U.S. FISH AND WILDLIFE SERVICE
SPECIES ASSESSMENT AND LISTING PRIORITY ASSIGNMENT FORM

SCIENTIFIC NAME: *Eurycea tonkawae*

COMMON NAME: Jollyville Plateau salamander

LEAD REGION: 2

INFORMATION CURRENT AS OF: April 2010

STATUS/ACTION

___ Species assessment - determined we do not have sufficient information on file to support a proposal to list the species and, therefore, it was not elevated to Candidate status
___ New candidate
**X** Continuing candidate
___ Non-petitioned

**X** Petitioned - Date petition received: June 13, 2005

**X** 90-day positive - FR date: February 13, 2007

**X** 12-month warranted but precluded - FR date: December 13, 2007

___ Did the petition request a reclassification of a listed species?

FOR PETITIONED CANDIDATE SPECIES:

a. Is listing warranted (if yes, see summary of threats below)? **Yes**
b. To date, has publication of a proposal to list been precluded by other higher priority listing actions? **Yes**
c. If the answer to a. and b. is “yes”, provide an explanation of why the action is precluded.

Higher priority listing actions, including court-approved settlements, court-ordered statutory deadlines for petition findings and listing determinations, emergency listing determinations, and responses to litigation, continue to preclude the proposed and final listing rules for Jollyville Plateau salamander. We continue to monitor Jollyville Plateau salamander populations and will change its status or implement an emergency listing if necessary. The “Progress on Revising the Lists” section of the current CNOR ([http://endangered.fws.gov/](http://endangered.fws.gov/)) provides information on listing actions taken during the last 12 months.

___ Listing priority change

Former LP: ___
New LP: ___

Date when the species first became a Candidate (as currently defined): December 13, 2007
___ Candidate removal: Former LPN: ___
   ___ A – Taxon is more abundant or widespread than previously believed or not subject to
   the degree of threats sufficient to warrant issuance of a proposed listing or
   continuance of candidate status.
   ___ U – Taxon not subject to the degree of threats sufficient to warrant issuance of a
   proposed listing or continuance of candidate status due, in part or totally, to
   conservation efforts that remove or reduce the threats to the species.
   ___ F – Range is no longer a U.S. territory.
   ___ I – Insufficient information exists on biological vulnerability and threats to support
   listing.
   ___ M – Taxon mistakenly included in past notice of review.
   ___ N – Taxon does not meet the Act’s definition of “species.”
   ___ X – Taxon believed to be extinct.

ANIMAL/PLANT GROUP AND FAMILY: Amphibian, Family Plethodontidae

HISTORICAL STATES/TERRITORIES/COUNTRIES OF OCCURRENCE: Texas

CURRENT STATES/COUNTIES/TERRITORIES/COUNTRIES OF OCCURRENCE:  Travis
and Williamson counties, Texas

LAND OWNERSHIP:  Many of the known sites for the Jollyville Plateau salamander are on
privately owned land.  A small percentage of the known sites are located on tracts that are
preserved by the City of Austin (COA), Travis County, or The Nature Conservancy.  The
recharge and contributing zones of the Barton Springs Segment of the Edwards Aquifer are a
combination of municipal and private lands.

LEAD REGION CONTACT:  Sarah Quamme, (505) 248-6419, Sarah_Quamme@fws.gov

LEAD FIELD OFFICE CONTACT:  Paige Najvar, 512-490-0057, Paige_Najvar@fws.gov

BIOLOGICAL INFORMATION

Species Description:  The Jollyville Plateau salamander was described by Chippindale et al.
(2000, pp. 1-48), based on morphology and genetic (mitochondrial DNA) tests.  Adults are
typically 1.5 to 2 inches (3.8 to 5 centimeters) long (COA 2001a, p. 5).  Those salamanders
occurring in spring habitat have large, well-developed eyes; wide, yellowish heads; blunt,
rounded snouts; dark greenish-brown bodies; and bright yellowish-orange tails (Chippindale et
morphologies, such as eye reduction, flattening of the head, and dullness or loss of color
(Chippindale et al. 2000, p. 37).

Taxonomy:  The Service has carefully reviewed the available taxonomic information for the
Jollyville Plateau salamander and has reached the conclusion that the species is a valid taxon.  A
taxonomic description of the Jollyville Plateau salamander was published by Chippindale et al.
(2000, pp. 1-48).  Chippindale et al. (2000, pp. 36-37) also suggested that additional salamander
species may occur in the geographic region known to be occupied by the Jollyville Plateau salamander, especially given the occurrence of morphologically divergent subterranean salamander populations in the Buttercup Creek drainage of southern Williamson County, Texas. Recent genetic analysis suggests a major taxonomic split within this species that appears to correspond to major geologic and topographic features of the region (Chippindale 2008, p. 5). However, these are preliminary results representing only a small fraction of collected data. The Service expects to receive more conclusive results by 2011.

**Habitat/Life History:** The Jollyville Plateau salamander’s spring-fed habitat is typically characterized by a depth of less than 1 foot (0.3 meters) of cool, well oxygenated water (COA 2001a, p. 128; Bowles *et al.* 2006, p. 118) supplied by the underlying Northern Segment of the Edwards Aquifer (Cole 1995, p. 33). Jollyville Plateau salamanders are typically found near springs or seep outflows and are thought to require constant temperatures (Sweet 1982, pp. 433-434; Bowles *et al.* 2006, p. 117). Salamander densities are higher in pools and riffles and in areas with rubble, cobble, or boulder substrates rather than on solid bedrock (COA 2001a, p. 128; Bowles *et al.* 2006, pp. 114-116).

Surface-dwelling Jollyville Plateau salamanders also occur in subsurface habitat within the underground aquifer (COA 2001a, p. 65; Bowles *et al.* 2006, p. 118). While no one has physically observed these salamanders in the aquifer, there are observations that support this behavior. For example, COA biologists have observed Jollyville Plateau salamanders at spring sites where the springs and associated spring runs had previously ceased flowing, particularly during the 2006 drought, and the surrounding area dried (COA 2006, pp. 5-6). Additionally, COA biologists have noted low counts for small juveniles followed by high counts for large (presumably older) juveniles at several monitoring sites, indicating small juveniles spent time within the subsurface habitat (COA 2001a, pp. 65-66).

This salamander species is a neotenic (does not transform into a terrestrial form) member of the family Plethodontidae. As neotenic salamanders, they retain external gills and inhabit aquatic habitats (springs, spring-runs, and wet caves) throughout their lives (COA 2001a, p. 3).

**Historical and Current Range/Distribution:** The Jollyville Plateau salamander occurs in the Jollyville Plateau and Brushy Creek areas of Travis and Williamson counties, Texas (Chippindale *et al.* 2000, pp. 35-36; Bowles *et al.* 2006, p. 112; Sweet 1982, p. 433). Upon classification as a species, Jollyville Plateau salamanders were known from Brushy Creek and, within the Jollyville Plateau, from Bull Creek, Cypress Creek, Long Hollow Creek, Shoal Creek, and Walnut Creek drainages (Chippindale *et al.* 2000, p. 36). Since it was described, the Jollyville Plateau salamander has also been documented within the Lake Creek drainage (COA 2006, p. 1).

Cave dwelling Jollyville Plateau salamanders are known from one cave in the Cypress Creek drainage and 12 caves in the Buttercup Creek cave system in the Brushy Creek drainage (Chippindale *et al.* 2000, p. 49; Russell 1993, p. 21; Service 1999, p. 6; HNTB 2005, p. 60).

**Population Estimates/Status:** COA survey data indicate that 4 of the 9 sites that were regularly monitored by COA staff between December 1996 and January 2007 (10 years) had statistically
significant declines in salamander abundance over those 10 years (COA 2006, p. 4). The average number of salamanders counted at these four sites declined from 27 salamanders counted during surveys from 1996 to 1999 to 4 salamanders counted during surveys from 2004 to 2007. The COA reports that these declines are related to degraded water quality from urban development in the contributing watersheds of the monitoring sites (COA 2006, p. 48).

In 2007, monthly mark-recapture surveys were conducted in concert with surface counts at three sites in the Bull Creek watershed over a 6 to 8-month period to obtain surface population size estimates and detection probabilities for each site (O’Donnell et al. 2008, p. 1, p. 3). COA personnel observed that most of the Jollyville Plateau monitoring sites that were monitored in 2007 still had “relatively pristine” habitat conditions (O’Donnell et al. 2008, p. 20), but varied in the amount and extent of suitable cover (i.e., loose rocks and other substrates) (O’Donnell et al. 2008, p. 35). Survey data were analyzed at three mark-recapture sites (Lanier Spring, Lower Rieblin, and Wheless Spring). Estimated surface population sizes within each site also varied month to month (O’Donnell et al. 2008, p. 34). Surface populations estimates at Lanier Spring varied from 94 to 249, surface population estimates at the Lower Rieblin site varied from 78 to 126, and surface population estimates at Wheless Spring varied from 186 to 1023 (O’Donnell et al. 2008, p. 34).

THREATS

We have no new information as of April 2010 regarding threats to the species.

A. The present or threatened destruction, modification, or curtailment of its habitat or range. Water quality degradation: The range of the Jollyville Plateau salamander is limited to northwest Travis County and southwest Williamson County, Texas, an area of rapid human population growth. As development increases, more opportunities exist for the chronic, long-term introduction of non-point source pollutants into the environments. For example, the ongoing application of pesticides and fertilizers to lawns is a constant source of pollutants (Menzer and Nelson 1980, pp. 663, 637-652). Petroleum products are also inherent components of urban environments from automobile operation and maintenance (Van Metre et al. 2000, p. 4069). During rain events, these chemical pollutants, which accumulate in soils and on impervious surfaces (such as roofs, parking lots, and roads) during dry periods, are transported by water downstream into areas where salamanders occur. This process can occur either through direct surface water runoff or through infiltration into groundwater that later discharges through springs (Schram 1995, p. 91). Elevated mobilization of sediment (soils of sand, silt, or clay) also occurs as a result of increased velocity of water running off impervious surfaces in the urban environment (Schram 1995, p. 88; Arnold and Gibbons 1996, pp. 244-245). Increased rates of storm water runoff cause erosion by scouring in headwater areas and sediment deposition in downstream channels (Booth 1991, pp. 93, 102-105; Schram 1995, p. 88).

Acute short-term increases in pollutants, particularly sediments, can occur during construction of new development. When vegetation is removed and rain falls on unprotected soils, large discharges of suspended sediments result and can have immediate effects of increased sedimentation in downstream drainage channels (Schueler 1987, p. 1.4; COA 2003, p. 24).
A number of point-sources of pollutants exist in the range of the salamander and result in accidental discharges from utility structures such as storage tanks or pipelines (particularly gas and sewer lines). Leaking underground storage tanks have been documented as a problem within the salamander’s range (COA 2001a, p. 16). Sewage spills from pipelines have been documented in watersheds supporting the salamander (COA 2001a, pp. 16, 21, 74). As an example, a sewage line overflowed an estimated 50,000 gallons (190,000 liters) of raw sewage into the Stillhouse Hollow drainage area of Bull Creek (COA 2007a, pp. 1-3). The location of the spill was a short distance downstream of currently known salamander locations, but no salamanders were thought to be affected.

As early as 1995, water quality deterioration, including increases in nutrient levels as a product of urban development, was cited for the Bull Creek watershed, where half of the drainage areas with Jollyville Plateau salamanders occur (Schram 1995, p. 87). The pollutants considered most problematic in Jollyville Plateau salamander habitats (discussed in more detail below) include sediments, ions (such as chlorides and sulfates) and dissolved solids (as measured by conductivity), nutrients (particularly nitrates and ammonia), and petroleum compounds (primarily polycyclic aromatic hydrocarbons). Other pollutants such as heavy metals are also possible sources causing water quality degradation from urban runoff, but have not been documented as elevated in the salamander’s habitat.

Amphibians, especially their eggs and larvae (which are usually restricted to a small area within an aquatic environment), are sensitive to many different aquatic pollutants (Harfenist et al. 1989, pp. 4-57). Contaminants found in aquatic pollutants may interfere with a salamander’s ability to develop, grow, or reproduce (Burton and Ingersoll 1994, pp. 120, 125). In addition, macroinvertebrates, such as small freshwater crustaceans, that the Jollyville Plateau salamander feeds on are especially sensitive to water pollution (Phipps et al. 1995, p. 282; Miller et al. 2007, p. 74). Studies in the Bull Creek watershed found a loss of some sensitive macroinvertebrate species, potentially due to nutrient enrichment and sediment accumulation (COA 2001b, p. 15).

Excess sedimentation is a form of water pollution found in Jollyville Plateau salamander habitats (COA 2006, p. 46). Sediments are mixtures of silt, sand, clay, and organic debris, which are washed into streams or aquifers during storm events. Sediments are either deposited into layers or become suspended in the water column (Ford and Williams 1989, p. 537; Mahler and Lynch 1999, p. 13). Sediment derived from soil erosion has been cited by Menzer and Nelson (1980, p. 632) as the greatest single source of pollution of surface waters by volume. Due to high organic carbon content, sediments eroded from contaminated soil surfaces can concentrate and transport contaminants (Mahler and Lynch 1999, p. 1). Sediment can affect aquatic organisms in a number of ways. Sediments suspended in water can clog gill structures, which impairs breathing of aquatic organisms, and can reduce their ability to avoid predators or locate food sources due to decreased visibility (Schueler 1987, p. 1.5).

Excessive deposition of sediment in streams will physically reduce the amount of available habitat and protective cover for aquatic organisms, by filling the interstitial spaces of larger substrates (such as gravel and rocks) surrounding the spring outlets that offer protective cover and an abundant supply of well-oxygenated water for respiration. As an example, a California study found that densities of two salamander species were significantly lower in streams that
experienced a large infusion of sediment from road construction after a storm event (Welsh and Ollivier 1998, pp. 1,118-1,132). The vulnerability of the salamander species in this California study was attributed to their reliance on interstitial spaces in the streambed habitats (Welsh and Ollivier 1998, p. 1128). The loss of interstitial spaces in stream substrates can be measured as the percent embeddedness. Embeddedness reflects the degree to which rocks (which provide cover for salamanders) are surrounded or covered by fine sediment. Increased sedimentation from urban development is a major water quality threat to the Jollyville Plateau salamander because it fills interstitial spaces and eliminates resting places and also reduces habitat of its prey base (small aquatic invertebrates) (COA 2006, p. 34).

Excess sedimentation may have contributed to declines in Jollyville Plateau salamander populations in the past. The COA monitoring found that, as sediment deposition increased at several monitoring sites, salamander abundances significantly decreased (COA 2001a, pp. 101, 126). As an example, the COA found that sediment deposition and embeddedness estimates have increased significantly along one of the long-term monitoring sites (Tributary 5) as a result of construction activities upstream (COA 2006, p. 34). This site has had significant declines in salamander abundance, based on 10 years of monitoring, and COA attributes this decline to the increases in sedimentation (COA 2006, pp. 34-35). The location of this monitoring site is within a large preserved tract. However, the headwaters of this drainage are outside the preserve and the development in this area increased sedimentation downstream and impacted salamander habitats.

One practical measure of water quality in freshwater springs, such as those where the Jollyville Plateau salamanders occur, is conductivity. Conductivity is a measure of the specific conductance in water and can be used to approximate salinity in terrestrial and aquatic environments. Water salinity reflects the concentration of dissolved inorganic solids (that is, salts such as chlorides or sulfates) in water that can affect the internal water balance in aquatic organisms. As ion concentrations such as chlorides, sodium, sulfates, and nitrates rise, conductivity will increase. These compounds are the chemical products, or byproducts, of many common pollutants that originate from urban environments as fertilizers and pesticides (Menzer and Nelson 1980, p. 633).

Measurements by the COA between 1997 and 2006 found that conductivity averaged between 550 and 650 microsiemens per centimeter (μS/cm) at rural springs with low or no development and averaged between 900 and 1000 μS/cm at monitoring sites in watersheds with urban development (COA 2006, p. 37). These results indicate that developed watersheds contribute to higher levels of water pollution in habitats of the Jollyville Plateau salamander.

High conductivity has been associated with declining salamander abundance. For example, 3 of the 4 sites with statistically significant declining salamander abundance over the last 10 years are cited as having high conductivity readings (COA 2006, p. 37). Similar correlations were shown in studies comparing developed and undeveloped sites from 1996 to 1998 (Bowles et al. 2006, pp. 117-118). This analysis found significantly lower numbers of salamanders and significantly higher measures of specific conductance at developed sites as compared to undeveloped sites (Bowles et al. 2006, pp. 117-118). However, developed sites also had a higher proportion of bedrock substrate, which is not used by salamanders and may have also contributed to the results
of lower salamanders in this study. Poor water quality, as measured by high specific conductance and elevated levels of ion concentrations, is cited as one of the likely factors leading to the statistically significant declines in salamander abundance at COA long-term monitoring sites (COA 2006, p. 46).

Excessive nutrient input to Jollyville Plateau salamander habitat is another form of pollution. Sources of excessive nutrients (elements or compounds, such as phosphorus or nitrogen, that fuel abnormally high organic growth in aquatic ecosystems) in water include human and animal wastes, municipal sewage treatment systems, decaying plant material, and fertilizers used on croplands (Garner and Mahler 2007, p. 29). Excessive nutrient levels typically cause algal blooms that ultimately die back and cause progressive decreases in dissolved oxygen concentration in the water from decomposition (Schueler 1987, pp. 1.5-1.6). Increased nitrate levels, which are often associated with fertilizer use, have been known to affect amphibians by altering feeding activity and by causing disequilibrium and physical abnormalities in individuals (Marco et al. 1999, p. 2837). Elevated nutrient levels, particularly nitrogen in the forms of nitrates and ammonia, have been documented by the COA in both surface water (COA 2006, p. 37) and groundwater (COA 2001a, pp. 54-56) at several salamander locations with high levels of development.

Water quality monitoring in streams occupied by the Jollyville Plateau salamander has shown that, overall, streams with developed watersheds have statistically significant higher levels of pollutants compared with rural watersheds (COA 2001a, p. 59). The COA defines rural sites as streams draining watersheds with less than 10 percent impervious cover; developed sites had impervious cover greater than 10 percent (COA 2001a, p. 12). Similar analysis of samples from seven springs also found water quality measures of pollutants in groundwater to be significantly higher in developed sites compared to rural sites (COA 2001a, pp. 54-56). Developed tributary streams also experienced significantly lower mean adult and juvenile Jollyville Plateau salamander abundances per square meter of wetted surface when compared to undeveloped tributary streams (COA 2001a, p. 99).

An assessment of water quality trends also found that sodium significantly increased between 1997 and 2006 at one site and conductivity significantly increased at three other sites (COA 2006, p. 29). The drainage areas to each of these sites have high levels of urban development (COA 2001a, pp. 29-33; COA 2006, pp. 3, 46).

Poor water quality, particularly elevated nitrates, may also be a cause of morphological deformities in individual Jollyville Plateau salamanders. The COA has documented very high concentrations of nitrates (averaging over 6 milligram per liter [mg/L]) with some samples exceeding 10 mg/L) and high conductivity at two monitoring sites in the Stillhouse Hollow drainage area (COA 2006, pp. 26, 37). For comparison, nitrate concentrations in undeveloped Edwards Aquifer springs (watersheds without high levels of urbanization) are typically close to 1 mg/L (COA 2006, p. 26). Salamanders observed at the Stillhouse Hollow monitoring sites have shown high incidences of deformities, such as curved spines, missing eyes, missing limbs or digits, and eye injuries (COA 2006, p. 26). The Stillhouse Hollow location was also cited as having the highest observation of dead salamanders (COA 2001a, p. 88). Although no statistical correlations were found between the number of deformities and nitrate concentrations (COA
environmental toxins are the suspected cause of salamander deformities (COA 2006, p. 25). Nitrate toxicity studies have indicated that salamanders and other amphibians are sensitive to these pollutants (Marco et al. 1999, p. 2837).

In an effort to reduce the high nitrate levels within the Stillhouse Hollow drainage, COA staff have been working with community residents upstream of Stillhouse Hollow and Barrow Springs in efforts to improve water quality at the spring (COA 2007b, p. 38). The goal of the conservation program, which started in 2001, is to educate more than 250 residents on environmentally appropriate fertilizer use. While the program has resulted in changes to fertilizer use in the targeted community, there have been no changes in water quality detected to date as a result of these efforts (COA 2007b, p. 40).

Polycyclic aromatic hydrocarbons (PAHs) are another form of aquatic pollution that may be affecting Jollyville Plateau salamanders, their habitat, or their prey. PAHs can originate from petroleum products, such as oil or grease, or from atmospheric deposition from the byproducts of combustion (for example, vehicular combustion). These pollutants are widespread and can contaminate water supplies through sewage effluents, urban and highway runoff, and chronic leakage or acute spills of petroleum and petroleum products from pipelines (Van Metre et al. 2000, p. 4067; Albers 2003, pp. 345-346). Petroleum and petroleum byproducts can adversely affect living organisms by causing direct toxic action, altering water chemistry, reducing light, and decreasing food availability (Albers 2003, p. 349). PAH exposure can cause impaired reproduction, reduced growth and development, and tumors or cancer in species of amphibians, reptiles, and other organisms (Albers 2003, p. 354). PAHs are also known to cause death, reduced survival, altered physiological function, inhibited reproduction, and changes in species populations and community composition of freshwater invertebrates (Albers 2003, p. 352).

Limited sampling by the COA has detected PAHs at concentrations of concern at three sites in the range of the Jollyville Plateau salamander. Most notable were the elevated levels of nine different PAH compounds at the Spicewood Springs site in the Shoal Creek drainage area (COA 2005, pp. 16-17). This is also one of the sites where salamanders have shown a significant decline in abundance during the COA long-term monitoring studies (COA 2006, p.47).

Human population growth and urbanization within Travis and Williamson counties, Texas continue to increase rapidly. Urbanization can dramatically alter the hydrologic regime and water quality of watershed drainages (Klein 1979, p. 959; Bannerman et al. 1993, pp. 251-254, 256-258; Center for Watershed Protection 2003, p. 91). The known range of the Jollyville Plateau salamander is entirely located within the Jollyville Plateau and Brushy Creek areas of the Edwards Plateau in Travis and Williamson counties, Texas. Therefore, we consider the destruction or modification of habitat due to acute or chronic water quality degradation in the Northern Segment of the Edwards Aquifer to be a threat to the Jollyville Plateau salamander now and in the foreseeable future.

Water quantity and spring flow declines: The northern segment of the Edwards Aquifer is the primary supply of water for Jollyville Plateau salamander habitat (Cole 1995, p. 33). In general, the aquifer has been described as localized, small, and highly susceptible to pollution, drying, or draining (Chippendale et al. 2000, p. 36). The portion of the Edwards Aquifer underlying the
Jollyville Plateau is relatively shallow, with a high elevation, thus being likely to not sustain spring flows during periods of drought (Cole 1995, pp. 26-27). Increased urbanization in the watershed has been cited as one factor, in combination with drought, causing declines in spring flows (COA 2006, pp. 46-47). This could occur because of the inability of the watershed to allow slow filtration of water through soils following rain events. Instead rainfall runs off impervious surfaces and into stream channels at higher rates, increasing downstream flows and decreasing groundwater recharge (Miller et al. 2007, p. 74).

We found no specific evidence that aquifer declines or spring flow losses have occurred as a result of urbanization or the direct use of aquifer water by pumping (TWDB 2003, p. 32). Predictions of future groundwater use in this area suggest a large drop in pumping as municipalities convert from groundwater to surface water supplies (TWDB 2003, p. 65). However, field studies have shown that a number of springs that support Jollyville Plateau salamanders have already gone dry periodically and that spring waters resurface following rain events (COA 2006, p. 46-47).

Future climate change could affect water quantity and spring flow for this aquatic species. According to the Intergovernmental Panel on Climate Change (IPCC 2007, p. 1), “warming of the climate system is unequivocal, as is now evident from observations of increases in global averages of air and ocean temperatures, widespread melting of snow and ice, and rising global average sea level.” Localized projections suggest the southwest United States may experience the greatest temperature increase of any area in the lower 48 states (IPCC 2007, p. 8), with warming increases in southwestern states greatest in the summer. The IPCC also predicts hot extremes, heat waves, and heavy precipitation will increase in frequency (IPCC 2007, p. 8).

Effects from climate change on aquifer-dependant species can be difficult to assess. This is because (1) there is little data available to correlate groundwater trends and climate change and (2) groundwater typically represents an integration of past climatic conditions over many years due to its time within an aquifer system (Mace and Wade 2008, p. 657). Although recharge, pumping, natural discharge, and saline intrusion of groundwater systems could be affected by climate change (Mace and Wade 2008, p. 657), we lack sufficient information to know how climate change will affect spring flows within Jollyville Plateau salamander habitat. The Service will continue to investigate this matter as new information becomes available in future years.

Although water quantity decreases and spring flow declines are cited as a threat to the Jollyville Plateau salamander (Bowles et al. 2006, p. 111), we did not find evidence that salamander habitats and populations are being substantially affected by lack of sufficient water quantity. Jollyville Plateau salamanders apparently spend some part of their life history in underground aquatic habitats and have the ability to retreat underground when surface flows decline. For example, one of the City of Austin monitoring sites where the salamanders are most abundant undergoes periods where there is no surface water for habitat use by the salamander (COA 2006, p. 47). Drying spring habitats can result in stranding salamanders, resulting in death of individuals (COA 2006, p. 16).

In summary, the intensity and exposure of water quantity threats posed by potential declining aquifer levels and loss of spring flow to the Jollyville Plateau salamander appear to be relatively
low. This is because the aquifer is not currently used to a large extent as a water source for human use, and it is unlikely that it will be in the future. Also, we do not have substantial evidence that declining water quantity is resulting in a negative response by the salamander. However, continued future development, which increases runoff and decreases aquifer recharge, and the potential use of water from the northern segment of the Edwards Aquifer may cause significant threats to the species’ existence in the future.

B. Overutilization for commercial, recreational, scientific, or educational purposes.
We are not aware of any information regarding overutilization of Jollyville Plateau salamanders for commercial, recreational, scientific, or educational purposes and do not consider this a significant factor affecting this species (i.e., a threat) now or in the foreseeable future.

C. Disease or predation.
COA found Jollyville Plateau salamander abundances were negatively correlated with the abundance of predatory centrarchid fish (carnivorous freshwater fish belonging to the sunfish family), such as black bass (*Micropterus* spp.) or sunfish (*Lepomis* spp.) (COA 2001a, p. 102). Predation of a Jollyville Plateau salamander by a centrarchid fish was observed during a May 2006, field survey (COA 2006, p. 38). However, Bowles *et al.* (2006, pp. 117-118) rarely observed these predators in Jollyville Plateau salamander habitat. Jollyville Plateau salamanders have been observed retreating into gravel substrate after cover was moved, suggesting these salamanders display anti-predation behavior (Bowles *et al.* 2006, p. 117). We have no data to indicate whether predation of the Jollyville Plateau salamander may increase in the future or is considered a significant factor affecting the species and therefore a threat.

Chytridiomycosis (Chytrid fungus) is a fungal disease that is responsible for killing amphibians worldwide (Daszak *et al.* 2000, p. 445). The chytrid fungus has been documented on the feet of Jollyville Plateau salamanders (COA 2006, pp. 22-23). However, for unknown reasons, the salamanders are not displaying signs of infection (COA 2006, p. 23); individuals held in captivity tested positive for 7 months, but never displayed symptoms (COA 2006, p. 23). We have no data to indicate whether impacts from this disease may increase or decrease in the future, and therefore, whether it is a significant factor affecting the species (i.e., a threat).

While predation and disease may be affecting Jollyville Plateau salamanders, neither factor is at a level that we consider to be threatening the continued existence of the salamanders now or in the foreseeable future.

D. The inadequacy of existing regulatory mechanisms.
The Jollyville Plateau salamander is not listed on the Texas State List of Threatened or Endangered Species (Texas Parks and Wildlife Department (TPWD) 2010, pp. 2-3). Therefore it is receiving no direct protection from the State. Under authority of the Texas Administrative Code (Title 30, Chapter 213), the Texas Commission on Environmental Quality (TCEQ) regulates activities having the potential for polluting the Edwards Aquifer and hydrologically connected surface streams. However, less than half of the known Jollyville Plateau salamander locations occur within those portions of the Edwards Aquifer regulated by TCEQ; therefore, many do not benefit from these protections (TCEQ 2001, p. 1). For those Jollyville salamander locations that are covered by the TCEQ regulations, the regulations do not address land use,
impermvious cover limitations, non-point source pollution, or application of fertilizers and pesticides over the recharge zone (30 TAC 213.3). We are unaware of any water quality ordinances more restrictive than TCEQ in Williamson County or in Travis County outside the COA.

The COA’s water quality ordinances (COA Code, Title 25, Chapter 8) provide some water quality regulatory protection to the salamander’s habitat within Travis County; however, based on water quality monitoring, they are not effective at reducing nutrient levels. In addition, Title 7, Chapter 245 of the Texas Local Government Code permits “grandfathering” of State regulations. Grandfathering allows developments to be exempted from new requirements for water quality controls and impervious cover limits if the developments were planned prior to the implementation of such regulations. However, these developments are still obligated to comply with regulations that were applicable at the time when project applications for development were first filed (Title 7, Chapter 245 of the Texas Local Government Code p. 1). Unpublished data (2007) provided by COA indicate that up to 26 percent of undeveloped areas within watersheds draining to Jollyville Plateau salamander habitat may be exempted from current water quality control requirements due to “grandfathering” legislation.

There are several other listed karst invertebrate and bird species that occur within the range of the Jollyville Plateau salamander. Land has been preserved through the Balcones Canyonlands Preserve (BCP) for listed karst invertebrates within the range of the salamander. Such land acquisition provides some water quality benefits for the salamander by conserving lands that are within the contributing watersheds for this species.

Data indicate that water quality degradation in streams occupied by Jollyville Plateau salamanders continues to occur despite the existence of current regulatory mechanisms in place to protect water quality (COA 2006, p. 29). Therefore, we conclude that the protections from the existing regulatory mechanisms are not adequate to limit or alleviate the threats to the Jollyville Plateau salamander.

E. Other natural or manmade factors affecting its continued existence.

We are not aware of any information regarding other natural or manmade factors affecting the Jollyville Plateau salamanders’ continued existence. Therefore, we have determined that there are no other natural or manmade factors significantly affecting this species now or in the foreseeable future that constitutes a threat to the Jollyville Plateau salamander.

CONSERVATION MEASURES PLANNED OR IMPLEMENTED: The BCP offers some water quality benefits to the Jollyville Plateau salamander in portions of the Bull Creek, Brushy Creek, Cypress Creek, and Long Hollow Creek drainages through preservation of open space (Service 1996a, pp. 2-28, 2-29). The BCP is managed as mitigation lands by the COA, Travis County, or others under the authority of an Endangered Species Act Section 10(a)(1)(B) permit and Habitat Conservation Plan for the protection of endangered birds and karst invertebrates. Although the permit that created the BCP did not include the Jollyville Plateau salamander, the BCP land management strategies provide strong protections for salamander habitats on lands within the preserve. Water quality in salamander sites located within the BCP, however, is influenced by land use practices upstream and outside the BCP preserves. Eight of the nine
COA monitoring sites occupied by the Jollyville Plateau salamander within the BCP are being affected or have been affected by water quality degradation occurring upstream and outside of the preserved tracts (see Factor A for discussion) (COA 2006, pp. 29, 34, 37, 49; COA 1999, pp. 6-11; Travis County 2007, p. 4). Additionally, because Jollyville Plateau salamanders are not a covered species under the permit under which the preserves were established (Service 1996b, pp. 1-10), they receive no specific protections under the BCP permit, such as mitigation to offset impacts from development. The COA is planning to develop a Candidate Conservation Agreement with Assurances for the Jollyville Plateau salamander with the Service in 2010 to further address the conservation needs for this species.

SUMMARY OF THREATS (including reasons for addition or removal from candidacy, if appropriate): The best available information indicates that habitat destruction, in the form of water quality degradation, is occurring in the majority of the range of the Jollyville Plateau salamander, as evidenced by elevated levels of sedimentation, dissolved solids, nutrients, and PAHs documented in salamander habitats within developed watersheds experiencing water quality degradation. The primary threat from water quality stressors is, therefore, at a significant level of exposure and is imminent because detrimental effects are already being manifested. Negative responses by Jollyville Plateau salamanders to habitat degradation from water quality declines include mortalities and deformities of individual salamanders at several sites and significant declines in abundance at four monitoring sites from 1996 to 2007. In addition, sedimentation results in physical loss of available habitat and changes in macroinvertebrate communities, which are the prey (food sources) for the salamander. These habitat modifications are most likely the result of urban development in the drainage areas where salamanders occur. Overall, the information available provides compelling evidence that urban development has led to decreases in water quality caused by higher levels of aquatic pollutants and increased sedimentation in habitats of Jollyville Plateau salamanders. Such habitat destruction or modification (in the form of decreased water quality) has shown to significantly lower salamander abundance.

We find that the Jollyville Plateau salamander is warranted for listing throughout all of its range, and, therefore, find that it is unnecessary to analyze whether it is threatened or endangered in a significant portion of its range.

For species that are being removed from candidate status:

___ Is the removal based in whole or in part on one or more individual conservation efforts that you determined met the standards in the Policy for Evaluation of Conservation Efforts When Making Listing Decisions (PECE)?

RECOMMENDED CONSERVATION MEASURES: The Service recommends developing and implementing comprehensive regional plans to address water quality threats. A plan to protect or enhance water quality should include measures for projects constructed over contributing and recharge zones of the Northern Segment of the Edwards Aquifer. Such measures should include impervious cover limits, buffer zones for streams and other sensitive environmental features, low-impact developments, structural water quality controls and other strategies to reduce pollutant loads. A comprehensive hazardous materials spills plan for the watersheds where the Jollyville Plateau salamander is known to occur should be developed to avoid or contain
potentially catastrophic spills. Land preservation through acquisition, conservation easements, or deed restrictions also can provide permanent protection for water quality and quantity. Programs should be developed to reduce pollutant loading from already existing development and other potential sources of pollutants such as golf courses and transportation infrastructure. Efforts should be made to protect the surface habitat of the salamander. The Barton Springs Salamander Recovery Plan (Service 2005, pp. 2.1-1-2.1-6) outlines conservation measures in more detail. The measures set forth in this recovery plan were developed to protect another aquatic salamander species in the Barton Springs Segment of the Edwards Aquifer, but many of these measures could be applied to the Jollyville Plateau salamander as well. Also, the Jollyville Plateau salamander is a high priority species in the Wildlife Action Plan of Texas (TPWD 2005, p. 748). This may help in securing State funds for both research and recovery efforts for this species.

LISTING PRIORITY

<table>
<thead>
<tr>
<th>Threat</th>
<th>Magnitude</th>
<th>Immediacy</th>
<th>Taxonomy</th>
<th>Priority</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>High</td>
<td>Imminent</td>
<td>Monotypic genus</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Species</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Subspecies/population</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Non-imminent</td>
<td>Monotypic genus</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Species</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Subspecies/population</td>
<td>6</td>
</tr>
<tr>
<td>Moderate to Low</td>
<td>Imminent</td>
<td>Monotypic genus</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Species</td>
<td>8*</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Subspecies/population</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Monotypic genus</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Species</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Subspecies/population</td>
<td>12</td>
<td></td>
</tr>
</tbody>
</table>

Rationale for listing priority number:

Magnitude: Water quality impacts threaten the continued existence of the Jollyville Plateau salamander by altering physical aquatic habitats and the food sources of the salamander, producing negative population responses. Negative responses by the salamander have been documented at both the individual level (mortalities and deformities) and the population level (significant declines in abundance from 1996 to 2007). We find the overall negative response by the salamander to be at a moderate level because deformities and deaths of salamanders have been limited in scope to a few localities and only one location may have experienced an extirpation. Otherwise, the current range of the salamander changed little from the known historic range.
Imminence: The Jollyville Plateau salamander occurs in one of the most rapidly growing regions in the United States. The immediacy of the threats is imminent because impervious cover and developed areas are chronic sources for water quality degradation that are currently occurring and are likely to increase with future urban development in the salamander’s range. Also, the species and its habitat are already being impacted in some areas.

X Have you promptly reviewed all of the information received regarding the species for the purpose of determining whether emergency listing is needed? Yes

Is Emergency Listing Warranted? Emergency listing is not warranted at this time. No information has been received that would indicate threats are likely to extirpate this species before a normal listing process could be conducted.

DESCRIPTION OF MONITORING: The COA initiated long-term monitoring of the Jollyville Plateau salamander in 1997 using traditional surface counts. The COA staff is conducting quarterly surface counts of Jollyville Plateau salamanders at 12 locations throughout the salamander’s range. About once a year, known salamander sites on properties with COA access are visited by COA staff to determine if salamanders are still present and to make observations on habitat conditions. They are also working to identify new locations for the Jollyville Plateau salamander. The COA indicated that these monitoring efforts are ongoing as of March 2010 (Nathan Bendik, COA, pers. comm. 2010).

COORDINATION WITH STATES: In March 2010, the Service contacted Andy Gluesenkamp, State Herpetologist for TPWD by e-mail requesting information on the status of this and other candidate species. In his response to this inquiry, Dr. Gluesenkamp did not provide new information on this species (Andy Gluesenkamp, TPWD, pers. comm. 2010).

Indicate which State(s) did not provide any information or comments: N/A

LITERATURE CITED:


Bendik, N. 2010. Personal communication from Nathan Bendik, City of Austin, to Paige Najvar, Service.


COA (City of Austin). 2007a. Email correspondence with City of Austin staff regarding sewage spill on Stillhouse hollow site. August 29, 2007. 3 pp.


Travis County. 2007. Status of the Jollyville Plateau Salamander (*Eurycea tonkawae*) on Travis County Balcones Canyonlands Preserve tracts. Report by Laura Zebehazy, Travis County, Natural Resources and Environmental Quality Division, 6 pp.


APPROVAL/CONCURRENCE: Lead Regions must obtain written concurrence from all other Regions within the range of the species before recommending changes, including elevations or removals from candidate status and listing priority changes; the Regional Director must approve all such recommendations. The Director must concur on all resubmitted 12-month petition findings, additions or removal of species from candidate status, and listing priority changes.

Approve: [Signature]  
Acting Regional Director, Fish and Wildlife Service

Concur: [Signature]  
Director, Fish and Wildlife Service

Do not concur: [Signature]  
Director, Fish and Wildlife Service

Director's Remarks:

Date of annual review: April 2010
Conducted by: Paige Najvar, Austin Ecological Services Office