

Title: Groundwater Protection in the Tumbling Creek Cave Recharge Area

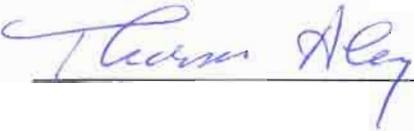
Objective: To reduce threats to the Tumbling Creek Cavesnail (a federally endangered species) and other Species of Conservation Concern by reducing the introduction of contaminants into the underground stream in which the aquatic cavesnail lives. The proposed work will accomplish Priority 1 recovery actions identified in the Tumbling Creek Cavesnail Recovery Plan

To increase recharge area landowners' awareness of, and involvement in, an on-going groundwater protection initiative within the nine square mile Tumbling Creek Cave Recharge Area

Duration: Anticipated time needed to complete this project is 2 years

Cost Summary:	Estimated Total Project Cost:	\$31,750 (100%)
	Private Stewardship Grant:	\$26,988 (85%)
	In-Kind Match:	\$4,762 (15%)

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Signed:  _____

A census of the Tumbling Creek Cavesnail population is made twice a year. Any increase in numbers will be at least partly a result of the proposed work.

Maintenance of Improvements

Dumps that are cleaned up will hopefully never again become established. Almost all landowners in the recharge area no longer dispose of trash by dumping it on their property.

One of the major water quality gains attributable to septic tank pump-outs is that home owners learn that routine maintenance of their systems every 3 to 5 years is necessary to ensure their proper performance and long term usability. We will strongly encourage any homeowner we have assisted in this program to routinely service his on-site system and to maintain any of the repairs or improvements made as a result of this program.

Project Budget

Trash Clean-up Work needed to cleanup 8 dumps.

Labor. 400 hours @\$18.00/hr. = \$7,200
On-site supervision. 80 hours @\$35.00/hr. = \$2,800
Project management by licensed geologist. 8 hrs. @\$110/hr. = \$880
Tools and safety equipment. = \$348
Mileage to and from disposal sites (landfill drop-off site and recycling site). 1400 miles @\$0.48 = \$672
Disposal fees (\$40/ton at landfill, no charge at recycling). \$1,100
Use of tractor with front-end bucket for loading. 100 hours @\$30/hr. = \$3,000
Subtotal, trash clean-up. \$16,000

Sewage System Maintenance, Hydrogeologic Assessment, and Repair.

Septic system pump-outs. 12 @\$165 ea. = \$1,980
Hydrogeologic assessments of individual systems and identification of needed improvements. 12 systems @ \$450 ea. = \$5,400
Mileage and misc. expenses. \$120
Budget for on-site improvements. \$7,500
Misc. labor associated with on-site improvements; to be done by home owners or OUL. \$750.
Subtotal, sewage system maintenance and repair. \$15,750

Total Project Cost: \$31,750.

Cost per dump cleaned up = \$2,000 ea.

Cost for sewage system maintained and hydrogeologically assessed = \$625. On-site improvements made will total an estimated \$8,250, but this will undoubtedly not meet the amount needed to make all necessary improvements. However, as a result of this project we will know the needs for future projects.

Note: Hydrogeologic assessments under Missouri law must be made by a state-licensed geologist. Tom Aley, the hydrogeologist who will do this work, holds the necessary license and has a current charge rate of \$110/hr. plus expenses.

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Potential for partial funding

This project could move forward with partial funding if necessary. We believe that the approximate even division of funding for trash clean-up and sewage system work should be maintained. We also believe that some funding for sewage system repairs and improvements should be maintained even with partial funding.

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Project Description

The proposed project is located in the area which contributes groundwater recharge to Tumbling Creek Cave; this is called the cave's recharge area. The cave and its recharge area are located in southeastern Taney County, Missouri.

Tumbling Creek Cave is the most biologically diverse cave west of the Mississippi River according to past U.S. Secretary of the Interior Cecil Andrus. Tumbling Creek Cave is home to nearly 120 animal species, including 13 troglobitic species according to the Missouri Department of Conservation's Cave Life Database. The stream that runs through the cave contains the only known population of the aquatic Tumbling Creek Cavesnail which, due to a precipitous population decline, was listed as endangered by the U.S. Fish & Wildlife Service in 2002 (subsequent to an emergency listing in 2001). A Recovery Plan for this species was approved in 2003.

Tumbling Creek Cave has been designated by the U.S. Department of Interior as a National Natural Landmark, due in substantial part to its large and diverse cave fauna. In addition, this cave has also been designated a Priority 1 gray bat cave ("absolutely essential" in preventing extinction). The cave also provides winter habitat for the endangered Indiana bat.

Tumbling Creek Cave provides habitat for 10 species of conservation concern. They are:

- 1) *Antrobia culveri*. Tumbling Creek Cavesnail
- 2) *Stygobromus ozarkensis*. Ozark cave amphipod
- 3) *Stygobromus onondagaensis*. Onondaga cave amphipod
- 4) *Caecidotea antricola*. Cave isopod
- 5) A cave crayfish not identified to species. All of the cave crayfish found within 100 miles of the cave are species of conservation concern.
- 6) *Brackenridgia ashleyi*. Ashley's cave isopod. A newly named species unique to Tumbling Creek Cave.
- 7) *Chaetaspis aleyorum*. Aley's cave millipede
- 8) *Causeyella* (formerly *Scoterpes*) *dendropa*. Causeyella cave millipede
- 9) *Myotis grisescens*. Gray bat
- 10) *Myotis sodalist*. Indiana bat

The first five of the identified species of conservation concern are aquatic species which are continuously impacted by water quality. Species 6 through 8 are troglobites which are sometimes found immediately adjacent to the cave stream.

Most recently, the Tumbling Creek Cave Ecosystem was highlighted in Missouri's Comprehensive Wildlife Strategy (CWS) as one of 33 profiled Conservation Opportunity Areas (see attached). Additionally highlighted in the Missouri's CWS, was a groundwater protection initiative aimed at delivering conservation to this globally unique karst ecosystem (see attached).

The Tumbling Creek Cave groundwater system has been delineated by groundwater tracing studies and shown to receive water from an area of 9.02 square miles. Water can move from the surface into and through this groundwater system very rapidly. As an illustration, one dye trace from a losing stream to a point in the known habitat area for the cavesnail traversed a straight-line distance of 12,800 feet in 14.5 hours for a mean travel rate of 880 feet per hour. With such rapid travel rates it is clear that the land and the groundwater system are not capable of providing effective natural cleansing for the waters passing into and through the groundwater system. The cave stream and its fauna are thus very susceptible to contaminants derived from dumps and inadequate on-site sewage systems.

As identified in the U.S. Fish and Wildlife Service's *Tumbling Creek Cavesnail Recovery Plan*, reducing the pollution entering the groundwater system is a Priority 1 recovery action that has yet to be accomplished. Priority 1 Actions are defined (recovery plan, page 58) as actions that must be taken to prevent extinction or to prevent the species from declining irreversibly in the foreseeable future.

Utilizing existing funding, refuse sites within the recharge area have been identified. Funding is now being sought for the cleanup of those sites that occur on private land within the recharge area. Additionally, the OUL will provide one-on-one technical assistance to their neighbors within the recharge area in order to improve on-site sewage treatment through one-time septic system maintenance or system upgrades if determined to be necessary. Most of the landowners in the area have limited financial resources and the OUL intends to provide dump cleanup and sewage system work at no direct cost to landowners. We expect that many landowners will contribute work, and perhaps a few will provide some funding, for efforts on their property.

Two non-profit entities in southwest Missouri have offered free septic tank pump-outs for individuals living in their areas of concern; these programs were extremely successful in establishing contacts with homeowners who had on-site sewage problems. Neither of those programs included the Tumbling Creek Cave recharge area. We would use the free septic tank pump-out approach to make initial one-on-one contacts with landowners in the cave recharge area. The septic tank pump-out provides useful information on potential problems that may exist with the individual systems and will enable us to identify systems that need upgrades. Upgrade needs will vary from system to system, and the OUL will work with the homeowners and the Taney County Sewer District (which has regulatory authority over on-site systems in the county) to correct identified problems.

The Recovery Plan estimated that the cost of trash cleanups in the recharge area would total \$75,000 and that the cost of improved sewage treatment disposal facilities would total \$100,000. This proposal does not anticipate completing either of these actions, but it will provide substantial improvements.

The Ozark Underground Laboratory seeks funding through the Private Stewardship Grant Program in order to cleanup identified refuse sites and improve human sewage treatment

facilities, thus implementing recovery actions 2.1.2 and 2.1.4 respectively. Both of these actions are Priority 1 items in the Recovery Plan. Each of the actions will be briefly described in the following sections. The actions cannot be accomplished without outside funding, and there are no other outside funds currently available for the actions, nor are any other funds currently being sought.

Refuse site cleanups

The Ozark Underground Laboratory is completing a project to identify, assess, and prioritize the cleanup of trash dumps in the recharge area for the cave. This work has been funded in part by the National Park Service since Tumbling Creek Cave is a designated National Natural Landmark. The project has identified 25 trash dumps in the recharge area. Six of these are small dumps on National Forest land and will not be involved in this project. Nineteen of the dumps are on private land, and permission to do cleanup work at 17 of these dumps has been obtained from landowners. Landowners who have agreed to participate include Tom and Cathy Aley, Aqua Hope LLC, Tumbling Creek Cave Foundation, Richard and Ester Myers, Denny and Doris Dendinger, and Mr. and Ms. Don Witt. These landowners control about 75% of all private land in the recharge area for the cave. Some cleanup work has already been done at several of the dumps to remove some of the potentially most harmful materials. However, harmful materials are sometimes not readily obvious until a dump is completely cleaned up.

Improve on-site sewage treatment

Given that about 75% of the land within the recharge area for the cave is private, voluntary involvement of recharge area landowners is critical to conservation success within the Tumbling Creek Cave Ecosystem. There are 25 current residences within the Tumbling Creek Cave recharge area. All of these are served by on-site sewage systems. Sewage systems serving all of the buildings used by the Ozark Underground Laboratory plus the two residences owned by Tom and Cathy Aley near the cave have recently been substantially upgraded with all wastewaters now being transported outside of the recharge area for the cave. Two other on-site systems are new enough that they should be providing adequate groundwater quality protection, and one other system has recently been improved. Finally, the Mark Twain School (which is in the recharge area for the cave) has just accepted a bid to replace their failing sewage system with a new advanced system capable of protecting waters in the cave. The school effectively used the fact that their failing sewage system was impacting an endangered species to raise the cost of the new sewage system (\$89,000) without the need for using any of their normal educational or operating budgets. However, about 21 of the residences in the recharge area for the cave have sewage treatment systems which are currently adding sewage contaminants to the cave stream which flows through Tumbling Creek Cave and which provides habitat for the Tumbling Creek Cavesnail.

Objectives

The proposed work has the following objectives:

- 1) To reduce threats to the Tumbling Creek Cavesnail and other aquatic species in Tumbling Creek Cave by implementing actions 2.1.2 (cleanup of refuse sites) and 2.1.4 (Improve human sewage treatment disposal facilities...) cited in the Tumbling Creek Cavesnail Recovery Plan.
- 2) To increase recharge area landowners' awareness of and involvement in the groundwater protection initiative within the Tumbling Creek Cave recharge area.

Anticipated Results and Benefits

The proposed following work will have the following results and benefits:

- 1) Landowners whose land management decisions impact high priority karst ecosystems will better understand the relationship between land management and karst ecosystem health, especially groundwater quality. Local ownership of the conservation issue provides the best chances for long-term conservation success.
- 2) Through implementation of the above objectives, the emerging sentiment that endangered species are a community asset, rather than a liability, will be reinforced. Given the overwhelming preponderance of privately owned land within this focus area, private landowners hold the key to conservation success.
- 3) Supports the implementation of the Tumbling Creek Cavesnail recovery plan
- 4) Supports the implementation of Missouri's Comprehensive Wildlife Strategy.
- 5) Implementing these objectives will reduce the contaminants and pollutants entering the karst groundwater systems in which the cavesnail and four other species of conservation concern live. This will result in improved groundwater quality, which will in turn benefit the species of conservation concern as well as tangentially benefit 5 additional species of conservation concern that live in the cave but are not aquatic species. The total cave fauna consists of almost 120 species.

Project Statement of Work

Project Design

This project consists of two separate tasks that will be conducted concurrently. The tasks are:

1) The cleanup of at least 8 dumps in the recharge area for Tumbling Creek Cave. More dumps will be cleaned up if funding permits.

2) The pump-outs of 12 private on-site septic systems in the recharge area for Tumbling Creek Cave. Hydrogeological assessments will be made of individual systems and needed improvements will be identified. Then, to the extent that funding under this

grant is available, improvements will be made to individual systems needing such improvements.

Dumps targeted for cleanup under this project are on land owned by Tom and Cathy Aley, Aqua Hope LLC, Tumbling Creek Cave Foundation, Mr. and Ms. Don Witt, Richard and Esther Myers, and possibly Denny and Doris Dendinger. Cleanup priority will be based upon a current study now nearing completion. To the greatest extent possible materials in the dumps are recycled. Materials that cannot be recycled are disposed of at a county-supported drop-off station for ultimate disposal at a licensed sanitary landfill. Materials which can neither be disposed of in sanitary landfills nor recycled (such as old tires, paints, pesticides, etc.) will be properly disposed of through various facilities and programs. Previous dump cleanup work in the recharge area has already removed about 100 tons of materials and appropriate disposal sites are now well known to the OUL.

Some of the dump cleanup work can be done with a tractor equipped with a front-end bucket. This equipment is especially useful in removing heavy items such as refrigerators and other large household appliances. Freon is removed by appropriate outside personnel from any equipment which may contain it. Unfortunately, much of the cleanup must be conducted by hand or by using hand tools and it is slow and tedious work. Supervisory personnel maintain close contact with cleanup work to ensure that harmful or hazardous materials are appropriately handled and disposed of.

The pump-outs of private on-site septic systems in the recharge area for Tumbling Creek Cave will be conducted as follows. Either Tom or Cathy Aley will visit with the landowner and explain the program and get his agreement to have his septic tank pumped and to have a hydrogeological assessment made of his system and site. All septic tank pumping will be conducted by a licensed pump-out company that will maintain records demonstrating that the wastes were disposed of at a public-owned treatment works. Based upon direct inspection by the pump out company and Tom Aley the size and condition of the tanks will be determined.

The hydrogeologic assessment will be made by Tom Aley. Under Missouri law all such groundwater investigations must be made by a person licensed as a Registered Geologist by the State of Missouri. Tom Aley holds such a license and will make the assessments. The assessment will consider, among various things, the nature of the bedrock and soils in the area, proximity to sinkholes and losing streams, proximity to areas known to rapidly convey waters into and through Tumbling Creek Cave, evidence of septic system failure, and then a determination of what improvements or repairs (if any) are needed. Repairs or improvements to on-site sewage systems will be made to the extent that funding is available. We anticipate that the extent of needed repairs and improvements will be greater than the funds available even if this proposal is fully funded. However, the resulting information about funding needs will facilitate future funding requests.

Organization and Responsibility

This project will be under the direction of Tom Aley, President of the OUL. Mr. Aley is a nationally recognized expert in the hydrology of karst areas and has over 40 years of professional experience. He will be assisted by Cathy Aley, who has 30 years of experience in conducting environmental work in karst areas. The Aleys are long-time residents of the area and this will greatly facilitate their work with other people in the recharge area.

Except for things such as septic tank pump-outs and Freon removal, most of the proposed work will be conducted by employees of the OUL or by other landowners assisting in the project. Some volunteers may assist in some of the trash cleanup. The OUL has a full-time staff of 8 people and may, on occasion, hire other helpers.

The OUL has conducted numerous previous conservation projects with state and federal funding and has never had a grant or contract cancelled, nor have we ever had to return funding for inadequate performance of any work.

Project Milestones

Trash dumps will be cleaned up as weather conditions permit. Dumps provide habitat for snakes (some of which are poisonous), so most cleanup work is restricted to the period from about November through March. The number of good days for cleanup of dumps is also limited by days with rain, snow, or very cold conditions.

Dumps also vary in volume and in their difficulty of cleanup. Our milestone objective will be to cleanup one dump a month during the November through March period.

Septic system pump-outs can best be conducted during periods when the ground is neither frozen nor saturated with moisture. Spring, summer, and fall are the best periods for this work. Our milestone objective will be to pump-out about one septic tank per month during suitable weather conditions and to complete the hydrologic assessment of that system within about a month of the date of pumping. Repairs to systems will hopefully be made within 3 months of the hydrologic assessment, presuming that weather conditions are suitable.

Evaluation Criteria and Procedures

Records will be maintained of dump cleanup efforts, time expended, and amount of wastes and types of wastes removed. Wastes discovered that could be especially harmful to groundwater quality will be described and quantified. This information will be included in a final report on the project.

Septic system pump-outs and hydrogeologic assessments will be identified by their locations. A final report will summarize all work conducted and the extent to which the systems have been improved.

A census of the Tumbling Creek Cavesnail population is made twice a year. Any increase in numbers will be at least partly a result of the proposed work.

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