



City of Austin

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Watershed Protection Department
P.O. Box 1088, Austin, Texas 78767

January 22, 2016

Ms. Tanya Sommer
U.S. Fish and Wildlife Service
Austin Ecological Services Field Office
10711 Burnet Rd., Suite 200
Austin, Texas 78758
512-490-0057

Dear Ms. Sommer:

Enclosed is the annual report for the 10(a)1(B) permit held by the City of Austin for protection of *Eurycea sosorum* for the year 2015. The report provides a summary of compliance and an assessment of status of both *E. sosorum* and *E. waterlooensis*.

Please do not hesitate to contact me at 512-974-3438 or Nathan Bendik, WPD Environmental Scientist Senior, at 512-974-2040.

Sincerely,

Mike Personett
Assistant Director

MP:nb

CC: Joseph G. Pantalion, P.E., Director , Watershed Protection Department
Nathan Bendik, Environmental Scientist, Watershed Protection Department
U.S.F.W.S., Region 2, Habitat Conservation Plans and Research Permits



MEMORANDUM

TO: Mayor and Council

FROM: Joseph G. Pantalione, P.E., Director *JGP*
Watershed Protection Department

DATE: January 27, 2016

SUBJECT: Annual Report to U.S. Fish and Wildlife Service

In September 2014, the U.S. Fish and Wildlife Service ("Service") amended the City of Austin's Endangered Species Act Section 10(a)(1)(B) Permit and renewed it for a period of 20 years. This permit covers incidental take of the federally protected Barton Springs and Austin Blind salamanders that may occur during operation and maintenance of Barton Springs Pool and the adjacent springs located in Zilker Park (Eliza, Old Mill/Sunken Garden, and Upper Barton springs).

In compliance with the measures set forth in the Habitat Conservation Plan, the Watershed Protection Department (WPD) has submitted to the Service the report for year 2015. This report details the City's compliance with the 45 measures listed in the permit. A requirement of the annual reporting measure in the permit is to provide a copy of the annual report to the City Manager, Mayor and City Council.

If you need additional information, please contact me at (512) 974-3438, or Nathan Bendik, WPD Environmental Scientist Senior, at (512) 974-2040.

Attachments: 10(a)(1)(B) Permit Report

CC: Marc A. Ott, City Manager
Sue Edwards, Assistant City Manager
Mike Personett, Assistant Director, Watershed Protection Department
Tanya Sommer, U.S. Fish and Wildlife Service

Annual Report January, 2015— December, 2015
Endangered Species Act Section 10(a)1(B) Permit for the Incidental Take of the Barton Springs Salamander (*Eurycea sosorum*) and Austin Blind Salamander (*Eurycea waterlooensis*) for the Operation and Maintenance of Barton Springs Pool and Adjacent Springs
Permit # TE 839031-1

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Summary of Compliance

Table 1. Summary of compliance for each HCP measure.

HCP Measure	Compliance Status
<p>6.1.1.1 The City will develop written habitat management plans for each spring site. These plans will include ongoing activities to improve the quality of aquatic habitat and ecosystem health. This includes but is not limited to introduction of native aquatic plants and maintenance of adequate tree canopy cover. Habitat management plans will be provided to the Service for review within one year of permit issue. The City will revise these plans with the written or verbal approval of the Service as necessary.</p>	<p> <input checked="" type="checkbox"/> Full Compliance <input type="checkbox"/> Partial Compliance <input checked="" type="checkbox"/> Measure Completed <input type="checkbox"/> Measure Needs Amendment Notes: Plans were submitted to the Service at the one year anniversary of permit issuance. </p>
<p>6.1.1.2 With the verbal or written approval of the Service, the City will redraw the footprint of protected salamander habitat in Barton Springs Pool (Figure 16) to include more habitat that is and can be maintained as suitable for salamander residence and exclude unsuitable habitat based on monitoring data and habitat condition. The total square footage of protected habitat in Barton Springs Pool will not be less than that delineated in the 1998 Habitat Conservation Plan.</p>	<p> <input checked="" type="checkbox"/> Full Compliance <input type="checkbox"/> Partial Compliance <input checked="" type="checkbox"/> Measure Completed Notes: Figure 16 in HCP delimits the footprint. </p>
<p>6.1.1.3 The City will be responsible for the management of aquatic and riparian habitats of:</p> <ol style="list-style-type: none"> a. Barton Springs Pool and Parthenia Spring (fissures, springs, and Beach habitat; Figure 1), b. Eliza Spring (spring pool, outflow pipe and/or stream; Figure 1), c. Old Mill Spring (spring pool and outflow stream; Figure 1), d. Upper Barton Spring (spring and outflow streams; Figure 1). 	<p> <input checked="" type="checkbox"/> Full Compliance <input type="checkbox"/> Partial Compliance <input type="checkbox"/> Measure Completed Notes: </p>
<p>6.1.1.4 The City will continue improvement and maintenance of suitable substrates in salamander habitat. If replacement of rocky substrate of salamander habitat is necessary, the City may use only limestone gravel or cobble in order to maintain the natural groundwater buffering of karst aquifers.</p>	<p> <input checked="" type="checkbox"/> Full Compliance <input type="checkbox"/> Partial Compliance <input type="checkbox"/> Measure Completed <input type="checkbox"/> Measure Needs Amendment </p>

<p>6.1.1.5 The City will make visual inspections of all protected habitat areas (spring sites when flowing) at least four days a week. City Parks and Recreation Department staff will be present at Barton Springs Pool when it is open and will visually inspect Parthenia Spring daily. Inspections will note any problem conditions such as vandalism, trash, debris, introduction of exotic fish or animals or disturbance of habitat. If problems are discovered, the City will take appropriate action to protect salamanders and their habitat. Appropriate actions may include but are not limited to repairing damage from vandalism, removal of trash, and removal of introduced exotic fish or animals</p>	<p><input checked="" type="checkbox"/> Full Compliance <input type="checkbox"/> Partial Compliance <input checked="" type="checkbox"/> Measure Completed Notes: Staff continues to remove trash and restore substrate to Upper Barton Spring.</p>
<p>6.1.1.6 The City will prohibit the following activities to reduce harassment of <i>Eurycea sosorum</i> and <i>Eurycea waterlooensis</i> and protect associated habitat:</p> <ul style="list-style-type: none"> a. unauthorized, deliberate disturbance of salamander habitat, including substrate, aquatic vegetation, algae, and leaf litter or woody material from terrestrial vegetation, b. unauthorized, deliberate disturbance or alteration of flow regime, c. introduction of non-native flora or fauna into any salamander habitat or Barton Springs Pool, d. unauthorized SCUBA in salamander habitat or Barton Springs Pool. 	<p><input checked="" type="checkbox"/> Full Compliance <input type="checkbox"/> Partial Compliance <input type="checkbox"/> Measure Completed Notes: Upper Barton Spring continues to see disturbances from recreating park visitors who build rock dams and leave trash at the site. New signs will be installed in this area this year to give notice that these practices are prohibited.</p>
<p>6.1.1.7 a. The City will clean salamander habitat as necessary to keep at least the upper 2-3 inches of habitat from becoming embedded with sediment. Easily observable or measurable characteristics of physical habitat (<i>e.g.</i>, embeddedness, sediment depth or percent sediment cover) will be used as benchmarks for determining when to clean.</p> <p>b. All salamander habitats will be cleaned with the spring water of Barton Springs at pressures not to exceed 30 lb/in² at the substrate and/or suspend rocks larger than 4 inches in diameter. Water for cleaning may be obtained by recirculation through submersible pumps, or other methods acceptable to the Service.</p>	<p><input checked="" type="checkbox"/> Full Compliance <input type="checkbox"/> Partial Compliance <input type="checkbox"/> Measure Completed</p>
<p>6.1.1.8 The City may remove woody debris from aquatic habitat if necessary by hand or any methods approved by the Service through verbal or written correspondence. All debris removed from</p>	<p><input checked="" type="checkbox"/> Full Compliance <input type="checkbox"/> Partial Compliance <input type="checkbox"/> Measure Completed</p>

<p>salamander habitat will be visually inspected for salamanders and their prey before and after removal. Live salamanders will be noted and returned to the water. Live prey will be returned to the water as much as is feasible.</p>	
<p>6.1.1.9 Sediment, algae and debris disturbed or collected during routine cleaning of the Pool will not be disposed of in, allowed to settle in, or otherwise adversely affect aquatic habitat.</p>	<p> <input type="checkbox"/> Full Compliance <input checked="" type="checkbox"/> Partial Compliance <input type="checkbox"/> Measure Completed </p> <p>Notes: Despite cleaning, accumulation of excess sediment on beach habitat downstream of the fault zone is an ongoing problem. The presence of the downstream dam reduces the water velocity along substrate such that it is too slow to maintain sediment in suspension. Effective maintenance of this area as suitable salamander habitat requires restoration of a more natural stream-like flow regime. A scientific study examining possible dam modifications that would achieve this flow improvement is a funded project described in the Barton Springs Pool Master Plan: Concepts for Improvement and Preservation. This project has begun and results are expected within 5 years. Furthermore, floods in 2015 resulted in excess sediment buildup in front of the springs in some areas while completely scouring other habitat areas. Remediation of this habitat is ongoing.</p>

<p>6.1.1.10 The City will minimize the detrimental impacts of withdrawal of spring water from Barton Springs Pool for irrigation and aquatic habitat cleaning by taking the following actions. The City will locate the intake for the pump inside Barton Springs Pool against the downstream dam but outside of habitat areas. The intake will be sufficiently baffled to reduce velocities and the likelihood of entrapment of salamanders on intake screens. Water withdrawn from Barton Springs Pool for irrigation will be used in a manner consistent with the other conservation measures of this plan, and irrigation water will not be allowed to runoff from the grounds back into the Pool. Withdrawal of water for irrigation will be limited to no more than 100 gallons/minute (0.2 ft³/s) and no more than 6,006,000 gallons will be withdrawn annually. This amount is equivalent to 0.2% of the total annual discharge from Barton Springs calculated using the lowest ever recorded instantaneous discharge value of 9.6 ft³/s applied for an entire year. Water withdrawn from Barton Springs Pool will be used for irrigation of only areas inside the fence surrounding Barton Springs Pool. The City will observe all watering restrictions applicable under City of Austin regulations when irrigating with water withdrawn from Barton Springs Pool.</p>	<input checked="" type="checkbox"/> Full Compliance <input type="checkbox"/> Partial Compliance <input type="checkbox"/> Measure Completed
<p>6.1.2.1 The City will reduce loadings of petroleum hydrocarbons, heavy metals and sediments to Barton Springs from current development and other activities located within the Barton Springs Zone in areas subject to the City's jurisdiction. This reduction in loadings will be achieved through the measures set out in the City's Stormwater Management Plan as required by the City's Texas Pollutant Discharge Elimination System (TPDES) storm water permit. The City's TPDES Stormwater Management Plan includes specific monitoring and protection measures for the Barton Springs Zone to protect the water quality of Barton Springs.</p>	<input checked="" type="checkbox"/> Full Compliance <input type="checkbox"/> Partial Compliance <input type="checkbox"/> Measure Completed

<p>6.1.2.2 The City will control local surface water runoff around Barton Springs Pool, Eliza Spring, Old Mill Spring, and Upper Barton Spring to the maximum extent practical. Runoff of storm water can carry sediment and potential pollutants directly into Barton Springs Pool and adjacent springs, which could adversely affect aquatic life. Stormwater may be diverted away from Barton Springs Pool or treated using structural best management practices prior to entering Barton Springs Pool. Runoff protection improvement projects will not have adverse effects on salamanders or their habitat. These controls do not include storm water runoff collecting in Barton Creek that causes basin-wide flooding that can inundate the springs.</p>	<p><input checked="" type="checkbox"/> Full Compliance <input type="checkbox"/> Partial Compliance <input type="checkbox"/> Measure Completed</p>
<p>6.1.3.1 The City will restore and maintain more natural flow regimes in Barton Springs Pool, Eliza Spring, and Old Mill Spring by modifying, replacing or removing existing infrastructure. Restoration of free-flowing spring pools and overland streams at Eliza and Old Mill springs will improve and enlarge surface salamander habitat and improve habitat quality (see section 3.3.3). Restoration of a more natural flow regime in Barton Springs Pool by modification and/or replacement of dams, modification of the bypass culvert infrastructure, and suitable changes in management activities will improve aquatic habitat quality and ecosystem stability, as well as provide maximum operational flexibility. The City will develop plans for these restoration projects and, with concurrence of the Service, implement restoration. Flow regime improvements will not compromise water quality during baseflow.</p>	<p><input type="checkbox"/> Full Compliance <input checked="" type="checkbox"/> Partial Compliance <input type="checkbox"/> Measure Completed</p> <p>Notes: Eliza Spring overland stream project is currently at 100% design and construction is anticipated to start no later than October 2016. The Service will receive these plans to review once the City has finalized their review. Old Mill Spring overland stream project is currently in design. Barton Springs Pool flow modeling project should be completed within the next 5 months.</p>

<p>6.1.3.2 The City will allow floodwater to pass through Barton Springs Pool as unimpeded as is feasible to restore or maintain a more natural disturbance regime, which includes increased water velocities that inhibit excess settling of sediment and debris within the Pool confines. This will also reduce the need for dredging or other removal of accumulated flood debris from the Pool, thereby reducing potentially detrimental impacts of such projects on salamanders or their habitat. Some floodwater may continue to enter the bypass culvert and pass around the Pool. Prior to opening the gates in the downstream dam in preparation for potential flooding, Pool staff will confirm with City biologists that Eliza Spring is properly prepared according to the Drawdown Plan. In the event of a flash flood or potential flash flood, Pool staff will prepare the Pool grounds for flooding and coordinate with City salamander biologists in conducting flood-related drawdowns. The City may open dam gates for all floods according to procedures described in the Drawdown Plan.</p>	<p><input checked="" type="checkbox"/> Full Compliance <input type="checkbox"/> Partial Compliance <input type="checkbox"/> Measure Completed</p>
<p>6.1.3.3 The City, with concurrence of the Service, will develop and implement a plan for routine silt and gravel removal from the deep channel of the Pool downstream of Parthenia Spring that does not compromise the continued survival of covered species. The Pool is bounded by upstream (southwest) and downstream (northeast) dams across Barton Creek. These dams cause accumulation of aquifer-borne silt as well as flood-borne silt and gravel within the Pool confines, altering flow regime and natural geomorphic processes. Removal of this material from the deep channel of the Pool has been and will continue to be necessary until the dams are modified, replaced, or removed. The plan will describe when the removal of material will occur and focus on vacuum dredging or other minimally invasive methods approved by the Service. The plan will be submitted to the Service within one year of the issuance of this permit and may be revised as necessary with the verbal or written approval of the Service.</p>	<p><input checked="" type="checkbox"/> Full Compliance <input type="checkbox"/> Partial Compliance <input type="checkbox"/> Measure Completed</p> <p>Notes: Plan was submitted to the Service at the one-year anniversary of issuance. Sediment removal in this area has not occurred during 2015.</p>
<p>6.1.3.4 The City will maintain a Drawdown Plan, which will provide standard operating procedures for use when Pool water elevation is drawn down. This plan requires the approval of the Service and will be submitted to the Service prior to issuance of this permit. The Drawdown Plan will be updated as needed with concurrence of the Service.</p>	<p><input checked="" type="checkbox"/> Full Compliance <input type="checkbox"/> Partial Compliance <input type="checkbox"/> Measure Completed</p>

<p>6.1.3.5 The City will not conduct a full drawdown of the water level in Barton Springs Pool if the combined discharge of the Barton Springs complex is less than 54 ft³/s without consultation and verbal or written concurrence of the Service. This measure is intended to prevent dewatering of surface habitat of Eliza Spring. When discharge is equal to or greater than 54 ft³/s, water can be maintained in surface habitat of Eliza Spring during a full drawdown, based on current substrate elevation. The 54 ft³/s threshold can be revised with the verbal or written approval of the Service if habitat restoration or changes in substrate elevation allow maintenance of wetted surface habitat at lower discharges.</p>	<input checked="" type="checkbox"/> Full Compliance <input type="checkbox"/> Partial Compliance <input type="checkbox"/> Measure Completed
<p>6.1.3.6 Approval from a City Salamander Conservation Program salamander biologist is necessary before the water level in Barton Springs Pool may be drawn down under any flow conditions.</p>	<input checked="" type="checkbox"/> Full Compliance <input type="checkbox"/> Partial Compliance <input type="checkbox"/> Measure Completed
<p>6.1.3.7 When water level in Barton Springs Pool is drawn down for cleaning and maintenance, trained and permitted City salamander biologists and staff under their direct supervision will visually inspect all exposed habitat for stranded salamanders before cleaning and maintenance activities in those areas begin. Any stranded salamanders will be moved to permanent water. Water level in Eliza Spring will be inspected to ensure that water is retained in surface habitat of the spring pool.</p>	<input checked="" type="checkbox"/> Full Compliance <input type="checkbox"/> Partial Compliance <input type="checkbox"/> Measure Completed
<p>6.1.3.8 A minimum of two City salamander biologists will be present when a full drawdown is conducted for cleaning and maintenance, and a minimum of one City salamander biologist will be present when a partial drawdown is conducted for cleaning and maintenance.</p>	<input checked="" type="checkbox"/> Full Compliance <input type="checkbox"/> Partial Compliance <input type="checkbox"/> Measure Completed

<p>6.1.3.9 The City may conduct 4 full drawdowns per year exclusive of floods, when the combined Barton Springs complex discharge is at least 54 ft³/s at the time of drawdown. Exposed habitat will be kept wetted with spring water or creek water while staff searches for stranded salamanders. The City will maintain water over the fissures area during drawdown for cleaning in order to minimize the stranding of salamanders. After the fissures area has been searched for stranded salamanders, the area may be allowed to dry and be cleaned.</p>	<input checked="" type="checkbox"/> Full Compliance <input type="checkbox"/> Partial Compliance <input type="checkbox"/> Measure Completed
<p>6.1.3.10 The City may conduct eight partial drawdowns per year exclusive of floods when the combined Barton Springs complex discharge is equal to or greater than 54 ft³/s. If the discharge is less than 54 ft³/s, partial drawdowns will only be conducted in consultation with the Service. The water depth over the beach will be maintained at greater than or equal to 12 inches and surface habitat in the adjacent perennial springs (Eliza and Old Mill) would not be allowed to go dry. This measure will minimize the impact of low aquifer levels at the adjacent perennial spring sites.</p>	<input checked="" type="checkbox"/> Full Compliance <input type="checkbox"/> Partial Compliance <input type="checkbox"/> Measure Completed
<p>6.1.4.1 Eliza Spring flow regime improvement will be implemented to the maximum extent feasible to recreate historical salamander habitat by restoring the surface outflow stream. Presently, the outflow from the spring is routed through an underground pipe into the Barton Springs Pool bypass culvert and ultimately into Barton Creek downstream of Barton Springs Pool; there is no surface stream. The underground pipe is proposed to be “daylighted” and a natural surface stream created in its place. The new stream will be protected salamander habitat and access will be restricted. To fully recreate a free-flowing spring-fed stream system, the natural elevation and composition of the substrate in the spring pool will be restored to the maximum extent feasible. This will eliminate hindrance of aquifer flow to surface habitat, and provide wetted surface habitat during low aquifer discharge conditions and drawdowns without hindering outflow from the spring pool. A natural substrate will also provide abundant avenues for movement to and from subterranean habitat, reducing the potential for stranding salamanders during drawdowns. The current outflow pipe may be repaired as necessary until the stream is restored. All restoration activities will be submitted to the Service and receive verbal or written approval before implementation. The City</p>	<input checked="" type="checkbox"/> Full Compliance <input type="checkbox"/> Partial Compliance <input type="checkbox"/> Measure Completed <p>Notes: Eliza Spring overland stream project is currently at 100% design and construction should start no later than October 2016.</p>

<p>will determine the feasibility of this restoration activity and submit an estimate of when construction activities may occur, if feasible, to the Service within 3 years of permit issuance.</p>	
<p>6.1.4.2 Old Mill Spring habitat restoration will be implemented to the maximum extent feasible to eliminate permanent, immovable obstructions and hindrances to free outflow from the spring pool to its stream. Infrastructure associated with the plugged outflow pipe on the Tier 1 stone wall (immediately surrounding the spring pool) will be removed within 3 years of permit issuance if feasible. The elevation of the outflow streambed may be lowered to ensure free water flow from the spring pool to its stream. A community of native aquatic vegetation will be established, which will help mitigate effects of low spring discharge by releasing oxygen into the water. Canopy cover vegetation will be maintained or increased to provide shade over the spring pool and stream, which will help mitigate increased surface water temperature during seasonal periods of high air temperature. Remaining stone walls of the amphitheater outside of aquatic salamander habitat and the supporting riparian habitat (Tiers 2 – 4) may be rehabilitated or stabilized as necessary to ensure safety in publicly accessible areas. Plans will be submitted to the Service and receive verbal or written approval before implementation.</p>	<p> <input type="checkbox"/> Full Compliance <input checked="" type="checkbox"/> Partial Compliance <input type="checkbox"/> Measure Completed Notes: Old Mill Spring overland stream project is currently in design. </p>
<p>6.1.4.3 The City will restore and permanently maintain groundwater flow and light penetration to the maximum extent feasible in salamander habitat of the fissures of Parthenia Spring. The City will not artificially obstruct groundwater flow or artificially inhibit light penetration in the fissures habitat area. Restoration will include permanent removal of concrete in the natural fissures transmitting groundwater to the surface in Parthenia Spring. Small areas of concrete may be removed gradually using underwater hand tools. Large areas may be removed at one time during drawdown, which would allow use of larger construction tools and foster retreat of salamanders from work area. Removal methods will be chosen to minimize harassment of resident salamanders and subject to verbal or written approval of the Service</p>	<p> <input type="checkbox"/> Full Compliance <input checked="" type="checkbox"/> Partial Compliance <input type="checkbox"/> Measure Completed Notes: The City is developing plans for Parthenia Spring restoration now. Restoration will be implemented upon completion of Eliza Spring outlet daylighting project and Old Mill stream restoration. </p>

<p>6.1.5.1 The City may move salamanders among spring sites or release salamanders born in captivity according to a Service-approved plan to maintain genetic diversity of the species. The four spring sites do not harbor genetically unique populations based on current genetic information. Transfer of individuals between sites will not adversely affect the genetic integrity of those populations and will maintain the genetic integrity of the species.</p>	<input checked="" type="checkbox"/> Full Compliance <input type="checkbox"/> Partial Compliance <input type="checkbox"/> Measure Completed <p>Notes: This has not been implemented yet. The City continues to pursue necessary scientific investigations to facilitate development of a plan for submission to the Service for approval.</p>
<p>6.1.6.1 The City may manually trim and remove aquatic vegetation (macrophytes, bryophytes and algae) as necessary. Vegetation management will not adversely affect habitat or compromise ecosystem health. Only City biologists listed under current federal Endangered Species Act 10(a)(1)(A) and state scientific permits are authorized to manage vegetation in salamander habitat areas.</p>	<input checked="" type="checkbox"/> Full Compliance <input type="checkbox"/> Partial Compliance <input type="checkbox"/> Measure Completed
<p>6.1.6.2 Specific areas will be designated for the fueling and maintenance of equipment and vehicles used in maintaining the springs and surrounding areas. Fueling and maintenance areas will be at least 25 feet away from the water to avoid the chance of detrimental impacts on the spring habitats or aquatic life. Absorbent pads will be used underneath or around all equipment, supplies, and vehicles containing toxic components during all operations, fueling and maintenance activities.</p>	<input checked="" type="checkbox"/> Full Compliance <input type="checkbox"/> Partial Compliance <input type="checkbox"/> Measure Completed
<p>6.1.6.3 The City will clean the shallow end of Barton Springs Pool without full drawdown of water level in the entire Pool. Adjustable gates in dams or similar water control devices may be used to conduct partial drawdowns that expose only the shallow end for cleaning.</p>	<input checked="" type="checkbox"/> Full Compliance <input type="checkbox"/> Partial Compliance <input type="checkbox"/> Measure Completed
<p>6.1.6.4 The City will use spring water for cleaning in Barton Springs Pool to the maximum extent feasible. The City will install an electrically powered pump system that provides spring water from Barton Springs Pool for cleaning of the Pool. The pump system may also be used to provide spring water for the fissures areas during Pool drawdown.</p>	<input checked="" type="checkbox"/> Full Compliance <input type="checkbox"/> Partial Compliance <input type="checkbox"/> Measure Completed
<p>6.1.6.5 The City will prohibit use of toxic chemicals for cleaning of the Pool.</p>	<input checked="" type="checkbox"/> Full Compliance <input type="checkbox"/> Partial Compliance <input type="checkbox"/> Measure Completed

<p>6.1.7.1 The City will monitor salamander populations and habitat. Salamander population surveys will be conducted at perennial Parthenia, Eliza, and Old Mill springs and at intermittent Upper Barton Spring when flowing at least bimonthly throughout the year or other interval sufficient to determine the status of the species and population dynamics as deemed appropriate by a City salamander biologist and approved by the Service. The City will develop and maintain a written monitoring plan. The City will ensure that all people surveying for salamanders are properly trained. Surveys can include methods to elucidate life history characteristics of both species. Methods will be evaluated by the Service and conducted under the terms and conditions of a valid federal Endangered Species Act 10(a)(1)(A) scientific permit issued to the City.</p>	<p><input checked="" type="checkbox"/> Full Compliance <input type="checkbox"/> Partial Compliance <input type="checkbox"/> Measure Completed</p> <p>Notes: Surveys at Eliza Spring have shifted to a capture-mark-recapture study design. Frequency is now quarterly, with three consecutive survey-days per event, for a total of 12 survey-days per year. The City is currently developing a plan for intermittent trapping of salamanders at Old Mill Spring, where low abundance of salamanders and low visibility survey conditions result in inefficient surveys following previous protocols. The City is also conducting capture-recapture at Upper Barton springs on a bimonthly basis, and count surveys at Parthenia spring at the same frequency. In 2016 the City plans to shift to photographic capture-recapture at all sites on a quarterly basis. A survey plan is forthcoming.</p>
<p>6.1.7.2 Eliza Spring and Old Mill Spring will be used as outdoor educational facilities for the study of the biology and ecology of Central Texas springs.</p>	<p><input checked="" type="checkbox"/> Full Compliance <input type="checkbox"/> Partial Compliance <input type="checkbox"/> Measure Completed</p>
<p>6.1.7.3 The City will ensure that Barton Springs Pool lifeguards and maintenance staff including seasonal employees are knowledgeable about the protected salamander species. At a minimum, staff will be trained yearly about the protected salamanders, resident aquatic wildlife and flora and the ecology of Edwards Aquifer springs. Training will include contaminant spill and response protocols, proper containment techniques, and remediation. An inventory of necessary containment and remediation equipment will be conducted by Pool staff annually and after the use of equipment in response to any spill. City Parks and Recreation Department Aquatics supervisors will direct and document all cleaning procedures at the Pool.</p>	<p><input checked="" type="checkbox"/> Full Compliance <input type="checkbox"/> Partial Compliance <input type="checkbox"/> Measure Completed</p>
<p>6.1.7.4 The City will ensure that all people conducting salamander and habitat monitoring are properly trained. All monitoring and surveys will be conducted under the terms and conditions of a current federal Endangered Species Act 10(a)(1)(A) scientific permit issued to the City of Austin.</p>	<p><input checked="" type="checkbox"/> Full Compliance <input type="checkbox"/> Partial Compliance <input type="checkbox"/> Measure Completed</p>

<p>6.1.7.5 The City of Austin will form the Barton Springs Scientific Advisory Committee, which will include local and regional experts. The committee may be divided into subcommittees that focus on specific areas of expertise and will meet at least annually to discuss and refine Barton Springs' maintenance and environmental management activities. A variety of interests including swimming, biology, hydrogeology, and captive breeding may be represented on this committee. In addition, this committee will periodically review this Plan and make suggestions for needed amendments as deemed necessary. The Advisory Committee will also be responsible for helping identify potential revisions to the Plan and suggest adaptive management strategies. The City will be responsible for implementation of adaptive management strategies with verbal or written approval of the Service.</p>	<p> <input checked="" type="checkbox"/> Full Compliance <input type="checkbox"/> Partial Compliance <input type="checkbox"/> Measure Completed </p> <p>The committee has not met within the past year. In 2016 the City will re-form the committee with new members.</p>
<p>6.2.1 Access to Eliza Spring and Old Mill Spring will be restricted to ensure no unauthorized disturbance of salamander habitat and/or its supporting riparian habitat. Unsupervised access to these sites is limited to individuals holding valid federal Endangered Species Act 10(a)(1)(A) and state scientific permits. Recreational access to Barton Springs Pool will continue to be permitted. Public access to Upper Barton Spring is not prohibited. Upper Barton Spring lies within the Barton Creek Greenbelt, and because of its location within the floodplain of Barton Creek it cannot be feasibly isolated from public access.</p>	<p> <input checked="" type="checkbox"/> Full Compliance <input type="checkbox"/> Partial Compliance <input type="checkbox"/> Measure Completed </p>
<p>6.2.2 The City will maintain a plan and necessary equipment and training for responding to, and mitigating the effects of catastrophic contaminant spills that threaten protected salamanders or their habitat. Should a catastrophic spill threaten to extirpate <i>E. sosorum</i> or <i>E. waterlooensis</i> in the wild, the City may conduct a full or partial drawdown as necessary to rescue salamanders. The City will notify the Service in the event of a catastrophic spill. Trained and permitted City staff will search all exposed habitat area for salamanders.</p>	<p> <input checked="" type="checkbox"/> Full Compliance <input type="checkbox"/> Partial Compliance <input type="checkbox"/> Measure Completed </p> <p>Notes: The City updated contact lists for the spill response plan to reflect recent staff changes.</p>

<p>6.2.3 The City will maintain viable, evolutionarily fit captive breeding populations of <i>Eurycea sosorum</i> and <i>Eurycea waterlooensis</i>. The City will designate a staff biologist and dedicate a minimum of \$28,000 annually to the development and maintenance of this program. This program may provide captive salamanders suitable for reintroduction into the wild if catastrophic events that compromise or cause extirpation of wild populations were to occur. This program may provide a refugium facility for salamanders collected in response to contaminant spills or other immediate threat that could cause extirpation of the species in the wild. The program will develop and maintain a captive population of each species that represents the genetic diversity of wild populations without compromising their size or fate by permanently removing individuals from the wild. This program is also intended to support research that contributes to elucidation of biology, life history and natural history of both species. The City will develop and maintain written plans for population management, reintroduction, and husbandry. These plans will be updated as necessary.</p>	<p><input checked="" type="checkbox"/> Full Compliance <input type="checkbox"/> Partial Compliance <input type="checkbox"/> Measure Completed</p>
<p>6.2.4 Under conditions when decreased dissolved oxygen concentrations may be harmful to salamanders, the City may supplement dissolved oxygen in Eliza, Old Mill, and Parthenia springs using air pumps, water recirculation, or other method approved by the Service.</p>	<p><input checked="" type="checkbox"/> Full Compliance <input type="checkbox"/> Partial Compliance <input type="checkbox"/> Measure Completed</p>
<p>6.3.1 The City of Austin will set up a fund for conservation and research efforts for <i>Eurycea sosorum</i> and <i>E. waterlooensis</i>. The City will deposit \$53,000 annually (for the term of the permit) into this fund from the revenues generated by Barton Springs Pool. This fund will also be open to donations from any group or private individual. A committee of technical representatives will determine the allocation of money from this fund. At a minimum, the committee will consist of one technical representative from the City and one technical representative from the Service. These technical representatives must be knowledgeable and experienced in salamander biology. Other committee members could include state, county, university representative or other qualified biologists and karst aquifer hydrogeologists, and swimmer/stakeholder representatives. The City and the Service would both retain “veto” power in deciding how the money is allocated. The funds would be used for study of salamander biology, captive breeding, refugium</p>	<p><input type="checkbox"/> Full Compliance <input checked="" type="checkbox"/> Partial Compliance <input type="checkbox"/> Measure Completed</p> <p>This City is continuing to work through contractual negotiations with ACF for the renewal of the agreement to manage the conservation fund. However, it is taking much longer than anticipated since their business model has changed since the original agreement for the term of the first HCP. Although a deposit has not yet been made for 2015, there is a large current balance of \$474,339 in our account.</p>

<p>development, reintroduction, watershed related research, improved cleaning techniques for natural water bodies, education and/or land acquisition.</p>	
<p>6.3.2 The City will continue to support research projects designed to gather and evaluate data applicable to wild or captive populations of the Barton Springs Salamander, <i>E. sosorum</i>, and the Austin Blind Salamander, <i>E. waterlooensis</i>. These projects would be in addition to the regular monitoring already conducted under the permit and would be approved by the Service when applicable.</p>	<p><input checked="" type="checkbox"/> Full Compliance <input type="checkbox"/> Partial Compliance <input type="checkbox"/> Measure Completed</p>
<p>6.3.3 The City will continue to provide educational programs to enhance public awareness and community support for <i>Eurycea sosorum</i>, <i>Eurycea waterlooensis</i>, Barton Springs, and the Edwards Aquifer. The SPLASH! Into the Edwards Aquifer Exhibit at Barton Springs Pool will continue to be a major focus of this effort. The mission of the SPLASH! Exhibit is to foster stewardship of the Barton Springs Segment of the Edwards Aquifer and Barton Springs through public education. The City of Austin Parks and Recreation Department will dedicate a minimum of \$10,000 annually from the revenues generated by Barton Springs Pool to the development and maintenance of this exhibit. The City of Austin Watershed Protection Department will make available at least \$35,000 annually for the support of exhibits and events, and maintaining museum operating hours at the SPLASH exhibit. Outdoor educational displays will emphasize the biology and ecology of Barton Springs and the Edwards Aquifer with an emphasis on the Barton Springs Salamander, <i>Eurycea sosorum</i>, and the Austin Blind Salamander, <i>Eurycea waterlooensis</i>.</p>	<p><input checked="" type="checkbox"/> Full Compliance <input type="checkbox"/> Partial Compliance <input type="checkbox"/> Measure Completed</p>
<p>6.3.4 The City will cooperatively develop a memorandum of understanding with the Barton Springs Edwards Aquifer Conservation District to formalize collaborative efforts to protect the Barton Springs Salamander, <i>Eurycea sosorum</i>, the Austin Blind Salamander, <i>Eurycea waterlooensis</i>, and the Barton Springs Segment of the Edwards Aquifer. The memorandum of understanding will be adopted by the City within one year of permit issuance.</p>	<p><input type="checkbox"/> Full Compliance <input checked="" type="checkbox"/> Partial Compliance <input type="checkbox"/> Measure Completed Notes: The Austin City Council authorized the City Manager to negotiate and execute an interlocal agreement with the Barton Springs Edwards Aquifer Conservation District on Aug 7, 2014. Further negotiations with BSEACD are on hold pending Service review of the BSEACD HCP application.</p>

6.3.5 The City will participate in regional water resource planning that may affect the Barton Springs Segment of the Edwards Aquifer and advocate for protection of water quality and quantity adequate to protect the Barton Springs Salamander, *Eurycea sosorum*, and the Austin Blind Salamander, *Eurycea waterlooensis*.

- Full Compliance
- Partial Compliance
- Measure Completed

Notes: The City continues to participate in a wide variety of regional water quality protection initiatives including regular meetings with the Barton Springs Regional Water Quality Protection Plan working group, review and involvement in multiple wastewater disposal permits within the Barton Springs Zone, and organizing and hosting the biennial Kent Butler Memorial Summit.

Incidental Take

Table 2. Collections of *Eurycea sosorum* (EUSO) and *E. waterlooensis* (EUWA) from permitted activities conducted January 2015 – December 2015.

Species	Site	County	Date	LAT	LONG	Collector	Current Disposition	Notes
EUWA	Eliza Spring	Travis	2/11/2015	30.264506	-97.769868	Nathan F. Bendik, Tom Devitt, Blake Sissel, Donelle Robinson, Dee Ann Chamberlain	TNHC	hatchling; died during capture-recapture survey while waiting to be photographed
EUWA	Old Mill Spring (Sunken Gardens)	Travis	3/26/2015	30.263474	-97.768117	Tom Devitt, Blake Sissel, Donelle Robinson, Dee Ann Chamberlain	TNHC	hatchling; injured during survey; collected alive and taken to captive breeding
EUSO	Upper Barton Spring	Travis	4/9/2015	30.263598	-97.774116	Tom Devitt, Blake Sissel	TNHC	found recently (<1 day) dead under rock, likely crushed under foot by someone walking in spring pool

Table 3. Drawdown event details for Barton Springs Pool and observed salamanders. The partial drawdowns did not expose salamander habitat, and therefore no take was assumed to have occurred from these events.

Date	Full or Partial Drawdown	Purpose	Total Barton Springs Discharge prior to drawdown (cubic feet/second)	Salamanders observed
1/23/2015	Full	Flood	67	None
3/2/2015	Full	Cleaning	77	None
5/6/2015	Full	Flood	92	None
5/17/2015	Full	Flood	93	None
5/24/2015	Full	Flood	93	None
8/20/2015	Partial	Cleaning	103	None
10/1/2015	Partial	Cleaning	92	1 <i>E. sosorum</i> live stranded on first step of Eliza; moved into water
10/24/2015	Full	Flood	84	None
10/30/2015	Full	Flood	81	None

Salamander Status and Biological Data Analysis

Here we show results of salamander surveys conducted, as reported in the City's 10(a)1(A) permit (TE-833851) report, and comment on the status of each salamander species.

Table 4. Barton Springs Salamander and Austin Blind Salamander Abundance December 2014–November 2015. Parthenia Spring is located within Barton Springs Pool. Old Mill Spring/Sunken Garden is represented by OMS/SG, and Upper Barton Spring, by UBS.

<i>Eurycea sosorum</i>			<i>Eurycea waterlooensis</i>		
Site	Date	Total	Site	Date	Total
Eliza	2/10/2015	90	Eliza	2/10/2015	0
Eliza	2/11/2015	72	Eliza	2/11/2015	0
Eliza	2/12/2015	53	Eliza	2/12/2015	0
Eliza	8/18/2015	74	Eliza	8/18/2015	0
Eliza	8/19/2015	69	Eliza	8/19/2015	0
Eliza	8/20/2015	50	Eliza	8/20/2015	1
Eliza	11/17/2015	80	Eliza	11/17/2015	0
Eliza	11/18/2015	48	Eliza	11/18/2015	0
Eliza	11/19/2015	41	Eliza	11/19/2015	0
Parthenia	12/18/2014	3	Parthenia	12/18/2014	0
Parthenia	6/11/2015	1	Parthenia	6/11/2015	0
Parthenia	8/27/2015	25	Parthenia	8/27/2015	1
Parthenia	10/22/2015	135	Parthenia	10/22/2015	0
OMS/SG	3/26/2015	0	OMS/SG	3/26/2015	3
OMS/SG	6/4/2015	0	OMS/SG	6/4/2015	1
OMS/SG	8/27/2015	0	OMS/SG	8/27/2015	1
OMS/SG	10/22/2015	1	OMS/SG	10/22/2015	4
UBS	12/10/2014	25	UBS	12/10/2014	0
UBS	2/13/2015	6	UBS	2/13/2015	0
UBS	4/9/2015	22	UBS	4/9/2015	0
UBS	6/11/2015	4	UBS	6/11/2015	0
UBS	8/13/2015	0	UBS	8/13/2015	0
UBS	10/7/2015	1	UBS	10/7/2015	0

Capture-mark-recapture studies

We conducted robust-design mark-recapture sampling at Eliza Spring using photographic identification methods for three consecutive days in February, August, and November of 2015. The scheduled May survey was canceled due to high, turbid water conditions from heavy rains that persisted for weeks.

We performed a closed-population analysis in MARK using the Huggins likelihood formulation. While complete closure within the confines of the concrete surface area of Eliza Spring were

likely not achieved, we believe the assumption of closure to permanent migrants to be reasonable. If the absence of closure is due to a “trap-shy” behavioral effect this can be accounted for (and tested) in models with a free parameter c . In the future, data will be combined into a robust-design analysis, and used to estimate survival and temporary emigration rates.

We also photographed individuals at Upper Barton Springs during all surveys for the reporting year, although this did not follow a robust-design. There were not many recaptures (Table 8), and therefore we only performed a simply constant detection and survival analysis with the CJS model. Because recaptures were low, estimates are imprecise (Table 9).

Table 5. Closed population model results for *E. sosorum* at Eliza Spring. Detection probability = p ; recapture probability = c ; (t) indicates time variation and (.) indicates a constant value.

February						
Model	AICc	Delta AICc	AICc Weights	Model Likelihood	Num. Par	Deviance
p(t) c(t)	489.987	0	0.57166		1	4 1022.189
p(t) = c(t)	491.6818	1.6948	0.24497	0.4285		3 1025.926
p(.) c(t)	492.5707	2.5837	0.15707	0.2748		3 1026.815
p(.) c(.)	496.1878	6.2008	0.02574	0.045		2 1032.463
p(.) = c(.)	503.8759	13.8889	0.00055	0.001		1 1042.171
August						
Model	AICc	Delta AICc	AICc Weights	Model Likelihood	Num. Par	Deviance
p(.) c(t)	412.9889	0	0.48624		1	3 814.77
p(t) c(t)	414.3656	1.3767	0.24429	0.5024		4 814.0963
p(t) = c(t)	414.4124	1.4235	0.23864	0.4908		3 816.1934
p(.) c(.)	419.1139	6.125	0.02274	0.0468		2 822.9326
p(.) = c(.)	421.179	8.1901	0.0081	0.0167		1 827.0227
November						
Model	AICc	Delta AICc	AICc Weights	Model Likelihood	Num. Par	Deviance
p(t) = c(t)	381.5783	0	0.54753		1	3 772.6598
p(t) c(t)	383.0631	1.4848	0.26061	0.476		4 772.0923
p(.) c(.)	384.7774	3.1991	0.11059	0.202		2 777.898
p(.) c(t)	385.3939	3.8156	0.08126	0.1484		3 776.4755
p(.) = c(.)	404.6347	23.0564	0.00001		0	1 799.7813

Table 6. Parameter estimates from the AIC top model for each month. N is the population size estimate.

February				
Parameter	Estimate	Standard Error	Lower 95% CI	Upper 95% CI
p1	0.48	0.21	0.15	0.82
p2	0.25	0.23	0.03	0.79
c1	0.48	0.05	0.38	0.58
c2	0.31	0.04	0.23	0.40
N	184	78	137	561
August				
Parameter	Estimate	Standard Error	Lower 95% CI	Upper 95% CI
p	0.64	0.05	0.53	0.74
c1	0.62	0.06	0.51	0.72
c2	0.40	0.05	0.31	0.50
N	113	3.4	110	125
November				
Parameter	Estimate	Standard Error	Lower 95% CI	Upper 95% CI
p1	0.66	0.05	0.54	0.75
p2	0.40	0.05	0.31	0.50
p3	0.34	0.05	0.26	0.44
N	120	6.1	112	137

Table 8. Capture-recapture data summary for Upper Barton Spring. $R(i)$ is the number of individuals captured, photographed and released; j is the number recaptured of that cohort for a given survey; total represents a sum of the recaptures for that cohort.

Occasion	$R(i)$	$j =$ Jan2014	Mar2014	Jun2014	Dec2014	Feb2015	Apr2015	Oct-15	Total
Dec2013	6	1	0	0	0	0	0	0	1
Jan2014	5		2	0	0	0	0	0	2
Mar2014	47			0	3	0	2	0	5
Jun2014	15				0	1	0	0	1
Dec2014	22					2	0	0	2
Feb2015	11						2	0	2
Apr2015	14							0	0

Table 9. Estimates of detection probability (p) and apparent survival (ϕ) from Cormack-Jolly-Seber model of Upper Barton Spring capture-recapture data.

Parameter	Estimate	Standard Error	Lower 95% CI	Upper 95% CI
p	0.09	0.05	0.04	0.24
ϕ	0.60	0.13	0.34	0.82

A pattern of relatively low *E. sosorum* abundance compared to years just prior the 2008 drought continues. This may be a reflection of reduced reproduction and recruitment as a consequence of a population decline from the 2008 drought. Whether this is within the norms of a drought response for this species or not is difficult to say.

Continued collection capture-mark-recapture data will allow us to determine survival rates for *E. sosorum* as well as estimate temporary migration rates. In the future, this may help determine the extent to which adult migration affects the number of individuals we observe at the surface, and what environmental conditions are associated with migration and mortality. Therefore, we will continue to conduct capture-mark-recapture using the robust design at Eliza Spring, and opportunistically at the other sites when abundances are high. This method is not feasible for the other spring sites at every survey, however. Low abundances at Old Mill Spring preclude the practical application of this approach, while the depth of Parthenia Spring introduces logistical constraints as well the possibility of trauma to the salamanders induced by rapid depth changes. We intend to investigate how moving salamanders to the surface from Parthenia and returning them after photography influences their behavior and well being. We will continue to photograph salamanders at Upper Barton Spring. These efforts at all sites will hopefully allow us to document any migration among the springs (if it occurs on such a short time-scale), as well as document returning individuals, and possibly (depending on the data structure and sample sizes) estimate open-population parameters.

Our knowledge of *E. waterlooensis* ecology continues to be constrained by it being a primarily subterranean-only dwelling organism. Occasional “accidentals” occur at the surface, and in the past juveniles had been observed in abundance at Old Mill Spring. Unfortunately a large abundance of juveniles no longer occurs at Old Mill and occurrence of *E. waterlooensis* at the surface in general remains a sporadic event.

Management Activities

Management activities for the current reporting period included routine silt and gravel agitation and removal during population monitoring surveys as well as during full-drawdowns in response to floods and routine pool maintenance. Of most significance to our management were several floods at Barton Springs Pool, resulting in scouring in some areas, deposition of a large rock pile in front of side spring, in addition to a large boulder calving off of the rock wall and falling into the pool. Flood events tend to either wash away gravel and cobble substrate, or deposit large amounts of it—however, aquatic vegetation is in very low abundance near the spring outlets. Biologists have responded by spreading out the rocks from immediately in front of the spring openings where salamanders were most abundant and where flow is the strongest. Table 10 summarizes management activities that were in addition to regular sediment removal by hand during surveys.

Table 10. Habitat management activities in addition to regular sediment removal during surveys.

Date	# hours	# people	Personnel	Description
2/28/15– 3/13/15	untracked	untracked	Numerous staff	Barton Springs Pool spring cleaning- hosed sediment and cleared out debris from fissures and the beach area.
3/18/2015	3	2	Tom Devitt, David Johns	Planted ~40 bald cypress seedlings in and around the Barton Springs Complex and Barton Creek
3/25/2015	3	2	Tom Devitt, Melissa Casarez	Removed 13 green sunfish from pool at Sunken Gardens with a gillnet
3/26/2015	3	1	Blake Sissel	used shovel to move sand from outflow tunnel of Sunken Garden pool
5/6/2015	6	3	Tom Devitt, Donelle Robinson, Dee Ann Chamberlain	Used hand-held garden hoses and submersible pumps to flush sediment and debris from fissures at BSP following flood
5/7/2015	7	4	Tom Devitt, Donelle Robinson, Dee Ann Chamberlain, Nate Bendik	Used hand-held garden hoses and submersible pumps to flush sediment and debris from fissures at BSP following flood
7/16/2015	4	3	Tom Devitt, Nate Bendik, Jacob Owen	Used hand-held garden hoses and submersible pumps to flush sediment from Eliza Spring
10/1/2015	3	3	Tom Devitt, Nate Bendik, Donelle Robinson	Used hose, submersible pump, and shovels to move sediment out of Old Mill Spring
ongoing	untracked	untracked	Tom Devitt, Jacob Owen, Blake Sissel	Fish removal from Old Mill

Flooding in Barton Springs Pool from late October rainfall resulted in limestone boulder calving off the rock outcrop above the main fissure, within salamander habitat (Figure 1). Safety professionals with our aquatics department were concerned the boulder posed a risk for entrapment of human swimmers. Large rocks sourced from the downstream end of the pool were

placed within the void below the boulder to prevent swimmers from climbing underneath it. We determined that removal of the boulder was a covered activity under 4.4 of our HCP. However, because of the size of the boulder, removal would have required either jackhammering in place, or use of heavy equipment within or near salamander habitat. We determined these solutions posed a greater risk to the salamander than the rock fill solution and that the latter would have a minor impact to the flow regime in this area. However, as salamanders are rarely, if ever, observed in this area, we did not believe this action would result in take that is not covered under our permit, or even that salamanders will be harmed. After the pool was filled, we dove to document the rock fill in this area. Fill was placed beneath the boulder between vertical and angled rock faces of a fissure (Figure 2). Based on visual observations while diving, flow on the spring side of the cleaved boulder was very slow, despite the high overall discharge rate of Barton Springs (99 ft³/s). We therefore believe there is negligible impact on flow in this area from the rock fill and should pose no harm to salamanders or their habitat.



Figure 1. View of boulder that calved from the rock face in Barton Springs Pool during a post-flood drawdown in early November, 2016.



Figure 2. Rock fill (bottom of photo) placed below boulder (top) that fell into Barton Springs Pool to prevent swimmers from entering the void under the boulder.

Habitat Restoration Updates

The overland stream restoration for Eliza Spring is currently at 100% design phase and construction is anticipated to start no later than October 2016. The overland stream restoration for Sunken Garden is currently in the design phase. Flow regime modification of Barton Springs Pool has not started. Phase one of the hydrodynamic modeling of Barton Springs Pool project has been completed, and further modeling efforts are being continued by Dr. Ben Hodges (University of Texas at Austin) and his students under contract to the City, due by March 1, 2016. Costs thus far for these projects were \$313,023.22 for Eliza outlet daylighting, \$96,193.96

for Old Mill, and \$175,402.26 for the Barton Springs Pool flow modeling. These reflect capital costs paid to contractors, not internal costs such as staff time.