

State Wildlife Grant Proposal

PROJECT NUMBER: T-45 D-1

PROJECT TITLE: The Illinois chorus frog (*Pseudacris illinoensis*) and wetland mitigation: What has worked?

PURPOSE: Several attempts have been made to combine statutory wetland mitigation with efforts to preserve Illinois threatened and endangered species that need wetlands at some stage in their life cycle. Judging the effect and result of wetland mitigation follows well-established procedures (e.g. Bailey et al., 2006). Gauging the effect on target animal species, however, has had little comprehensive study (Pechmann et al., 1991). The purpose of this project is to examine three mitigation projects designed to produce habitat suitable for the Illinois chorus frog (*Pseudacris illinoensis*), a state threatened amphibian (Herkert, 1992). This study is designed to determine a level of habitat modification or wetland mitigation that is required to permit successful breeding by the Illinois chorus frog. The project will gather data on previous actions, breeding success, and current conditions, resulting in a preliminary mitigation guide describing the minimum actions necessary to provide breeding habitat. Although only three sites have been selected they are unique in the past mark/recapture efforts that have been made at these sites. Such pre-project data are necessary to determine the long term effects of mitigation.

NEED: The Illinois chorus frog (*Pseudacris illinoensis*) is a small hylid anuran that has a unique fossorial life history (Brown, 1978; Brown et al., 1972; Tucker, 1997a). This frog is listed as threatened in Illinois (Herkert, 1992). It occupies sand prairie habitats (Brown and Rose, 1988; Paukstis and Brown, 1987). It has a limited distribution in Illinois (Figure 1).

Highway construction such as the improvements to U.S. Route 67 in Morgan and Cass Counties and construction of a new bridge across the Illinois River at Beardstown may have detrimental effects on the Illinois chorus frog. Projects designed to mitigate habitat loss and to construct breeding sites for the Illinois chorus frog can be anticipated. Three such projects have been completed in Cass County (Tucker, 2003a; 004) (Figure 2), Morgan County (Tucker, 2003b) (Figure 3), and Madison County (e.g., Tucker and Philipp, 1995; 1996; Tucker, 1999; 2005) (Figure 4). The response of the frog to these projects has not been completely reviewed. Thus the need for a complete review will be met in the final report for this project. There is a need to evaluate these completed projects to determine what the best mitigation strategies are for future mitigation efforts.

These three sites differ radically in the degree to which they were altered for mitigation. The Morgan County site was created by Morgan County road department and consists only of three small breeding ponds (see Figure 3 for the general location of the site). The U. S. Army Corps of Engineers constructed the

Cass County site and considerably greater effort was put into breeding pond construction (see Figure 2 for the general location of the site). Finally the Madison County site is an Illinois Department of Transportation site and has been subjected to mitigation actions for upland habitats (prairie vegetation restoration) as well as wetland mitigation (see Figure 4 for the general location of the site).

There are thus three actions that could have happened at each site. First would be the obvious of establishing a breeding site through wetland or pond construction. Second is the acquisition of buffering upland habitat with no habitat rehabilitation. The most complete and third alternative would be wetland or pond construction, acquiring buffering upland habitat, and rehabilitation of that habitat. Each step adds to the cost of the site and the difficulty of management. The question is what level of effort is needed to be successful? Is creating a breeding pond enough or is complete and expensive wetland and upland habitat restoration needed to create successful projects? If success is generated by simple pond construction then costs for mitigation may be much reduced compared to projects utilizing stages two and three.

The need and value of analysis of mitigation efforts is supported by elements of the Illinois Comprehensive Wildlife Conservation Plan & Strategy (IL WAP). The Illinois chorus frog is a state threatened species (IL WAP X/Appendix 1/306) and a critical species in greatest need of conservation (IL WAP IV/B/134). Moreover the habitats where these mitigation projects are located are part of the Illinois River Sand Areas Natural Division (IL WAP IV/C/143). The Illinois chorus frog is listed as a critical species in this division (IL WAP IV/C/143). It is also important that three reptiles are also listed as critical species in this habitat. These include the ornate box turtle (*Terrapene ornata*), the Illinois mud turtle (*Kinosternon flavescens*), and the western hog-nosed snake (*Heterodon nasicus*). The latter two species are listed as state endangered and state threatened, respectively (IL WAP X/Appendix 1/306). Thus methods that are shown to be successful in mitigating habitat loss for the Illinois chorus frog may also be applicable to two other critical species.

OBJECTIVES: The objective is to survey three completed mitigation projects to determine the degree of mitigation necessary for successful chorus frog recruitment.

Job 1. Construct characteristic matrix and identify management actions at each site from previously submitted reports and documents. [Time allocated: 5%; budget allocations Salary: 10%, Travel: 5%; Time frame: June-August 2007; May 2008]

1.1 Analyze and characterize actions taken at each site in order to provide data for a preliminary assessment of the minimum management actions associated with successful mitigation and to be used in management recommendations.

- Job 2. Survey mitigation sites for breeding activity to determine successful chorus frog recruitment. [Time allocated: 50%; budget allocations Salary: 50%, Travel: 75%, Materials & Supplies: 90%; Time frame: June-August 2007; January-May 2008]
- 2.1 Using nighttime calling surveys establish which sites are used by frogs.
 - 2.2 Estimate population (Bailey, 1951; Donnelly and Guyer, 1994) and survivorship (Tucker, 2000) by marking adult frogs (Green, 2001) and recapture of previously marked frogs.
 - 2.3 Use day surveys to locate eggs and tadpoles to establish which sites are used as breeding sites.
 - 2.4 Monitor tadpole development during weekly visits to identify which sites had successful breeding and recruitment (Tucker, 1995; 1997b).
 - 2.5 Mark transforming froglets in 2007 to allow for estimates of recruitment (a criterion for success) based on recapture of marked frogs in 2008.
- Job 3. Identify physical characteristics of mitigation sites. [Time allocated: 25%; budget allocations Salary: 25%, Travel: 10%; Time frame: June-December 2007; January-May 2008]
- 3.1 Measure breeding pond physical parameters such as maximum depth and presence and nature of submersed and emergent vegetation.
 - 3.2 Track persistence of breeding ponds by estimating pond surface area for each visit until transformation of tadpoles occurs.
 - 3.3 Survey potential predators.
- Job 4. Complete a final report. [Time allocated: 20%; budget allocations Salary: 15%, Travel: 10%, Materials & Supplies: 10%; Time frame: January-May 2008]
- 4.1 Use information gathered from the assessment of work (Job 1) to describe previous actions taken at each of the three mitigation sites.
 - 4.2 Use information from the survey of breeding activity (Job 2) to determine which sites were successful
 - 4.3 Use current physical characteristics of sites (Job 3) to compare and contrast mitigation efforts and their effect on successful chorus frog recruitment.
 - 4.4 Analyze and interpret information gathered in Jobs 1-3 to provide management recommendations for future mitigation sites.
 - 4.5 Complete a final report with sections: Introduction, Materials and Methods, Results, Discussion, Summary and Management Recommendation, Literature Cited.

EXPECTED RESULTS OR BENEFITS: The mitigation actions at three sites selected for this project differ remarkably. The simplest project in Morgan County (Tucker, 2003b) consisted of digging three small depressions along a small ditch in farm fields. The Cass County (Tucker, 2003a; 2004) project was more intensive and involved wetland construction and sand deposition but did not do

any secondary tasks such as hydrologic studies or prairie restoration. The Madison County project (Tucker and Philipp, 1995; 1996; Tucker, 1999; 2005) was the most intensive with wetland restoration, prairie restoration, and hydrologic studies. It is important to have a range of effort so that each step up in complexity can be compared. If the simplest project is as effective as the most complex (and expensive), then simpler and less expensive projects might yield the desired results. Thus, it is important to contrast and compare mitigation results among sites. The obvious benefit would be that a suggested template for success could be produced. Thus, examination of the sites should give an idea of how much effort needs to be made to increase the likelihood of breeding success. Such knowledge will make future mitigation activities more likely to be successful.

Results from the current study will be used to plot recommended actions at mitigation sites. It may be that prairie restoration and hydrologic studies are not central to properly planning wetland restoration. Wetland restoration is central to all mitigation projects because the frog cannot breed without proper wetlands (Butterfield et al., 1989; Tucker, 1997b). Prairie restoration may also be necessary because young frogs may not be able to grow into adults without such actions (Tucker, 1995; 1997c; 2000). Moreover, growth (Tucker, 1997c) and survivorship (Tucker, 1997a; 2000) may be low when habitats are not restored. The main benefit of this project will be to estimate minimum necessary actions to preserve Illinois chorus frog populations. Should none of the three sites prove to be successful then this project will still have value. The benefit is that further management actions likely to overcome population stress can be suggested. These could include such actions as expanding the mitigation area to include more acreage, predator removal (Petranka et al., 1987), or other actions.

Establishment of which sites are successful is vital to assessing the efforts required to achieve success as pointed out in the Need section above. Without some basis to tie minimal efforts to successful mitigation the project cannot achieve the stated Purpose of identifying what those actions are. Moreover, wetland habitats and environments are variable. This project cannot predict what changes the Illinois chorus frog may face in the future. Climatic conditions in the last 20 years have warmed and precipitation has decreased. Thus continued persistence of the frog may be intimately tied to wetland restoration. While the project is unable to predict the future, it should be able to decide what the best short-term strategy is to get to that future.

APPROACH:

Job 1. Construct characteristic matrix and identify management actions at each site from previously submitted reports and documents.

Assessment of management actions include but are not limited to examination of pond construction, hydrologic studies, effort made to ensure access to

nonbreeding habitats, habitat restoration efforts, acquisition of buffer zones to protect sites from agricultural encroachment, and total cost of project.

Job 2. Survey mitigation sites for breeding activity to determine successful chorus frog recruitment.

Each of the three mitigation areas will be visited at night to conduct calling surveys. The Illinois chorus frog is known to be present in the general area of each site in Madison, Morgan, and Cass Counties (Axtell and Haskell, 1977; Brown and Rose, 1988). This frog characteristically calls after spring rainfall of at least 3 cm once temperatures have reached 15°C (Tucker, 1997b). At each night visit an attempt will be made to capture and mark individuals at these sites. This is important because all three sites have had adult Illinois chorus frogs previously marked and released. The year of capture for each previously marked frog would be known and recaptures will allow estimates of population size and survivorship (Tucker, 2000).

Should frogs be heard at any particular site, it does not necessarily follow that breeding will occur. Breeding can be established by the presence of amplexing pairs of frogs, which would be found during calling surveys. Furthermore, discovery of egg masses or tadpoles during daylight visits would also be evidence of breeding at a site (Butterfield et al., 1989; Tucker, 1997b). Tadpole surveys would have to be conducted weekly because tadpoles are not identifiable at small growth stages (Gosner, 1960).

Even if breeding is known to have occurred, it does not mean that the site is a successful one. At each site evidence of transforming froglets must be found to establish the site as a successful breeding site. I have had much experience finding and timing transformation events (Tucker, 1995; 1997c). These events occur around June 1 and transforming froglets are easily found at night visits during rainfall events. A successful site will demonstrate recruitment of new frogs into the population. This can be demonstrated through recapture of the previous years newly marked froglets (May-June, 2007) in the next spring (March-May, 2008).

Job 3. Identify physical characteristics of mitigation sites.

This task includes three main subsections. Breeding pond physical parameters such as area and depth are important factors that must be measured. Area will be measured using a range finder to measure the length and width of the water covered portion of each excavation. Fortunately most of the excavated ponds at these sites are oval or rectangular in shape allowing straight forward measurements to be made. Depth of water will be measured in the center of each excavated pond. Measurements will be made weekly continuing until

tadpoles transform, which is usually about May 31. These activities allow the second task, tracking persistence of ponds to be measured for each site.

The third important task is to survey potential predators. There are two sorts of predators including those that prey on adults and transformed froglets such as snake and those that prey on tadpoles. Snakes will be visually surveyed by recording numbers and species observed during each visit. These will primarily be garter snakes such as the eastern garter snake (*Thamnophis sirtalis*) and the western ribbon snake (*Thamnophis proximus*) as well as species of water snakes (genus *Nerodia*). Aquatic predators include insect larvae (primarily odonates or dragonfly larvae), adult insects such as the diving beetle and the giant water bug, and salamander larvae. The latter include smallmouth salamanders, *Ambystoma texanum* and the tiger salamander, *A. tigrinum*. The latter is known to prey on anuran tadpoles and can have important impacts on tadpole numbers. The number of aquatic predators will be recorded per dip net haul, with ten or more dip net hauls per visit.

Job 4. Complete a final report.

Presuming that successful reproduction for the Illinois chorus frog can be confirmed at any of these sites then a preliminary characterization of the minimum needs for mitigation can be established. With the three diverse sites available it should be possible to arrive at a preliminary guide to mitigation for the Illinois chorus frog.

A successful mitigation site will be one that progresses through the following steps:

- 1) Adult frogs called from the site (established during calling surveys)
- 2) Adult frogs bred at the site (established by the presence of amplexing adults, observation of egg mass, or presence of tadpoles)
- 3) Tadpoles transform into froglets (established by observation of newly transformed froglets)
- 4) Froglets were recruited into the population (established by frog surveys from January to March of 2008).
- 5) have wetlands that support tadpole development from egg deposition (March) to transformation (June) (Jobs 2.3 and 2.4, Tucker, 1995; 1997c); and
- 6) have habitat sufficient to support adult and transformed froglets during the non-breeding season (Job 2.2; Brown, 1978; Brown et al., 1972; Tucker, 2000).

Once fieldwork and management action survey characteristics have been established, the completed report will outline those management tasks taken at successful sites. These can be compared in the report to sites that seemed to have failed. The report will include the following sections: Introduction, Materials

and Methods, Results, Discussion, Summary and Management Recommendations, Literature Cited.

The report will have breeding activity (i.e., did frogs call at the site and were eggs laid), population estimates for each site (i.e., mark-recapture results for previously marked and newly marked frogs); recruitment success (i.e., were tadpoles able to transform), and survivorship estimates (i.e., rate of recapture for each year cohort at each site). Action taken during mitigation for each site will be outlined including, wetland restoration methods, habitat restoration, and hydrological modifications. Relative success or failure will be addressed in stages: Breeding...Egg laying...Tadpole development...Transformation and Migration to non-breeding habitat. Reporting will include a compilation of data from the past years of work done at these sites to provide a "Best Management Practices for the Illinois chorus frog at Wetland Mitigation Sites". The report will summarize of the basic biology of this species, the landscape factors that suggest where and when such mitigation should be considered, and a rank ordering of practices from most important to least important from the perspective of the long term viability of the species and local populations.

The Management Recommendations section of the report will contain detailed recommendations for site mitigation based on the survey conducted herein. Recommendations will also draw upon the principal investigator's long experience with these sites (up to 14 years and a minimum of 5 years). Data collection during this project will be critical to formulating management decisions because the project is the only attempt to examine effects at completion of mitigation. It is important to understand that previous studies at all sites do not address the need outlined here. Previous work centered on marking frogs and determining existing numbers. The current project performs the important task of finding out which of these frogs are still there and how many new ones are being added. Moreover, none of the three sites were studied simultaneously and variation among sites could not be directly compared. Finally, all of the previous studies were conducted while the sites were being modified and none were made after mitigation was completed. Post-mitigation study is the only way to examine and compare methods. At present, previous studies provide helpful population data collected during mitigation activities and tells us that some level of frog usage may occur. Without comparative study focused on the question outlined here previous ground work will not provide us answers.

LOCATION:

The fieldwork for this project will be conducted in Madison County at the Sand Road mitigation area 6 miles west of Edwardsville, in Morgan County at a site along the newly constructed coal haul road just east of Meredosia, and in Cass County at a site just off Sixth Street in Beardstown.

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PROJECT SCHEDULE:

	June-August, 07	September-December, 07	January-April, 08	May, 08
Job 1. Characterize procedures and actions at each site	X			X
Job 2 Survey mitigation sites for breeding activity.				
Calling surveys			X	
Breeding surveys			X	X
Tadpole development	X			X
Transformation	X			X
Recruitment				X
Job 3. Identify		X	X	X

characteristics of successful sites				
Job 4. Report production			X	X

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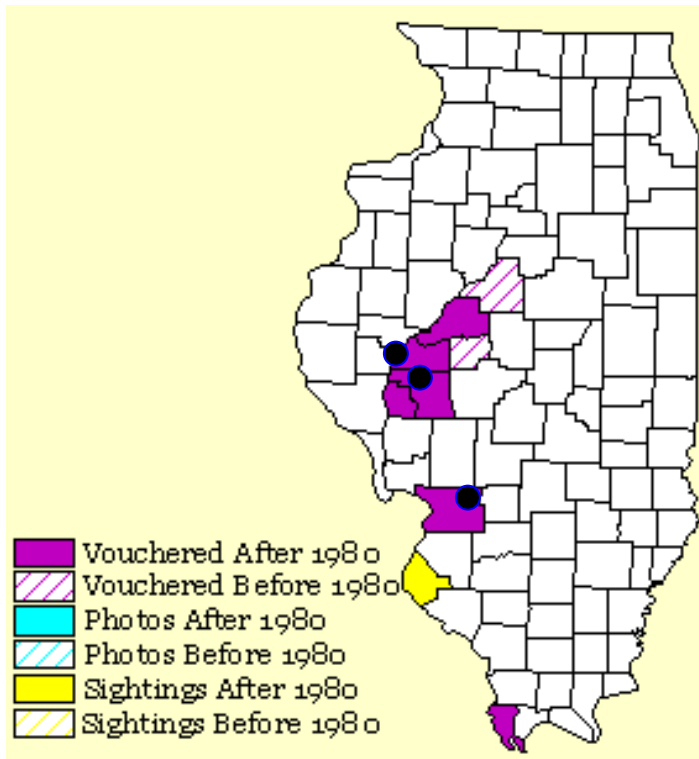


Figure 1. The distribution of the Illinois chorus frog (*Pseudacris illinoensis*) in Illinois. Black circles indicate approximate locations for each of the three sites. Map from WWW.inhs.uiuc.edu/cbd/collections/amprep.

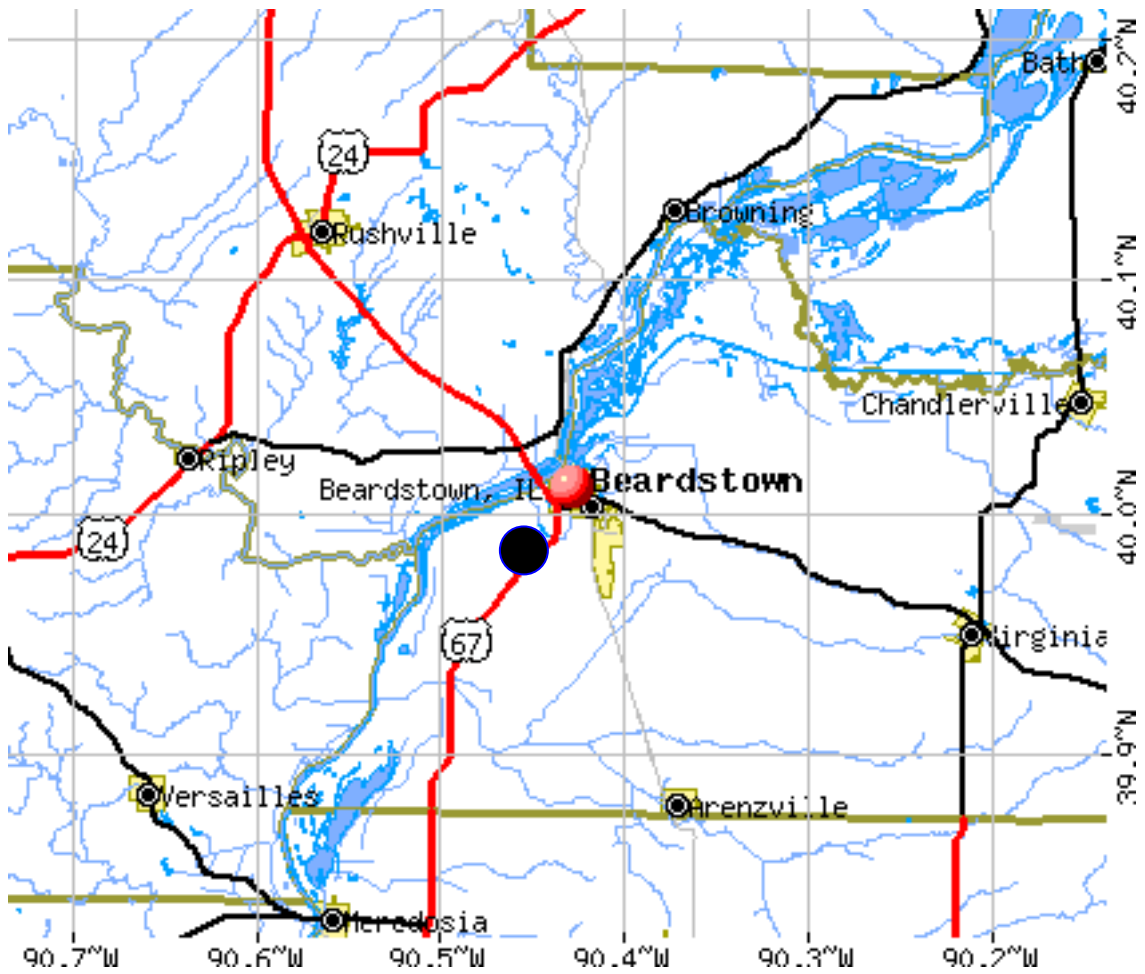


Figure 2. Detail of the Beardstown site in Cass County. The black circle represents the location of the U.S. Army Corps of Engineers Illinois chorus frog mitigation site and dredge deposition location

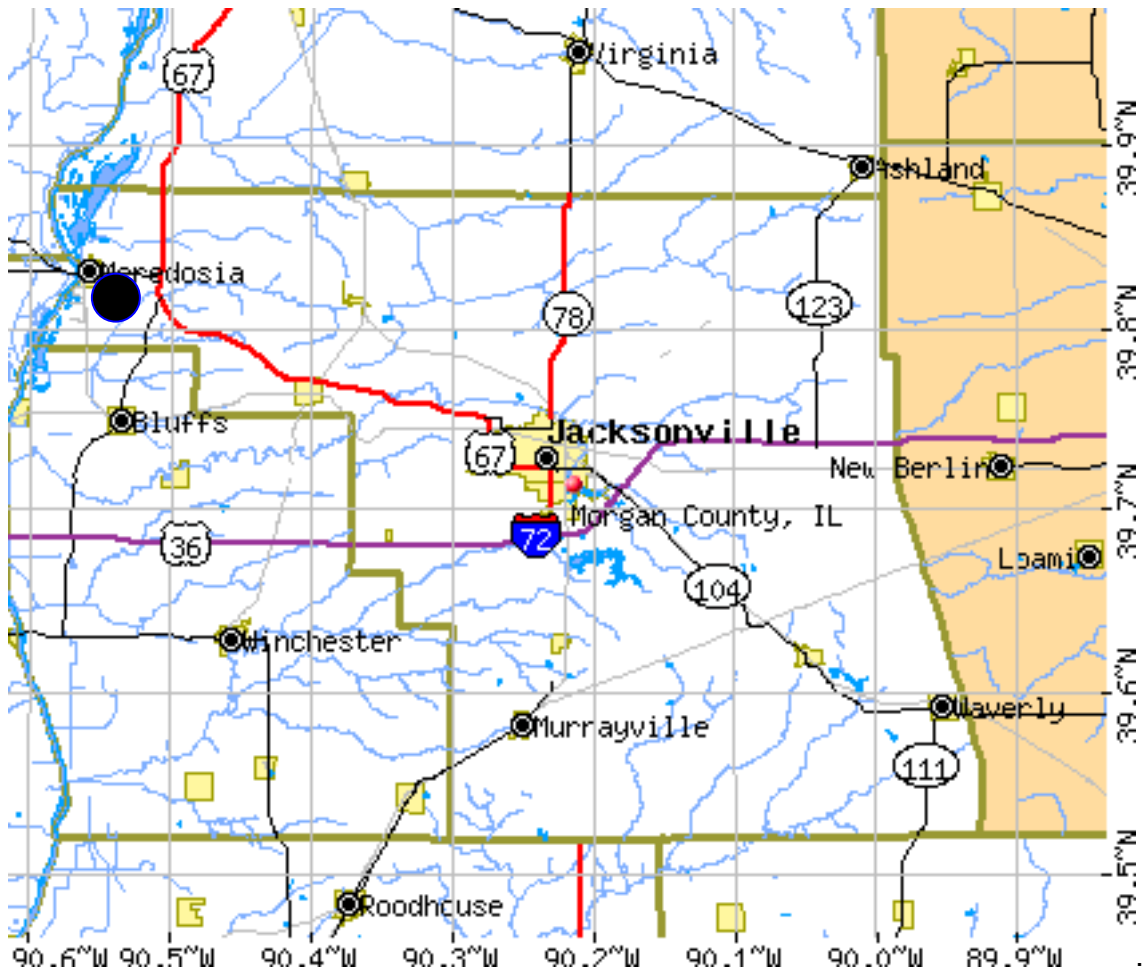


Figure 3. Map of Morgan County, Illinois. The black circle marks the location of the Morgan County Illinois chorus frog mitigation site.

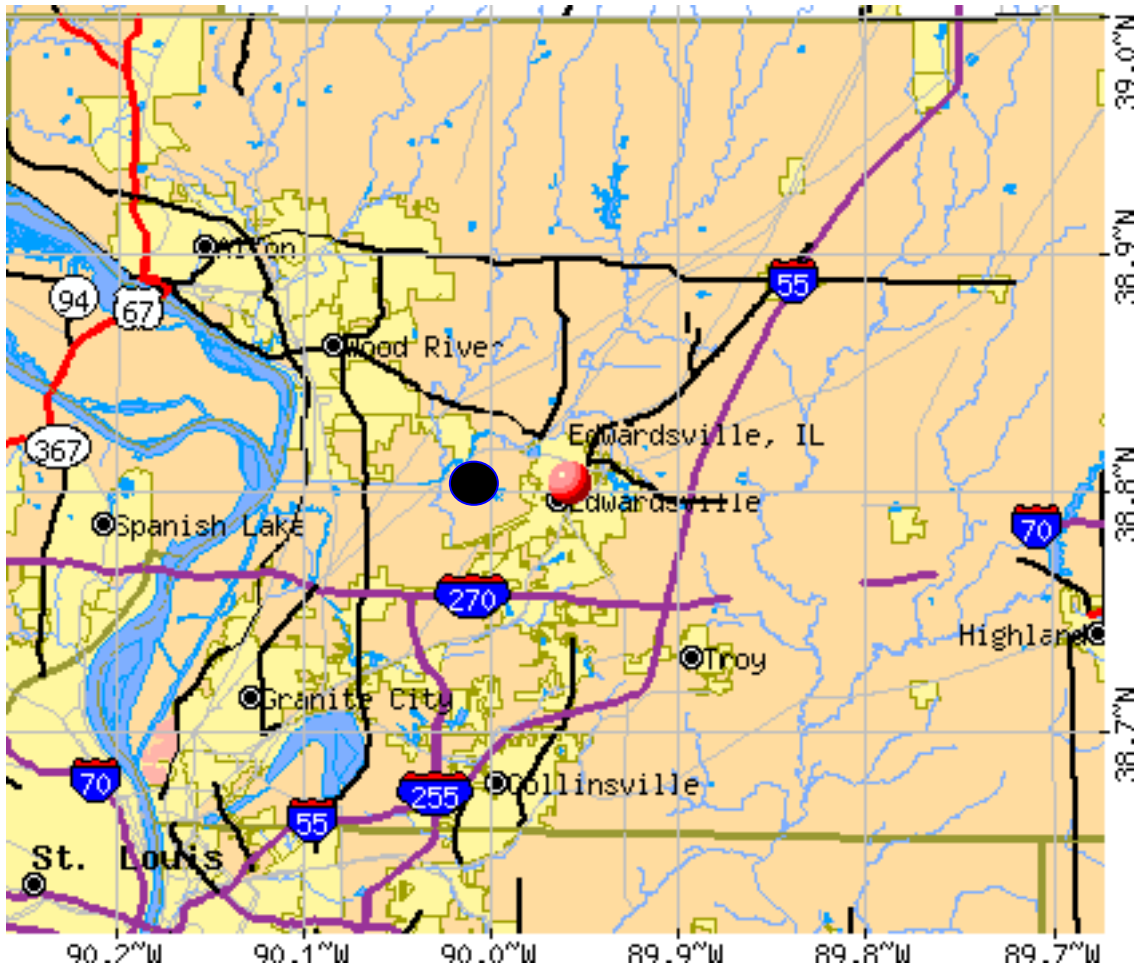


Figure 4. Map of Edwardsville, Madison County, Illinois. Black circle indicates the location of the Illinois Department of Transportation, Sand Road, Illinois chorus frog mitigation area.