) reported one recent sighting in Vermilion County.

Table 1. Vouchered specimens of Franklin's ground squirrel from Champaign, Piatt, and Vermilion counties, Illinois

Location	Date	No.	Source
Champaign County			
Urbana	1907	2	INHS
Urbana	1929	1	INHS
Urbana Township	1949	1	UIMNH
E of Urbana	1956	1	INHS
0.4 mi W Mayview	1951	2	UIMNH
Mayview Cemetery	1947	3	UIMNH
1.2 mi E Mayview	1951	1	UIMNH
1.5 mi E Mayview	1975	1	UIMNH
2 mi E Mayview	1951	3	UIMNH
1.5 mi W St. Joseph	1975	1	UIMNH
1.2 mi W St. Joseph	1951	4	UIMNH
Champaign	1966	1	ISM
St. Mary's Cemetery, Champaign	1950	1	UIMNH
1 mi S Champaign	1952	1	UIMNH
3 mi S Champaign	1980	3	UIMNH
2 mi S Savoy	1954	1	UIMNH
Willard Airport, Savoy	1965	1	UIMNH
vicinity Parkland College, Champaign	1983	1	UIMNH
10 mi N, 2 mi W Champaign	1948	1	UIMNH
I mi W Champaign, Rt. 150	1950	1	UIMNH
3.5 mi W Champaign	1952	1	ISM
Seymour	1935	1	UIMNH
Piatt County			
I mi N Monticello, on highway	1947	1	UIMNH
1 mi E DeLand	1961	1	ISM
Vermilion County			
10 mi W Danville	1949	1	UIMNH

INHS = Illinois Natural History Survey Mammal Collection; UIMNH = University of Illinois Museum of Natural History Mammal Collection; ISM = Illinois State Museum Mammal Collection

Study Sites and Methods

Trapping was conducted at 15 sites: three in Vermilion County, nine in Champaign County, and three in Piatt County (Table 2, Figure 2). The majority of the sites were located in Champaign County because it had the largest number of Franklin's ground squirrel records. When specimen information included a specific location, the collection sites in the three counties had been visited to determine if suitable habitat for Franklin's ground squirrel still was present. Eleven of the trapping sites were located in the vicinity of historical records where a dense cover of grasses and forbs was found; the other four sites were selected because of the presence of apparently suitable habitat for this species. Two sites (1 and 2) were established in large grassland tracts at Kennekuk County Park in Vermilion County; all of the other sites were located along active or abandoned railroad lines. Dominant plant species at each site were recorded as well as estimates of the relative amount of vegetative cover and the height of the vegetation. Maps and descriptions of the individual trapping sites are provided in the Appendix.

Table 2. Locations of trapping sites during Franklin's ground squirrel survey in Champaign, Piatt, and Vermilion counties, Illinois, 1998 (distances were measured from the center of the trap line to the center of the named town)

Site	Common location	Legal location
1	Kennekuk County Park, Vermilion Co.	T.20N, R.12W, NE/4 Sec. 16
2	Kennekuk County Park, Vermilion Co.	T.20N, R.12W, SE/4 Sec. 15
3	0.7 km W Bronson, Vermilion Co.	T.19N, R.13W, NE/4 Sec. 15 and SE/4 Sec. 10
4	1.5 km W St. Joseph, Champaign Co.	T.19N, R.10E, NE/4 and NW/4 Sec. 15
5	1.8 km E Mayview, Champaign Co.	T.19N, R.10E, NE/4 Sec. 17 and NW/4 Sec. 16
6	1.4 km W Mayview, Champaign Co.	T.19N, R.9E, NE/4 Sec. 13 and SE/4 Sec. 12
7	5.2 km S Savoy, Champaign Co.	T.18N, R.8E. NE/4 Sec. 23
8	2.0 km S Savoy, Champaign Co.	T.18N, R.8E, NW/4 Sec. 12
9	5.0 km S Champaign, Champaign Co.	T.19N, R.8E, SE/4 Sec. 25
10	1.6 km W Seymour, Champaign Co.	T.19N, R.7E, NW/4 Sec. 17 and NE/4 Sec. 18
11	3.9 km E Bondville, Champaign Co.	T.19N, R.8E, NW/4 and NE/4 Sec. 17
12	5.1 km NW Champaign, Champaign Co.	T.19N, R.8E, NW/4 Sec. 3
13	2.4 km NE White Heath, Piatt Co.	T.19N, R.6E, SW/4 and SE/4 Sec. 14
14	3.7 km W Monticello, Piatt Co.	T.18N, R.5E, SE/4, Sec. 10
15	1.4 km E DeLand, Piatt Co.	T.19N, R.5E, SW/4 Sec. 10

Twenty collapsible, single-door Tomahawk live traps (Tomahawk Live Trap Co., Tomahawk, WI) measuring 48 x 16.5 x 16.5 cm and three Tomahawk simple rodent traps measuring 61 x 13 x 13 cm were used at each site (except at one site that was only long enough for 22 traps). Traps were placed on the ground at intervals of approximately 20 m. A single line of traps was established at each site, except for the Vermilion County sites where traps were placed in two parallel rows. The traps were baited with a mixture of cracked corn, carrot, and sliced meat (Carl Buddig) placed in disposable Petri dishes. At each site they were set during the morning (most often between 0645 and 0900 h) and checked during the evening (usually between 1815 and 2030 h) for three consecutive days. All of the trapping was conducted between 19 May and 19 June 1998.

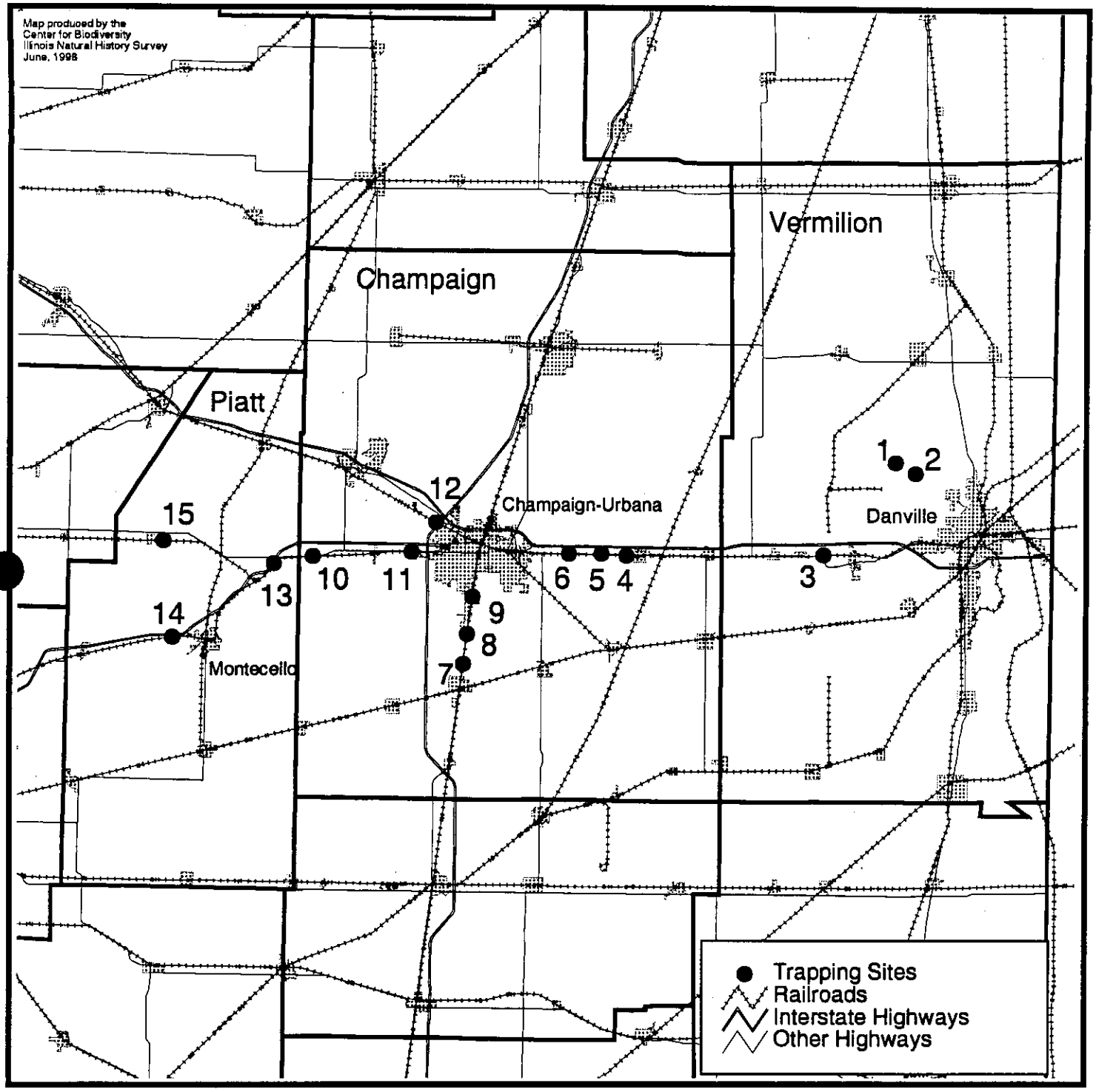

Figure 2. Locations of trapping sites for Franklin's ground squirrel survey, Champaign, Piatt, and Vermilion counties, Illinois, 1998

Results and Discussion

Only one Franklin's ground squirrel was captured during 1032 trap-days at the 15 sites in this survey. An adult male was trapped on 27 May 1998 at site 5, east of Mayview in Champaign County (Figure 2). The trap was located at the base of an abandoned railroad embankment opposite county road 2000 E (Appendix: Figure A4).

There were 25 additional mammal captures during this survey. Eastern cottontails (*Sylvilagus floridanus*) were trapped at seven sites; there were 15 captures of this species which represented 12, or possibly 13, different individuals. Thirteen-lined ground squirrels were caught at three sites; eight captures represented five, or possibly six, individuals. Two meadow voles (*Microtus pennsylvanicus*) were caught at one site. Two birds (a grackle and brown thrasher) also were trapped. No mammals were caught at five of the 15 sites.

The results of this survey indicate that Franklin's ground squirrel still is present in east-central Illinois, but suggest that the species may be very uncommon. However, three factors that could have contributed to the lack of trapping success need to be considered: weather conditions, inappropriate habitat at trapping sites, and natural fluctuations in the abundance of the species. Weather conditions during the survey generally were favorable for Franklin's ground squirrel activity (Sowls 1948, Krohne et al. 1973). Eleven days were sunny to partly cloudy with temperatures above 90°F on one day, in the 80's on nine days, and in the upper 70's on one day. One day was mostly cloudy and relatively cool (high temperature in the 60's) and twice there was a period of rain during mid-day. Only once was there rain throughout much of the day. Thus, weather should not have prevented Franklin's ground squirrels from being caught if they were present at a trapping site.

The preferred habitat for Franklin's ground squirrel consists of undisturbed areas covered with tall, dense herbaceous or shrub vegetation (Choromanski-Norris and Sargeant 1982, Jones et al. 1983, Masulis and Wells 1988). Although most of the trapping sites in this survey contained a high percentage of non-native grass and forb species (Appendix), the sites were chosen because the structure of the vegetation appeared suitable for Franklin's ground squirrels. Herbaceous cover at all sites was 90% to 100%, although there was little or no vegetation on the tops of some of the railroad embankments. The height of the herbaceous vegetation was not necessarily uniform throughout a site. At some sites the vegetation was predominantly 50 to 70 cm tall, at others it was approximately 1 m tall. At least a few shrubs or small trees also were present at each site. Furthermore, 11 of the 15 trapping sites were located near Franklin's ground squirrel records and were likely to be the same type of habitat in which the specimens had been collected.

Populations of Franklin's ground squirrels have been found to fluctuate in abundance from year to year (Sowls 1948, Erlien and Tester 1984) so it is possible that 1998 was a low year for this species in east-central Illinois. It might be advisable to survey some of the trapping sites again in a year or two to determine if squirrels were present in greater numbers (perhaps concentrating on Champaign County which has the most recent records).

Franklin's ground squirrel may never have been common in Illinois (Lewis and Rongstad 1992) and throughout its range this species is thought to be much less abundant than it was prior to the conversion of land for agriculture (Jones et al. 1985). In the early 1800's 93.7% of Champaign County, 91.4% of Piatt County, and 79.1% of Vermilion County was prairie (Iverson et al. 1989). Nearly all the prairie in these counties has been lost to agriculture or urban development; in 1976 no high-quality prairie remained in Champaign and Piatt counties and only 4.1 acres were found in Vermilion County (White 1978). Despite the disappearance of native prairie, habitat containing grasses, forbs, and shrubs remained in fencerows, roadsides, railroad rights-of-way, old fields, pastures, and hayfields and along the banks of streams and drainage ditches.

Unfortunately roadsides often are mowed so intensively that the vegetation is too short to be used by Franklin's ground squirrels and many fencerows have been removed over the years. Some sections of the abandoned railroad lines in east-central Illinois provide relatively undisturbed, dense vegetation, but elsewhere the rights-of-way are or in the future may be mowed, hayed, or planted in crops.

Whenever possible, locations in Champaign, Piatt, and Vermilion counties where Franklin's ground squirrels had been collected (Table 1) were visited to see if suitable habitat remained (the information for some specimens was too vague for a collection location to be identified). The area north of Monticello has been altered by construction of I-72 (although grass and forbs occur in the rights-of-way and interchanges) and very little suitable habitat was found northwest of Champaign or west of Champaign along Rt. 150. Mayview (= Mt. Olive) and St. Mary's cemeteries and Willard Airport are mowed, but suitable habitat occurs nearby along railroad rights-of-way. All other records probably represent specimens collected along railroads. Dense herbaceous and shrubby vegetation is present along much of the abandoned railroad between Urbana and St. Joseph (and farther east towards Danville), the Illinois Central Railroad south of Champaign, the abandoned railroad between Champaign and Seymour (and west to Cisco), the abandoned spur line to DeLand, and the Norfolk & Southern Railroad that is adjacent to Parkland College.

Clearly less habitat for Franklin's ground squirrels is present in east-central Illinois now, but seemingly suitable habitat trapped during this survey was unoccupied by these squirrels and additional potential habitat is being created in the form of prairie restorations and grasslands planted for wildlife (e.g., by Pheasants Forever). Thus, habitat loss is unlikely to be the only reason for an apparent decline in this species. Herbaceous areas such as old fields or prairie restorations in east-central Illinois exist as isolated habitat fragments. Populations inhabiting small, isolated habitat patches are especially vulnerable to local extirpation and such patches are less likely to be colonized or re-colonized. The railroad rights-of-way frequently occupied by Franklin's ground squirrels provide long stretches of habitat and can serve as dispersal corridors. Nonetheless, these linear habitats are interrupted (e.g., when they pass through towns) and may not be connected to other areas of suitable habitat. Therefore they could be considered somewhat isolated in an agricultural landscape. A disadvantage of habitat corridors is that they also provide travel corridors for predators and may be easy places for predators to hunt for prey (Simberloff and Cox 1987). Furthermore, railroads in east-central Illinois typically are adjacent to crop fields. Franklin's ground squirrels enter fields to eat corn and soybean plants and, even though they also probably consume economically harmful insects, some farmers may perceive them as pests (Jackson 1961). A farmer (pers. comm.) reported that he had killed several Franklin's ground squirrels (gray gophers) in recent years at one of the trapping sites in Champaign County. No squirrels were captured at that site.

In summary, the results of this survey support the perception of many biologists that Franklin's ground squirrel has become rare in Illinois. Further trapping in east-central Illinois would be informative and other types of herbaceous habitat, including interstate highway rights-of-way and drainage ditch banks, probably should be sampled to determine if they are being used by Franklin's ground squirrels. Because railroad embankments can provide ideal habitat for this species in the Midwest (Mumford and Whitaker 1982, Hoffmeister 1989) the preservation or enhancement of vegetation along abandoned railroad corridors should be beneficial. Another conservation approach might be the establishment of populations in relatively large and protected grasslands; Franklin's ground squirrels have been translocated to a restored prairie in Knox County (Van Petten and Schramm 1972) and a native prairie in Cook County (Panzer 1986). Several potential translocation sites occur in Champaign, Piatt, and Vermilion counties (e.g. Allerton Park near Monticello, Meadowbrook Park in Urbana, and Vermilion County Conservation District properties).

Acknowledgments

Kristine Priede, Jean Porterfield, Tom Kompare, Bill Handel, and Steve Amundsen made major contributions to this project by assisting with the trapping. Bill Handel provided the information on the vegetation at each site and Tom Kompare produced the map of the trapping sites. George Batzli of the University of Illinois supplied many of the traps used during the project and the Vermilion County Conservation District granted permission to trap at Kennekuk County Park. Rickard Toomey provided the collection data for specimens in the Illinois State Museum Mammal Collection.

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Appendix

Trapping Sites for Franklin's Ground Squirrel Survey in East-Central Illinois

Site 1. Vermilion County: T.20N, R.12W, NE/4 Sec. 16, Danville NW, IL. 7.5' topographic quadrangle (Figure A1)
grassland tract near Bunker Hill Historic Area, Kennekuk County Park

Much of this field, which once had been cropland, was dominated by fescue, but a few prairie species may have survived. The vegetation was about 60 cm tall and a few shrubs were scattered throughout the field. One portion of the area was mowed and had been planted with small trees as a memorial grove. The field was bordered by park roads and forest.

Dominant plant species: *Agrostis alba* (red top), *Aster novae-angliae* (New England aster), *Cirsium discolor* (field thistle), *Festuca pratensis* (tall fescue), *Juncus* sp. (rush), *Poa pratense* (Kentucky bluegrass), *Rudbeckia hirta* (black-eyed Susan), *Solidago canadensis* (tall goldenrod), *Sorghastrum nutans* (Indian grass)

Dates trapped: 19-21 May 1998
Captures: none

Site 2. Vermilion County: T.20N, R.12W, SE/4 Sec. 15, Danville NW, IL 7.5' topographic quadrangle (Figure A1)
grassland tract near the entrance of Kennekuk County Park

This field contained several native prairie species. Shrubs and small trees covered about 40% of the area; some trees such as sweet gums and white oaks had been planted. The herbaceous vegetation was about 70 cm tall. The field was bordered by a park road and forest.

Dominant plant species: *Agromonia pubescens* (soft agrimony), *Agrostis alba* (red top), *Carex glaucodea* (bluegreen sedge), *Cirsium discolor* (field thistle), *Elaeagnus umbellata* (autumn olive), *Festuca pratensis* (tall fescue), *Liquidambar styraciflua* (sweet gum), *Panicum* sp. (panic grass), *Phleum pratense* (timothy), *Poa pratense* (Kentucky bluegrass), *Quercus alba* (white oak), *Pycnanthemum tenuifolium* (slender mountain mint), *Rosa setigera* (rose), *Rubus flagellaris* (dewberry), *Solidago canadensis* (tall goldenrod), *Solidago nemoralis* (dyersweed), *Solidago speciosa* (showy goldenrod), *Vernonia missurica* (Missouri ironweed)

Dates trapped: 19-21 May 1998
Captures: none

Site 3. Vermilion County: T.19N, R.13W, NE/4 Sec. 15 & SE/4 Sec. 10, Oakwood, IL 7.5' topographic quadrangle (Figure A2)
railroad embankment 0.7 km W of Bronson (west of county road 680 E)

Trap lines were set on both sides of an abandoned railroad embankment with ballast on the top. Vegetation consisted of grasses and forbs, with some small trees on one side of the embankment. The vegetation was about 70 cm tall, although patches up to 1.5 m tall were present. Most of the plants were non-native species or native species that are tolerant of extreme disturbance. The right-of-way on the north side was narrow (5-6 m wide) and bordered a cornfield. On the south side an area 25 m wide between the embankment and a county road (1700 N) had been planted with grass for pheasant habitat.

Dominant plant species: *Ambrosia trifida* (giant ragweed), *Apocynum sibiricum* (prairie dogbane), *Bromus inermis* (smooth brome grass), *Bromus tectorum* (cheat grass brome), *Conium maculatum* (poison hemlock), *Eupatorium altissimum* (tall boneset), *Helianthus grosserratus* (sawtooth sunflower), *Monarda fistulosa* (wild bergamot), *Oenothera biennis* (evening primrose), *Pastinaca*

sativa (wild parsnip), *Phalaris arundinacea* (reed canary grass), *Spartina pectinata* (prairie cordgrass)

Dates trapped: 19-21 May 1998
Captures: *Sylvilagus floridanus* (1)

Site 4. Champaign County: T.19N, R.10E, NE/4 & NW/4 Sec. 15, St. Joseph, IL 7.5' topographic quadrangle (Figure A3)
railroad right-of-way 1.5 km W St. Joseph

This site was a 20-m wide, highly degraded prairie remnant between an abandoned railroad embankment (with the tracks removed) and a paved local road. It contained a high percentage of non-native species and a few shrubs and trees were present. The vegetation in most of the area was 50-60 cm tall. On the other side of the embankment there was a 10-m wide strip of herbaceous vegetation bordering a cornfield; a soybean field was located between the road and US Rt. 150.

Dominant plant species: *Andropogon gerardii* (big bluestem), *Bromus inermis* (smooth brome grass), *Festuca pratensis* (tall fescue), *Melilotus alba* (white sweet clover), *Pastinaca sativa* (wild parsnip), *Phleum pratense* (timothy), *Silphium integrifolium* (rosinweed), *Silphium laciniatum* (compass plant), *Silphium terebinthinaceum* (prairie dock), *Sorghastrum nutans* (Indian grass). *Trifolium pratense* (red clover)

Dates trapped: 27-29 May 1998
Captures: none

Site 5. Champaign County: T.19N, R.10E, NE/4 Sec. 17 & NW/4 Sec. 16, St. Joseph, IL 7.5' topographic quadrangle (Figure A4)
railroad embankment 1.8 km E Mayview (east of Fulls grain elevator)

This site was a degraded prairie remnant along an abandoned railroad embankment with ballast on the top. The herbaceous vegetation was about 90 cm tall and numerous shrubs were present. The plant community included many non-native species, but the eastern portion of the site was of better quality. The right-of-way between the embankment and US Rt. 150 (to the north) was 10 m wide; the right-of-way on the south side of the embankment was 20 m wide and bordered a crop field.

Dominant plant species: *Agrostis alba* (red top), *Andropogon gerardii* (big bluestem), *Apocynum cannabinum* (Indian-hemp), *Asclepias sullivantii* (prairie milkweed), *Asclepias syriaca* (common milkweed), *Bromus inermis* (smooth brome grass), *Cirsium discolor* (field thistle), *Conium maculatum* (poison hemlock), *Elymus canadensis* (nodding wild rye), *Erigeron strigosus* (daisy fleabane), *Helianthus grosserratus* (sawtooth sunflower), *Helianthus rigidus* (prairie sunflower), *Pastinaca sativa (*wild parsnip), *Rubus allegheniensis* (wild blackberry), *Spartina pectinata* (prairie cordgrass), *Tradescantia ohiensis* (Ohio spiderwort)

Dates trapped: 27-29 May 1998
Captures: ***Spermophilus franklinii*** (1), *Sylvilagus floridanus* (1)

Site 6. Champaign County: T.19N, R.9E, NE/4 Sec. 13 & SE/4 Sec. 12, Urbana, IL 7.5' topographic quadrangle (Figure A5)
railroad embankment 1.4 km W Mayview (west of county road 1800 E)

This site was a highly degraded forbland along a steep abandoned railroad embankment with ballast on the top. Shrubs were relatively common at the site and a few trees also were present. The herbaceous vegetation was about 1 m high. The right-of-way between the embankment and US Rt. 150 (to the north) was 15-20 m wide and the 20-m wide right-of-way south of the embankment bordered a crop field.

Dominant plant species: *Ambrosia trifida* (giant ragweed), *Conium maculatum* (poison hemlock), *Equisetum arvense* (common horsetail), *Nepeta cataria* (catnip), *Oenothera biennis* (evening primrose), *Pastinaca sativa* (wild parsnip)

Dates trapped: 27-29 May 1998
Captures: *Spermophilus tridecemlineatus* (1)

Site 7. Champaign County: T.18N, R.8E, NE/4 Sec. 23, Bondville, IL 7.5' topographic quadrangle (Figure A6)
railroad right-of-way 5.2 km S Savoy (south of Philo Road)

A relatively good-quality dry-mesic prairie remnant dominated by native species occurred in the right-of-way between the steep embankment of the Illinois Central Railroad and a cornfield. The site was 20 m wide. Most of the herbaceous vegetation was 50-70 cm high and a few shrubs and trees were present.

Dominant plant species: *Andropogon gerardii* (big bluestem), *Aster laevis* (smooth aster), *Bromus inermis* (smooth brome grass), *Carex* sp. (sedge), *Melilotus alba* (white sweet clover), *Panicum virgatum* (switch grass), *Silphium laciniatum* (compass plant), *Silphium terebinthinaceum* (prairie dock), *Solidago canadensis* (tall goldenrod), *Solidago rigida* (stiff goldenrod), *Tradescantia ohiensis* (Ohio spiderwort), *Zizia aurea* (golden Alexanders)

Dates trapped: 2-4 June 1998
Captures: *Spermophilus tridecemlineatus* (4)

Site 8. Champaign County: T.18N, R.8E, NW/4 Sec. 12, Bondville, IL 7.5' topographic quadrangle (Figure A7)
railroad right-of-way 2.0 km S Savoy (south of Airport Road)

This was a highly disturbed site in the 25-m wide right-of-way between the steep embankment of the Illinois Central Railroad and a soybean field. It was dominated by non-native grasses and forbs, but a few prairie species were present. The herbaceous vegetation was about 60 cm tall and a few shrubs and trees also grew in the right-of-way. The trap line extended on both sides of an unpaved field access.

Dominant plant species: *Agrostis alba* (red top), *Bromus inermis* (smooth brome grass), *Bromus tectorum* (cheat grass brome), *Fragaria virginiana* (wild strawberry), *Morus alba* (white mulberry), *Pastinaca sativa* (wild parsnip), *Rubus flagellaris* (dewberry), *Solidago canadensis* (tall goldenrod)

Dates trapped: 2-4 June 1998
Captures: *Sylvilagus floridanus* (2)

Site 9. Champaign County: T.19N, R.8E, SE/4 Sec. 25, Urbana, IL 7.5' topographic quadrangle (Figure A8)
railroad and powerline right-of-way 5.0 km S Champaign (north of Curtis Road)

A row of 22 traps was placed in a disturbed prairie remnant in the right-of-way between the Illinois Central Railroad embankment and a cornfield. The right-of-way was 20 m wide up to the northern end of the site where corn was planted all the way to the base of the embankment. The vegetation was 50 to 70 cm high and a few trees were present.

Dominant plant species: *Andropogon gerardii* (big bluestem), *Festuca pratensis* (tall fescue), *Fragaria virginiana* (wild strawberry), *Morus alba* (white mulberry), *Pastinaca sativa* (wild parsnip), *Phleum pratense* (timothy), *Rubus allegheniensis* (wild blackberry), *Silphium integrifolium* (rosinweed), *Silphium terebinthinaceum* (prairie dock), *Solidago canadensis* (tall goldenrod), *Solidago rigida* (stiff goldenrod), *Sorghastrum nutans* (Indian grass)

Dates trapped: 2-4 June 1998
Captures: *Sylvilagus floridanus* (2), *Microtus pennsylvanicus* (2)

Site 10. Champaign County: T.19N, R.7E, NW/4 Sec. 17 & NE/4 Sec. 18, Seymour, IL 7.5' topographic quadrangle (Figure A9)
railroad embankment 1.6 km W Seymour

Dry-mesic prairie of good quality occurred along an abandoned railroad embankment (this was the best trapping site in terms of prairie vegetation). The site was 40 m wide and was located between IL Rt. 10 and corn and soybean fields. The embankment was covered with dense herbaceous vegetation about 1 m tall and scattered trees were present. The trap line extended on both sides of a gravel road (100 E). West of this road the right-of-way consisted of a low-lying area between the embankment and an overgrown, unpaved roadbed along the edge of the field. East of the road the right-of-way consisted of a gentle slope rather than a depression.

Dominant plant species: *Andropogon gerardii* (big bluestem), *Aster praealtus* (willow-leaved aster), *Ceanothus americanus* (New Jersey tea), *Centaurea maculosa* (spotted knapweed), *Coreopsis tripteris* (tickseed), *Erygium yuccifolium* (rattlesnake master), *Helianthus grosserratus* (sawtooth sunflower), *Silphium integrifolium* (rosinweed), *Silphium terebinthinaceum* (prairie dock), *Solidago rigida* (stiff goldenrod), *Sorghastrum nutans* (Indian grass), *Spartina pectinata* (prairie cordgrass), *Stipa spartea* (needle grass), *Zizia aurea* (golden Alexanders)

Dates trapped: 11-13 June 1998
Captures: *Sylvilagus floridanus* (1)

Site 11. Champaign County: T.19N, R.8E, NW/4 & NE/4 Sec. 17, Bondville, IL 7.5' topographic quadrangle (Figure A10)
railroad right-of-way 3.9 km E Bondville

This site consisted of good-quality mesic to wet-mesic prairie in the right-of-way between an abandoned railroad embankment (with the tracks still in place) and IL Rt. 10. The right-of-way was 25 m wide and the vegetation was about 1 m high. There was a sparsely vegetated, ponded area near the middle of the trap line. Following a heavy rain on the first day of the trapping session standing water was present in portions of the right-of-way. Some traps were moved to the south side of the embankment where a 10-m wide strip of herbaceous vegetation, shrubs, and trees bordered a cornfield.

Dominant plant species: *Andropogon gerardii* (big bluestem), *Eupatorium serotinum* (late boneset), *Helianthus grosserratus* (sawtooth sunflower), *Pastinaca sativa* (wild parsnip), *Scirpus pendulus* (red bulrush), *Silphium integrifolium* (rosinweed), *Silphium terebinthinaceum* (prairie dock), *Solidago rigida* (stiff goldenrod), *Sorghastrum nutans* (Indian grass), *Spartina pectinata* (prairie cordgrass)

Dates trapped: 11-13 June 1998
Captures: none (1 bird)

Site 12. Champaign County: T.19N, R.8E, NW/4 Sec. 3, Rising, IL 7.5' topographic quadrangle (Figure A11)
railroad embankment 5.1 km NW Champaign (east of Duncan Road)

A very highly disturbed prairie remnant occurred at this site along the Norfolk & Southern Railroad embankment. Scattered shrubs and trees were present. Some of the herbaceous vegetation was about 1 m tall, but there were extensive stands of poison hemlock that was about 2 m high. The corridor was 35 m wide and was bordered by a cornfield on the south and a soybean field on the north. The railroad crossed I-57 and the last five traps in the line were placed east of the interstate overpass where the embankment is adjacent to Parkland College.

Dominant plant species: *Bromus tectorum* (cheat grass brome), *Conium maculatum* (poison hemlock), *Festuca pratensis* (tall fescue), *Melilotus alba* (white sweet clover), *Melilotus officinalis* (yellow sweet clover), *Pastinaca sativa* (wild parsnip), *Poa pratense* (Kentucky bluegrass), *Psoralea onobrychis* (French grass), *Solidago canadensis* (tall goldenrod)

Dates trapped: 11-13 June 1998
Captures: *Sylvilagus floridanus* (4)

Site 13. Piatt County: T.19N, R.6E, SW/4 & SE/4 Sec. 14, Seymour, IL 7.5' topographic quadrangle (Figure A12)
railroad and powerline right-of-way 2.4 km NE White Heath

A highly disturbed non-native forbland was located in the right-of-way between an abandoned railroad embankment and an old section of paved road that was barricaded at one end; it was also under a transmission line. The site was 20 m wide. The vegetation in the right-of-way was up to 1 m high. The embankment was covered with grasses, forbs, and shrubs; the back side of the embankment was wooded. A cornfield separated the old road from I-72.

Dominant plant species: *Festuca pratensis* (tall fescue), *Pastinaca sativa* (wild parsnip), *Poa pratense* (Kentucky bluegrass), *Rhus glabra* (smooth sumac), *Solidago canadensis* (tall goldenrod), *Toxicodendron radicans* (poison ivy)

Dates trapped: 17-19 June 1998
Captures: none

Site 14. Piatt County: T.18N, R.5E, SE/4 Sec. 10, Monticello, IL 7.5' topographic quadrangle (Figure A13)
railroad embankment 3.7 km W Monticello

This site consisted of a highly disturbed non-native forbland along an abandoned railroad embankment covered with grasses, forbs, and a few small trees. The corridor was 30 m wide and was located between IL Rt. 10 and a cornfield. The vegetation was 60 cm to 1 m tall. The trap line extended on both sides of an unpaved field access and ended at the edge of a forested area along Wildcat Creek.

Dominant plant species: *Apocynum cannabinum* (Indian-hemp), *Asclepias syriaca* (common milkweed), *Bromus inermis* (smooth brome grass), *Festuca pratensis* (tall fescue), *Pastinaca sativa* (wild parsnip), *Poa pratense* (Kentucky bluegrass), *Sambucus canadensis* (elderberry), *Solidago canadensis* (tall goldenrod)

Dates trapped: 17-19 June 1998
Captures: *Sylvilagus floridanus* (4)

Site 15. Piatt County: T.19N, R.5E, SW/4 Sec. 10, Weldon East, IL 7.5' topographic quadrangle (Figure A14)
railroad embankment 1.4 km E DeLand (east of county road 600 E)

This site was a highly disturbed abandoned railroad embankment with very little prairie vegetation. The top of the embankment was covered with gravel, but had some vegetation growing in the center. The vegetation was up to 1 m tall and a few small trees grew along the embankment. The right-of-way on the south side of the embankment was 10 m wide and bordered a cornfield; to the north only a 5-m wide right-of-way separated the embankment from a soybean field.

Dominant plant species: *Ambrosia trifida* (giant ragweed), *Apocynum sibiricum* (prairie dogbane), *Bromus inermis* (smooth brome grass), *Centaurea maculosa* (spotted knapweed), *Conium maculatum* (poison hemlock), *Melilotus alba* (white sweet clover), *Rumex crispus* (curly dock), *Spartina pectinata* (prairie cordgrass)

Dates trapped: 17-19 June 1998
Captures: *Spermophilus tridecemlineatus* (3), 1 bird

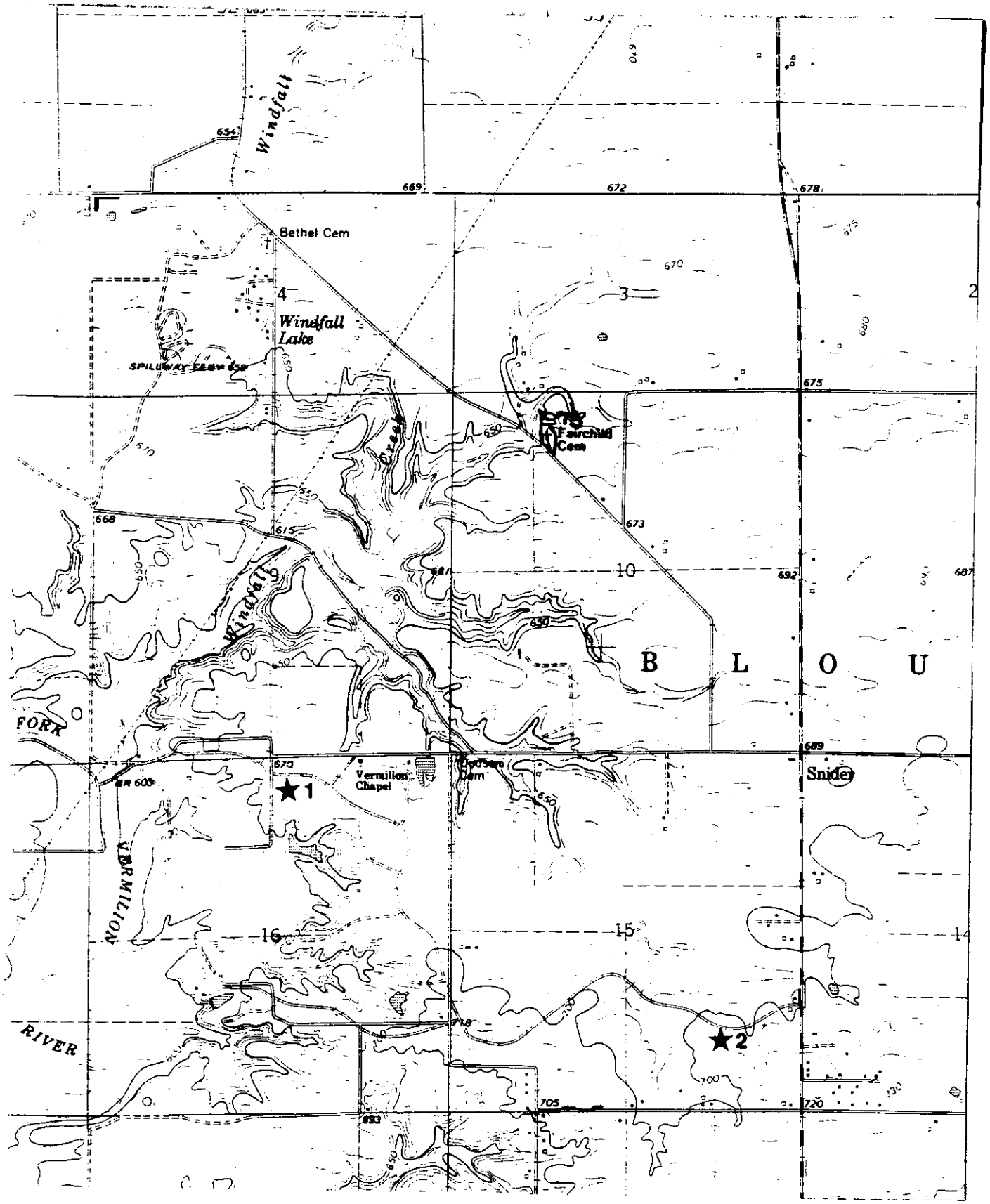

Figure A1. Locations of trapping sites 1 and 2, Vermilion County (Danville NW 7.5' quadrangle)

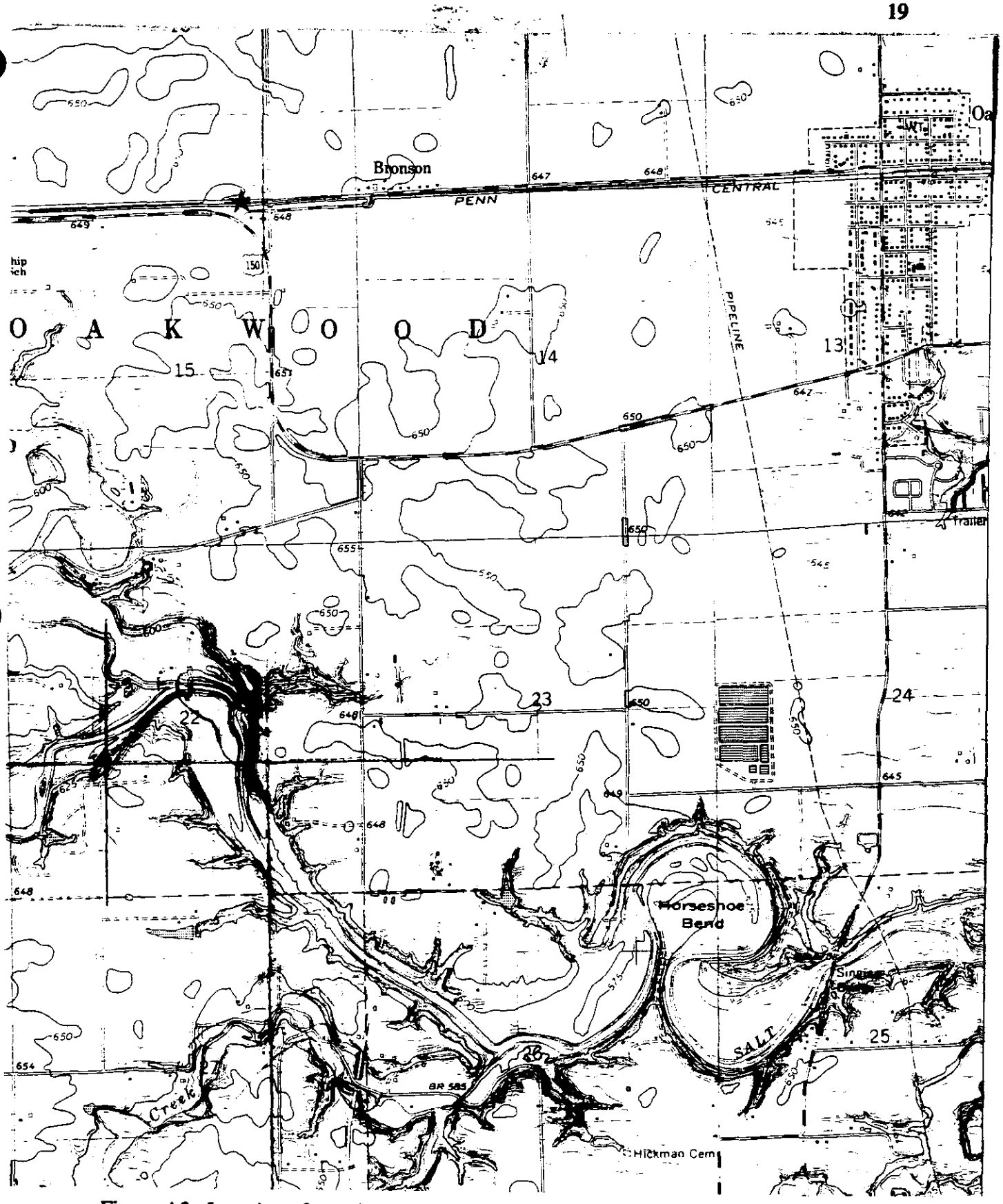

Figure A2. Location of trapping site 3, Vermilion County (Oakwood 7.5' quadrangle)

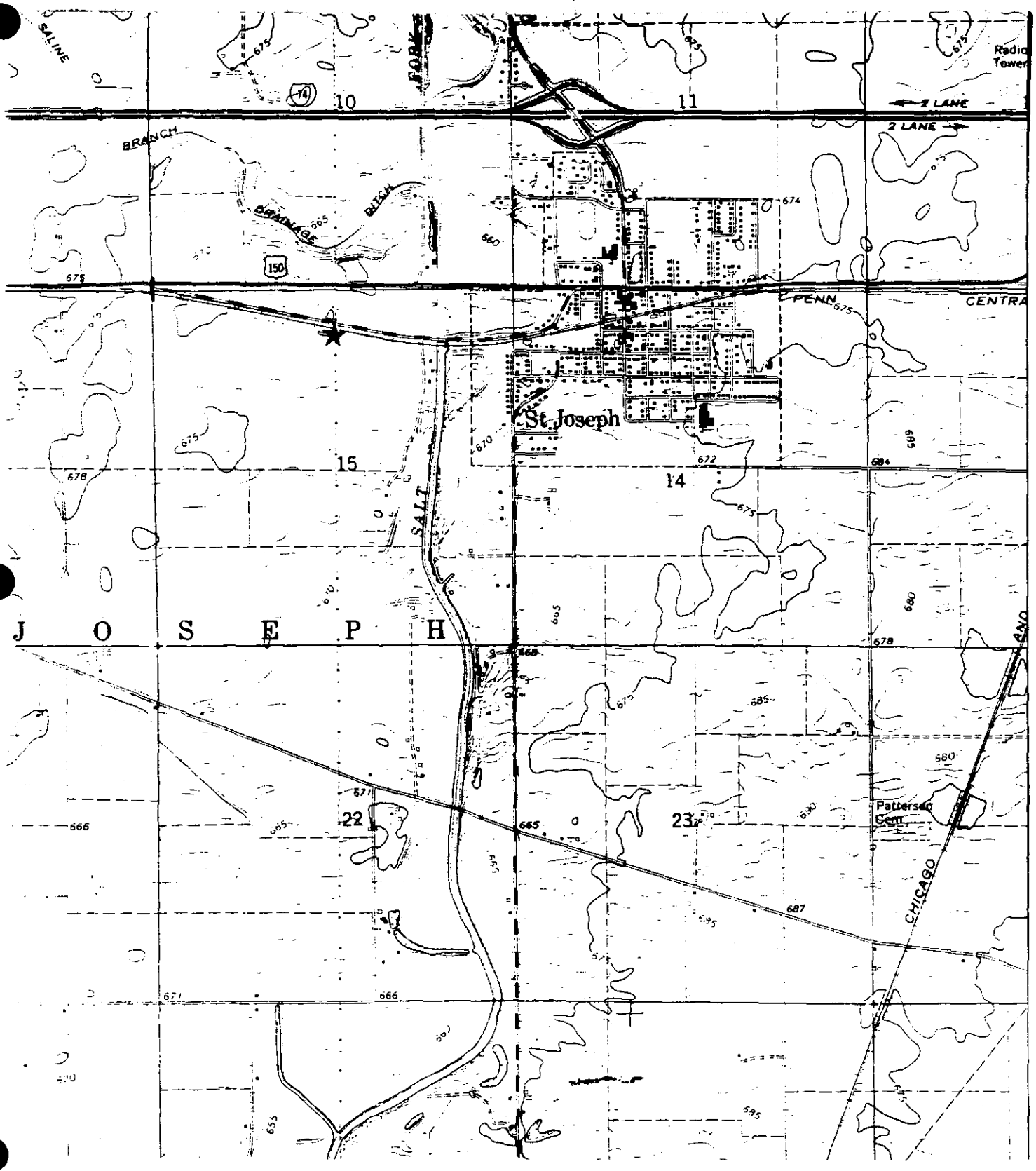

Figure A3. Locations of trapping site 4, Champaign County (St. Joseph 7.5' quadrangle)

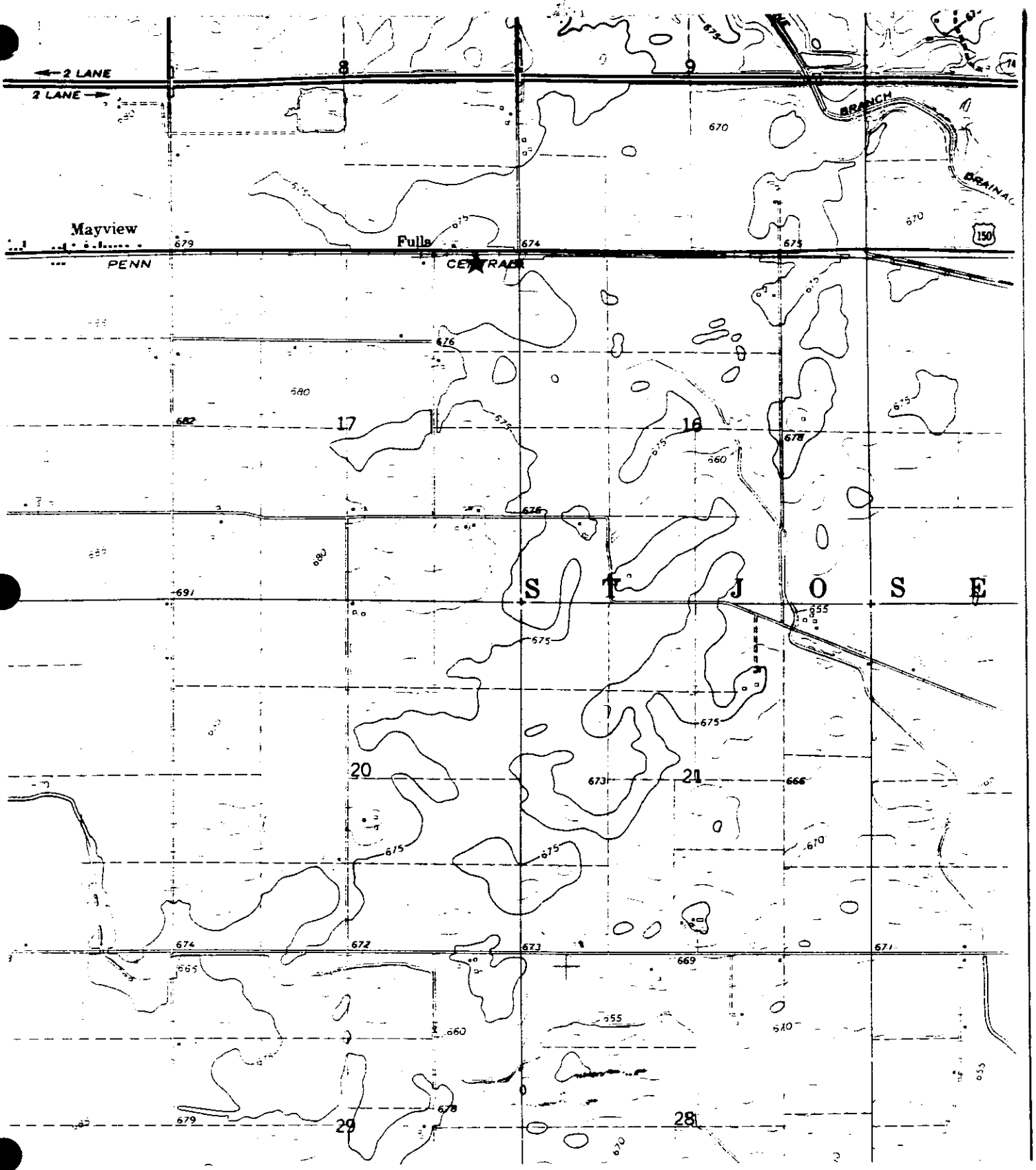

Figure A4. Location of trapping site 5, Champaign County (St. Joseph 7.5' quadrangle)

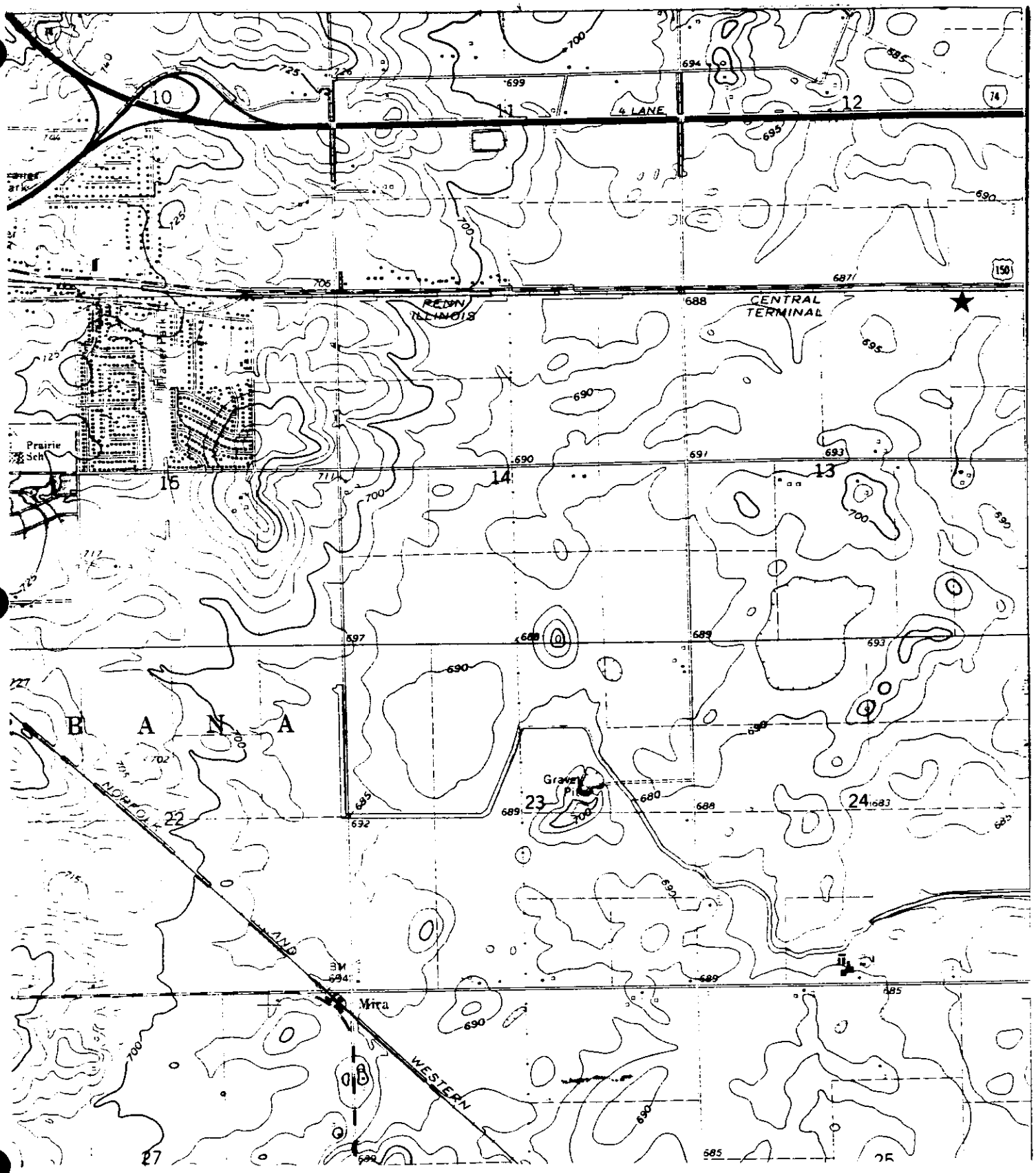

Figure A5. Location of trapping site 6, Champaign County (Urbana 7.5' quadrangle)

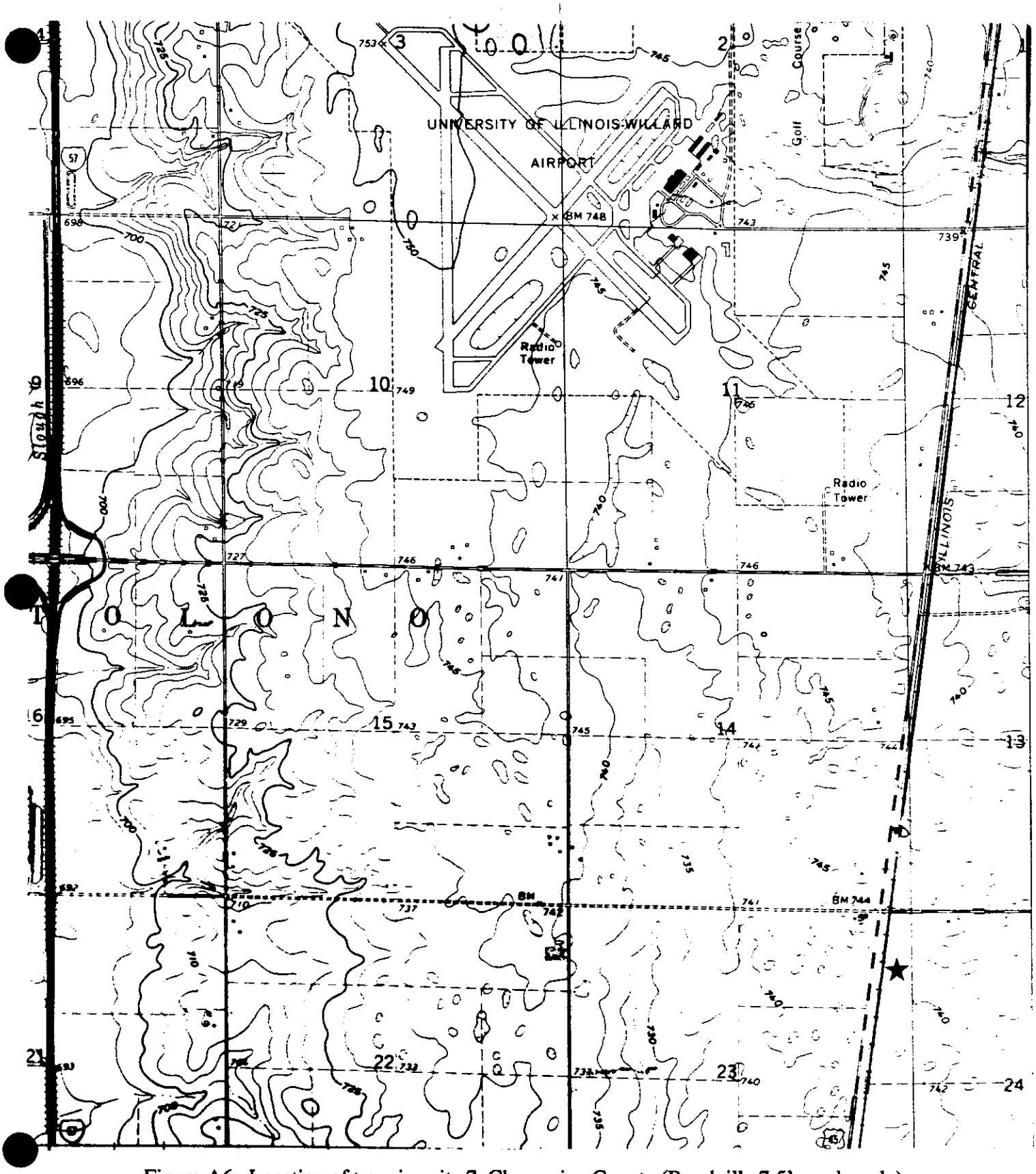

Figure A6. Location of trapping site 7, Champaign County (Bondville 7.5' quadrangle)

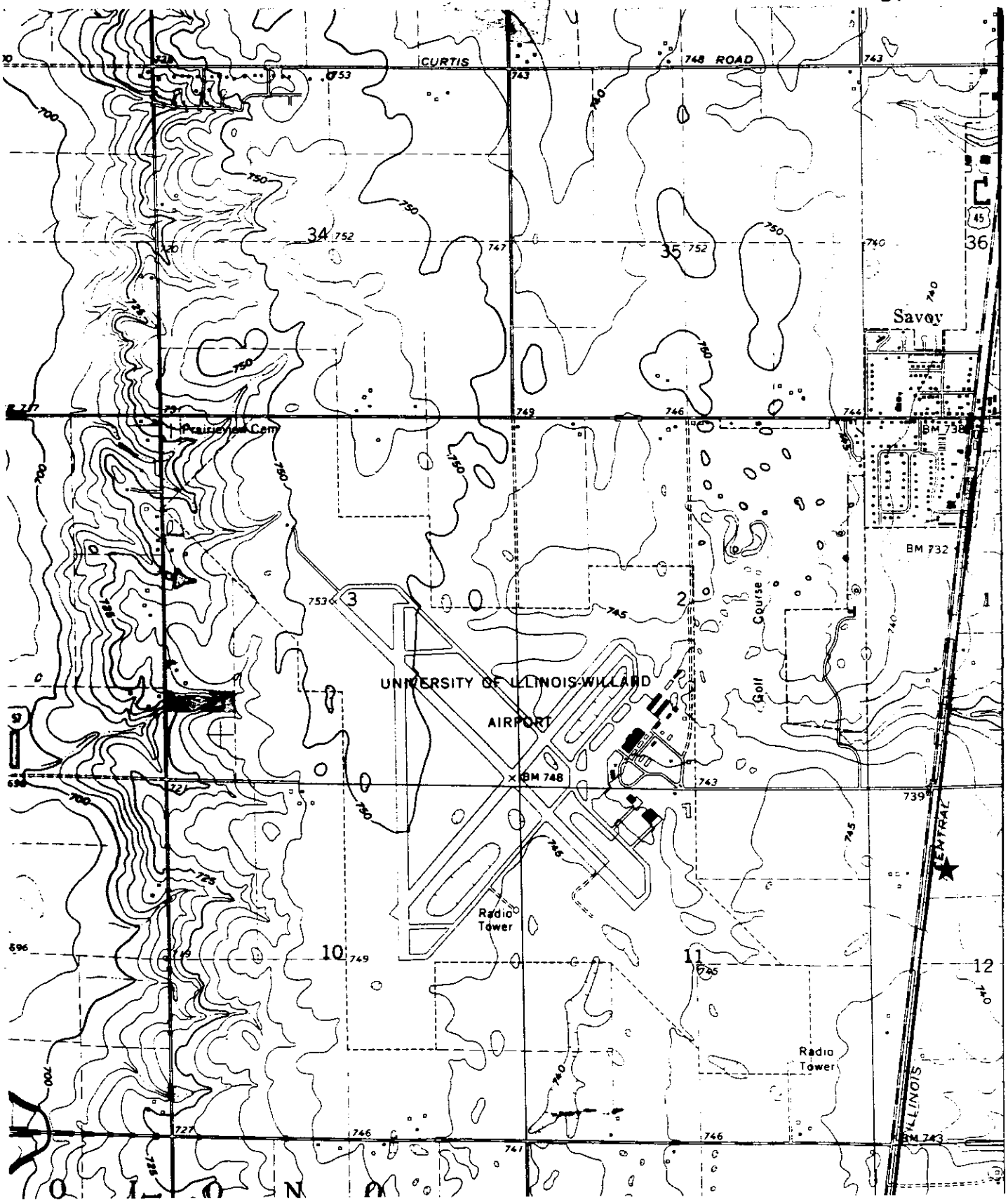

Figure A7. Location of trapping site 8, Champaign County (Bondville 7.5' quadrangle)

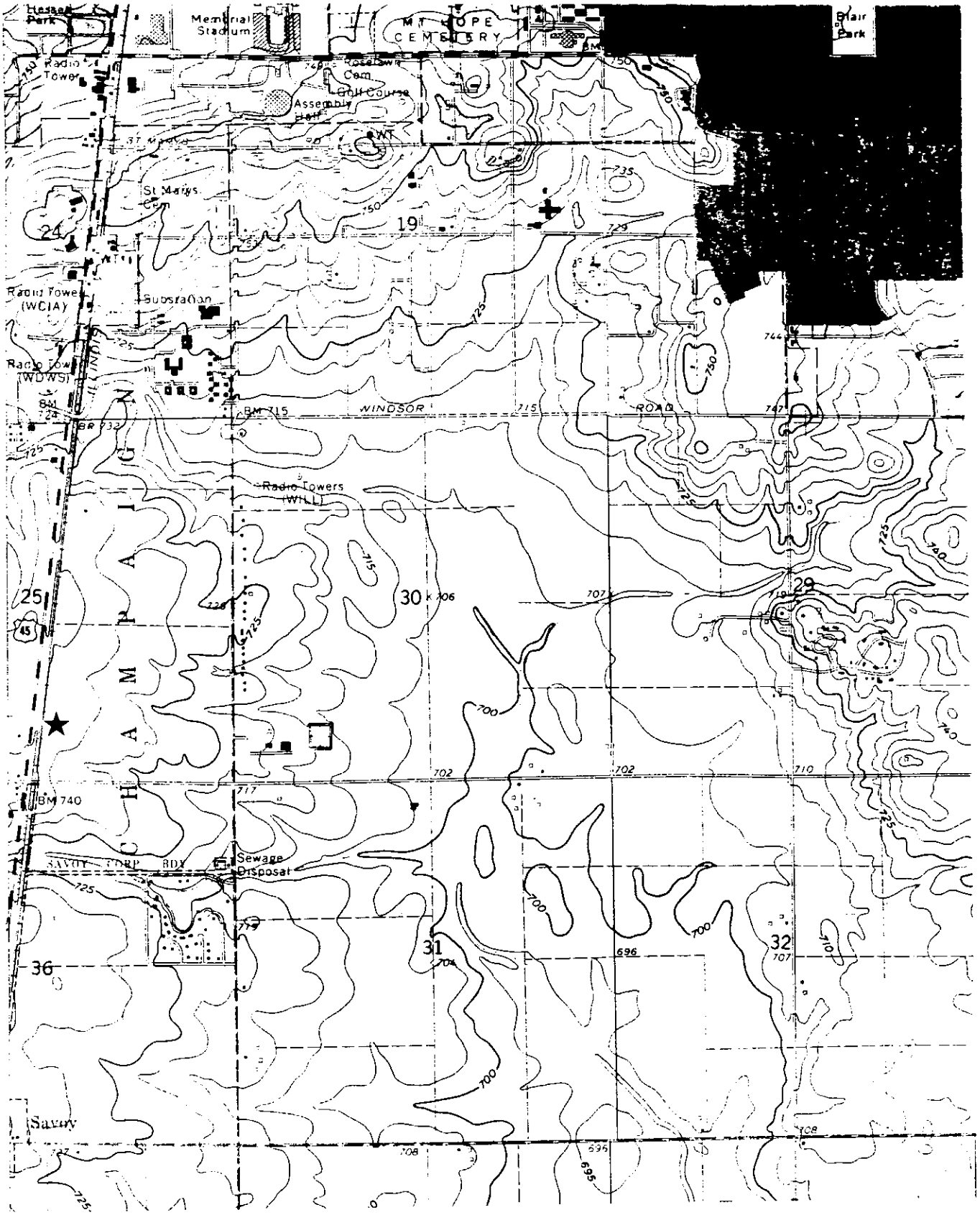

Figure A8. Location of trapping site 9, Champaign County (Urbana 7.5' quadrangle)

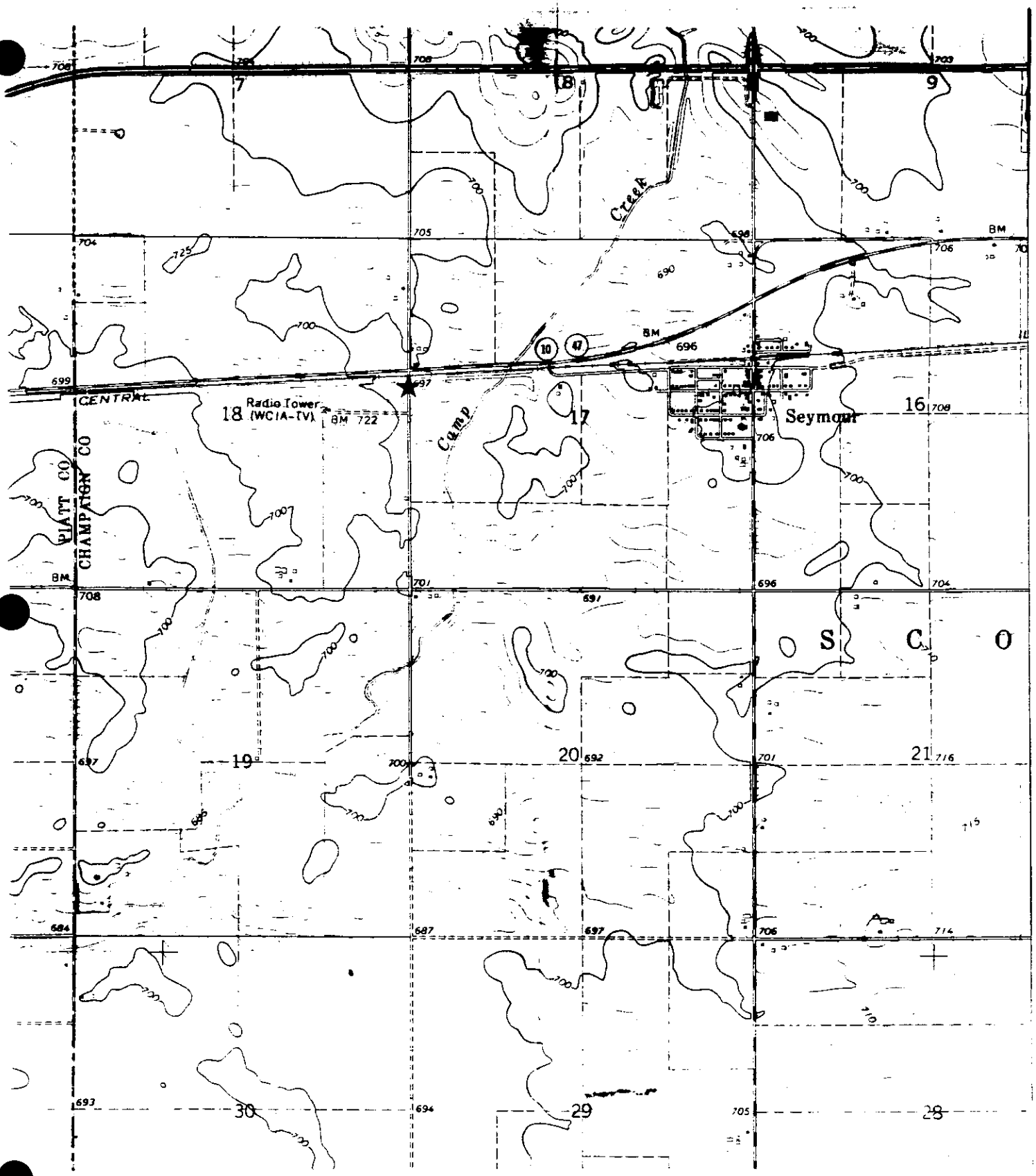

Figure A9. Location of trapping site 10, Champaign County (Seymour 7.5' quadrangle)

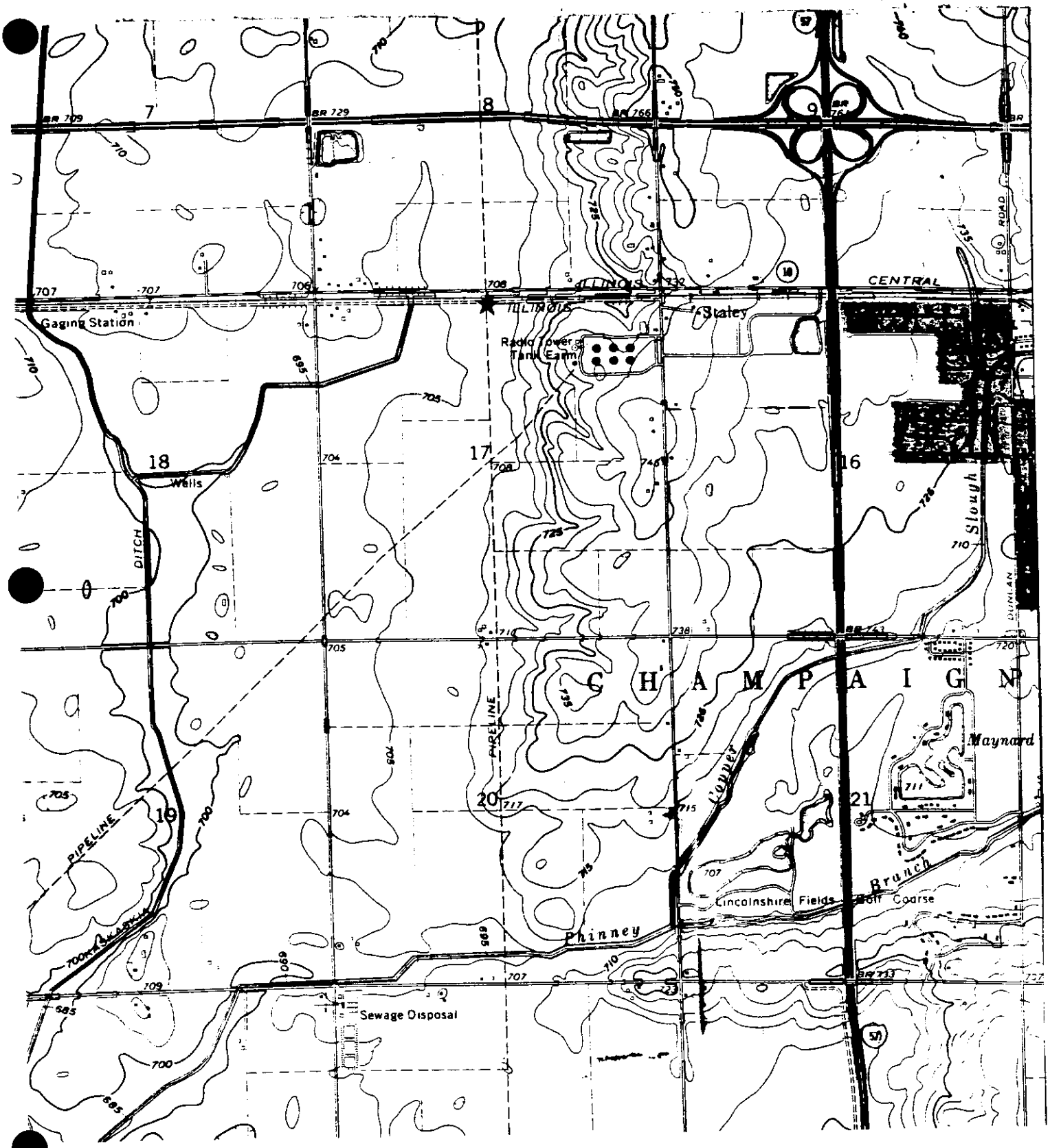

Figure A10. Location of trapping site 11, Champaign County (Bondville 7.5' quadrangle)

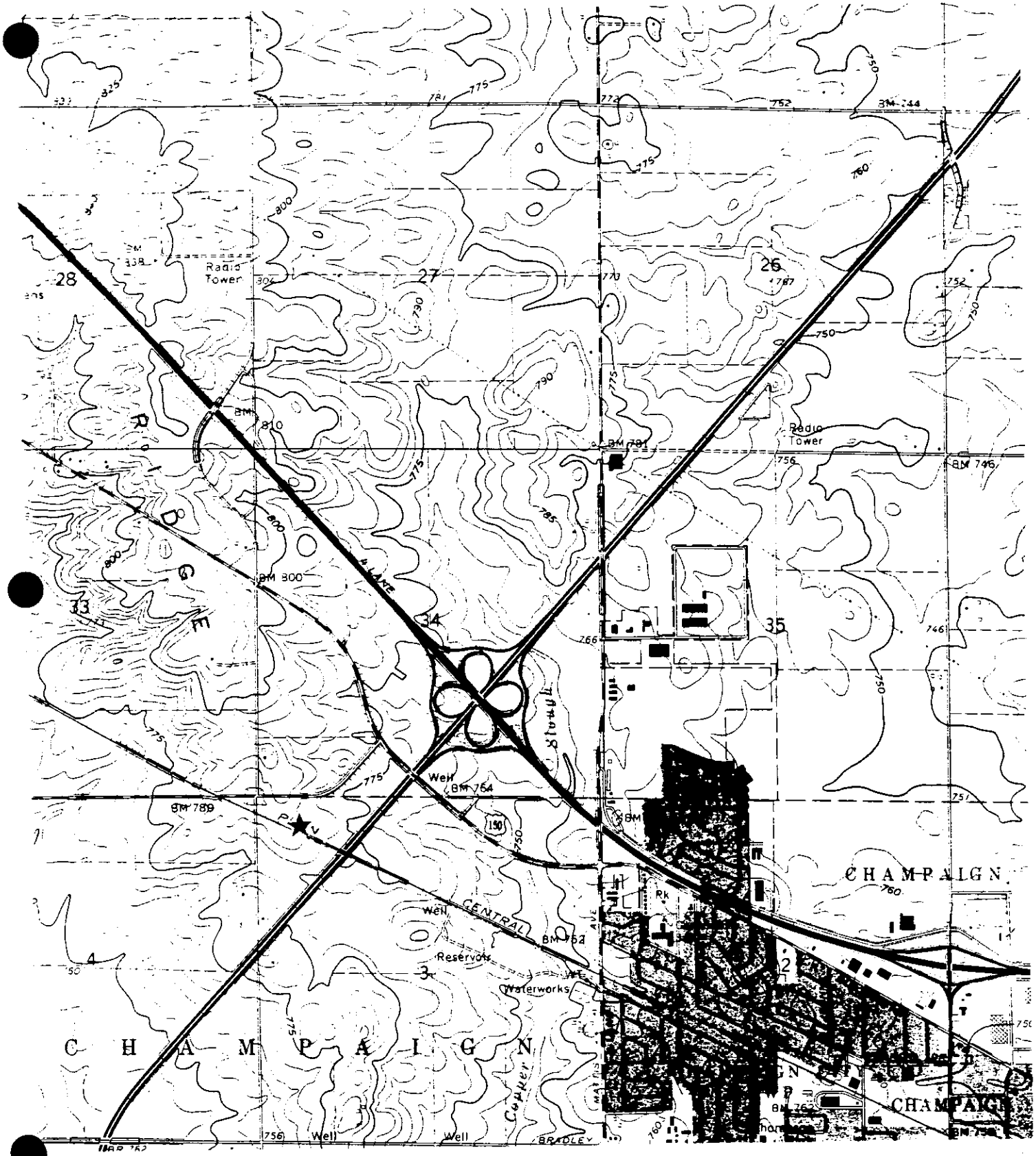

Figure A11. Location of trapping site 12, Champaign County (Rising 7.5' quadrangle)

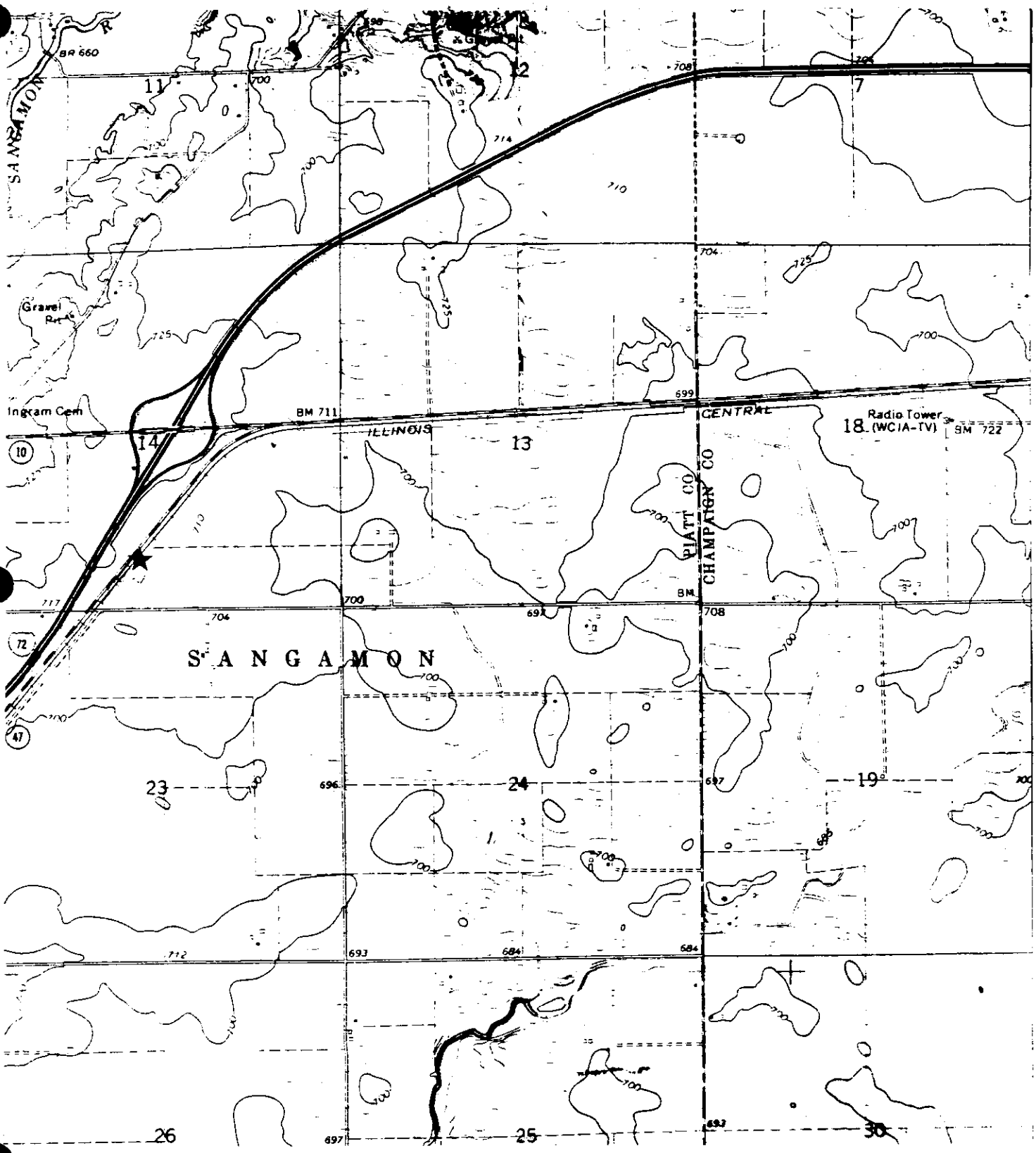

Figure A12. Location of trapping site 13, Piatt County (Seymour 7.5' quadrangle)

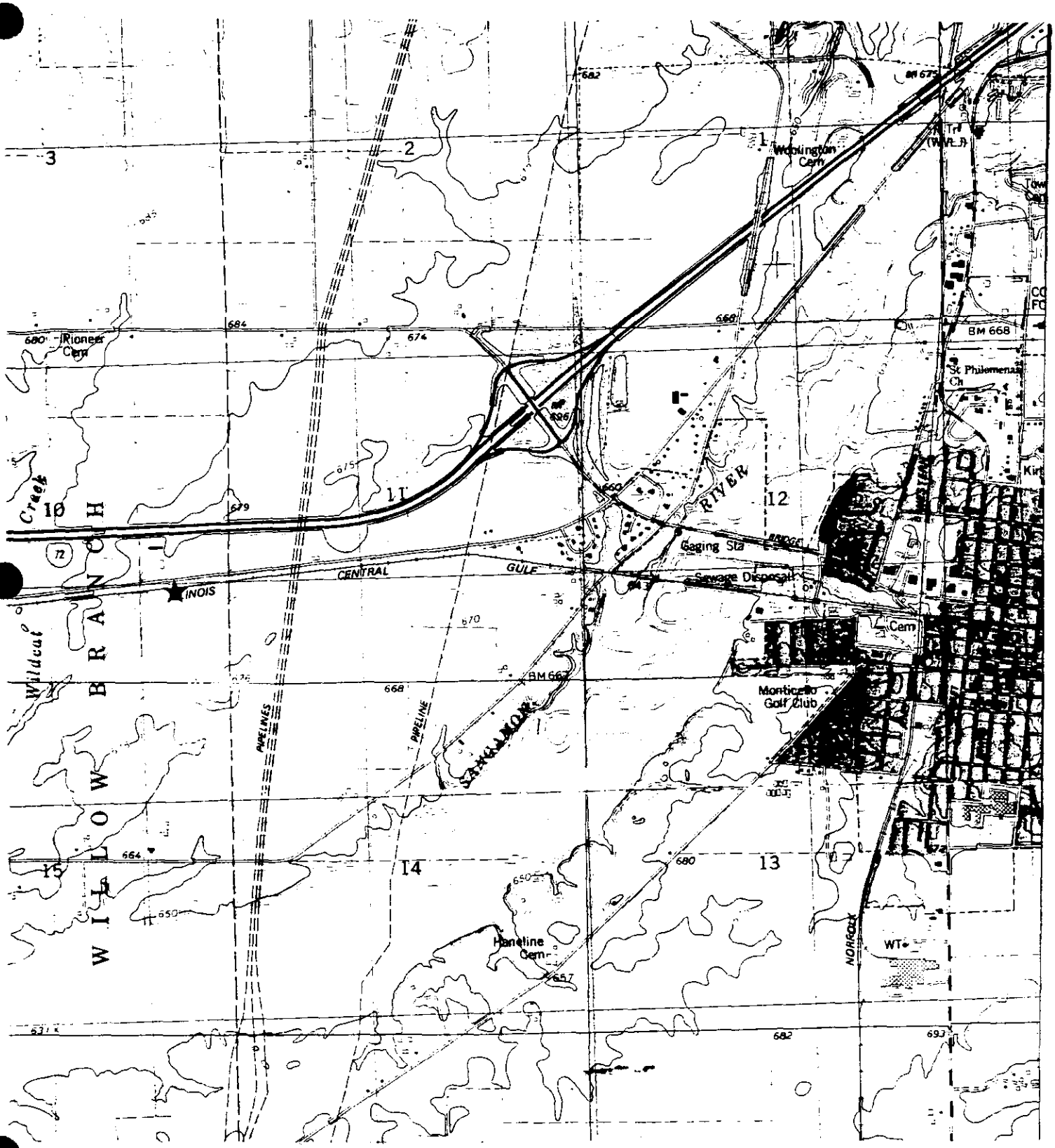

Figure A13. Location of trapping site 14, Piatt County (Monticello 7.5' quadrangle)

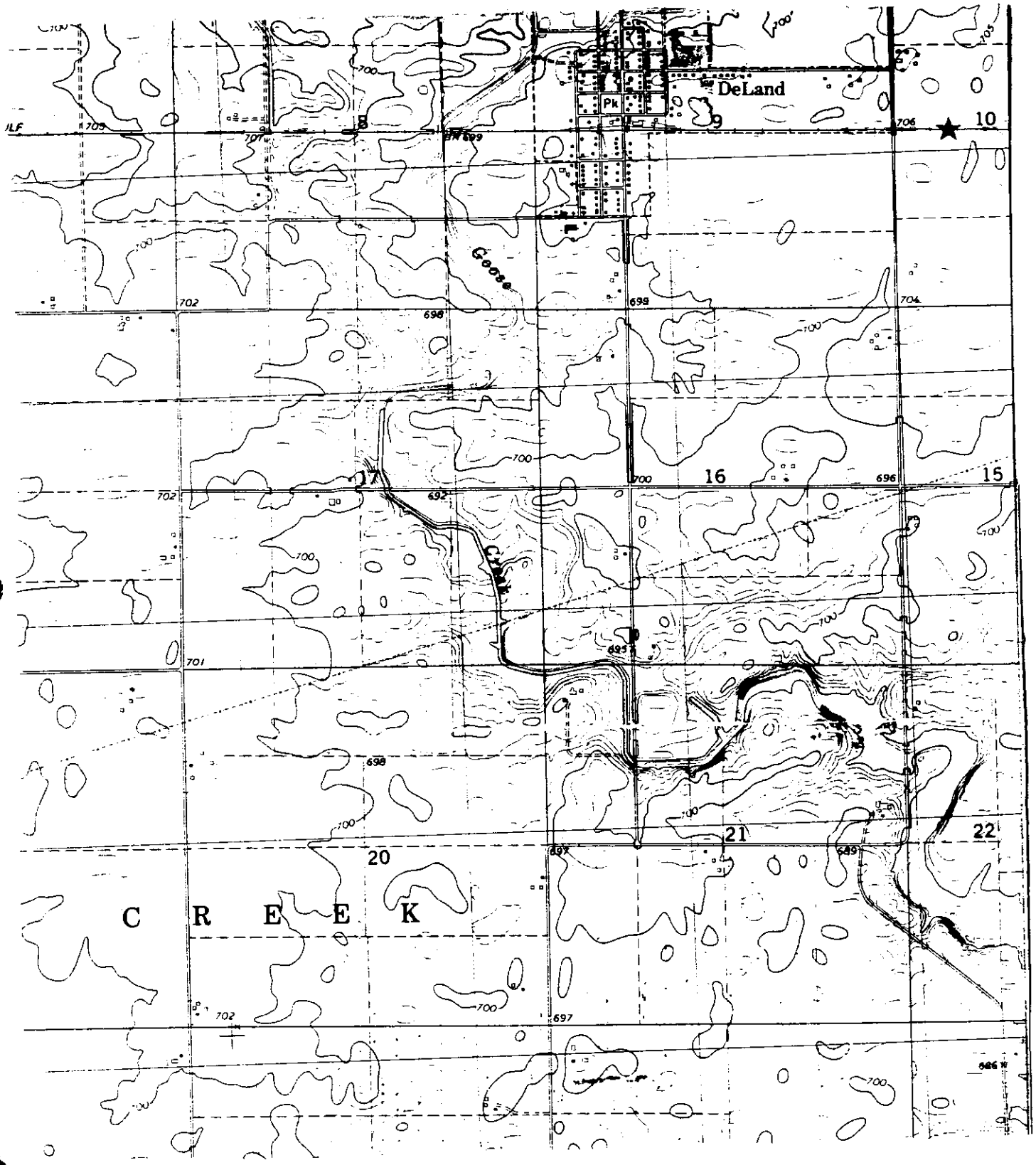

Figure A14. Location of trapping site 15, Piatt County (Weldon East 7.5' quadrangle)