

Health Consultation

CLIFF VILLAGE WELLS SITE

CITY OF CLIFF VILLAGE, NEWTON COUNTY, MISSOURI

MARCH 21, 2005

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service
Agency for Toxic Substances and Disease Registry
Division of Health Assessment and Consultation
Atlanta, Georgia 30333

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Prepared by:

Missouri Department of Health and Senior Services
Under Cooperative Agreement with the
U.S. Department of Health and Human Services
Agency for Toxic Substances and Disease Registry

Health Consultation: A Note of Explanation

An ATSDR health consultation is a verbal or written response from ATSDR to a specific request for information about health risks related to a specific site, a chemical release, or the presence of hazardous material. In order to prevent or mitigate exposures, a consultation may lead to specific actions, such as restricting use of or replacing water supplies; intensifying environmental sampling; restricting site access; or removing the contaminated material.

In addition, consultations may recommend additional public health actions, such as conducting health surveillance activities to evaluate exposure or trends in adverse health outcomes; conducting biological indicators of exposure studies to assess exposure; and providing health education for health care providers and community members. This concludes the health consultation process for this site, unless additional information is obtained by ATSDR which, in the Agency's opinion, indicates a need to revise or append the conclusions previously issued.

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Cliff Village Wells Site

Cliff Village, Newton County, Missouri

March 8, 2005

Prepared by:

Missouri Department of Health and Senior Services
Division of Environmental Health and Communicable Disease Prevention
Section for Environmental Public Health
under cooperative agreement with the
Agency for Toxic Substances and Disease Registry

STATEMENT OF ISSUES AND BACKGROUND

The Missouri Department of Health and Senior Services (DHSS) prepared this health consultation under a cooperative agreement with the federal Agency for Toxic Substances and Disease Registry (ATSDR). This health consultation was requested by the Missouri Department of Natural Resources (MDNR) to evaluate reports of health concerns and possible private well water problems expressed by several residents in the Cliff Village area. The health consultation will determine if a health hazard exists for residents of the Cliff Village area from data generated by the MDNR investigation and the follow up DHSS investigation.

BACKGROUND

The Cliff Village Well Site is a small residential community located within the southern border of Joplin, Missouri in northern Newton County (1,2). The site is a triangle shaped community located south of U.S. Interstate 44. Missouri State Highway 86 borders the community on the east, with Shoal Creek (a major water source for the city of Joplin) as its southern border (Figure 1). The majority of residences at the site are located on Shoal Cliff Drive (Figure 2). According to the 2000 U.S. Census, the village had a total population of 33 in 15 housing units. The majority of the housing units were built before 1959 (3). Residents of Cliff Village obtain their drinking water from individual private wells that range in depth from 150 to 400 feet (some well depths are unknown) (2).

MDNR received a referral from the U.S. Environmental Protection Agency (EPA) in January 2003, which indicated that several residents and domestic animals in the Cliff Village area had experienced unusual health problems. In some cases, health problems were severe enough to result in the death of a domestic animal. Some residents suspected that the drinking water from their private wells could be the cause of the health problems. Several hazardous waste sites with known groundwater issues exist in the vicinity of Cliff Village. These sites include part of the Tri-State Mining district, the Jasper County Mine Site (contaminated with lead, cadmium, and zinc) and the Newton County Wells Site (contaminated with trichloroethylene [TCE] from industrial dumping). Additionally, Cliff Village is underlain by karst geology. Karst geology is rock that is characterized by dissolved openings in the underground limestone, caves, sinkholes, and springs (2). Because of the combination of information about the reported health problems, the nearby hazardous waste sites, and the karst geology, MDNR collected samples of drinking water from private wells in Cliff Village.

At the Newton County Well site, which is located 3 miles west of Cliff Village, DHSS discovered TCE in 1991 at levels above EPA's Maximum Contaminant Level (MCL) in private wells in the community of Silver Creek, and later in Saginaw (2). An MCL is the highest level of a contaminant that EPA allows in public drinking water. Because of the TCE contamination, EPA placed the Newton County Well Site on the National Priority List (NPL). The NPL is

EPA's list of the most serious uncontrolled or abandoned hazardous waste sites identified for possible long-term cleanup. Residents of Silver Creek and Saginaw were provided with public drinking water to eliminate exposure to the TCE contaminated groundwater (2). Groundwater sampling by EPA has shown that the TCE plume (a spreading area of contamination) has migrated south from the Newton County Wells Site through Silver Creek and Saginaw. Since the Newton County Wells Site is west of Cliff Village and the TCE plume is migrating directly south, that site is not expected to have an effect on the Cliff Village area (2,4).

TCE is a manufactured volatile organic compound (VOC) that evaporates easily in air, but stays in soil and water without much decomposition. Because TCE is heavier than water it can pass easily through the soil and into the groundwater. TCE is used mainly as a solvent to remove grease from metal parts, but can also be found in household products such as wood stains, varnishes, lubricants, adhesives, typewriter correction fluid, paint removers, and cleaners.

The Tri-State Mining District is a historic lead and zinc mining area covering portions of southwest Missouri, southeast Kansas and northeast Oklahoma. In Missouri, the Tri-State Mining District covers parts of Newton and Jasper counties. Elevated cadmium and lead concentrations have been found in groundwater in some portions of the district. Cadmium generally occurs naturally with the lead and zinc deposits. Surface deposits of mining waste (tailing and chat), containing elevated levels of lead, zinc, and cadmium, are present throughout the district. According to historical mining maps, the nearest mined area to Cliff Village is the Leadwood Prospects, which is located approximately one-half mile east of Cliff Village (5).

As explained previously, the Cliff Village area has karst geology, which typically has caves, losing streams (streams that contribute to groundwater), and springs. The combination of karst geology and underground mining in the region can create pathways for the unusual or unexpected movement of groundwater.

Water Sampling

To address resident's health and environmental concerns, MDNR conducted a pre-CERCLIS Site Screening Investigation (2). A pre-CERCLIS Site Screening investigation is an investigation done to determine if there is sufficient contamination to warrant listing in EPA's CERCLIS database. CERCLIS is a national database, which contains information on hazardous waste site assessment and remediation. As part of the site screening, 10 private residential wells of the approximately 15 private residential wells in the community were sampled in March 2003. Permission to sample the remaining private wells was not obtained. The samples were analyzed for 62 VOCs, total metals (e.g. lead, cadmium, and zinc), and physical properties (e.g. pH, turbidity, temperature). Two of these residential well samples were also analyzed for "priority pollutants." A priority pollutant scan includes pesticides/herbicides, polychlorinated biphenyls (PCBs), semi-volatile organic compounds, and 10 additional metals. The additional metals were: antimony, arsenic, beryllium, chromium, copper, mercury, nickel, selenium, silver, and thallium (2).

TCE was detected in one well at 0.85 parts per billion (ppb), which is below EPA's MCL of 5 ppb for public drinking water. EPA does not regulate private well water, but their standards (including MCLs) are used for comparison values in this document. No other VOCs or priority pollutants were detected in well water from Cliff Village. Metal concentrations were either not detected or below public drinking water standards.

Because TCE was detected in the one private well, MDNR requested that DHSS conduct two quarterly rounds of sampling of that private well and provide a health consultation concerning the reported ill health effects. Follow-up testing was done by DHSS to determine if the detected TCE was consistently present in the well and if any trend related to TCE levels could be determined (6).

DHSS and Newton County Health Department personnel collected private well water samples and interviewed residents of Cliff Village in December 2003. When access was available, water samples were taken from the faucet where the resident actually used the water. DHSS resampled the original 10 private wells sampled by MDNR in March 2003 and an additional 3 private wells. Water samples from the private wells were analyzed for metals (cadmium, lead, zinc, and arsenic), nitrate-N, and for total coliform and E. coli bacteria. Water from two wells--the well that originally showed TCE and a well on an adjacent property--was submitted by DHSS to a contracted laboratory for a complete VOC scan.

Results of the well water analysis showed that with the exception of one sample, levels of cadmium, lead, zinc, arsenic, and nitrate-N were within public drinking water standards. The one sample that did not meet public drinking water standards was for lead at 0.017 parts per million (ppm). This is slightly above EPA's action level for public drinking water of 0.015 ppm. EPA's action level is a level of contaminant concentration where EPA first considers taking action to have the lead concentration reduced in public water systems. The residence from which this sample came had not been sampled previously. The sample was taken from an outside household faucet and the lead level could have been affected by lead in the household plumbing. TCE was again detected in the original well at 2.0 ppb (original test 0.85 ppb), but below the MCL for TCE of 5 ppb. TCE was not detected in the adjacent private well water. Of the 13 private wells sampled, three were found to have total coliform bacteria present that made them unsatisfactory for drinking water purposes. The Newton County Health Department followed up with the owners of these three private wells to help them correct the bacterial contamination problem with chlorination.

The second quarterly follow-up of VOC sampling was conducted in March 2004, and consisted of sampling the well where TCE was first detected and two additional nearby private wells, one of which had been chlorinated to correct total coliform problems. Water samples from these three wells were analyzed for 61 VOCs as in the previous sampling. The additional well, which had not been previously sampled, was also tested for bacteria, nitrate-N, and metals. VOCs, including TCE, were all below the laboratory detection limit, with the exception of the well that had been chlorinated. The VOCs that were detected are byproducts of the chlorination of that well. The VOC levels were below public drinking water standards and the VOCs should disperse in a short period of time through normal usage of the well.

Resident Interviews

During the December 2003 water sampling, available residents were interviewed about health concerns, members of households, and housing, and comments were solicited. The majority of residents expressed no health concerns, but some did express concern about past illnesses such as cancer deaths in the family or at the residence. Present day concerns were about sick or dying animals. At one residence where animals have died, the animals were dogs that reportedly did not venture outside of the fenced yard. Questions were asked about other sources of pollution or poisons to which animals might be exposed, but nothing could be determined as a cause for the animals' bad health or death. Another resident also expressed concern about sick animals. This resident also had a fenced yard, but the animals seemed less contained and were allowed to roam farther, creating the potential for a wider range of exposure to things that could cause health problems.

During an interview between DHSS and a resident, the resident mentioned that he remembered a machine shop in the area that was suspected to have cut metal. In a later conversation between DHSS and the MDNR investigator who had completed the pre-CERCLIS investigation, he mentioned that he had not been made aware of, nor discovered the machine shop. Because of this new information, it is unlikely that the shop or its processes have been investigated.

DISCUSSION

Because of some resident's concern that their private well water may be causing health problems in humans and animals, MDNR sampled the majority of private wells in the village in March 2003. Analysis of the ten private well water samples found TCE in one private well. The TCE level was below EPA's MCL. However, because TCE is present in groundwater at another site in the area, MDNR requested that DHSS conduct two quarterly follow-up sampling for VOCs. The purpose of the additional sampling was to determine whether TCE was present, and if so, whether the concentration of TCE would increase over time.

In December 2003, DHSS conducted the first quarterly follow-up sampling of private well water in Cliff Village. To investigate other possible sources of contamination that could be causing health problems, DHSS's sampling included VOCs, metals, bacteria, and nitrate-N. In March 2004, DHSS conducted the second quarterly sampling for VOCs in the original TCE contaminated well and two nearby private wells.

A total of 14 private residential wells have been sampled at least once by DHSS or MDNR. Of those 14 private wells, nine were sampled twice and two private wells were sampled three times. TCE, lead, nitrate-N, bacteria, and chlorine residue were each detected in at least one private well. TCE was detected in one well in two of the three samples collected. Both detections of TCE were below EPA's MCL. TCE was not detected in the third round of testing. Given the low levels of TCE that were found, we do not expect any health problems to occur from the exposure to TCE below the MCL in that private well.

Lead was detected in only one private well sample, at a concentration slightly above the EPA Action Level. At the detected level, lead is not likely to cause a health problem, but re-sampling is recommended.

Total coliform bacteria were detected in three private wells. The Newton County Health Department worked with these well owners to chlorinate their private wells and remediate possible problems with them. Two of the private wells were resampled after chlorination for bacteria. One of these wells was also sampled for VOCs. At the third private well, the well owner was going to have the well treated by a private company (personal phone conversation with well owner). The bacteria problem has been corrected, but chlorination by-products were detected at low concentrations in the private well tested for VOCs. These concentrations were below drinking water standards and should disperse with normal use of the well. No health problems are expected from bacteria unless the bacteria problems reoccur. No problems are expected from the chlorination by-products, as concentrations should decrease with normal well usage. DHSS recommends an annual test for bacteria in private wells.

Children under one year of age and pregnant women are at risk for adverse health effects from nitrate exposure. Exposure to nitrate-N may cause methemoglobinemia (infant cyanosis) or blue baby disease in infants less than 6 months old. Nitrate-N levels were below the recommended 10-ppm health level, so nitrate-N is not a problem at the private wells in Cliff Village (7).

In summary, the reported human and animal health problems cannot be associated with exposure to water from the private wells of the residences of Cliff Village. Information from residential interviews regarding other possible sources of contamination (household and outdoors) that could be affecting the health of humans and animals proved inconclusive.

Children's Health

ATSDR's Child Health Initiative recognizes that the unique vulnerabilities of infants and children demand special emphasis in communities faced with contamination in their environment. Children are at greater risk than adults from certain kinds of exposures to hazardous substances because they drink more water, eat more food, and breathe more air than adults per kilogram of body weight, and they have a larger skin surface in proportion to their body volume. In addition, children may get more contaminated dirt on their hands, and they may ingest some of the dirt if they do not properly wash their hands before eating. They are also shorter than adults and thus are more exposed to dust, soil, and vapors because they are closer to the ground. The developing body systems of children can sustain permanent damage if toxic exposures occur during critical growth stages. Most importantly, children depend completely on adults for risk identification and management decisions, housing decisions, and access to medical care.

DHSS and ATSDR evaluated the likelihood for children to be exposed to contaminants at the Cliff Village Well site. All VOCs and nitrate-N were found to be below appropriate health screening values. Of the 14 private wells sampled, three private wells samples were found to

have bacteria contamination, and one well was slightly above EPA's action level for lead for regulated public water systems. Since the bacteria problems have been corrected and the lead level is only slightly above the EPA lead action level in an seldom used outdoor water tap when sampled, children should be able to safely drink and use the water from private wells in Cliff Village.

CONCLUSIONS

No apparent public health hazard exists for residents of the Cliff Village area using potable water from their private wells that were tested. The category of No Apparent Public Health Hazard is used for sites where human exposure to contaminated media is occurring or has occurred in the past, but the exposure is below a level of health concern. The levels of VOCs, metals, and nitrate-N in all wells analyzed were not detectable or lower than health screening values. The exception was one private well where lead was detected slightly above its action level, so re-sampling should be considered. Total coliform bacteria were found in three private wells but follow-up actions with the Newton County Health Department or resident has eliminated that potential health risk.

Because TCE was detected in two rounds of sampling and not detected in the third, it is still unknown why it was detected, what the source was, and if it will be detected again in the future. A resident did report the possible presence of a machine shop in the area that cut metal in the past and could have used TCE in their process.

RECOMMENDATIONS

1. Conduct annual sampling of private well water for at least two years to determine if TCE reappears and determine whether a trend exists.
2. Residents of Cliff Village should maintain the integrity of their private well and have a bacterial test done on their private wells annually, especially those found with previous bacterial contamination.
3. Residents with homes that have copper plumbing where lead solder was used (pre 1986) should flush their water taps approximately 15 to 30 seconds before using it for drinking or cooking.
4. MDNR should consider conducting a further investigation into the machine shop mentioned by a resident to determine if it may have used TCE as part of its metal cutting process and if it could possibly be a source of the TCE detected earlier in a private well.

PUBLIC HEALTH ACTION PLAN

This Public Health Action Plan (PHAP) for the Cliff Village Well Site contains a description of actions to be taken by the Missouri Department of Health and Senior Services (DHSS), the Agency for Toxic Substances and Disease Registry (ATSDR), and other stakeholders. The purpose of the PHAP is to ensure that this health consultation not only identifies public health hazards, but provides an action plan to mitigate and prevent adverse human health effects resulting from past, present, and future exposures to hazardous substances at or near the site. Below is a list of commitments of public health actions to be implemented by DHSS, ATSDR, or other stakeholders at the site:

Past Activities:

1. DHSS/Newton County Health Department has provided test results and information to residents about their private test results, answered their questions, and has followed up with residents on eliminating bacteriological contamination in their private wells.

Future Activities:

1. DHSS/ATSDR will conduct annual private well water sampling to determine if TCE is present, and if so, if concentrations are increasing over time.
2. DHSS/ATSDR will continue to address community health concerns and questions as they arise and provide necessary community and health professional education.
3. Newton County Health Department will provide bacteria analysis of private well water and assistance as appropriate.

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5. Missouri Department of Natural Resources. Inventory of lands affected by non-coal mining (208 Strategy) with US Geological Survey Quadrangles maps. 1982 December 16.
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7. University of Missouri-Columbia, University Extension. Understanding your Water Test Report. 1993 July.

Certification

This Cliff Village Wells Site Public Health consultation was prepared by the Missouri Department of Health and Senior Services under a cooperative agreement with the federal Agency for Toxic Substances and Disease Registry (ATSDR). It was completed in accordance with approved methodologies and procedures existing at the time the health consultation was initiated. Editorial review was completed by the Cooperative Agreement partner.

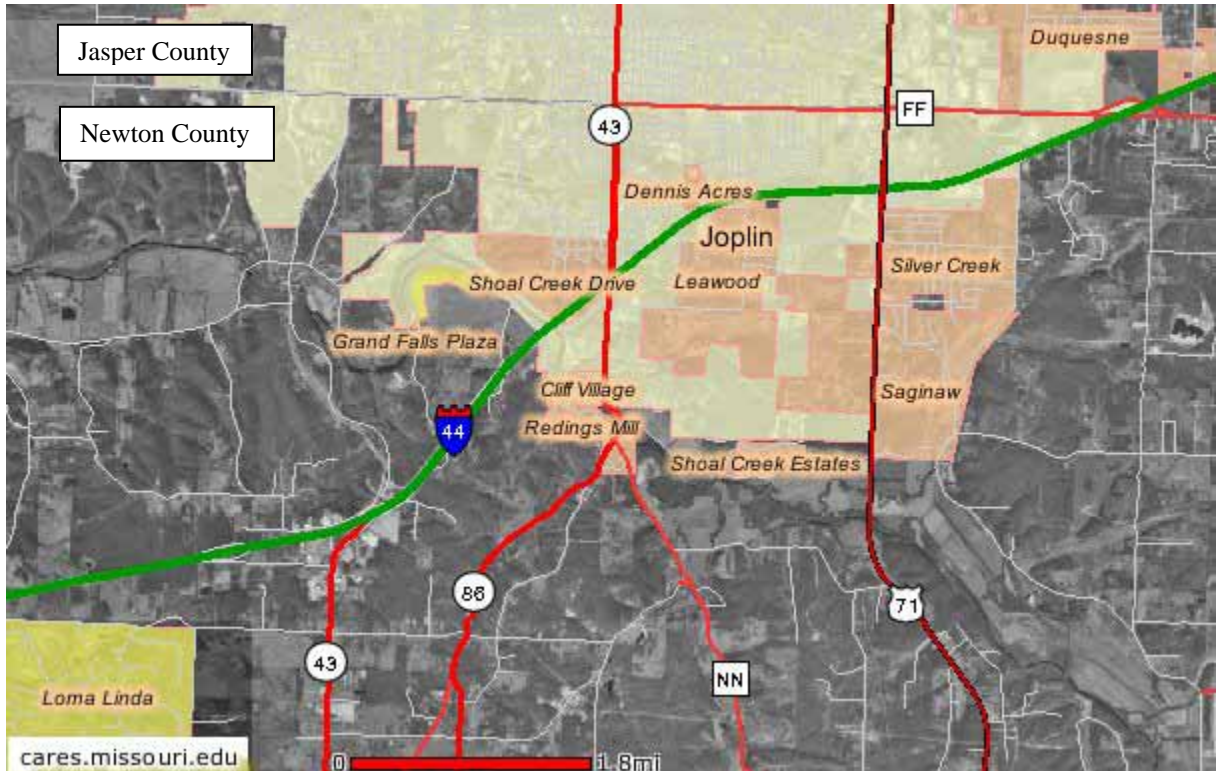
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The Division of Health Assessment and Consultation (DHAC), ATSDR, has reviewed this health consultation and concurs with its findings.

Team Lead, CAT, SPAB, DHAC, ATSDR

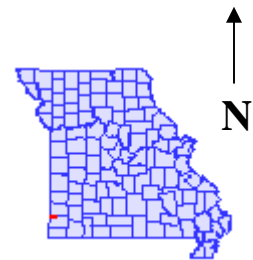
Figure 1

Location of Cliff Village Wells Site
Newton County, Missouri



- Roads and Highways**
- Interstate
 - U.S. Highway
 - State Numbered Highway
 - State Lettered Highway
 - Principal Road
 - Road or Street
 - County Boundaries
 - Incorporated Areas (cont)

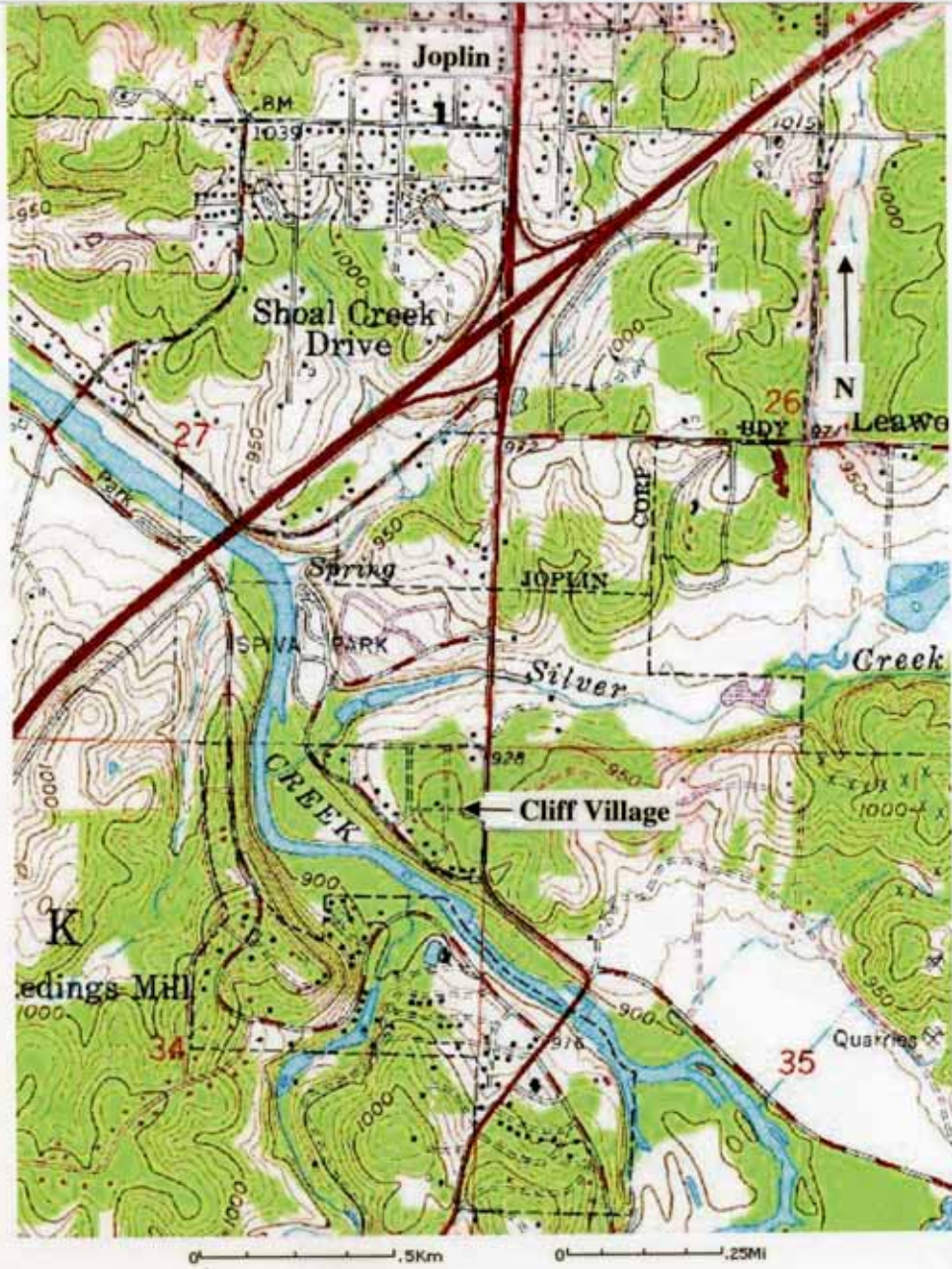
- City
- Town
- Village
- Census Designated Place
- Other
- 1994-2000 Aerial Photo (DOQQs)



Map prepared from:
<http://cares.edu>, 9/15/04

Figure 2

Cliff Village Wells Area Map
Newton County, Missouri



Source: USGS TerraServer Map, Joplin West
Topographic Quadrangle, 1991.