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AMENDMENT TO THE ENVIRONMENTAL ASSESSMENT/HABITAT CONSERVATION PLAN FOR AN ENDANGERED SPECIES ACT SECTION 10(a)(1)(B) INCIDENTAL TAKE PERMIT FOR THE GOLDEN-CHEEKED WARBLER PREVIOUSLY ASSOCIATED WITH THE 440-ACRE SCHLUMBERGER PROPERTY TO INCLUDE INCIDENTAL TAKE OF THE JOLLYVILLE PLATEAU SALAMANDER DUE TO ACTIVITIES ASSOCIATED WITH THE CONSTRUCTION, OPERATION, AND MAINTENANCE OF CONCORDIA UNIVERSITY TEXAS

Travis County, Texas

March 2020

Submitted to:
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Austin, Texas, 78758

On Behalf of:
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List of Acronyms

AASHE	Association for the Advancement of Sustainability in Higher Education
A&M	Avoidance and Minimization
BAT	Biological Advisory Team
BCCP	Balcones Canyonlands Conservation Plan
BCVI	Black-capped Vireo
CHU	Critical Habitat Unit
COA	City of Austin
EA	Environmental Assessment
ESA	Endangered Species Act
ECOS	Environmental Conservation Online System
EKI	Endangered Karst Invertebrate
EO	Element Occurrence
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
FM	Farm-to-Market Road
GCWA	Golden-cheeked Warbler
HCP	Habitat Conservation Plan
IPAC	Information for Planning and Consultation
IPM	Integrated Pest Management
ITP	Incidental Take Permit
NEPA	National Environmental Policy Act
OEM	Optional Enhanced Measures
PCE	Primary Constituent Element
SOP	Standard Operating Procedure
STARS	Sustainability Tracking, Assessment, and Rating System
TCAD	Travis Central Appraisal District
TCEQ	Texas Commission on Environmental Quality
TNDD	Texas Natural Diversity Database
TPWD	Texas Parks and Wildlife
TSS	Total Suspended Solids
USFWS	U.S. Fish and Wildlife Service

Amendment to the Environmental Assessment/Habitat Conservation Plan Previously Associated with the 440-acre Schlumberger Property for Concordia University Texas

March 2020

1.0 INTRODUCTION

Concordia University Texas (Concordia) is seeking the amendment to their existing Section 10(a)(1)(B) Endangered Species Act (ESA) Incidental Take Permit (ITP) (TE-827597-3). The amended ITP will continue incidental take coverage of the golden-cheeked warbler (*Setophaga chrysoparia*) for Concordia's actions in accordance with the original permit and Environmental Assessment/Habitat Conservation Plan. This amendment will add additional incidental take coverage for the Jollyville Plateau salamander (*Eurycea tonkawae*) associated with the present and future development, operation, and maintenance of the Concordia campus, and will provide a framework for implementation of Concordia's Master Plan for the campus throughout the next 30 years. This amendment also seeks to extend the terms of the ITP for 30 years from the date of approval.

The 440-acre property (Property) was originally owned and initially developed by Schlumberger in the 1980s, prior to the federal listing of the golden-cheeked warbler as endangered. Following the listing of the golden-cheeked warbler, Schlumberger processed an Environmental Assessment/Habitat Conservation Plan and was issued an ITP in 1997 with an established conservation easement covering approximately 250.62 acres of the overall 437.23-acre property (previously called 440-acre). In 2005, Concordia purchased the 437.23-acre property with the goal of relocating their campus to this location, and in 2007 the ITP was transferred to Concordia. The Jollyville Plateau salamander, which is present within the Property, was first identified as a candidate species by the USFWS in the 1994 Candidate Notice of Review and was federally listed as threatened with critical habitat in 2013. Concordia has recently completed a comprehensive Master Plan (Master Plan) to guide the development of their campus within the Property and seek to add incidental take coverage for the Jollyville Plateau salamander to the ITP in order to provide certainty that the full implementation of the Master Plan will comply with the ESA.

Numerous springs located within or adjacent to the developable area of the Property are known to be occupied by the Jollyville Plateau salamander (salamander springs). Additionally, federally designated surface and subsurface critical habitat for the Jollyville

Plateau salamander is located on or under portions of the Property, including the developable area of the Property. This amendment will provide certainty to Concordia that future development and other activities necessary to implement the Master Plan within the vicinity of these salamander springs will sufficiently avoid, minimize, or mitigate for any potential direct or indirect effects to the Jollyville Plateau salamander.

Concordia's Master Plan is designed to be a framework for future growth and development within Concordia and has a limited amount of flexibility to adopt and change to meet unforeseen future needs. As areas of the campus are renovated and re-purposed, the mission and themes of stewardship, sustainability, and harmony with nature will be paramount. Reinforcing the outdoor, natural, and sustainable environment of the campus layout will build institutional pride while maintaining a uniquely collegiate setting, differentiating it from a light industrial, corporate, or municipal campus. All future design efforts will continue to emphasize the blending of the natural and the built environment, strengthen the connection to the existing environment, and inform the future campus design. While there may be certain elements of the Master Plan that have distinctive sightlines and identity features, the overall feel of the campus experience will reflect sustainability, comfort, and harmony with the natural environment.

The conservation measures in this plan focus on the long-term protection and restoration of the springsheds that contribute surface water to the salamander spring sites within the Concordia developable area, as well as the salamander spring sites located in the existing preserve area. To the extent this amendment protects hydrological inputs to salamander springs in the general area, it will protect subterranean habitat and the implementation of these conservation measures will be beneficial to the Jollyville Plateau salamander.

1.1 *Regulatory Framework*

Section 9 of the ESA prohibits "take" of any federally listed threatened or endangered wildlife. Take is defined as an action that may harm, harass, pursue, shoot, wound, hunt, kill, trap, capture or collect members of an endangered species. Section 10(a)(1)(B) of the ESA authorizes the U.S. Fish and Wildlife Service (USFWS) to issue a permit allowing take of protected species that is incidental to otherwise lawfully conducted activities. For the issuance of an incidental take permit, the applicant must submit a conservation plan that satisfies the requirements of Section 10(a)(2)(A) of the Act.

Section 10(a)(2)(B)(ii) of the Act allows non-federal entities to conduct otherwise lawful activities likely to cause take of endangered species, as long as the detrimental effects of the activities are minimized or mitigated to the maximum extent practicable. Habitat conservation plans are the vehicles by which such take can be authorized, given that it will be minimized and mitigated to the maximum extent practicable.

This amended habitat conservation plan was developed to satisfy the requirements of Section 10(a)(2)(A) of the Act by increasing the likelihood of the survival and recovery of the Jollyville Plateau salamander (JPS) and golden-cheeked warbler species in the wild to the maximum extent practicable. This plan describes the effects of the incidental harm to the JPS, identifies the measures by which those effects will be avoided, minimized, and mitigated, compares alternatives to the preferred alternative, and identifies the parties responsible for implementing and funding implementation of the plan. This plan describes habitat conservation actions throughout the proposed implementation and build out of Concordia's Master Plan (30 years). This plan describes how the proposed conservation measures contribute to protecting the health of the species.

The issuance of an incidental take permit by USFWS requires an analysis of the environmental impacts resulting from activities listed in a habitat conservation plan in accordance with the National Environmental Policy Act (NEPA). NEPA requires that the USFWS provide a formal assessment of impacts of the proposed issuance of an incidental take permit on the human environment and a review of alternatives to the proposed actions. The Environmental Assessment associated with Concordia's amended habitat conservation plan will be prepared as a separate document in conjunction with the USFWS.

Concordia's campus is located within the city limits of the City of Austin, Texas (COA). The COA requires the protection of water quality within its city limits and extra-territorial jurisdiction by limiting impervious cover, requiring setbacks from critical environmental features, preventing erosion during construction, and requiring treatment of storm water runoff from development projects through regulations specified in Chapter 25-8 of the COA Land Development Code.

State regulations require protections for sediment transfer into waterbodies under the Texas Pollution Discharge Elimination System, which is consistent with the federal Clean Water Act.

Additional water quality protection measures for projects located over the Edwards Aquifer are required by Texas Commission on Environmental Quality (TCEQ) Edwards Aquifer Rules (30 TAC 213). The TCEQ, in conjunction with the USFWS, has also developed Optional Enhanced Measures (TCEQ 2007) to provide additional protections for some federally listed species. While the Concordia property is not located over the TCEQ-mapped Edwards Aquifer recharge zone (TCEQ 2005a) and, as such, is not subject to the TCEQ Edwards Aquifer Rules, the project will implement enhanced water quality measures (Enhanced Measures) consistent with the optional enhanced measures developed by the TCEQ and the USFWS to ensure the protection of surface and groundwater quality within the Edwards Aquifer recharge zone.

1.2 *Currently Permitted Build Out*

Concordia currently holds a Section 10(a)(1)(B) ITP (TE-827597-3) that was originally granted to Schlumberger in 1997 and was amended in 2007 to list Concordia as the permittee following the transfer of ownership of the Property from Schlumberger to Concordia. This permit will expire on December 31, 2027. The original ITP (Appendix A) and associated Environmental Assessment/Habitat Conservation Plan (Appendix B) was issued prior to the federal listing of the JPS as threatened in 2013, and currently provides incidental take coverage for only the golden-cheeked warbler. The existing EA/HCP specifically noted that the "potential for the proposed [Schlumberger] development to cause significant indirect impacts to the quality of habitat available to salamanders is considered to be extremely low based on the persistence of the Jollyville Plateau salamanders at several urbanized localities and the relatively low amount of development proposed for areas considered likely to lie within the recharge zone of the Schlumberger Springs."

The approximately 437.23-acre Property is currently zoned under COA zoning Ordinance No. 20070215-042, and the site is permitted to construct uses allowed under the Research and Development (R&D) District Regulations. In addition, impervious cover is permitted on up to 50% of the land within the Property with slopes of 0-15% gradient. Out of the approximately 437.23-acre site, 348.60-acres fall within the 0-15% gradient range. Therefore, the Property is entitled to construct up to 174.30-acres of impervious cover.

Based on the overall acreage of the site (437.23 acres), this equates to a maximum of 39.8% impervious cover allowed for the entire Property. However, a 250.62-acre tract within the larger Property has been previously dedicated as a conservation easement as part of the previous ITP and EA/HCP, so the remaining developable acreage within the overall development is 186.61 acres. Therefore, under applicable COA ordinances, the developable area has a maximum of 93.40% impervious cover within the remaining developable acreage (174.30 acres of allowed impervious cover / the remaining developable acreage of 186.61 acres).

The primary control strategy for water quality basins within the COA is to capture a minimum volume of stormwater runoff for treatment, and to release the treated volume in forty-eight (48) hours or as specified. The minimum volume is the first one-half (0.5) inch of runoff plus an additional one-tenth (0.1) inch for each ten (10) percent increase of impervious cover over twenty (20) percent. This depth of runoff from the contributing drainage area to the control is referred to as the Capture Volume, also known as the "Water Quality Volume." The water quality volume must consist of runoff from all impervious surfaces such as roadways, parking areas and roof tops, and all developed pervious areas. The City of Austin allows multiple types of water quality controls to provide water quality treatment, including rain gardens and biofiltration ponds.

2.0 COVERED ACTIVITIES

According to the *Habitat Conservation Planning and Incidental Take Processing Handbook* (USFWS 2016; Handbook), an HCP must describe all activities that may result in all effects to covered species or their habitats, including any effects that do not rise to the level of take. Additionally, the Handbook describes the process for establishing what the HCP should describe. The process is as follows:

- An HCP should thoroughly describe activities and associated components that are likely to have impacts, but should not include overly detailed information about sub-activities that do not affect covered species;
- Brief descriptions of such sub-activities and citations to support why they do not impact species is sufficient; and
- Describing all the ways a particular activity could be conducted may not be necessary if the anticipated impacts would be the same. For instance, if the impacts of a proposed development are solely the permanent loss of a specified amount of currently unoccupied habitat that is projected to remain unoccupied in the future,

> whether the structures are residential or commercial may not be important. In this case, broadly describing the activity as development gives the applicant flexibility without affecting the outcome of analyses of impacts.

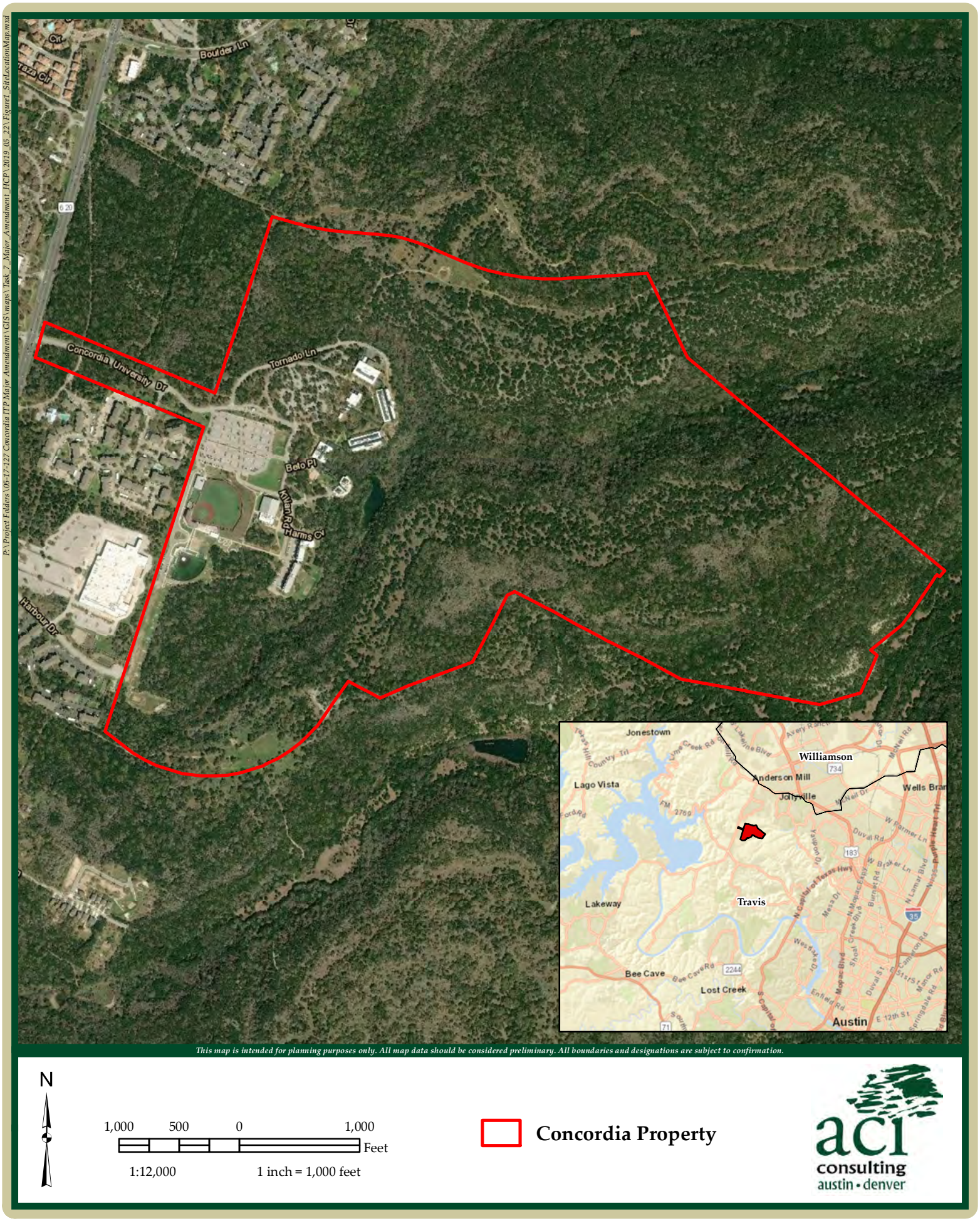
Additionally, the Handbook states the following:

> Section 10 of the ESA and its regulations require that an HCP describes actions the applicant considered as alternatives to the take that would result from the proposed action and the reasons why they are not using those alternatives. When describing alternative actions in the HCP, the applicant should focus on significant differences in project design that would avoid or reduce the take. These alternatives should be meaningful and not merely involve small changes in project implementation or minimization and mitigation measures that do not avoid or reduce take.

2.1 *Project Background*

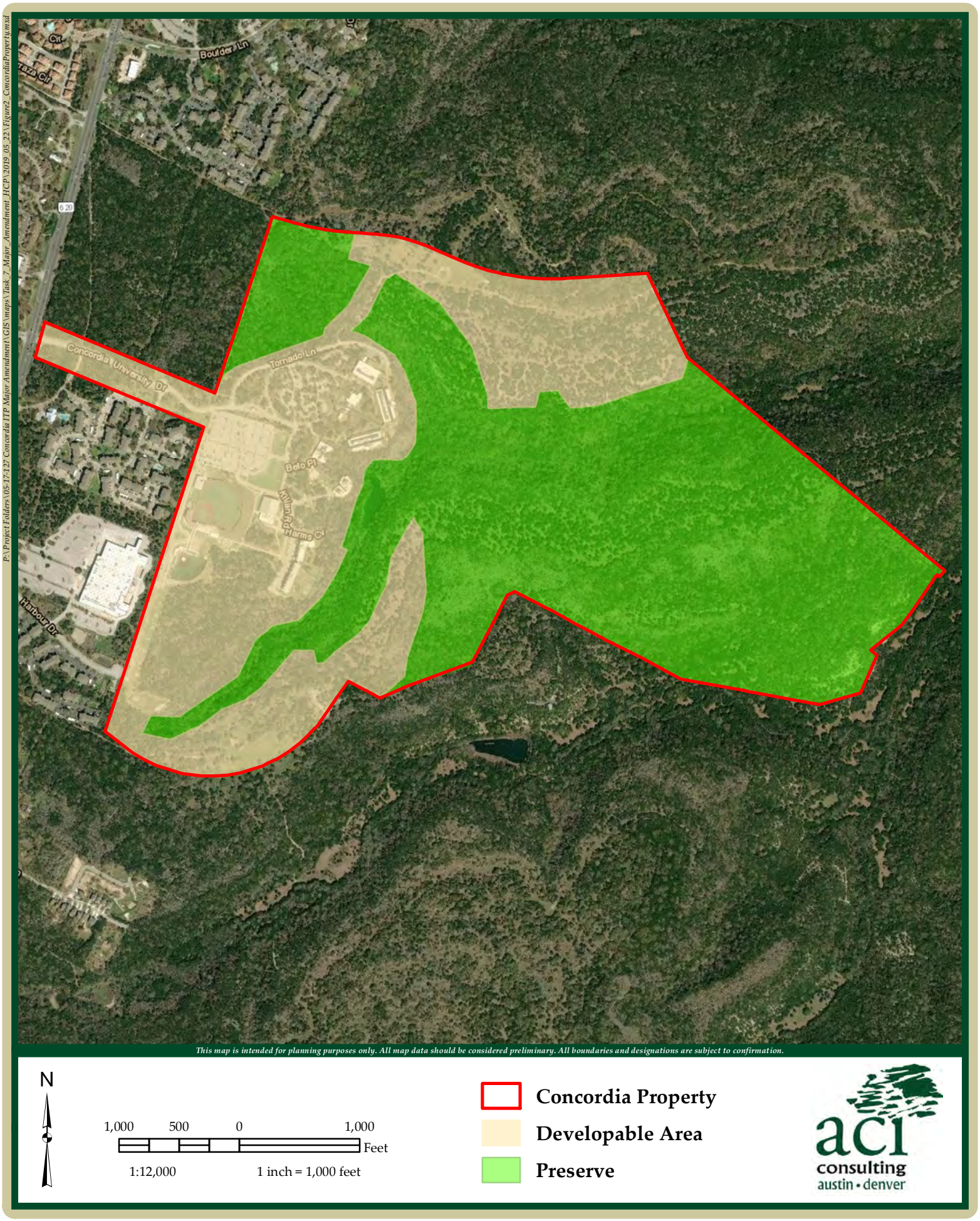
Concordia is located approximately 1.3 miles north-northeast of the intersection of Farm-to-Market Road (FM) 2222 and FM 620 at the intersection of Concordia University Drive and FM 620 (Figure 1). Currently, approximately 2,600 students are enrolled at Concordia with approximately 1,800 students utilizing the main campus on a week to week basis. Of these regular students, approximately 315 students currently live on campus. In addition to the traditional on-campus students, Concordia enrolls approximately 675 online students at this time.

Those activities within the developable area may include, but are not limited to, parking, roadways, classrooms, laboratories, dormitories, dining halls, athletic facilities, water quality structures, and administrative and maintenance facilities (Figure 2).



Concordia Habitat Conservation Plan Amendment **aci Project No.: 05-17-127**

Figure 1: Site Location Map **March 2020**



Concordia Habitat Conservation Plan Amendment **aci Project No.: 05-17-127**

Figure 2: Concordia Property **March 2020**

2.2 *Concordia Master Plan*

Concordia's Master Plan is meant to be an adaptable and somewhat dynamic conceptual guideline within which the university may adapt and change to meet unforeseen future needs. The Master Plan calls for following four overriding guidelines to ensure adherence to the goals and vision articulated during drafting of the Master Plan.

The four guidelines for the Master Plan are Aesthetics, Functionality, Culture, and Method, and are as follows:

1. **Aesthetics:**
    a. Establish a campus style or look to accurately portray the institution's spirit, and
    b. Establish a palette of materials and kit of parts for architectural consistency.
2. **Functionality:**
    a. Create an organizational theme – plazas and open spaces,
    b. Include and celebrate gathering spaces,
    c. Provide adequate parking, and
    d. Create a cohesive organization to the placement and layout of the build environment.
3. **Culture:**
    a. Provide teaching and research space to meet the university's mission,
    b. Preserve the existing balance of open space,
    c. Maintain the campus character of working with nature, and
    d. Blend with the surrounding community and create outreach links to it.
4. **Method:**
    a. In conjunction with civil engineers, document physical and governmental constraints,
    b. Confirm a strategy to incorporate and address environmental requirements as stewards of the land,
    c. Edge of preserve – paradox; want to be part of preserve, but separate of it to protect it, and
    d. Define campus zones as build spaces, nature spaces, water quality areas, etc.

Since the Master Plan is adaptable, and full buildout will likely not occur for approximately 30 years, exact locations or detailed designs of buildings, parking lots, water quality areas, nature spaces, or other products of the proposed built environment

have not been finalized. However, the Master Plan lays out an assessment of current needs, which are the final goals of the proposed project.

The Master Plan classified areas of the campus into twelve types of use, needs within each use type, and square footage of structures necessary to meet those needs.

Overall, approximately 1,165,600 square feet, or approximately 27 acres of structures have been identified as needs within the 186.61 acres of developable space. These numbers are approximate and conceptual and were calculated to determine what amount of development would be adequate to provide for all needs while protecting the aquatic environment and ensuring the conservation of the JPS population on the property. A conceptual design of the Master Plan is included as Figure 3.

2.3 *Proposed Development, Redevelopment, and Implementation of the Master Plan*

Concordia proposes to construct the previously identified needs of its Master Plan throughout the developable area with the goal to increase on-campus residence to 1,000-1,200 residents and to increase overall enrollment to approximately 5,000-6,000 students. While no exact locations or detailed designs for buildings, parking lots, athletic facilities, or other construction have been finalized, Concordia proposes to implement the Master Plan on their campus by establishing stream buffers and other environmental setbacks from sensitive features that will limit development in environmentally sensitive areas. These buffers and setbacks will be established in accordance with the standards established in the TCEQ Optional Enhanced Measures for the *Protection of Water Quality in the Edwards Aquifer (Revised) Appendix A to RG-348 – Complying with the Edwards Aquifer Rules: Technical Guidance on Best Management Practices* (September 2007) ("RG-348A").

On February 14, 2005, the TCEQ published *Appendix A to RG-348: Optional Enhanced Measures for the Protection of Water Quality in the Edwards Aquifer*, which presents optional measures that may be implemented for new development in areas subject to the Edwards Rules (TCEQ 2005b). The Optional Enhanced Measures (OEMs) were revised in September 2007 (TCEQ 2007). On September 14, 2007, USFWS designated the

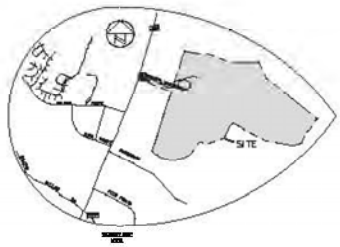


Figure 3

CONCEPTUAL MASTER PLAN

CONCORDIA UNIVERSITY TEXAS

PROPOSED MASTER DEVELOPMENT PLAN

AUSTIN, TEXAS
JANUARY 2018

Kimley»Horn
16914 JOLLYVILLE RD
AVALLON IV, SUITE 200
AUSTIN, TEXAS
512-419-0771
STATE OF TEXAS REGISTRATION NO. F-928

OEMs as non-degradation for several central Texas salamander species that occur on the Edwards Aquifer (USFWS 2007a) and determined that projects incorporating the OEMs will avoid "take" of federally listed salamanders.

The OEMs provide a higher level of water quality protection and may be voluntarily adopted by those who desire to implement additional enhanced water quality protection measures for environmental protection, to ensure compliance with the Endangered Species Act, or to satisfy requirements of agencies other than TCEQ. These enhanced water quality measures include:

- Conducting a Geologic Assessment to identify sensitive environmental features within the subject area;
- Identifying stream buffers;
- Addressing sensitive features identified during the construction phase of a development project;
- Designing sensitive feature buffers and stream buffers;
- Constructing cave gates;
- Implementing permanent BMPs to address stormwater runoff and hazardous material runoff from the subject area;
- Protecting stream morphology; and
- Maintaining BMPs constructed on the subject area.

It is important to note that the TCEQ OEMs were designed to ensure that "no take" would occur to federally listed salamanders from projects that incorporated these OEMs. In order to grant "no take" concurrence generally and over a large landscape, the USFWS conservatively limited its concurrence to specifically exclude projects that (1) occur outside of the area regulated by the TCEQ Edward Aquifer Rules and projects, (2) result in water quality impacts that may affect federally listed species, (3) result in impacts to listed species that are not water quality related, or (4) occur within 1 mile of occupied spring openings.

Although most of the developable area is within one mile of an occupied spring opening, these enhanced measures are an effective strategy to maintain or improve the overall water quality of the Property, thereby providing an adequate minimization strategy to help reduce and minimize any direct or indirect effects to the JPS that would occur due to construction activities, maintenance, and operations related to the proposed project at

all but two spring locations, Springs C and D, within the Permit Area. Due to the proximity of existing development to Springs C and D, combined with the inability to "retrofit" the existing water quality BMPs within the springsheds for Springs C and D to meet or exceed the 80% removal efficiency for TSS required by the OEMs, it is expected that over time the buildings, ongoing operations and maintenance, and student and staff activity within the springsheds for Springs C and D may effect, and are likely to adversely affect, JPSs in and immediately adjacent to those two occupied springs. Similarly, although the Property is not within the Edwards Aquifer recharge or contributing zones, as defined by TCEQ, and is therefore not subject to the TCEQ Edwards Aquifer Rules, the site contains similar Edwards, Walnut, and Glen Rose geology as areas mapped within the Edwards Aquifer, and is mapped by the City of Austin as occurring within the Edwards Aquifer. The existing water quality BMPs, which were designed and constructed prior to the currently established standards and practices for water quality BMPs, cannot be retrofitted due to their location within the Permit Area, size, and construction methodology. If these areas are redeveloped, the existing, substandard water quality BMPs would likely be removed and appropriate BMPs designed to current specifications would be constructed.

Concordia will incorporate and adhere to all of the Enhanced Measures contained in RG-348A, a copy of which is attached as Appendix C, for future development. Sensitive karst features are not anticipated within the developable area; however, a Geological Assessment will be conducted within each area proposed for development prior to the submittal of each building permit. Should any sensitive features or caves be identified, appropriate buffers will be established prior to any new construction in the developable area. Any new buffer areas will be identified and included in annual reporting to the USFWS. Previous karst surveys of the developable area, including a karst survey performed by Mike Warton for the existing HCP, have revealed no caves or other "sensitive features;" therefore, the primary measure for water quality protection proposed is expected to be stream buffers.

Stream buffers are established from the centerline of a stream based on the drainage area to that point in the stream. For instance, any point along a stream with a drainage area between 5 and 40 acres would have a 25-foot stream buffer around its center line; whereas a drainage area between 40 and 128 acres would require a 50-foot buffer. Table 1 details drainage area sizes for establishing buffers along streams and Figure 4 depicts the buffers established according to these standards within the developable area.

Additionally, RG-348A requires that projects remove 80% of annual TSS loads from a site. The proposed development and redevelopment will remove a minimum of 80% of the increase in annual TSS loads from stormwater leaving the limits of disturbance of the developed or redeveloped area.

Table 1: OEM Stream Buffer Criteria

Drainage Area (acres)	Buffer Width from Centerline (feet)
0 to 5	No Buffer Required
5 to 40	25
40 to 128	50
128 to 320	100
320 to 640	200
Greater than 640	300

These buffers will remain free from most types of construction, development, or other alterations. However, within the developable area, storm water treatment systems are allowable development within the stream buffers as long as the drainage to the proposed location is less than 128 acres. Additionally, within the developable area, minimal road construction is allowed within the buffer zones as long as the construction is minimized and constructed only when necessary, such as when a significant portion of the developable area can only be reached by crossing a buffer zone. Furthermore, within the developable area, other alterations to buffer zones are allowed only when necessary and include utility crossings, fences, low impact parks, and open space. Any roadways or utilities will be constructed perpendicular to the buffer zones. No development of any kind will occur within the preserve area.

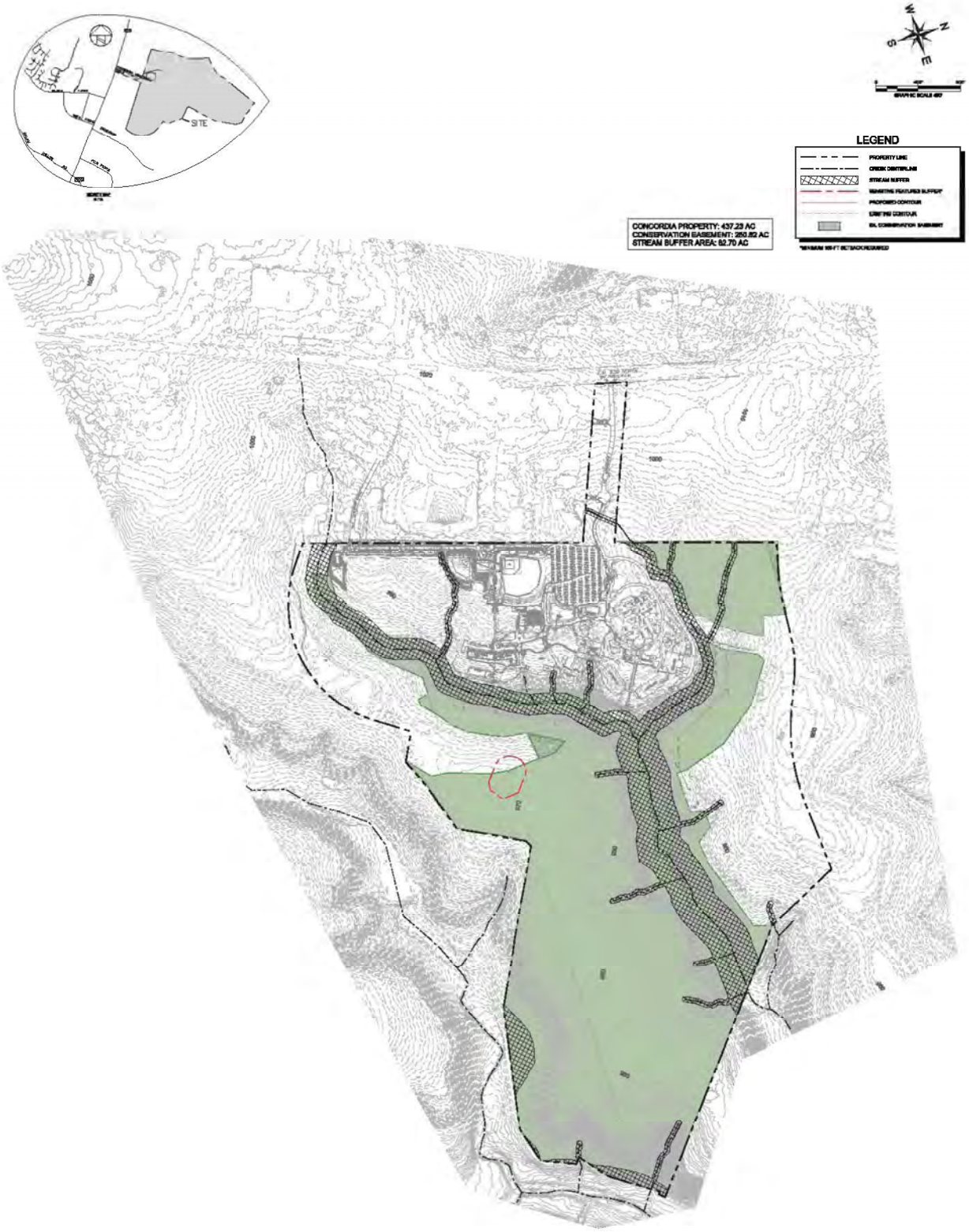


Figure 4

STREAM BUFFERS

CONCORDIA UNIVERSITY TEXAS
PROPOSED MASTER DEVELOPMENT PLAN
JPS ENHANCED MEASURES OVERLAY
AUSTIN, TEXAS
JANUARY 2018

Kimley»Horn
18014 JOLLYVILLE RD
AVALLON IV, SUITE 300
AUSTIN, TEXAS
512-418-1771
STATE OF TEXAS REGISTRATION NO. F-928

2.4 *Covered Activities of the Proposed Project*

This action would provide for the continuing conservation of JPS while allowing Concordia to continue development of its campus to meet its future scholastic, social, and athletic needs. The 250.62-acre preserve area will be unaltered by the covered activities and will continue to operate as previous mitigation and continued conservation for the golden-cheeked warbler. The covered activities for this amendment are described as follows.

2.4.1 Covered Activity 1: Development and Redevelopment

New development and redevelopment in the developable area of the Concordia Campus in accordance with the Concordia Master Plan, the TCEQ RG-348A document, the Enhanced Measures, and applicable COA Watershed Ordinances.

2.4.2 Covered Activity 2: Continuing and future operations and maintenance of the Concordia University campus.

All activities associated with the operation and maintenance of the Concordia campus as an institution of higher learning. The covered activities include, but are not limited to, standard operation of existing and future structures; standard maintenance of existing and future structures; standard use of the existing and future structures; ingress, egress, and parking of automobiles; general residential activities of the residents of the on-campus dormitories; standard campus activities regular to an institution of higher learning; and maintenance of native and adapted landscaping within the developable area.

3.0 PLAN AND PERMIT AREA

The Plan and Permit Area (Permit Area) for the amended HCP will correspond with the original 437.23-acre (originally called 440 acres) Schlumberger Property Boundary from the original HCP associated with the current ITP (TE-827597-3). This area also corresponds with Concordia's Property boundary. The Permit Area includes the 250.62 acres of preserve land and 186.61 acres of developable land owned by Concordia. These areas are identified by the Travis Central Appraisal District (TCAD) as Property Identification Numbers 497836 and 768380 (Figure 5).

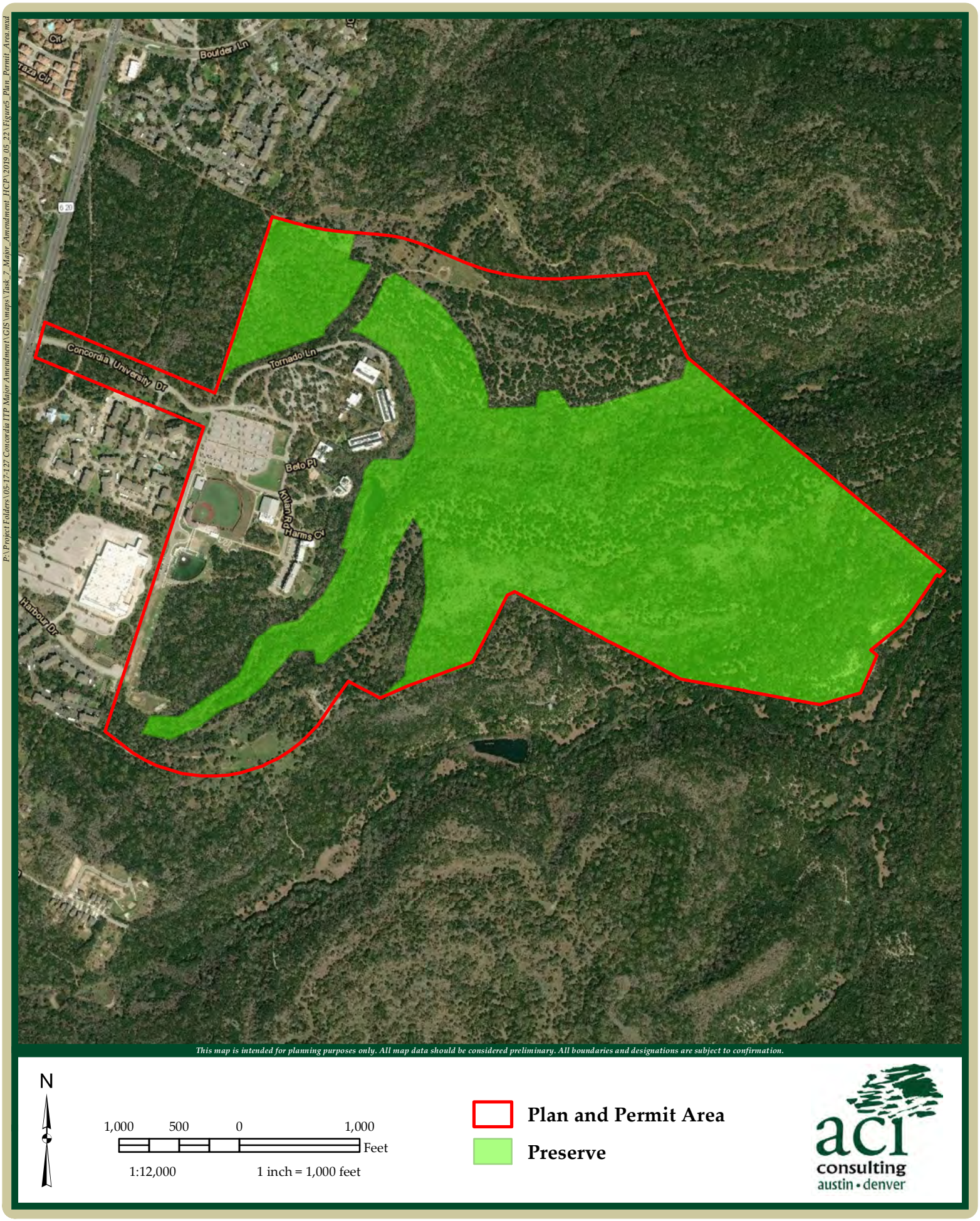


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Figure 5: Plan and Permit Area **March 2020**

4.0 SPECIES ADDRESSED BY THE AMENDMENT

According to the USFWS *Environmental Conservation Online System* (ECOS), *Information, Planning, and Conservation System* (IPaC), 17 species that are designated as candidates for federal listing, or federally listed as threatened or endangered occur within Travis County and have the potential to be affected by the proposed project (USFWS 2018). Of the 17 species, six are designated as candidates for federal listing, one is federally listed as threatened, and 10 are federally listed as endangered.

The species that are federally listed under the ESA as endangered within Travis County, Texas, include two amphibians: Austin blind salamander and Barton Springs salamander; two birds: golden-cheeked warbler (GCWA) and whooping crane; and six endangered karst invertebrates (EKI): Bee Creek Cave harvestman, Bone Cave harvestman, Tooth Cave spider, Tooth Cave pseudoscorpion, Kretschmarr Cave mold beetle, and Tooth Cave ground beetle. One species, JPS, is federally listed as threatened. Six species identified as candidates for federal listing include five mussels, the golden orb, smooth pimpleback, Texas fatmucket, Texas fawnsfoot, and Texas pimpleback; and one plant, the bracted twistflower. Additionally, the Bald and Golden Eagle Protection Act (16 U.S.C. 668-668c) prohibits "take" of bald eagles and golden eagles without a permit.

Three additional bird species, the least tern (*Sterna antillarum*), piping plover (*Charadrius melodus*), and red knot (*Calidris canutus*), are federally listed as endangered, threatened, and threatened, respectively, in Travis County. However, the USFWS ECOS IPaC database (USFWS 2018) states that each of these three bird species should only be considered in an effects analysis if the project is a wind energy project. Since the proposed activities are not related to a wind energy project, potential impacts associated with the proposed project to the least tern, piping plover, and red knot will not be assessed in this review.

Table 2 lists the federally listed threatened, endangered, and candidate species in Travis County, Texas, and other species addressed by the amendment. GCWA is not included in this amendment due to its current coverage by the existing ITP.

Table 2: Federally Listed Species for Travis County, Texas

Common Name	Latin Name	Federal Status
Austin blind salamander	*Eurycea waterlooensis*	E
Barton Springs salamander	*Eurycea sosorum*	E
Bee Creek Cave harvestman	*Texella reddelli*	E
Bone Cave harvestman	*Texella reyesi*	E
Golden-cheeked warbler	*Setophaga chrysoparia*	E
Jollyville Plateau salamander	*Eurycea tonkawae*	T
Kretschmarr Cave mold beetle	*Texamaurops reddelli*	E
Least tern*	*Sterna antillarum*	E
Piping plover*	*Charadrius melodus*	T
Red knot*	*Calidris canutus rufa*	T
Tooth Cave ground beetle	*Rhadine persephone*	E
Tooth Cave pseudoscorpion	*Tartarocreagris texana*	E
Tooth Cave spider	*Neoleptoneta myopica*	E
Whooping crane	*Grus americana*	E

*Potential effects only considered for wind energy projects. (USFWS 2018)

4.1 *Covered Species*

The purpose of the amendment is to include the JPS as an additional Covered Species to the existing ITP and to extend the permit for a period of 30 years from the date of approval of this amendment.

4.1.1 Jollyville Plateau Salamander Background Information

The JPS was included in five Candidate Notices of Review (59 FR 58982, November 15, 1994; 73 FR 75176, December 10, 2008; 74 FR 57804, November 9, 2009; 75 FR 69222, November 10, 2010; 76 FR 66370, October 26, 2011). On August 22, 2012, USFWS released a proposed rule for the JPS (JPS) to be listed as endangered with federally designated critical habitat (USFWS 2012). On August 20, 2013, USFWS released the final rule listing the JPS as threatened (USFWS 2013a) and the final rule designating critical habitat for the JPS (USFWS 2013b).

The JPS is a neotenic (does not metamorphose from its juvenile form) salamander endemic to the Jollyville Plateau and Brushy Creek areas of the Edwards Plateau in Travis and Williamson counties. JPS likely breed year-round with increased breeding between

November and February. Due to the lack of evidence of eggs within surface habitats, JPS are assumed to conduct their breeding and lay their eggs within subsurface habitat (USFWS 2012) generally in fall and winter (Bendik 2017). Juveniles are present year-round and likely reach sexual maturity within six months to a year of hatching (Bowles et al. 2006) with individuals living approximately 2.3 years (Bendik 2017). The JPS and other brook salamanders feed on benthic macroinvertebrates whose populations are typically positively correlated with high quality ground water with population numbers typically increasing in the spring and summer. Within the surface habitat, JPS are typically more abundant in springs or streams with higher amounts of cobble or rubble, which is their preferred cover. Much about threats, possible impacts, population numbers, trends, and the status of these salamanders as distinct separate species is presently unknown. However, urbanized watersheds are known to contain lower JPS densities than non-urbanized watersheds (Bowles et al. 2006).

JPS is known from Brushy Creek and, within the Jollyville Plateau, from the Bull Creek, Cypress Creek, Long Hollow Creek, Shoal Creek, and Walnut Creek drainages. JPS has also been documented within the Lake Creek drainage. Cave-dwelling JPS are known from one cave in the Cypress Creek drainage and 12 caves in the Buttercup Creek cave system in the Brushy Creek drainage (USFWS 2012). Within the JPS's range, two distinct population groups have developed, the eastern group is generally located within the Bull Creek watershed and the western group is generally located within the Brushy, Shoal, and Walnut Creek watersheds (Devitt et al. 2019) The JPS's spring-fed tributary habitat is typically characterized by a depth of less than one foot of cool, well oxygenated water supplied by the underlying Edwards Aquifer (USFWS 2012). JPS are typically found near springs or seep outflows and are thought to require constant temperatures. Salamander densities are higher in pools and riffles and in areas with rubble, cobble, or boulder substrates rather than on solid bedrock. Surface-dwelling JPS can also occur in subsurface habitat within the underground aquifer (USFWS 2012). JPS are well adapted for utilizing spring habitats that may periodically go dry (Bendik 2017).

Based on a study by O'Donnell et al. (2008) at a site located on the property directly south of the Permit Area along Bull Creek and an unnamed tributary Bull Creek, the estimated percentage of JPS that occupy surface or subterranean habitat varies based on surface conditions. When surface conditions are suitable (consistent surface flow), the majority

of JPS occupy surface habitat with few occupying the subterranean habitat. Generally, approximately 59 to 81% of JPS are located in surface habitat areas, while 41 to 19% are located in subterranean areas within the spring itself or in subterranean spaces within the aquifer (O'Donnell et al. 2008).

The listing package for JPS (USFWS 2013a) identified the following as potential contaminants and pollutants that may have an adverse effect on JPS: petroleum aromatic hydrocarbons (PAH); pesticides; and nutrients, such as phosphorus and nitrogen. Additionally, changes in water chemistry were identified as potential causes of adverse effects to JPS and include the following: conductivity, salinity, and dissolved oxygen (DO). Water quantity degradation and physical modification of surface habitat were also identified as activities that may have an adverse effect on JPS.

Federally designated critical habitat (USFWS 2013b) for the JPS was established as two separate habitat types: Surface Habitat and Subsurface Habitat. Effects to federally designated critical habitat are only reviewed if they result from federal agency action or occur on federal land. Although Concordia is not a federal agency and the property is not located on federal land, we will use the JPS primary constituent elements listed in the USFWS's critical habitat designation (USFWS 2013b) to assess potential impacts to the JPS, and its habitat, whether federally designated or not. The use of the primary constituent elements herein are strictly to analyze impacts from covered activities to the species and its habitat. This HCP was not developed, nor the amendment being sought to address potential impacts to federally designated critical habitat; rather, the amendment sought is to provide coverage for incidental take of individual JPS associated with the covered activities.

For each federally designated critical habitat type, primary constituent elements (PCE) were identified that allow for the federally designated critical habitat to support viable populations of JPS. The PCEs are as follows:

Surface Habitat PCEs

i. *Water from the Trinity Aquifer, Northern Segment of the Edwards Aquifer, and local alluvial aquifers.* The groundwater is similar to natural aquifer conditions as it discharges from natural spring outlets. Concentrations of water quality

constituents and contaminants should be below levels that could exert direct lethal or sublethal effects (such as effects to reproduction, growth, development, or metabolic processes), or indirect effects (such as effects to the JPS's prey base). Hydrologic regimes similar to the historical pattern of the specific sites are present, with at least some surface flow during the year. The water chemistry is similar to natural aquifer conditions, with temperatures from 64.1 to 73.4 °F (17.9 to 23 °C), dissolved oxygen concentrations from 5.6 to 8 mg/L, and specific water conductance from 550 to 721 uS/cm.

ii. *Rocky substrate with interstitial spaces.* Rocks in the substrate of the salamander's surface aquatic habitat are large enough to provide salamanders with cover, shelter, and foraging habitat (larger than 2.5 in (64 mm)). The substrate and interstitial spaces have minimal sedimentation.

iii. *Aquatic invertebrates for food.* The spring environment supports a diverse aquatic invertebrate community that includes crustaceans, insects, and flatworms.

iv. *Subterranean aquifer.* Access to the subsurface water table should exist to provide shelter, protection, and space for reproduction. This access can occur in the form of large conduits that carry water to the spring outlet or porous voids between rocks in the streambed that extend down into the water table.

Subsurface Habitat PCEs

i. *Water from the Trinity Aquifer, Northern Segment of the Edwards Aquifer, and local alluvial aquifers.* The groundwater is similar to natural aquifer conditions. Concentrations of water quality constituents and contaminants are below levels that could exert direct lethal or sublethal effects (such as effects to reproduction, growth, development, or metabolic processes), or indirect effects (such as effects to the JPS's prey base). Hydrologic regimes similar to the historical pattern of the specific sites are present, with continuous flow. The water chemistry is similar to natural aquifer conditions, including temperature, dissolved oxygen, and specific water conductance.

ii. *Subsurface spaces.* Voids between rocks underground are large enough to provide salamanders with cover, shelter, and foraging habitat. These spaces have minimal sedimentation.

iii. *Aquatic invertebrates for food.* The habitat supports an aquatic invertebrate community that includes crustaceans, insects, or flatworms.

Critical Habitat Special Management Considerations

The final rule designating critical habitat (2013b) also established special management considerations for the JPS. These considerations are described as "management activities that could ameliorate threats" and include the following:

1. Protecting the quality of groundwater by implementing comprehensive programs to control and reduce point sources and non-point sources of pollution throughout the Barton Springs and Northern Segments of the Edwards Aquifer and contributing portions of the Trinity Aquifer;
2. Protecting the quality and quantity of surface water by implementing comprehensive programs to control and reduce point sources and non-point sources of pollution within the surface drainage areas of the salamander spring sites;
3. Protecting groundwater and spring flow quantity (for example, by implementing water conservation and drought contingency plans throughout the Barton Springs and Northern Segments of the Edwards Aquifer and contributing portions of the Trinity Aquifer);
4. Fencing and signage to protect from human vandalism;
5. Protecting water quality and quantity from present and future quarrying; and
6. Excluding cattle and feral hogs through fencing to protect spring habitats from damage.

4.1.2 General Site-Specific Geology and Watersheds

The Permit Area occurs, in part, on the Jollyville Plateau which is a dissected upland area west of the Balcones Escarpment in northern Travis County and adjacent parts of Travis County, Texas. It is underlain by the lower part of the Edwards Limestone and is an outlier of the once-continuous Edwards Plateau (Barnes 1974). Except for local hilltops and ridge lines capped with Edwards strata, the intervening areas have been deeply eroded by tributaries of the Colorado River. Compared to those small remnant Plateau surfaces south of the Colorado River, the Jollyville Plateau is aerially extensive, and it merges with the more extensive Lampasas Cut Plain to the north.

The Jollyville Plateau is a paleo-structure with its areal extent resulting mainly from its position along the drainage divide separating the Colorado River watershed from that of

the Brazos River to the north. While the limestone bedrock has resisted erosion at the surface, it has been affected by dissolution to create a network of karst voids at depth and a surface with sinkholes, solution cavities and solution enlarged fractures (Lattman et al. 1964). In short, the Edwards Limestone (Ked) forms a caprock that marks the edge of the Jollyville Plateau, but this gently sloping upland has been undermined by the work of groundwater. Moreover, the southern margin of the Jollyville Plateau has been cut on almost all sides by surface water courses, most of which drain to the Cypress Creek Arm of Lake Travis or to Bull Creek. The geometry of these deeply incised streams creates an isolated Plateau upland that now remains connected to the more extensive Edwards terrain to the north via a narrow neck that is bisected by FM 620 near its intersection with Anderson Mill Road.

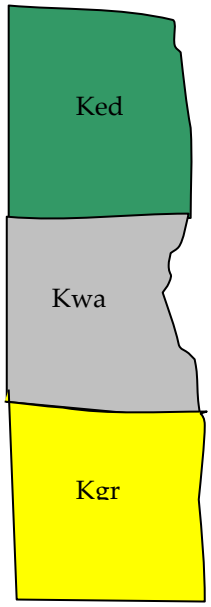
This deep erosion is due to the proximity of the main stem of the Colorado River to the Colorado/Brazos divide, which at its closest lies at a distance of a mere 5.5 miles. In contrast, the Brazos River at Waco lies about 88 straight-line miles away. As postulated by Woodruff (1994), the Colorado River is expanding its watershed northward by diversion of high-standing, low-order drainage basins on the margin of the Brazos watershed.

The long-term evolution of the Jollyville Plateau has created distinct groundwater regions. The southern dissected edge of the Jollyville Plateau, although underlain by Edwards Limestone, is not considered part of the Edwards aquifer by the TCEQ, who delineates the regulatory aquifer boundary at the Travis-Williamson County Line (which coincides with the Colorado-Brazos divide).

Despite this regulatory boundary, groundwater does occur in the porous, karstic Edwards Limestone strata capping the dissected southern edges of the Plateau, but it is best described as a perched water-table resource occurring within the attenuated Edwards section. Water levels vary dramatically depending on local porosity and on prevailing weather conditions, so the water tends to accumulate in interior parts of the Plateau with flow lines radiating out toward topographic embayments created by the incised drainage courses. Springs tend to occur at or near the heads of these incised draws, although some draws are dry except during wet periods. Many of the perennial springs occur near the base of the Edwards Limestone, as the underlying Walnut Formation (Kwa) tends to act as an aquitard. However, springs locally discharge groundwater farther down the geologic section in various members of the Walnut and in

the Upper Glen Rose Formation (Kgr(u)). It is likely that spring sites in the Walnut are controlled in part by structure features (joints and/or faults). Hydrologic communication among these bedrock units is the subject of ongoing studies. Figure 6 illustrates the general stratigraphic profile of the Jollyville Plateau, and Figure 7 depicts the regional mapped geology.

Figure 6: Jollyville Plateau Stratigraphic Profile



The cap rock in the area ranges in thickness from 100 feet to 0 feet. Where present the **Ked (Edwards Limestone)** exhibits significant karst development and potential cave formation. Significant water volume loss was reported during soil borings.

The **Kwa (Walnut Formation)** in the area is on the order of 100 feet thick with exposures in the lower elevations. Numerous springs are identified within this unit with minor karst development in the lower portions. Significant water loss was reported during soil borings.

The **Kgr(u) (Glen Rose Formation)** is exposed in the lowest elevations of the area and provides spring flow to the headwaters of Bull Creek. Zones of water loss during borings have been reported.

Watersheds are typically divided into two types, surface and subsurface. Surface watersheds are wholly controlled by topography whereas meteoric waters simply flow from the surface high to the low points.

The Permit Area is located at the juncture of a surface watershed divide between the Cypress and Bull Creek watersheds. The Cypress Creek watershed provides surface water to Lake Travis to the west and Lake Austin to the east along the divide which is approximated by FM 620 illustrated in Figure 8.

Subsurface watersheds are a bit more complex and are usually divided vertically by confining or retarding geologic units and laterally by primary and secondary porosity (De La Garza 1986). The results of the subsurface drainage are often showing in the form

of springs and seeps. These types of watersheds are often referred to as "springsheds". The local Edwards limestone is well known for karstic development resulting in significant secondary porosity and is responsible for numerous springs within the Permit Area, which occur at or near the contact of the Ked and Kwa contact shown in Figure 7.

The local geology is a well-documented karstic area with known caves and springs. The known caves in the Jollyville Plateau are generally contained in the Ked along with numerous documented surface recharge features. These features along with simple infiltration of meteoric waters provide water recharge sources for the upper springsheds. Vertical rock-jointing and small displacement faulting provides recharge pathways into and through the Kwa aquitard unit. These springsheds are likely somewhat localized in nature.

A second source of regional recharge comes from a semiconfined aquifer in the upper Glen Rose Kgr(u) which is likely sourced from a much larger recharge area.

The Jollyville Plateau is somewhat unique in that it is completely dissected from the more regional surface and subsurface flow regimes. Surface flow is controlled by surface topography and site development which uses water quality controls. Upper subsurface drainage areas appear to be localized and controlled by the Kwa geologic unit acting as an aquitard resulting in numerous springs. Some upwelled from the semi-confined lower subsurface drainage appears to be present in some of the streambed springs.

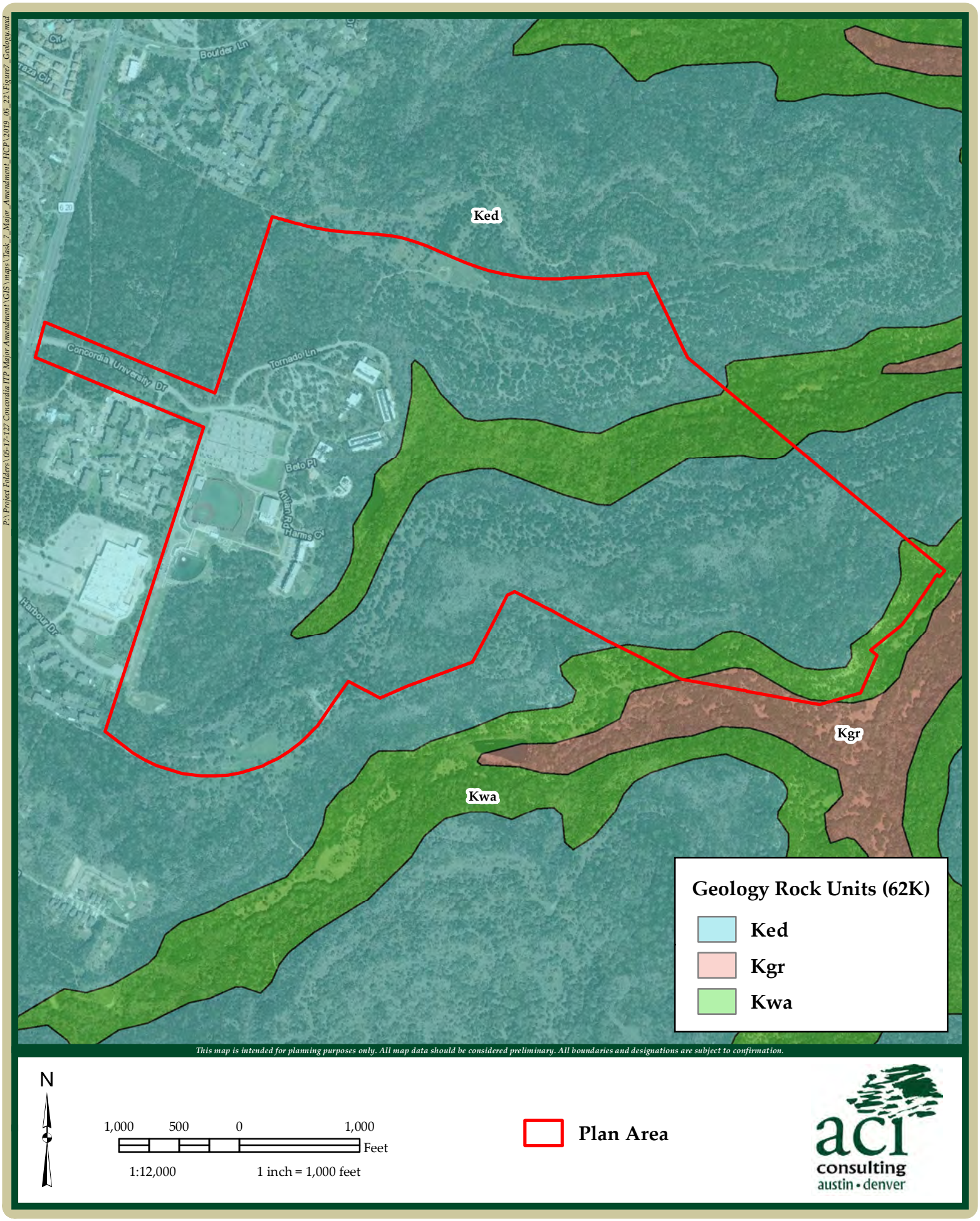


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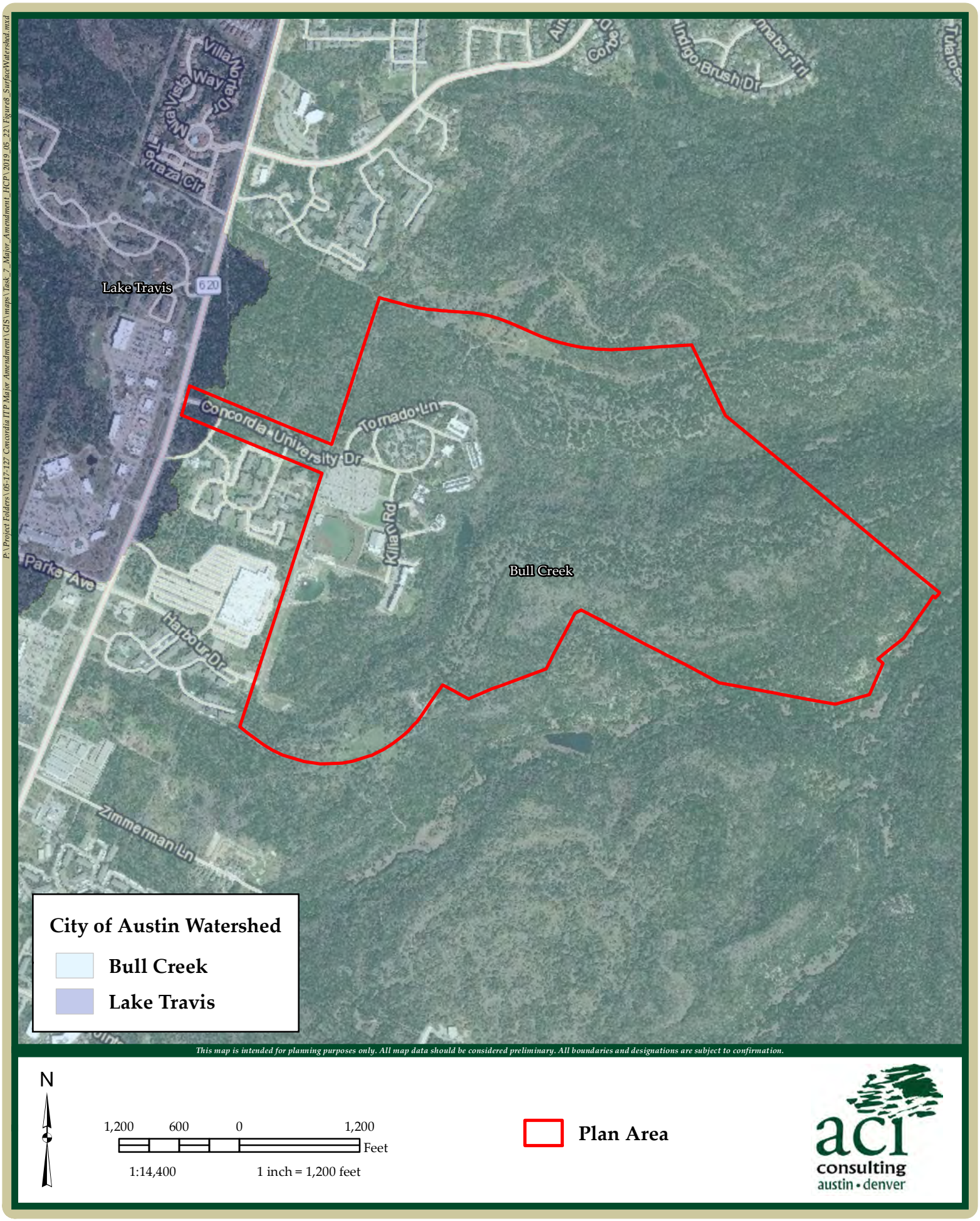
Figure 7: Regional Mapped Geology **March 2020**



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Concordia Habitat Conservation Plan Amendment **aci Project No.: 05-17-127**

Figure 8: Surface Watershed Divide **March 2020**

4.1.3 Jollyville Plateau Salamander within the Permit Area

The Permit Area is located within the headwaters of the Bull Creek watershed. According to the USFWS Critical Habitat Portal (2017), the Permit Area intersects two Critical Habitat Units (CHU): *Unit: 18 Bull Creek 2 Unit* and *Unit: 17 Bull Creek 1 Unit*. Within *Unit: 18 Bull Creek 2 Unit*, four occupied springs (Schlumberger Spring #2, Concordia Spring X, Concordia Spring Y, and #6) are located within the Permit Area, and two springs (Schlumberger Spring #1 and 19) are located directly adjacent to the Permit Area.

The federally designated subsurface and surface critical habitat of these springs intersects the developable area. Additionally, the eastern extent of the Permit Area intersects the federally designated surface and subsurface critical habitat of springs within the Unit: 17 Bull Creek 1 Unit CHU but does not intersect any occupied springs (Figure 9). However, staff from aci consulting, Kimley-Horn, and Concordia conducted an investigation to locate Schlumberger Spring #1 and #19, on December 15, 2017 (K. Ramberg, personal communication, December 15, 2017) but was unable to identify their location and determined that no potential habitat for the JPS exists at these locations. The CHUs for Schlumberger Spring #1 and #19 may have been mistakenly placed in an incorrect location during the rulemaking process for the federally designated critical habitat.

A recent JPS survey (Travis County 2017) identified 10 spring locations (salamander springs) within the Permit Area (Figure 10). Four of these spring locations corresponded with the Schlumberger Spring #2, Concordia Spring X, Concordia Spring Y, and #6 mapped as federally designated critical habitat.

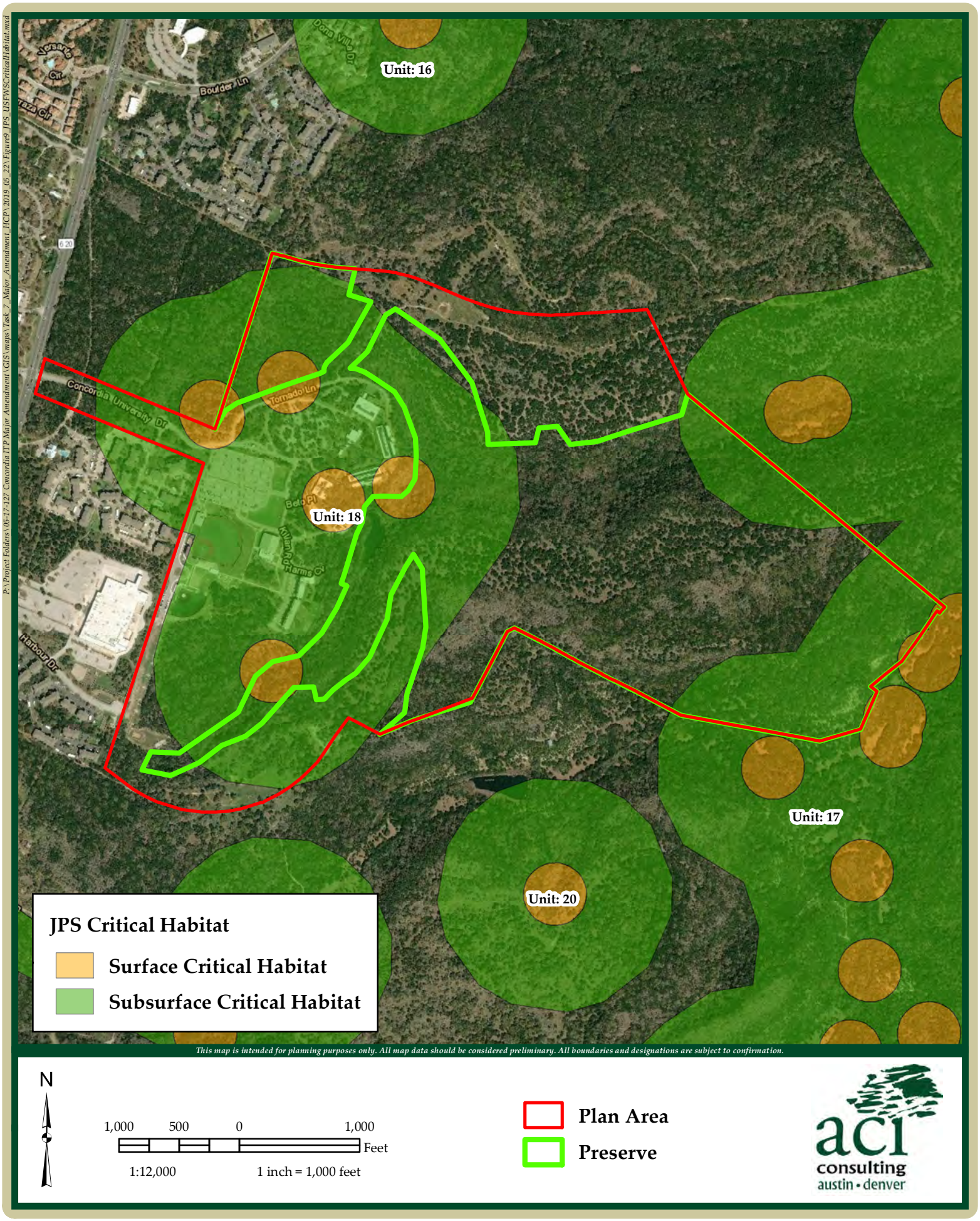

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Figure 9: Jollyville Plateau Salamander USFWS Critical Habitat **March 2020**

4.1.4 Existing TSS Removal within the Permit Area

The surface watersheds for each of the 10 salamander springs identified in the Travis County (2017) study were delineated, existing water quality controls were located, and the current TSS removal efficiencies without any additional development or redevelopment for each surface watershed draining to each salamander spring were calculated. The calculated surface watersheds are depicted in Figure 11 and the existing TSS removal efficiencies are detailed in Table 3. The Engineering report detailing these calculations is included as Appendix D.

Table 3: Existing TSS Removal Efficiencies for each Salamander Springshed

Existing Spring Name	Existing Drainage Area (acres)	Existing TSS Removal Efficiencies (%)*
Spring A	55.50	33.9
Spring B	65.15	40.5
Spring C	4.87	55.2
Spring D	5.91	59.6
Spring E	52.47	83.9
Spring F	62.52	83.5
Spring G	94.12	83.9
Spring H	247.88	64.9
Spring I	309.67	64.9
Spring J	323.77	64.9

* These calculations only apply to water sourced from within the Permit Area. Some watersheds may receive water from outside of the Permit Area.

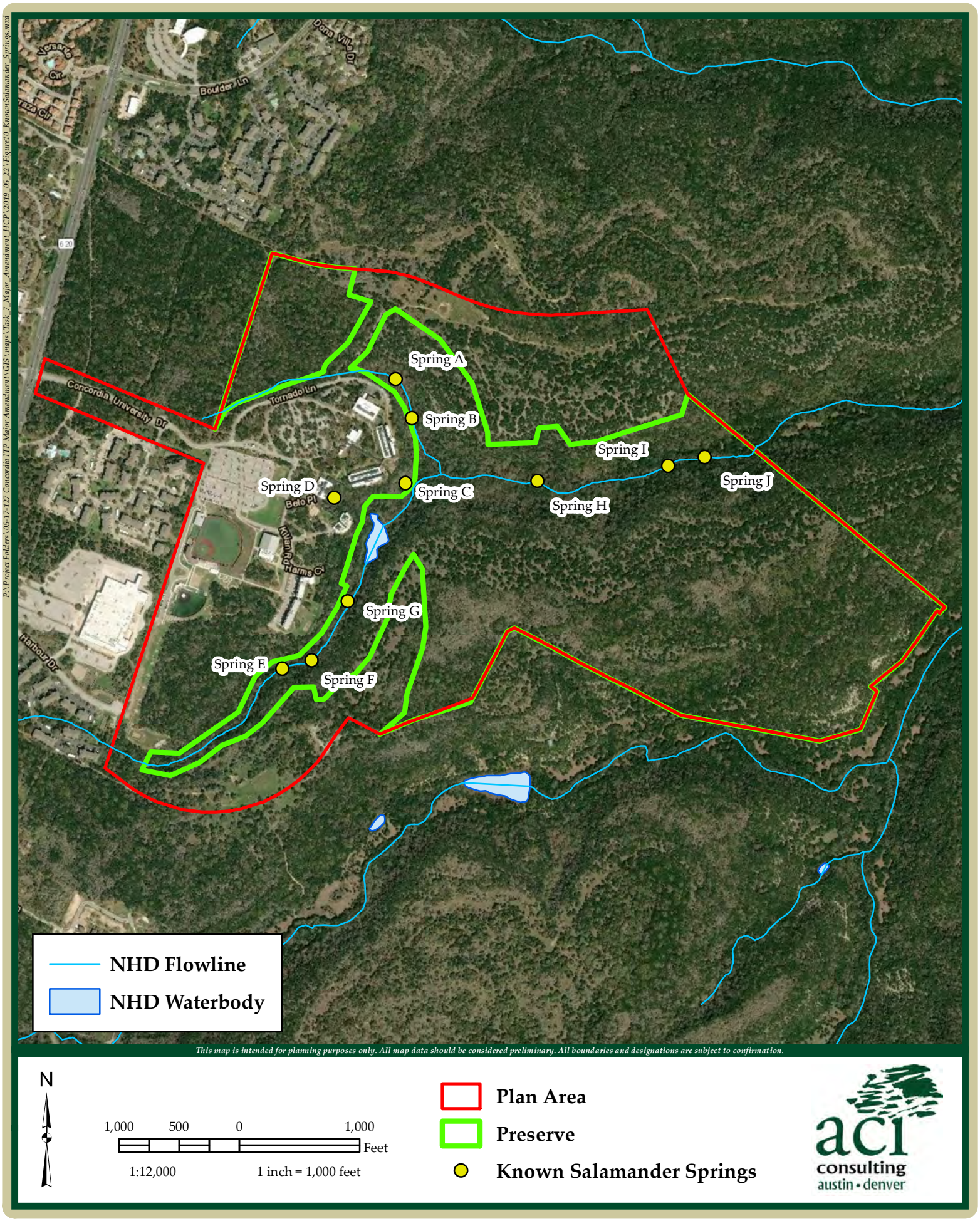

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Figure 10: Known Salamander Springs **March 2020**

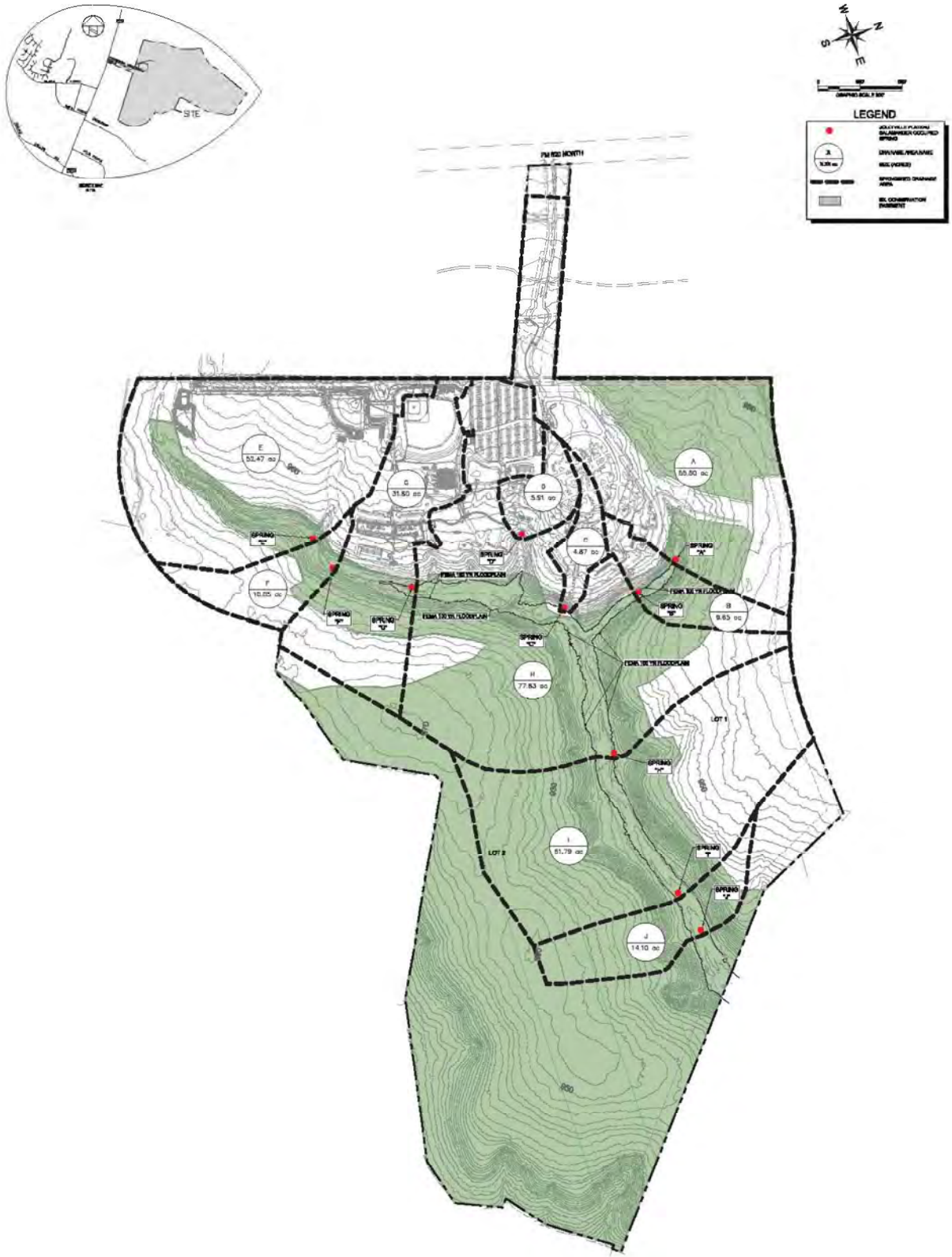

Figure 11

SALAMANDER SPRING WATERSHEDS

CONCORDIA UNIVERSITY TEXAS
EXISTING DEVELOPMENT
SPRINGSHED DRAINAGE AREAS
AUSTIN, TEXAS
JANUARY 2018

Kimley»Horn
18014 JOLLYVILLE RD
AVALLON IV, SUITE 300
AUSTIN, TEXAS
512-418-1771
STATE OF TEXAS REGISTRATION NO. F-928

4.2 *Other Federally Listed Species, Candidates for Listing, and Species of Concern*

Other federally listed species or candidates for federal listing that occur within Travis County but are not located within the Permit Area or will be unaffected by the proposed project include the Austin blind salamander, Barton Springs salamander, whooping crane, Bee Creek Cave Harvestman, Bone Cave harvestman, Tooth Cave spider, Tooth Cave pseudoscorpion, Krestchmar Cave mold beetle, Tooth Cave ground beetle, golden orb, smooth pimpleback, Texas fatmucket, Texas fawnsfoot, Texas pimpleback, and bracted twistflower. Additionally, the canyon mock-orange has been identified as a species of concern and the bald eagle is protected under the Bald and Golden Eagle Protection Act.

Species descriptions and the nearest known element occurrence (EO) of each species is identified below. It is anticipated that these species will not be affected by the proposed project.

4.2.1 Austin Blind Salamander

On August 22, 2012, USFWS released a proposed rule for the Austin blind salamander to be listed as endangered (USFWS 2012). This salamander was federally listed as endangered by the USFWS on August 20, 2013, with federally designated critical habitat (USFWS 2013a and USFWS 2013b). This species is an entirely aquatic and neotenic salamander known to occur in three of the four spring outlets of Barton Springs in the COA's Zilker Park, Austin, Texas. This salamander has not been observed at the fourth Barton Springs outlet known as Upper Barton Spring. This salamander grows to a length of approximately 2.5 inches, lacks external eyes, and has permanent external gills, a narrow head and an extended snout. The salamander's coloring is described as faintly reflective and pearly white in color with a lavender hue (USFWS 2012). The Austin blind salamander is described as a primarily subsurface dwelling species that spends most of its time living in the Edwards aquifer.

The primary stated threat to this species is habitat modification in the form of reduced flows and degradation of water quality of spring habitats as a result of urbanization within the watersheds and recharge and contributing zones of the Edwards aquifer (USFWS 2012).

According to the USFWS Critical Habitat Portal, the closest Critical Habitat Unit (CHU) of the Austin blind salamander (CHU #01) is approximately 10.7 miles southeast of the subject area at Barton Springs in Zilker Park within Travis County, Texas (USFWS 2017b). According to the TPWD TNDD (2017), the closest EO (EO ID#4046) corresponds with the CHU.

4.2.2 Barton Springs Salamander

The Barton Springs salamander was federally listed as endangered in 1997 and is an entirely aquatic and neotenic amphibian, which at the time of listing was only officially known to occur around four spring outlets within Zilker Park, Austin, Texas. The springs are collectively known as Barton Springs and consist of Parthenia, Eliza, Old Mill, and Upper Barton Springs (USFWS 1997). Devitt and Nissen (2018) identified seven additional occupied springs or well locations within the Onion and Barton Creek watersheds with water sourced from both the Edwards and Trinity Aquifers. The salamander is concentrated near the spring openings where food sources are abundant, water chemistry and temperature are relatively constant, and where the salamander has access to both surface and subsurface habitat (USFWS 1997).

The primary threat to the Barton Springs salamander is degradation to the quality and quantity of water that feeds Barton Springs from the Barton Springs watershed (USFWS 1997).

According to the TPWD TNDD (2017), the closest EO of the Barton Springs salamander is approximately 10.7 miles southeast of the subject area at Barton Springs in Zilker Park within Travis County, Texas (EO ID# 2464).

4.2.3 Whooping Crane

The whooping crane was federally listed as endangered on June 2, 1970, (USFWS 1970) under the Endangered Species Conservation Act of 1969. This species is also protected under the Migratory Bird Treaty Act (USFWS 2013c). The whooping crane typically breeds among rushes and sedges in marshes and meadows in Canada and winters on the estuarine marshes, shallow bays and tidal salt flats of the Texas coast. During migration, the crane typically stops to rest and feed in open bottomlands of large rivers, marshes, and in agricultural areas. Whooping cranes are omnivorous feeders. Some of the more common food items taken are crabs, clams, shrimp, snails, frogs, snakes, grasshoppers,

larval and nymph forms of flies, beetles, water bugs, birds, and small mammals (Campbell 2003). In Texas, critical habitat for the whooping crane is the area, land, and airspace of Aransas National Wildlife Refuge and vicinity (USFWS 1978).

According to the TPWD TNDD (2017), the nearest EO (EO ID# 4506) for the whooping crane is approximately 150.5 miles southeast of the project between Keller Bay and Matagorda Bay south of the City of Olivia in Calhoun County.

The nearest known occurrence of whooping cranes to the project is Granger Lake in Williamson County, Texas, approximately 30.6 miles northeast of the project area. Anecdotal observations of nine whooping cranes were made at the lake during the 2011-2012 winter season (TPWD 2012).

4.2.4 Bald Eagle

The bald eagle was originally listed as endangered in the lower 48 states in 1967 (USFWS 1967) but was reclassified as a threatened in 1995 (USFWS 1995) and subsequently delisted by the USFWS in 2007 (USFWS 2007b). The bald eagle is currently under a post-delisting monitoring plan, which began in early 2009 (USFWS 2009). This plan monitors the bald eagle every five years, for a 20-year period. Possession or take of the species is still prohibited under the Bald and Golden Eagle Protection Act. The purpose of this act is to protect bald and golden eagles from "take" of their parts, nests and/or eggs (USFWS 1999). No critical habitat rules have been published for the bald eagle in the 48 contiguous states. This species is also protected under the Migratory Bird Treaty Act and therefore it is illegal to "take, possess, import, export, transport, sell, purchase, barter, or offer for sale, purchase, or barter, any migratory bird, or the parts, nests, or eggs of such a bird except under the terms of a valid permit issued pursuant to Federal regulations" (USFWS 2013c).

The bald eagle is found primarily near seacoasts, rivers and large lakes where food resources such as fish and waterfowl are readily available. Eagles typically build their nests in 40- to 120-foot tall trees; nests are usually in the tallest trees in an area with an unobstructed flight path. Nest sites are also commonly within one to two miles of large water bodies such as lakes or reservoirs (Campbell 2003). The bald eagle nests from October to July in Texas with peak egg laying around December and hatching in January. In Texas, two populations are present year-round during the spring and fall: 1) breeding

populations – occurring in the east and along the coast line counties from Rockport to Houston and 2) wintering populations – occurring in the Panhandle, East and Central Texas and other suitable habitat throughout the state (Campbell 2003).

According to the TPWD TNDD (2017) the nearest EO (EO ID# 7363) for this species is approximately 28.4 miles southeast of the Permit Area on the Colorado River in Bastrop County, Texas.

4.2.5 Endangered Karst Invertebrates

Six endangered karst invertebrates have the potential to be present in Travis County. Descriptions of each species are as follows:

4.2.5.1 Bee Creek Cave Harvestman

The Bee Creek Cave harvestman was federally listed as endangered on September 16, 1988 (USFWS 1988). It is characterized as a long-legged, eyeless, yellowish-brown harvestman with a small body (2 mm or less). The species lives in Tooth, Bee Creek, McDonald, Weldon, and Bone Caves in Travis and Williamson counties, Texas. It is often found under rocks in complete darkness or dim light and preys on collembolans (Campbell 2003).

According to the TPWD TNDD (2017) the nearest EO (EO ID# 5981) for this species is approximately 1.9 miles southeast of the Permit Area approximately along Jester Boulevard approximately 1.5 miles north of the intersection of FM 2222 and Jester Boulevard in Travis county, Texas.

4.2.5.2 Bone Cave Harvestman

The Bone Cave harvestman was federally listed as endangered on August 18, 1993 (USFWS 1993), as an independent species from the Bee Creek Cave harvestman. It is characterized as a long-legged, blind, pale-orange harvestman. This species is often found under large rocks but can occasionally be seen walking on moist floors. In the summer, the species can be found only in the coolest, dampest spots of caves (Campbell 2003).

According to the TPWD TNDD (2017) the nearest EO (EO ID# 3337) for this species is approximately 0.7 mile southwest of the Permit Area approximately 0.2 mile northwest of the intersection of FM 2222 and FM 620 in Travis County, Texas.

4.2.5.3 Tooth Cave Spider

The Tooth Cave spider was federally listed as endangered on September 16, 1988 (USFWS 1988). It is characterized as a pale, long-legged spider that measures approximately 1.6 mm. Although it is a troglobite, reduced eyes are present. The species is found exclusively in Tooth Cave in Travis County. The species is sedentary and preys on microarthropods that are captured in its web (Campbell 2003).

According to the TPWD TNDD (2017) the nearest EO (EO ID# 3800) for this species is approximately 1.8 miles southwest of the Permit Area approximately 0.9 mile southwest of the intersection of FM 2222 and FM 620 in Travis County, Texas.

4.2.5.4 Tooth Cave Pseudoscorpion

The Tooth Cave pseudoscorpion was federally listed as endangered on September 16, 1988 (USFWS 1988). It is characterized as an eyeless, troglobitic pseudoscorpion that reaches approximately 4 mm. The species resembles a small, tailless scorpion that lacks a stinger, and is harmless to humans. The species uses pincers to capture small insects and other arthropods. It is found exclusively in Tooth and Amber Caves in Travis County, Texas. While the species is usually found under rocks, little else is known about its habits (Campbell 2003).

According to the TPWD TNDD (2017) the nearest EO (EO ID# 6824) for this species is approximately 0.6 mile southwest of the Permit Area approximately 0.2 mile north of the intersection of FM 2222 and FM 620 in Travis County, Texas.

4.2.5.5 Krestchmar Cave Mold Beetle

The Kretschmarr Cave mold beetle was federally listed as endangered on September 16, 1988 (USFWS 1988). It is characterized as a very small (less than 3 mm) dark-colored, eyeless, troglobitic beetle with long legs, and short wings. Available habitat for this species is limited and is restricted to Kretschmarr, Amber, Tooth, and Coffin Caves in Travis and Williamson Counties, Texas. This mold beetle is found in complete darkness under rocks amongst organic debris and buried in silt (Campbell 2003).

According to the TPWD TNDD (2017) the nearest EO (EO ID# 5006) for this species is approximately 0.5 mile west of the Permit Area approximately 0.6 mile north of the intersection of FM 2222 and FM 620 in Travis County, Texas.

4.2.5.6 Tooth Cave Ground Beetle

The Tooth Cave ground beetle was federally listed as endangered on September 16, 1988 (USFWS 1988). It is characterized as a small (5/16 inch), reddish-brown, troglobitic ground beetle. This is the largest, most visible, and most active of listed karst species in this area. It is usually found under rocks, but it has been seen walking on damp rocks and silt when conditions are favorable. This species appears to be restricted to areas of deep, uncompacted silt that is favored by cave crickets (*Ceuthophilus secretus*), where it digs holes to feed on cricket eggs. No critical habitat has been designated for this species (USFWS 1988).

According to the TPWD TNDD (2017) the nearest EO (EO ID# 826) for this species intersects the Permit Area. This EO is an approximately 1.25-mile buffer around Lamm Cave, which is described as occurring two miles north of Four Points and east of Ranch Road 620. The location of Lamm Cave is not located within the Permit Area, but the EO intersects the Permit Area.

4.2.5.7 Mapped Endangered Karst Invertebrate Habitat

In 1992 (revised 2007), Veni and Associates delineated four karst zones to define geologic areas with the potential for subsurface endangered karst invertebrates. The zones are:

- Zone 1: Areas known to contain listed invertebrate karst species;
- Zone 2: Areas having a high probability of containing habitat suitable for listed invertebrate karst species;
- Zone 3: Areas that have a low probability for containing listed invertebrate karst species; and
- Zone 4: Areas, both cavernous and non-cavernous, that do not contain endangered karst invertebrate species.

The Permit Area intersects approximately 26.5 acres of Zone 1: Areas known to contain listed invertebrate karst species, 331.1 acres of Zone 3: Areas that have a low probability for containing listed invertebrate karst species; and 81.2 acres of Karst Zone 4: Areas, both cavernous and non-cavernous, that do not contain endangered karst invertebrate species. A previous karst survey by Mike Warton of the Permit Area was conducted in 1993 and determined that no karst features were present that were considered to have the potential to provide habitat for any listed karst invertebrate. Based upon this survey, no federally listed karst invertebrates were included as covered species under the EA/HCP or the ITP.

4.2.6 Candidate Species

Six species that are candidates for federal listing occur within Travis County have the potential to be affected by the proposed project (USFWS 2018).

4.2.6.1 Golden Orb

The golden orb, a freshwater mussel, has been known to occur within the Brazos, Colorado, San Marcos, Guadalupe, San Antonio, Frio, and Nueces River systems. The species is subrectangular to broadly elliptical in shape and is approximately 77 mm in shell length. Habitat for this species typically consists of stable sand, gravel, and firm mud in flowing waters to depths of two to three meters (Howells et al. 1996).

According to the TPWD TNDD (2017), the nearest EO (EO ID# 9904) of the golden orb is approximately 51.6 miles southeast of the Permit Area along the San Marcos River in between Caldwell and Guadalupe Counties, Texas.

4.2.6.2 Smooth Pimpleback

The smooth pimpleback, a freshwater mussel, can grow to approximately 69 mm in length and generally has a shell that is "subquadrate to suboval or nearly round, solid, thick, inflated" shape (Howells 2014). This species occurs in rivers, creeks (moderately sized), and some reservoirs within the sand, mud, and gravel (Howells 2014). Howells (2014) states that this species is endemic to the Colorado and Brazos drainage basins.

According to the TPWD TNDD (2017), the nearest EO (EO ID# 9843) of the smooth pimpleback is approximately 26.3 miles northwest of the Permit Area along the Colorado River intersecting U.S. Highway 281 in Burnet County, Texas.

4.2.6.3 Texas Fatmucket

The Texas fatmucket, a freshwater mussel, is known to occur in the Colorado, Concho, San Saba, Llano, Pedernales, San Marcos, Guadalupe, and San Antonio River systems. The species is rhomboidal to slightly elongate in shape, is at least 90 mm in shell length and 53 mm in shell height (Howells et al. 1996). Habitat for this species typically consists of sand, mud and gravel in streams, and rivers with moderately flowing waters (Howells et al. 1996). In Colorado River tributaries, the species has been found between bedrock slabs (Howells et al. 1996).

According to the TPWD TNDD (2017), the nearest EO (EO ID# 9769) of the Texas fatmucket is approximately 18.9 miles southeast of the subject area along Onion Creek near the intersection of SH 130 and SH 71.

4.2.6.4 Texas Fawnsfoot

The Texas fawnsfoot, a freshwater mussel, can grow to approximately 60 mm in length and generally has a more compressed and elongated shell than other Truncilla species native to Texas (Howells 2014). Living populations are found in rivers and creeks (moderately sized), flowing waters, and in mud, sand, and gravel substrates (Howells 2014). Howells (2014) states that the Texas fawnsfoot is endemic to the Colorado and Brazos Rivers.

According to the TPWD TNDD (2017), the nearest EO (EO ID# 12649) of the Texas fawnsfoot is approximately 59.4 miles northwest of the proposed subject area along the Colorado River near Colorado Bend State Park along the San Saba and Lampasas County line, Texas.

4.2.6.5 Texas Pimpleback

The Texas pimpleback, a freshwater mussel, can grow to approximately 103 mm in length and generally has a shell that is "subquadrate to suboval or nearly round, solid, thick, moderately inflated" shape (Howells 2014). This species occurs in moderate to larger creeks and rivers with flowing waters and gravel, sand, or mud bottoms (Howells 2014). Howells (2014) states that this species is endemic to the Colorado and Guadalupe-San Antonio basins of Central Texas.

According to the TPWD TNDD (2017), the nearest EO (EO ID# 12355) of the Texas pimpleback is approximately 31.7 miles southwest of the proposed subject area along the Blanco River in Hays County, Texas.

4.2.6.6 Bracted Twistflower

This annual plant has delicate pink flowers and usually grows no taller than three feet. Bracted twistflower occurs on thin clay soils blanketing limestone. All Travis County populations occur in oak-juniper woodland with a canopy cover of 25 to 100%, and most

known sites are in areas that contain thick brush which appears to provide protection from deer. Plants that occur in association with bracted twistflower include evergreen sumac (*Rhus virens*), Mexican silktassel (*Garrya ovata* var. *lindheimeri*), shin oak (*Quercus sinuata* var. *breviloba*), elbowbush (*Forestiera angustifolia*), and myrtlecroton (*Bernardia myricifolia*) (BAT 1990).

This species is known to occupy similar habitats as the canyon-mock orange. The previous EA/HCP determined that the Permit Area was identified in a 1989 status report (Mcneal) to have an area of potential habitat for the canyon mock-orange within and on the upper slopes of the canyon and its northern tributary. However, the Property has not been surveyed for this species.

Most of this previously identified area of potential bracted twistflower is protected within the 250.62 preserve area and will not be affected by the proposed project. The potential habitat is identified in Figure 12.

According to the TPWD TNDD (2017), the nearest EO (EO ID# 12689) for the bracted twistflower is approximately 3.6 miles southeast of the Permit Area approximately 0.3 mile northeast of the intersection of Lakewood Drive and Loop 360 in Travis County, Texas.

4.2.7 Canyon Mock-orange

Canyon mock-orange occurs on steep and extensive outcrops of limestone. The known distribution of this species in Travis County is limited; however, the species appears tolerant of a wide range of sun exposure and is found in a variety of types of woodland. The previous EA/HCP determined that the Permit Area was identified in a 1989 status report (Mcneal) to have an area of potential habitat for the canyon mock-orange within and on the upper slopes of the canyon and its northern tributary. However, the Property has not been surveyed for this species.

The majority of this previously identified area of potential canyon-mock orange habitat is protected within the 250.62-acre preserve area and will not be affected by the proposed project. The potential habitat is identified in Figure 12.

According to the TPWD TNDD (2017), the nearest EO (EO ID# 5458) for the canyon mock-orange is approximately one mile southeast of the Permit Area along a West Bull Creek canyon in Travis County, Texas.

5.0 CONSERVATION STRATEGY

The purpose of this amendment is to allow for Concordia to sustainably develop the developable area within the Permit Area in order to fulfill the academic institution's mission consistent with its Master Plan and existing ITP, while employing long-term conservation strategies the JPS. Impacts to JPS will be avoided and minimized by employing sustainable development techniques in the developable area, particularly techniques designed to protect water quality and to implement "management activities that could ameliorate threats" that were previously described in Section 4.1.1.

The salamander springs in the existing preserve area will be protected from direct impacts associated with development and ongoing operations and maintenance of the Concordia campus. In addition, the utilization of the enhanced water quality measures (RG-348), which minimize pollutant loads within stormwater runoff, will preserve the springsheds of the occupied salamander springs located in the preserve area. Two of the salamander springs, Springs C and D, located outside of the preserve area and within the developable area, are expected to be adversely impacted over time due to their location, proximity to existing development, ongoing maintenance and operations associated with existing development, and future redevelopment.

Concordia is committed to continuing to include threatened and endangered species biology as part of its academic curriculum. The existence of occupied salamander springs in both the preserve area as well as the developable area created a unique opportunity to monitor the effects of development, redevelopment, existing infrastructure, ongoing operations, and maintenance activities on water quality in the spring locations, as well as potential impacts to salamanders. In essence, Concordia can harness its institutional resources to develop and implement studies, surveying, and monitoring in a "living laboratory."

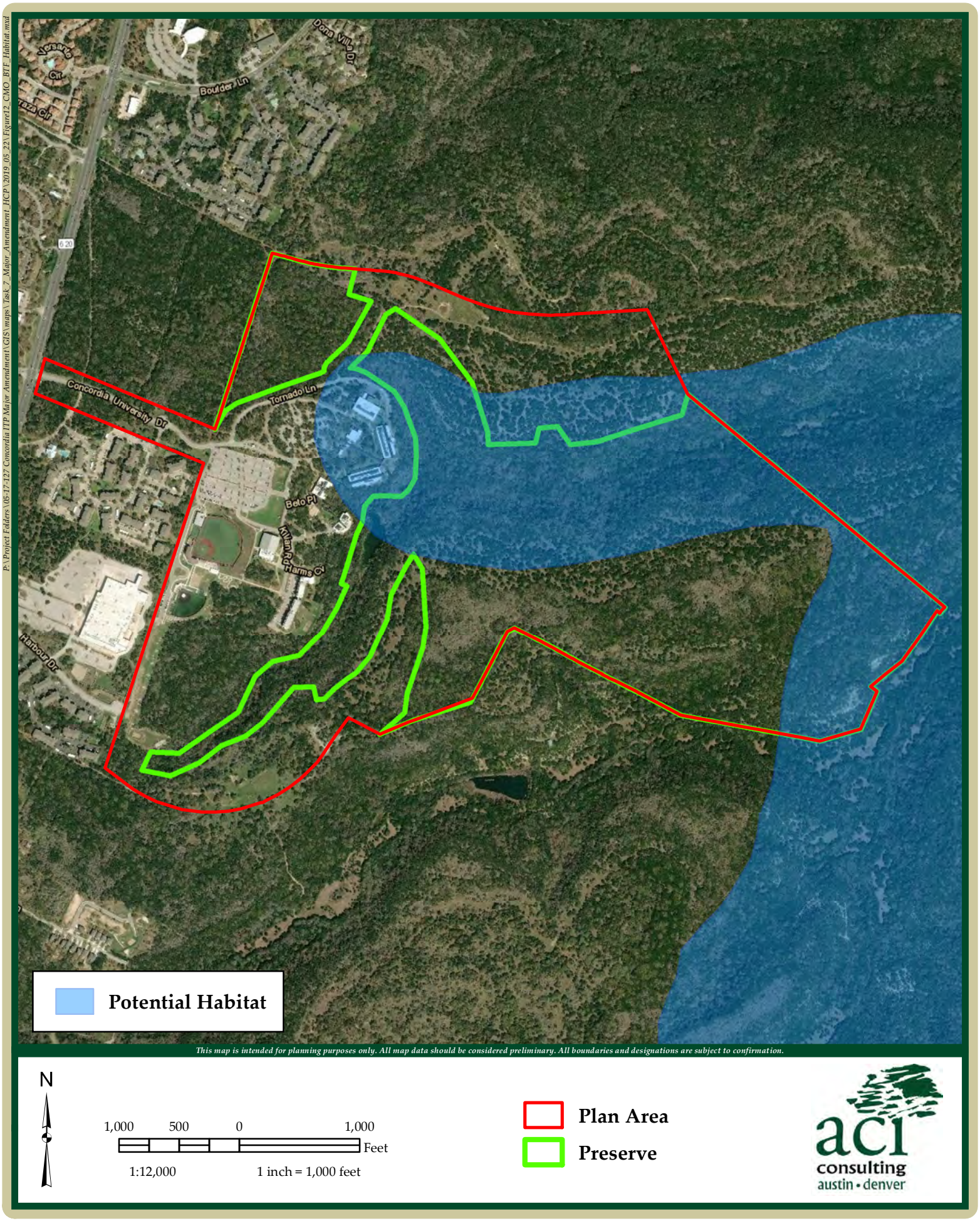

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Figure 12: Probable Habitat for *Amorpha roemeriana* and *Philadelphus ernestii* **March 2020**

The results of this education and monitoring will help to inform future conservation efforts for the JPS throughout its range.

5.1 *Biological Goals*

Biological goals broadly describe the desired future conditions of an HCP and objectives are the incremental steps taken to achieve those goals. Objectives are specific, measurable, achievable, result-oriented, and time-fixed, and are implemented through individual conservation measures. To meet each goal, each conservation measure is implemented to satisfy each objective.

The Biological Goals for this amendment are:

1. To protect, maintain, and/or enhance water quality at JPS springs by protection of surface water quality in their respective springsheds, and preserve the integrity and function of PCEs associated with JPS designated critical habitat from destruction or adverse modification within the Permit Area;
2. To contribute to JPS scientific knowledge to improve understanding and inform effective conservation strategies for the species;
3. Establish a campus-wide framework for ecological sustainability and environmental sensitivity; and
4. Improve surface water quality within the Permit Area to improve surface water quality downstream within the Bull Creek watershed.

5.2 *Objectives*

The objectives to establish a framework of sustainable development for Concordia that will outline the measures necessary to preserve or improve the current surface water quality within known JPS springs that intersect the Permit Area and protect federally designated surface and subsurface critical habitat from destruction or adverse modification are as follows:

1. Identify the existing TSS removal efficiencies of each watershed draining to each spring;
2. Identify best management practices for sustainable development that protect water quality for aquifer dependent species; and
3. Determine the post-construction TSS removal efficiencies of each watershed following completion of the proposed development.

Concordia will meet the goal of providing for the continuing understanding of the species by conducting monitoring and study program for JPS within the Permit Area. This monitoring and study program will be incorporated into numerous curricula administered throughout Concordia's numerous departments and is further described in Section 5.4.2.3. This monitoring and resulting data will help provide further understanding of the species as it relates to conservation measures administered within their watersheds and the effects of the proposed development on the water quality of their habitats and overall sustainability of their localized populations. The monitoring and study program is described in Section 9.1.

5.3 *Conservation Measures*

This section describes the avoidance, minimization, and mitigation measures for the JPS that are necessary to meet the biological goals and objectives of this amendment. These measures were primarily identified to protect parameters consistent with the PCEs USFWS identified as being essential for JPS habitat and special management considerations for the species. The PCEs and the special management considerations were previously identified in Section 4.1.1.

The conservation measures are based on the PCEs and special management considerations due to USFWS' determination that if the PCEs are present in an area, those areas may provide suitable habitat for the JPS, and if the special management considerations are adhered to, those JPS habitat areas are unlikely to be degraded to the point that JPS are adversely impacted on a permanent basis.

5.3.1 Avoidance

Every known salamander spring will be specifically avoided during development planning and construction activities. Additionally, every known salamander spring within the Permit Area except for Spring C and Spring D are located within preserve land either owned by Concordia or the COA and are fenced off from public access. Spring D is located below a walkway on Concordia's campus within the developable area and Spring C is located at the bottom of the canyon adjacent to the preserve area. Although they are not located within the limits of the designated preserve area, both Spring C and Spring D are contained within the gated high fencing of the preserve and are protected from human activity because they are not accessible from campus.

These avoidance measures will protect the rocky substrate with interstitial spaces, aquatic invertebrates used for food, and subsurface spaces identified as PCEs of the federally designated critical habitat for the species. Additionally, these measures satisfy or contribute to special management considerations 4, 5, and 6.

5.3.2 Minimization

5.3.2.1 Protecting the quality of groundwater by implementing comprehensive programs to control and reduce point sources and non-point sources of pollution on the developable areas of the Concordia campus.

Concordia will comply with the parameters outlined in the TCEQ RG-348 document and the Enhanced Measures, which establishes buffers around drainage areas larger than 5 acres. Furthermore, all future development will be designed so that any surface water discharges will meet or exceed an 80% TSS removal efficiency. These water quality measures will reduce both point source and non-point sources of pollution and protect the quality of groundwater.

Concordia has a rigorous Integrated Pest Management plan (IPM) (Appendix E) for the campus and a hazardous materials plan (Appendix F), that protects groundwater from both point source and non-point source pollution from contaminants, fuel spills, pesticides, herbicides, or fertilizer. Concordia has implemented an IPM, emergency spill plan, and has limited the amount of hazardous materials on campus to the minimum necessary and stores these materials away from sensitive recharge features. The IPM is included as Appendix E and the hazardous materials plan is included as Appendix F.

Concordia does not establish typical lawns comprised of non-native grasses and other non-native vegetation on campus, instead preserving native vegetation along with allowing additional native grasses and forbs to become established. Native vegetation will be utilized for the revegetation of areas disturbed during development. The species that will be included in the seed mix will generally correspond with established Texas Department of Transportation (TxDOT) seed planting mixes for the Austin District. Table 4 depicts the permanent seed mix for time of year and soil type that will be applied to revegetate disturbed areas. If the seeding date falls out of this timeframe, a temporary seed mix outlined in Table 5 will be planted to temporarily stabilize the soil prior to the final seed mix being applied.

Table 4: Permanent Seed Mixes and Planting Dates

Planting Date	Clay Soils (Species)	Rates lbs PLS/acre	Sandy Soils (Species)	Rates lbs PLS/acre
February 1 – May 15	Green Sprangletop (Van Horn)	1.0	Green Sprangletop (Van Horn)	1.0
	Sideoats Grama (South Texas)	1.0	Hooded Windmillgrass (Mariah)	0.2
	Texas Grama (Atascosa)	1.0	Shortspike Windmillgrass (Welder)	0.2
	Hairy Grama (Chaparral)	0.4	Hairy Grama (Chaparral)	0.4
	Shortspike Windmillgrass (Welder)	0.2	Slender Grama (Dilley)	1.0
	Little Bluestem (OK Select)	0.8	Sand Lovegrass (Mason)	0.2
	Purple Prairie Clover (Cuero)	0.6	Sand Dropseed (Borden County)	0.2
	Engelmann Daisy (Eldorado)	0.75	Partridge Pea (Comanche)	0.6
	Illinois Bundleflower (Sabine)	1.3	Little Bluestem (OK Select)	0.8
	Awnless Bushsunflower (Plateau)	0.2	Engelmann Daisey (Eldorado)	0.75
			Purple Prairie Clover	0.3

Table 5: Temporary Seed Mix and Planting Dates

Planting Date	Species	Rates (lbs PLS/acre)
Cool Season Sep 1 – Nov 30	Tall Fescue Oats Wheat	4.5 24.0 34.0
Warm Season May 1 – Aug 31	Foxtail Millet	34

Concordia will coordinate with other entities to apply construction best management practices related to surface and subsurface work near aquatic salamander springs. For example, Concordia will coordinate with the TxDOT to review any standard roadway construction BMPs near salamander springs. In the March of 2018, Concordia representatives visited USFWS's National Conservation Training Center (NCTC) to learn some of NCTC's BMPs for managing the campus, building, and natural areas. Concordia plans to continue to collaborate with NCTC regarding general low impact BMPs on campus. These measures will be implemented to the maximum extent practicable.

Implementation of this minimization measure will help protect the subterranean aquifer, aquatic invertebrates used for food, and subsurface spaces identified as PCEs of the federally designated critical habitat for the JPS.

5.3.2.2 Protecting the quality and quantity of surface water by implementing comprehensive programs to control and reduce point sources and non-point sources of pollution within the surface drainage areas of the known salamander spring sites.

Concordia will comply with the parameters outlined in the TCEQ RG-348 document and the Enhanced Measures, which establishes buffers around drainage areas larger than 5 acres. Furthermore, all future development, which includes redevelopment of existing development, will be designed that any surface water discharges leaving the developable area or flowing into a salamander spring will meet or exceed an 80% TSS removal efficiency. These water quality measures will serve to reduce both point and non-point sources of pollution and protect surface water drainages to known, occupied salamander spring sites.

Concordia has a rigorous IPM and a hazardous materials plan that protects known, occupied salamander spring sites from both point source and non-point source pollution from contaminants, fuel spills, pesticides, herbicides, or fertilizer. Concordia has implemented an IPM, emergency spill plan, and has limited the amount of hazardous materials on campus to the minimum necessary and stores these materials away from sensitive features including known, occupied salamander springs.

Additionally, Concordia will coordinate with other entities such as the COA, Travis County, and the TCEQ to apply construction best management practices related to surface and subsurface work near aquatic salamander springs. For example, Concordia will coordinate with TxDOT to review any standard construction BMPs near salamander springs. In March of 2018, Concordia representatives visited USFWS's National Conservation Training Center (NCTC) to learn some of NCTC's BMPs for managing the campus, building and natural areas. These BMPs include practices that will minimize impacts to the JPS, specifically:

- Buildings designed for permanence and low maintenance.
- Modeling NCTC and USFWS natural resource land management practices.

- Through mowing, controlling invasive species of flora and fauna, and re-establishment of native vegetation efforts, Concordia is able to provide ample protection for native plants and wildlife.
- Concordia is a walking campus with parking areas on the outskirts of buildings, minimizing need for interior roads and paved surfaces.
- Environmental controls through integrated pest management and pesticide use.

Concordia plans to continue to collaborate with NCTC regarding general low impact BMPs on campus. These measures will be implemented to the maximum extent practicable.

Implementation of this minimization measure will protect the surface storm water quality and the areas containing the elements identified as PCEs of the federally designated critical habitat for the JPS.

5.3.2.3 Protecting groundwater and spring flow quantity by implementing water conservation and drought contingency plans.

To better protect the local environment, Concordia plans to participate in the Association for the Advancement of Sustainability in Higher Education (AASHE) Sustainability Tracking, Assessment, and Rating System (STARS). STARS is a transparent, self-reporting framework for colleges and universities to measure their sustainability performance.

Two key areas of the AASHE STARS for protecting JPS are Water Use and Rainwater Management. Water use consists of the institution gathering data on potable water use, total water use (potable and non-potable), numbers of campus users, gross square feet/meters of floor area, and area of vegetated grounds. Rainwater management consists of the institutions use of green infrastructure and low impact development (LID) practices to help mitigate stormwater runoff impacts and treat rainwater as a resource rather than as a waste product. Concordia will attempt to minimize both potable and non-potable water use on the Property as well as maximize the green infrastructure and minimize their development impacts to the maximum extent practicable. Concordia will incorporate rainwater collection into new development and redevelopment and will slowly disperse the rainwater into rain gardens or utilize the water for irrigation.

These minimization measures will protect the aquifer water quality and quantity, subterranean interstitial spaces, aquatic invertebrates used for food, and subsurface spaces identified as PCEs of the federally designated critical habitat for the JPS. Additionally, these measures satisfy or contribute to special management considerations 1, 2, and 3, which will serve to ameliorate potential degradation to JPS habitat within the Permit Area, and minimize negative effects to the individual JPS in those areas.

5.3.2.4 Fencing and signage to protect from human vandalism and to educate students, staff, and faculty.

Concordia currently utilizes fencing and signage to protect the preserve area from human vandalism. In addition, Concordia utilizes fencing and signage to protect the two known, occupied springs located within the developable area of the campus from human vandalism.

Concordia utilizes signage and kiosks throughout its campus to inform faculty, staff, and students about the federally listed endangered species located on and around the campus. These signs and kiosks serve an educational purpose and help create a campus-wide conservation ethos.

5.3.2.5 Protecting water quality and quantity from present and future quarrying.

Concordia commits to refrain from conducting any quarrying activities on any area within the Permit Area. As noted above, Concordia is will participate in AASHE STARS. As part of this, Concordia will be utilizing sustainable building products, hardscaping products, and landscaping supplies, that are sustainable and will integrate in harmony with the natural environment.

5.3.2.6 Monitoring and Study of JPS and JPS habitat

Monitoring efforts will be conducted for the JPS and its habitat within the Permit Area. This monitoring and study will also be incorporated into Concordia's curricula. Both the monitoring and study and the Concordia curricula will revolve around conservation on campus and in the surrounding landscape and demonstrate that Concordia is dedicated to their Property operating as a living laboratory for the study of the species within the Permit Area. Furthermore, Concordia will conduct or facilitate ongoing water quality and salamander population studies within the Permit Area and contribute that data to USFWS as part of the reporting requirements to accommodate the increased knowledge

of the species. The proposed monitoring program for this HCP is further detailed in Section 9.1.

In 2017, Concordia established and filled the full-time position for Director of Environmental Stewardship. This position serves as the primary liaison between Concordia and Travis County, the conservation easement holder for the preserve. The Director of Environmental Stewardship is also involved in the development of curricula, preserve access and the environmental management systems on campus.

5.3.3 Mitigation

Concordia anticipates that adhering to the previously described avoidance and minimization measures during build out of the campus in accordance with the Master Plan will largely minimize effects to the JPS. However, the Covered Activities have the potential to result in "take" of the JPS. As such, actions to mitigate for any potential incidental take are described below.

5.3.3.1 Invasive Species Control

Concordia currently implements an invasive species control strategy throughout the Permit Area for both flora and fauna. Current invasive species control activities include invasive vegetation removal and feral hog control coordinated with Travis County personnel. Feral hogs can directly disturb aquatic areas including salamander habitat and the PCEs for JPS surface and subsurface critical habitat. Feral hog activity, including foraging activity, can uproot and disturb native vegetation, disturb and dislodge native soils, and kill or injure native wildlife. The uprooting and destruction of native plants, as well as disturbing and dislodging native soils, can lead directly to adverse impacts to water quality within the spring sheds for occupied salamander springs. In addition, increased sedimentation can directly cause the destruction or adverse modification of surface and subsurface PCEs for JPS Critical Habitat.

There are numerous invasive plant species that occur throughout the Permit Area including Japanese privet (*Ligustrum japonicum*), Chinese privet (*L. sinense*), chinaberry (*Melia azedarach*), Nandina (*Nandina domestica*), Japanese honeysuckle (*Lonicera japonica*), tree of heaven (*Ailanthus altissima*), Chinese tallowtree (*Triadica sebifera*), and paper mulberry (*Broussonetia papyrifera*). These invasive plant species can overtake or displace native plants and have an adverse impact on the native ecosystem. In addition, invasive plant species in some cases can utilize far more water than native plant species, which

over time, can disrupt natural spring flows and water quantity in the aquifer. The eradication or control of these invasive plant species is necessary to protect the native ecosystem, and to protect water quantity.

A comprehensive invasive species control strategy through the Permit Area will require significant resources to implement, but should provide significant conservation benefit by: 1) protecting the quality of groundwater by helping to control and reduce adverse impacts from invasive species will reduce point sources and non-point sources of pollution; 2) protecting the quality and quantity of surface water by helping to control and reduce adverse impacts from invasive species on point source and non-point source of pollution within the surface drainage areas of known, occupied salamander spring sites; and by protecting groundwater and spring flow quantity. These measures will promote the survival of individual JPS at each spring location.

The conservation easement (CE) for the preserve area granted by Concordia and held by Travis County identifies the responsibilities of each entity with respect to feral hogs and invasive species as follows, *[Concordia] will coordinate with [Travis County] in [Concordia's] plans for feral hog and invasive species control on the Preserve Tract.* The CE also establishes that the preserve area is included under the management principles of the Balcones Canyonlands Conservation Plan (BCCP) Tier II Land Management Plan (LMP), described in the BCCP HCP as "Land Management Plan and Guidelines" (Appendix G).

Concordia will enter into a written agreement with Travis County for land management and monitoring activities for the Preserve Tract and the Development Tract. Concordia is currently working with Travis County to establish the feral hog and invasive plant species control protocol, along with other protocols, for the preserve area. Once completed, this written agreement for land management and monitoring will establish the exact responsibilities of Concordia and Travis County with respect to these protocols.

The Current Tier II LMP, which applies to all BCCP-managed tracts states the following:

> *Typical animal control efforts on preserve tracts will likely involve some combinations of the following approaches: public education; manipulation of problem species habitat; selective relocation of individual problem animals; and destruction of problem animals on a population level. Control efforts should use methods that emphasize maximum selectivity and effectiveness at minimum cost. Destruction of problem animals will be done in a humane manner.*

Concordia will work with Travis County to complete a written agreement for land management and monitoring that will allow for the following invasive species control measures or similar measures:

1. Conduct a bi-monthly survey within 262 feet (80 m) of the known occupied JPS springs to document locations of invasive vegetation and signs of feral hog damage;
2. If invasive vegetation is identified, the vegetation will be cut and treated and left in place;
3. If signs of feral hog damage are present, note the area of impact;
4. Implement a feral hog trapping program throughout the preserve area and destroy any caught feral hogs humanely;
5. Optional - Conduct feral hog hunts throughout the preserve area during the winter and summer when classes are not scheduled. If feral hog hunts will occur, the Director of Environmental Stewardship or Associate Vice President of Building Operations for Concordia will be notified two weeks in advance and signs will be placed around the Concordia Campus to provide notification that hunting will be occurring in the adjacent preserve area. Additionally, the COA Police Department and Fire Department will be notified the day before the proposed hunts;
6. Optional – Travis County will conduct similar activities on the adjacent preserve lands not owned by Concordia.

5.3.3.2 Restoration of damaged or impaired spring sites and JPS habitat areas

Concordia will restore salamander spring sites and JPS habitat areas that have been damaged or impaired due to invasive species or human activity. These restoration efforts will be developed in coordination with Travis County and the USFWS. Restoration activities will be conducted by Concordia in coordination with Travis County within the preserve area.

If impaired spring sites are identified during monitoring activities (Section 9.1), the type of impairment will be identified, which could include invasive species colonization of the spring site, feral hog rooting, and litter or trash accumulation due to human pedestrian use. If invasive species have colonized the spring site, each individual of an invasive species will be cut, pulled, or treated at that site. If feral hogs have impacted the spring site, the impacted area will be inspected for JPS individuals, and if no individuals are identified, shovels and rakes will be utilized to re-contour the area back to its assumed

pre-impact contour. Following the re-contouring, a native grass seed mix that includes fast-growing annuals will be applied to the site at the recommended rates to stabilize the area and promote native species growth. If litter or trash is identified at a spring site, the litter or trash will be collected and disposed of through Concordia's solid waste disposal system. Currently, only Spring C has been identified as being impaired by feral hog activity.

5.4 *Conservation Program*

The objectives and the avoidance, minimization, and mitigation conservation measures proposed to achieve each goal are described in the following sections.

5.4.1 Goal 1

To protect, maintain, and/or enhance water quality at JPS springs by protection of surface water quality in their respective springsheds, and preserve the integrity and function of PCEs associated with JPS designated critical habitat from destruction or adverse modification within the Permit Area.

5.4.1.1 Objective 1

Concordia will avoid direct impacts to designated JPS critical habitat PCEs during all phases of development and redevelopment within the Permit Area.

Conservation Measure 1

All known, occupied JPS springs within the Permit Area will be avoided during development planning and construction activities.

Conservation Measure 2

No residential, commercial, or institutional development will be allowed within the limits of the 250.62 acre preserve.

Conservation Measure 3

Within the developable area, no new construction will be allowed in JPS springs. Springs C and D are located within Concordia's "developable area," however, Springs C and D are enclosed within the protective confines of the preserve's high fence. No new construction activities will be allowed within portions of the developable area that are currently within the preserve's protective fencing around Springs C and D.

Conservation Measure 4

Ongoing operation and maintenance activities will not be conducted in Springs C or D; however, operation and maintenance activities will be allowed to continue within the surface critical habitat for Springs C and D as necessary.

5.4.1.2 Objective 2

Concordia will ensure the protection of known, occupied JPS springs and critical habitat PCEs throughout the continued operation of Concordia as a university within the Permit Area.

Conservation Measure 1

Continue to restrict access to existing JPS springs by maintaining fences and limiting access to the preserve to authorized personnel and activities. A running log of all personnel accessing the JPS springs will be maintained.

Conservation Measure 2

Continue educating/training Concordia faculty, staff, students, and visitors on the JPS and the rules restricting access to protected JPS features and any potential consequences for unauthorized access or intentional damage. All education and training for faculty, staff, students and visitors will be documented and maintained.

Conservation Measure 3

To the maximum extent practical, continue preserving native vegetation instead of establishing non-native grass lawns within the developable area. Utilize native vegetation for the revegetation of areas disturbed during development or redevelopment.

Conservation Measure 4

Where evidence of disturbance exists, coordinate with Travis County to install exclusionary fencing and signage around disturbed JPS springs to protect spring habitats from invasive species damage and human vandalism. The exclusionary fencing would be installed within the boundaries of the existing preserve fence. This commitment will be implemented under the written agreement for land management and monitoring between Concordia and Travis County.

Conservation Measure 5

Continue the feral hog reduction/elimination program. A formal plan will be finalized with Travis County in conjunction with the creation of the written agreement for land management and monitoring between Concordia and Travis County prior to issuance of the ITP.

5.4.1.3 Objective 3

Concordia will identify baseline TSS removal efficiencies within the Permit Area based on the existing development to determine if future implemented water quality BMPs associated with new development or redevelopment will maintain or improve water quality in JPS springsheds.

Conservation Measure 1

Concordia has completed a water quality baseline assessment and established baseline TSS removal efficiencies for each springshed (Table 3). The baseline information will provide a measure to determine if future implemented water quality BMPs associated with new development or redevelopment will maintain or improve water quality in JPS springsheds.

5.4.1.4 Objective 4

Concordia will maintain or improve water quality and designated JPS critical habitat PCE integrity and function by implementing established water quality BMPs and identifying other BMPs to further improve sustainable future development and redevelopment.

Conservation Measure 1

Ensure that any development or redevelopment within the Permit Area will implement BMPs to maintain and/or improve water quality in JPS springsheds by complying with the OEMs during all future development and redevelopment. Additionally, implement a Stormwater Pollution Prevention Plan (SWP3) during construction activities.

The SWP3 will include weekly inspections of all stormwater BMPs. If a 0.5-inch rain event occurs at the construction area, an inspection of the temporary BMPs will be performed within 24 hours.

Conservation Measure 2

Concordia will coordinate with external partners such as State and Federal entities on the most current BMPs related to surface and subsurface work near neotenic salamander springs.

In March of 2018, Concordia representatives visited USFWS's National Conservation Training Center (NCTC) to learn some of NCTC's BMPs for managing the campus, building and natural areas. Concordia will continue to collaborate with NCTC regarding general low impact BMPs on campus. These measures will be implemented to the maximum extent practicable. These BMPs include:

- Buildings designed for permanence and low maintenance.
- Walking and hiking trails inner-connect the buildings for guest and staff access, yet allow quick detours to explore the campus.
- Modeling NCTC and US Fish and Wildlife Service natural resource land management practices.
- Through mowing, controlling invasive species of flora and fauna, and re-establishment of native vegetation efforts, Concordia makes it a priority to provide ample protection for native plants and wildlife.
- Concordia is a walking campus with parking areas on the outskirts of buildings, yet these lots offer premier parking spots for hybrid and motorcycles.
- Environmental controls through integrated pest management and pesticide use.

Conservation Measure 3

Concordia will continue to use the established IPM program (Concordia IPM; Appendix E) for the entire developable area and will continue to only use pesticides inside buildings and will not utilize pesticides or herbicides throughout the exterior of Concordia's property except within the athletic fields.

Conservation Measure 4

Hazardous materials will be stored away from areas draining toward existing JPS springs and an emergency spill plan will be maintained and implemented if a spill was to occur.

5.4.1.5 Objective 5

Implement a monitoring program (Section 9.1) within Springs C and D to monitor the TSS removal efficiencies of each spring watershed prior to, during, and following the completion of future development and redevelopment.

Conservation Measure 1

All work will follow Section 9.1.1 Water Quality Monitoring Protocol for *general water quality monitoring* and *water quality monitoring protocol during development cycle*, and Section 9.1.2 JPS Presence/Absence Surveys for *general* and *development cycle JPS Presence/Absence surveys*.

5.4.2 Goal 2

Contribute to JPS scientific knowledge to improve understanding and inform effective conservation strategies for the species. The following objectives and conservation measures describe the implementation of this goal.

5.4.2.1 Objective 1

Implement a monitoring program to track the water quality of the springs with respect to development practices within the Permit Area.

Conservation Measure 1

All work will follow Section 9.1.1 Water Quality Monitoring Protocol for *general water quality monitoring* and *water quality monitoring protocol during development cycle*, and Section 9.1.2 JPS Presence/Absence Surveys for *general* and *development cycle JPS Presence/Absence surveys*.

Conservation Measure 2

Calculate the percentage ground disturbance within each springshed that has an active development or redevelopment occurring. Ground disturbance will be calculated as the area within an active development or redevelopment that has an active SWP3 once earthwork has begun. This data may be utilized to correlate changes in development with changes in water quality data or JPS presence/absence.

This calculation will be conducted within 1 week (before or after) of each sampling event in Conservation Measure 1 for this objective.

5.4.2.2 Objective 2

Implement a monitoring program to monitor the future TSS removal efficiencies for each spring drainage area during and following the completion of new development and redevelopment.

These conservation measures will be conducted as part of Goal 2 – Objective 5 but will also apply to this goal and objective.

Conservation Measure 1

All work will follow Section 9.1.1 Water Quality Monitoring Protocol for *general water quality monitoring* and *water quality monitoring protocol during development cycle*, and Section 9.1.2 JPS Presence/Absence Surveys for *general* and *development cycle JPS Presence/Absence surveys*.

5.4.2.3 Objective 3

Conduct JPS studies and disseminate the science.

Conservation Measure 1

Concordia's School of Natural and Applied Sciences, working in conjunction with the Environmental Stewardship will conduct interdisciplinary studies within the Permit Area related to JPS and establish curricula to be taught within the college.

Conservation Measure 2

Presence/absence surveys for JPS at Springs C and D quarterly of each year. Section 9.1.2 further describes the presence/absence monitoring.

Conservation Measure 3

Concordia will present at least six JPS-related presentations at scientific conferences or symposia throughout the duration of the ITP. JPS-related articles published within scientific journals may be substituted for the presentations. Additionally, theses or dissertations published by Concordia relating to JPS may be substituted for presentations as well.

Should Concordia choose to host a conservation symposium on campus, each hosted symposium may substitute for one presentation or other method of science dissemination.

The presentations will occur at least once every five years from the issuance of the ITP.

5.4.3 Goal 3

Implement a campus-wide program standard operating procedure (SOP) for ecological sustainability and environmental sensitivity to reduce the environmental impact of Concordia on the local watershed and downstream JPS.

5.4.3.1 Objective 1

Create and fund a permanent and full-time staff or faculty position at Concordia in charge of developing and implementing a campus-wide SOP for development practices and JPS management and monitoring.

Conservation Measure 1

Concordia has established and funded the full-time position of the Director of Environmental Stewardship who will oversee establishment of the campus-wide SOP.

5.4.3.2 Objective 2

Participate in a nationally recognized collegiate organization that promotes ecological sustainability and environmental sensitivity to reduce local water demand within the watershed

Conservation Measure 1

Concordia is a member of the Advancement of Sustainability in Higher Education (AASHE) and are committed to being a member and utilizing the Sustainability Tracking, Assessment, and Rating System (STARS). STARS is a transparent, self-reporting method for colleges and universities to measure their sustainability performance.

An important aspect STARS is water use and rainwater management, which will help reduce runoff and discharge of stormwater within the Permit Area. For future development, rainwater will be harvested and slowly dispersed into rain gardens or utilized for irrigation. This water conservation program and drought contingency program will be implemented and utilized campus wide. Additionally, Concordia will utilize sustainable building products, hardscaping products, and landscaping supplies, which are sustainable and will integrate in harmony with the natural environment.

5.4.4 Goal 4

Improve water quality downstream of the Permit Area.

5.4.4.1 Objective 1

Control invasive vegetation within the Preserve Area.

Conservation Measure 1

Prior to issuance of the ITP, Concordia will create, in partnership with Travis County, a written agreement for land management and monitoring activities that will allow for the control of Japanese privet, Chinese privet, chinaberry, nandina, Japanese honeysuckle, tree of heaven, Chinese tallowtree, and paper mulberry within the Permit Area. The written agreement for land management and monitoring will be created prior to issuance of the ITP.

These invasive plant species can overtake or displace native plants and have an adverse impact on the native ecosystem. In addition, invasive plant species in some cases can utilize far more water than native plant species, which over time, can disrupt natural spring flows and water quantity in the aquifer. The eradication or control of these invasive plant species is necessary to protect the native ecosystem, and to protect water quantity. The Permit Area is near the headwaters of Bull Creek, any control of invasive species within this area will reduce the future seed bank for the invasive species in the downstream portions of the watershed.

6.0 INCIDENTAL TAKE AND IMPACT

Take is defined as an action that may harm, harass, pursue, shoot, wound, hunt, kill, trap, capture, or collect members of a federally listed species.

Harm is defined by regulation to mean an act which actually kills or injures wildlife. Such act may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering.

6.1 *Jollyville Plateau Salamander*

The current salamander population in each of the occupied springs within the Permit Area is unknown, however a 2016 Travis County presence/absence survey (Travis County 2017) determined that each of the salamander springs identified in Table 3 were occupied. Salamander abundance and density also vary with environmental conditions, thus, any annual take which might occur will vary with salamander abundance. It is extremely difficult to determine precisely the number of salamanders that will be harmed

annually by actions in this amended HCP. In particular, it is nearly impossible to accurately predict take from ongoing and future campus activities, including operation and maintenance activities. To date, there have been no documented salamander mortalities from construction, maintenance, or general campus activities, although there is little possibility of finding the body of a dead salamander before it deteriorates, flows downstream, or is eaten by other animals. The majority of the occupied salamander springs are located in the preserve area, which is strictly off limits to the public. In addition, the two occupied salamander springs located within the developable area, Springs C and D, are within a fenced area, and protected from recreational activities and public access.

There are two general activities for which Concordia is seeking take coverage: 1) New development and redevelopment and 2) continued and future operations and maintenance activities. The take summary is included as Table 6.

6.1.1 New Development or Redevelopment

As noted above, Concordia views the enhanced water quality measures contained in this HCP to be an effective strategy to maintain or improve the overall water quality of the Property, thereby providing an adequate conservation strategy to help reduce and minimize the likelihood of any direct or indirect effects to the point that they are insignificant. Impacts are only expected to potentially rise to the level of take at Springs C and D, which are located within the developable area.

As the result of the conservation strategy and enhanced water quality measures discussed within this amendment, surface and subsurface water quality within the springsheds for Springs A, B, E, F, G, H, I, and J will be protected from degradation. In addition, downstream dilution through the preserve area will further protect surface populations of salamanders at those spring sites. New development or redevelopment activities are not likely to adversely affect salamanders at Springs A, B, E, F, G, H, I, and J within the Permit Area and are not expected to rise to the level of "take." As noted in the introduction, Schlumberger developed the site in the 1980's prior to the listing of JPS and under the site development regulations and restrictions of that time. The most recent, most comprehensive JPS salamander survey onsite conducted by Travis County in 2017 (Travis County 2017) confirmed occurrence of JPS at 10 spring locations within the Permit Area. This provides the best available scientific information on the persistence of the

species onsite despite initial construction and ongoing operations and maintenance within the Development Area.

Due to the proximity of existing development to Springs C and D, it is expected that stormwater runoff associated with any development or redevelopment activities that may occur within the springsheds for Springs C and D are likely to harm JPSs in those two occupied springs. This harm will likely be most acute during construction phases of any redevelopment activities within the springsheds for Springs C or D due to the proximity of the redevelopment activities to the springs.

JPS that are underground or within the subterranean spring itself should not be impacted due to the low probability of impairment of groundwater. However, during development or redevelopment activities, those salamanders in the surface habitat adjacent to and downstream of Springs C or D would potentially be harmed by any degradation in water quality of stormwater runoff in the springsheds contributing to the surface water volume in those surface habitat areas.

Take is a function of the number of salamanders and the location of the salamanders, as well as the frequency of harm. It is estimated that take resulting from new development or redevelopment activities will be limited to individual JPS located in surface habitat areas adjacent to and downstream from the spring openings for Springs C and D. Concordia anticipates a low frequency of development and redevelopment activities and generally follow the master plan as shown in Figure 3. The phasing of the redevelopment and development of the master plan is not known at this time; however, the master plan includes an approximation of the ultimate facilities and programming within the surface catchment areas of Springs C and D (as shown in Figure 11).

Specific to Springs C and D, the watersheds draining to these springs include a portion of the original 1980's parking facility and existing Schlumberger buildings. Concordia retrofit these building to accommodate their current academic needs. The master plan anticipates the original parking facility to be replaced by pedestrian open space plaza and academic buildings. The Spring C drainage area would correspond to pedestrian Plaza 1 and portions of four academic buildings to be retrofit. The Spring D drainage area would correspond to portions of pedestrian Plaza 2 and the retrofitting an existing building into chapel and offices.

It is estimated that the percentage of JPS that occupy surface or subterranean habitat varies based on surface conditions. When surface conditions are suitable (consistent surface flow), the majority of JPS occupy surface habitat with few occupying the subterranean habitat. Generally, approximately 59% to 81% of JPS are located in surface habitat areas, while 41% to 19% are located within the spring itself or in subterranean spaces within the aquifer (O'Donnell et al. 2008). The O'Donnell et al. study (2008) sampled from several JPS spring with varying quality and extent of surface habitat. Conservation measures are expected to be effective at avoiding take of the subterranean JPS in Springs C and D. However, those JPS in surface habitat areas will likely be subjected to take during the construction phase of any new development or redevelopment in those springsheds. The majority of the take associated with JPS in surface habitat areas will be non-lethal take associated with stress caused to individuals due to temporary, localized water quality degradation from surface water runoff. Only a minimal amount of lethal take is expected to occur.

Conservation measures for Springs C and D are estimated to be almost completely effective at reducing lethal take of JPS. Conservatively, only a minimal amount (estimated to be less than 5%) of the surface populations of JPS in and adjacent to Springs C and D will be vulnerable to lethal take. Therefore, corresponding to surface population percentage, only 2.9% to 4.1% of JPS in or adjacent to Springs C or D would be subject to lethal take during the construction phase of any new development or redevelopment in those springsheds.

O'Donnell et al. (2006) described that previous development, which occurred prior to 2015, within the Bull Creek Watershed near the Four Points Development periodically resulted in increased sedimentation at an occupied JPS spring, identified as "Site 349," prior to 2005, which is located approximately 0.5 mile east, but not hydrologically downstream, of the Concordia Preserve Area. However, O'Donnell et al. (2006) noted that Site 349 appears to have recovered [as of 2005], since no further construction activities have been initiated in this watershed." No additional information regarding the sedimentation was provided in the O'Donnell et al. (2006) report other than Site 349 being described as (as of 2005) "the most pristine in the Bull Creek watershed." Site 349 is currently occupied by JPS (Bendik 2017) and is assumed to have fully returned to providing "pristine" ecological function for the JPS. Therefore, should increases in sedimentation occur due to increased TSS levels at Springs C or D that result in a minimal amount of lethal take of individual JPS in the surface habitat in or adjacent to Springs C

or D, it is expected that any reduction in the JPS population would recover following the completion of the construction activities. In addition, the Spring C and D habitats should recover following the completion of construction activities and any detriment to the species associated with new development or redevelopment in Springsheds C or D will be temporary and minimal. Of note, the Four Points Section 10(a)(1)(B) permit includes JPS as a covered species. The Four Points permit does not require the various conservation measures proposed by Concordia including: general water quality monitoring, development cycle water quality monitoring, JPS presence/absence surveys, and adaptive management.

6.1.2 Continued and future operations and maintenance activities

As noted above, Concordia views the enhanced water quality measures contained in this HCP to be an effective strategy to maintain or improve the overall water quality of the Property, thereby providing an adequate conservation strategy to help reduce and minimize any direct or indirect effects to JPS that would occur due to continued and future maintenance and operations activities related to the proposed project at all but two spring locations (Springs C and D) within the Permit Area.

Any impacts that may occur to salamanders as the result of continued operations and maintenance activities at all but these two spring locations (Springs C and D) within the Permit Area are not expected to rise to the level of "take."

As the result of the conservation strategy and enhanced water quality measures, water quality within the springsheds for Springs A, B, E, F, G, H, I, and J will be protected from degradation. In addition, downstream dilution through the preserve area will further protect surface populations of salamanders at those spring sites. Continued and future maintenance and operations activities related to the proposed project are not likely to adversely affect salamanders at Springs A, B, E, F, G, H, I, and J within the Permit Area and are not expected to rise to the level of "take."

Due to the proximity of existing development to Springs C and D, combined with the inability to "retrofit" the existing buildings, impervious cover, and water quality BMPs within the springsheds for Springs C and D to meet or exceed the 80% removal efficiency for TSS required by the OEMs, it is expected that over time the existing buildings and infrastructure, ongoing operations and maintenance, and student and staff activity

within the springsheds for Springs C and D are likely to harm JPSs in those two occupied springs.

The continued maintenance of, use of, and occupancy of existing buildings, as well as maintenance and human activity in other areas within in these springsheds will result in indirect impacts to JPS in and around Springs C or D. JPS that are underground or within the subterranean spring itself will likely not be impacted; however, those salamanders in the surface habitat adjacent to and downstream of the Springs C or D will be harmed by any degradation in water quality of stormwater runoff in the watershed contributing to the surface water volume in those surface habitat areas. The majority of the take associated with JPS in surface habitat areas will be non-lethal take associated with stress caused to individuals due to temporary, localized water quality degradation from surface water runoff.

Another potential cause of harm to salamanders is littering and vandalism. Littering and vandalism on campus is strictly prohibited, but 100% compliance is unlikely. As noted previously, Spring D is located below a walkway on Concordia's campus within the developable area and Spring C is located at the bottom of the canyon adjacent to the preserve area. In estimating take due to ongoing campus activities, key factors would include the number of people on campus and using the elevated walkway over Spring D, as well as the number of salamanders present in those springs and the likelihood that litter or vandalism would adversely impact Spring C or Spring D resulting in harm of a salamander.

Take is a function of the number of salamanders and the location of the salamanders, as well as the frequency of harm. It is estimated that take resulting from continued operations and maintenance activities will be limited to individual JPS located in surface habitat areas adjacent to and downstream from the spring openings for Springs C and D. It is estimated that 59% to 81% of JPS are located in surface habitat areas, while 41% to 19% are located within the spring itself or in subterranean spaces within the aquifer (O'Donnell et al. 2008). Conservation measures are estimated to be effective at reducing or avoiding take of the subterranean JPS in Springs C and D, however those JPS in surface habitat areas will potentially be subjected to non-lethal take during the continued operations and maintenance activities in the spring surface watershed.

6.1.3 Cumulative Take from all Activities

There are currently 10 occupied JPS springs in the Permit Area. Take of JPS in surface habitat areas of Springs C and D represent a take of approximately 59% to 81% of individual JPS associated with the surface flow at the two springs. This represents roughly 11.8% to 16.2% of the salamanders in the springs within the Permit Area. In addition, only a minimal amount (less than 5%) of any anticipated take is expected to be lethal take resulting from covered activities, which represents approximately 0.6% to 0.8% of the salamanders in the known springs within the Permit Area.

In addition, although it is anticipated that a minimal amount of lethal take is likely to occur during construction activities, the Spring Sites C and D are expected to recover to their pre-construction condition (O'Donnell et al. 2006) following the completion of the construction activities. Additionally, subterranean-dwelling individuals would likely repopulate any surface habitats following sufficient storm events that flush the subterranean individuals to the surface.

No incidental take from ongoing campus activities is expected to occur at the occupied springs in the preserve area (Springs A, B, E, F, G, H, I, and J) because public access is intentionally restricted at these sites, and the known, occupied springs are sufficiently buffered and located away from any construction activities, maintenance, or operations associated with the developable area.

Construction projects necessary to fulfil the Concordia Master Plan are discrete, finite actions. These projects will likely be conducted as gradual and incremental additions and improvements over the next thirty years. Since these construction projects are site-specific, the TCEQ RG-348A Optional Enhanced Measures, COA Water Quality Ordinances, and other appropriate conservation measures will be implemented to ensure that no direct impacts to any occupied salamander springs will occur, and take will not exceed the estimates provided in this HCP for Spring C and Spring D. A summary of take is below in Table 6.

Table 6: Take Summary

Species	Covered Activity	Type of Take	Life Stage Affect	Anticipated amount of take as a result of Activity and implementation of A&Ms
JPS	New Development or Redevelopment	Harm	All	**Springs C & D (w/in developable area)** • Lethal due to habitat degradation o 2.9% to 4.1% of JPS within surface habitat of Springs C and D during redevelopment construction activities. • Non-lethal take due to surface habitat degradation o Non-lethal take is anticipated to occur to the 59% to 81% of JPS at Springs C & D (in surface habitat) during development or redevelopment construction activities 59 % to 81%.
	Operation and Maintenance	Harm	All	**Springs C & D (w/in developable area)** • Non-lethal take due to operation and maintenance o Non-lethal take of all individuals present within surface habitat areas adjacent to and downstream from Springs C & D due to ongoing and future operation and maintenance of existing facilities in close proximity of these springs.

7.0 ALTERNATIVES ANALYSIS

The following sections describe two alternatives to the proposed covered activities, proceeding with development according to the current ITP and EA/HCP and COA zoning and not proceeding with any additional development or redevelopment.

7.1 *Full COA Development Entitlements*

The proposed project could proceed with development in accordance with the full entitlements negotiated with the COA on the Schlumberger Site and those described in the existing ITP and EA/HCP. This alternative could result in up to 93.40% impervious cover in the developable area and would not establish the protective measures described in TCEQ RG-348 and the Enhanced Measures.

Without the protections and water quality BMPs described in the preferred alternative, there is an increased risk of water quality degradation in the springsheds located within the developable area and potentially within the preserve area, and there is an increased risk that the survival of the JPS within the occupied springs could be jeopardized as a result. In addition, this action could potentially result in the destruction or adverse

modification of the PCEs of the federally designated surface critical habitat within the developable area.

The no-action alternative would continue to provide protection for the golden-cheeked warbler; however, the authorization for incidental take would expire in 2027. No "take" of the golden-cheeked warbler would be anticipated due to the establishment of the conservation easement on the preserve area and the continued operation of the preserve area for conservation of the golden-cheeked warbler.

This alternative could potentially result in adverse effects to the JPS and federally designated critical habitat. Furthermore, this alternative would not provide Concordia the certainty it seeks to implement its Master Plan while ensuring compliance with the ESA. As such, this alternative was dismissed.

7.2 *"No-build" Alternative*

Concordia examined a scenario in which it would completely abstain from development on or above federally designated surface or subsurface critical habitat for the JPS. JPS surface critical habitat includes the spring outlets and outflow up to the high water line and 262 feet (80 m) of upstream and downstream habitat, represented on critical habitat maps by a circular area with an 80-m radius. The subsurface critical habitat includes underground features in a circle with a radius of 984 feet (300 m) around the cave and surface salamander locations, represented on critical habitat maps as a circle with a 300-m radius. The entirety of Concordia's current campus and the majority of the developable area for Concordia's campus is within surface critical habitat or above subsurface critical habitat for the JPS. The conclusions from the analysis of a "no-build" analysis indicate that Concordia will find it extremely challenging to further its mission and goals by dramatically limiting enrollment capacity, capping residential capacity, and restricting curricular, research, and co-curricular activities that define how the institution runs.

The impetus for Concordia's purchase of its campus ten years ago was to grow enrollment to better serve its community. Concordia's previous campus location, near downtown Austin, was landlocked with little opportunity for expansion. Concordia took a strategic step by purchasing a new property with an existing HCP and 10(a) ITP, and made plans for future growth to fulfill the needs of its student body and the community. An alternative which requires Concordia to abstain from any future development on the developable area of its campus on or above federally designated JPS critical habitat does

not just stunt its growth; it effectively caps it where it is. In addition, Concordia will be unable to reduce their developable footprint to areas that are not on or above federally designated JPS critical habitat because it would still be necessary to construct roads, utilities, and other infrastructure across and over JPS critical habitat in order to make those areas accessible. Even if it were somehow able to confine future development of its campus to the minimal areas that are not on or over JPS critical habitat, the university would have very little room to construct academic facilities, student support areas, athletic facilities, and residence halls. For an institution whose financial model is tuition-driven, as opposed to an institution whose operations are underwritten by a large endowment, steady growth up to a certain point is critical for ensuring its financial future. Concordia's long-term future is unsustainable without growth in enrollment up to that described in its master plan, but it cannot generate that growth without the facilities to both attract and support students. In fact, the only growth in programs and enrollment the university would be able to accommodate would be in the online delivery program. While online delivery is part of Concordia's institutional model, it is not, and is never intended to be, the primary one.

Limiting Concordia's future campus development to portions of the current developable areas not on or over JPS critical habitat would force it to take a very different approach to its development model and its master plan. The vested impervious cover allocations for the property are very generous compared to those typically seen in this area, and a reduction in overall developable property would cause Concordia to use every bit of that allotment. Assuming enough road and utility development could be done through and over federally designated JPS critical habitat to access non-critical habitat portions of the campus (not a foregone conclusion), Concordia would find itself unable to be as thoughtful and judicious in its development strategy as it currently proposes to be; at that point, every square foot of developable space would have to be used. Every office, every classroom, every sidewalk, every parking space will matter. This would likely lead to disparate pockets of highly concentrated development, which would likely be problematic for overall water quality across the campus.

At present, there is existing development on and above federally designated JPS critical habitat. Concordia purchased the property with existing development and has added development to its campus over the last decade while pursuing a conservation mission and instilling a conservation ethic in its university culture. Concordia seeks to continue to demonstrate how conservation can be achieved utilizing thoughtful, intentional design

and development, by using the best available science and information about federally listed species, as well as cutting edge water quality engineering, construction techniques, materials, and sustainability programs.

8.0 CHANGED AND UNFORESEEN CIRCUMSTANCES

Federal No Surprises Assurances (codified at 50 CFR 17.3, 17.22(b)(5), 17.32(b)(5); 50 CFR 222.307(g)) provides assurances to Section 10 permit holders that, as long as the permittee is properly implementing the HCP and the ITP, no additional commitment of land, water, or financial compensation will be required with respect to covered species, and no restrictions on the use of land, water, or other natural resources will be imposed beyond those specified in the HCP without the consent of the permittee. The No Surprises rule has two major components: changed circumstances and unforeseen circumstances.

8.1 *Changed Circumstances*

Changed circumstances are defined in the No Surprises rule as "changes in circumstances affecting a species or geographic area covered by [an HCP] that can reasonably be anticipated by [plan] developers and the [USFWS] and that can be planned for. If additional conservation and mitigation measures are deemed necessary to respond to changed circumstances, and such measures were not provided for in the HCP, USFWS will not require any additional measures beyond those provided for in the HCP, without the consent of the permittee, provided the HCP is being properly implemented (50 CFR 17.22(b)(5)(ii), 17.32(b)(5)(ii); 50 CFR 222.307(g)(2)).

Climatic, water quality, or water quantity conditions outside of the control of Concordia could change over the proposed 30-year term of the permit. Changed circumstances that can be reasonably anticipated include:

- catastrophic events leading to temporary loss of habitat (hazardous material spills, temporary dewatering)
- permanent loss of habitat or habitat degradation from climate change
- permanent loss of habitat or habitat degradation from wildfire
- covered species become de-listed
- covered species become extinct
- unintentional introduction of invasive plants that modify salamander habitat
- unintentional introduction or increase in population of non-native predators in habitat areas

8.1.1 Catastrophic Events – Hazardous Spill

In the event of a catastrophic event such as a hazardous material spill leading to temporary loss of habitat, Concordia will notify the USFWS verbally within 24 hours or in writing within five business days. Concordia will implement the measures detailed in their Spill Response Plan to limit or remediate the impacts of the spill and rescue as many salamanders as possible. Rescued salamanders may be temporarily housed in a captive breeding facility or other suitable aquarium facilities. Concordia will determine when conditions are appropriate for salamanders to return to wild habitats.

Concordia will fund all activities associated with the Spill Response Plan and remedial actions. Should a catastrophic event occur that results in the permanent loss of habitat, the event will be considered an unforeseen circumstance and USFWS will be notified. All Spill Response Plan actions will be conducted to remediate impacts of the spill. Any rescued salamanders would be returned to unaffected areas of habitat within the Permit Area.

The Spill Response Plan is funded through Concordia's campus operating budget and is funded irrespective of the implementation of this HCP. No additional costs are associated with implementing this changed circumstance.

8.1.2 Catastrophic Events - Wildfire

In the event of a catastrophic event such as a wildfire leading to habitat degradation, temporary loss of habitat, or permanent loss of habitat, Concordia will notify the USFWS verbally or in writing. Concordia will maintain the exclusion of development from the preserve area allowing natural regeneration of the forest ecosystem and hydrology. It is anticipated that should a wildfire occur within or near the JPS surface habitat, that the JPS could seek refuge in subsurface habitat that is currently unidentified but associated with the surface habitat. JPS would be expected to recolonize any surface habitat temporarily affected by wildfire. Should a wildfire cause a permanent loss of habitat, then that catastrophic event would be considered an unforeseen circumstance and USFWS will be notified.

No additional costs are associated with implementing this changed circumstance.

8.1.3 Climate Change

Concordia is committed to permanent protection of threatened salamander habitat and compliance with the requirements of the Act. It is possible that climate change may lead to changed precipitation patterns in the Edwards Aquifer contributing and recharge zones. Climate change has the potential to alter regional distribution of vegetative and macroinvertebrate communities within salamander habitat. Climate change could result in permanent loss of suitable habitat. Unlike temporary dewatering of habitat areas, these changes may be irrevocable and are completely outside of the control of Concordia. There is currently insufficient information available to predict the potential for habitat in the Permit Area to be affected by climate change over the proposed 30-year term of this HCP.

The effects of climate change on central Texas water resources are uncertain, in part because of the difficulty in incorporating climate models into hydrological studies (Mace and Wade 2008). Loaiciga et al. (2000) predicted that under a doubling of atmospheric carbon dioxide, water resources of the Edwards Balcones Fault Zone Aquifer would diminish even if pumping did not increase above its current level. The Edwards Aquifer is one of the most vulnerable watersheds to climate change impacts in part due to anthropogenic water demands, a strong relationship between precipitation and recharge, and high variability of precipitation and the occurrence of multi-year droughts (Loaiciga et al. 2000).

Even if climate change does not affect Texas within the next 30 years, the threat of multi-year droughts is still significant, as historical records based on tree-ring data indicate that droughts more severe than the drought of the 1950's have occurred many times in the past several hundred years (Cleaveland et al. 2011). Thus, an extreme drought would not be out of the ordinary in the context of prehistoric environmental conditions, yet current anthropogenic activities (groundwater withdrawal, reduced recharge from impervious cover, increased contaminants) could significantly alter the frequency and severity of droughts. The ultimate effects of such a drought on the JPS are partially dependent on whether these changes differ from climatic variation under which these species evolved.

There is insufficient information to plan for alternative conservation measures to mitigate for any adverse effects of climate change. If climate change results in a decrease in quality and quantity of suitable habitat for the covered species, Concordia will consult with the USFWS to determine what modifications of the conservation measures are necessary to mitigate the adverse effects. As information on the effects of climate change on the

Central Texas environment becomes available, Concordia will periodically review monitoring procedures and study needs over the proposed term. Concordia may propose adjustment or addition of monitoring and studies to the USFWS to evaluate the effect of climate change on salamanders and habitat. Knowledge obtained through these monitoring and study efforts may be used to determine suitable mitigation measures or alternative conservation measures. Concordia may pursue modifications to this habitat conservation plan in consultation with the USFWS if warranted by climate change impacts and supported by scientific evidence. The adaptive management framework described in this document (Section 9.3) provides guidance for evaluation of changes in environmental conditions that are unforeseeable or unpredictable at this time.

No additional costs are associated with implementing this changed circumstance.

8.1.4 Covered Species Become Delisted

The objective of this habitat conservation plan is to ensure the persistence of the covered species (golden-cheeked warbler and JPS) in the wild over the proposed 30-year term. If either species recovers during the proposed 30-year term such that protection under the ESA is no longer necessary, the species could be de-listed by the USFWS. To de-list a species, the USFWS is required to determine that the identified threats have been eliminated or controlled. The ESA requires the USFWS to monitor the species for at least five years after recovery to assess the long-term sustainability without federal protection. If either species becomes de-listed due to recovery over the proposed 30-year term, Concordia will notify the USFWS and discuss any potential changes to this HCP or associated ITP that may be appropriate.

No additional costs are associated with implementing this changed circumstance.

8.1.5 Invasive or Non-native Vegetation

Unintentional introduction and colonization of the habitat areas by invasive or non-native plants may occur that could negatively impact habitat suitability for the covered species. Concordia will notify the USFWS verbally or in writing if this occurs. Concordia will remove the nuisance vegetation using USFWS-approved methods or will consult the USFWS if additional methods are necessary to maintain habitat areas. This changed circumstance is not expected to escalate to an unforeseen circumstance.

Concordia currently conducts invasive and non-native species removal within the preserve area as part of their existing operating budget and as part of the conservation strategy of this HCP. No additional costs are anticipated for this changed circumstance.

8.1.6 Predation

Changed conditions in habitat areas could lead to an overabundance of existing native predator populations or introduction and colonization of a new, non-native predator in occupied salamander springs or the preserve area. Concordia will notify the USFWS verbally within 24 hours or in writing within 5 business days if this occurs. Concordia will use best efforts to manage the predator populations such that the predators would have no unnatural detrimental effect on the covered species, if appropriate. Predator management methods would be consistent with the conservation measures of this plan. Concordia will assess conditions leading to the change in predator populations and consult with the USFWS if modifications to this habitat conservation plan are necessary. No additional costs are associated with implementing this changed circumstance.

8.1.7 Extinction

Despite the existence of this habitat conservation plan and the best efforts of Concordia to help preserve the species in perpetuity, either the golden-cheeked warbler or the JPS may become extinct over the proposed 30-year term due to uncontrollable changes in environmental conditions. Concordia will remain in regular contact with the USFWS to ensure that all necessary permit obligations are satisfied to conserve the covered species. Should either the golden-cheeked warbler or the JPS become extinct in the wild, Concordia will notify the USFWS and discuss any potential changes to this HCP or associated ITP that may be appropriate.

No additional costs are associated with implementing this changed circumstance.

8.2 *Unforeseen Circumstances*

Unforeseen circumstances are defined as changes in circumstances affecting a species or geographic area covered by a conservation plan that could not reasonably have been anticipated by plan developers and the USFWS at the time of the negotiation and development of the plan and that result in a substantial and adverse change in the status of the covered species (50 CFR17.3). If unforeseen circumstances are found, the permittee is not required to come up with additional resources or funds to remedy unforeseen circumstances, but the USFWS and the permittee may work together to determine an

appropriate response within the original resource commitments in the HCP. Potential unforeseen circumstances are as follows: catastrophic events – hazardous spill, catastrophic events – wildfire, climate change, and predation.

Should these unforeseen circumstances occur, Concordia may coordinate with USFWS to address potential conservation methods necessary to preserve the species.

9.0 MONITORING AND ADAPTIVE MANAGMENT

9.1 *Monitoring*

The following sections describe the monitoring that will occur as part of this HCP.

9.1.1 JPS Water Quality Monitoring Protocol

Concordia will conduct two water quality monitoring protocols, a general protocol that will be conducted during times where development or redevelopment activities are not occurring, and a development cycle protocol for when development or redevelopment is occurring.

9.1.1.1 General Water Quality Monitoring Protocol (Outside of Development Cycle)

Concordia will implement the general water quality monitoring protocol during periods outside of a development or redevelopment cycle for the duration of the permit term. Concordia will collect water quality samples from all springs described in Figure 10 within the Permit Area. The first sampling occurrence will occur within the first quarter following the issuance of the ITP or before new development or redevelopment begins, whichever comes first. Water quality parameters to sample will include at a minimum:

- Air Temperature;
- Water Temperature;
- Total Suspended Solids (TSS);
- Dissolved Oxygen (DO);
- Potential Hydrogen (pH);
- Conductivity; and
- Nitrate.

Sampling will occur at least once per quarter. Time between sampling occurrences will be no less than six weeks and no greater than four months. The first sampling occurrence will occur within the first quarter following the issuance of the ITP.

9.1.1.2 Water Quality Monitoring Protocol during Development Cycle

Concordia will implement the following water quality monitoring protocol during a development cycle at the impacted spring. This protocol will specifically be used if development or redevelopment activities are to occur within springsheds for Springs C and D only (Figure 10). The development cycle begins two months prior to construction activities associated with any new development or redevelopment and ends one month after project completion. Monitoring protocol during a development cycle is organized into predevelopment, during development, and post development. Water quality parameters to be sampled are the same as those listed under Section 9.1.1.1 above.

Predevelopment

Two months prior to the mobilization of any earthmoving equipment for future development or redevelopment, Concordia will collect a water quality sample from the spring whose watershed will have development or redevelopment occur (either Spring C or D). For example, if development is to occur within the springshed for Spring C, then monitoring will occur at Spring C for the duration of that particular development cycle. Concordia will also collect water quality samples from an additional occupied JPS spring within the permit area, but not from Springs C or D. For example, additional springs outside of the impacted springshed could include Springs A, B, E, F, G, H, I, or J.

These data along with the data along with the ***general monitoring*** will establish the baseline water quality parameters to be utilized to identify changes in water quality potentially caused by development activities.

During Development

Within one week of the initiation of earthwork for future development or redevelopment, Concordia will collect water quality samples from the spring whose watershed will have development or redevelopment occur (either Spring C or D). Concordia will also collect water quality samples from an additional occupied JPS spring within the permit area, but not from Springs C or D. For example, additional springs outside of the impacted springshed. After the initial sample, Concordia will collect additional data on water quality parameters for the impacted spring monthly during the development cycle. Concordia will alter routine ***during development*** monitoring and implement this protocol within 24 to 48 hours if a precipitation event of at least 0.5 inch within the impacted springshed occurs. This event will also trigger an inspection of the temporary BMPs.

Post Development

Within one month of the completion of development or redevelopment Concordia will collect one water quality sample from the respective spring (Spring C or D) in the impacted springshed. Concordia will also collect water quality samples from an additional occupied JPS spring within the permit area, but not from springs C or D. For example, additional springs outside of the impacted springshed. Concordia will alter routine ***post development*** monitoring and implement this protocol within 24 to 48 hours if a precipitation event of at least 0.5 inch within the impacted springshed occurs. This event will also trigger an inspection of the temporary BMPs.

The development or redevelopment will be considered complete following the termination of the SWP3 following the establishment of permanent BMPs at project closeout and removal of the temporary BMPs.

Water Quality Immediate Reporting Triggers During the Development Cycle

Based on information (COA 2015) from the regularly monitored occupied spring, Site 349, located within the same Bull Creek watershed as the permit area, Concordia has determined that if TSS levels increase by 20% from the initial pre-construction sample, the Director of Environmental Stewardship or Associated Vice President of Building Operations for Concordia will be notified immediately and adaptive management procedures in Section 9.3 will be implemented. The USFWS will also be notified.

Site 349, also known as "Bull Creek US of Trib 7 (Franklin)", is located approximately 0.8 mile downstream of the Permit Area. Water quality parameters were first collected at Site 349 in 2004 (COA 2015), which indicated the sediment scores for the site using the Environmental Integrity Index (EII) have ranged from "fair" to "good" since 2007. The worst sediment score occurred on July 2, 2014, which corresponded with the scores for other nearby monitored sites. The cause of this change in score was not documented and rainfall in the month of June was approximately 100% to 110% of normal. In 2014, the TSS ranged from as high as 46.3 mg/L on July 2, 2014, to as low as 1.0 mg/L on September 9, 2014. The average TSS at this site was 12.4 mg/L.

Based on the wide range of TSS concentrations recorded downstream at Site 349, the threshold of 20% above baseline levels is expected to be well below the background variability of TSS in the watershed.

9.1.2 JPS Presence/Absence Surveys

Similar to Section 9.1.1.1, Concordia will conduct two JPS presence/absence monitoring protocols, a general protocol that will be conduct during times where development or redevelopment activities are not occurring, and a development cycle protocol for when development or redevelopment is occurring.

9.1.2.1 General JPS Presence/Absence Survey Protocol (Outside of Development Cycle)

A USFWS permitted biologist will conduct presence/absence surveys at Springs C and D according to generally accepted protocols quarterly each year. The survey will primarily be conducted to determine whether JPS is present or absent at the spring; however, the number of individual salamanders identified will be recorded, but density calculations, size characteristics, sex, and other data will not be recorded.

9.1.2.2 JPS Presence/Absence Protocol during Development Cycle

Concordia will implement the following presence/absence survey protocol during a development cycle at the impacted spring. This protocol will specifically be used if development or redevelopment activities are to occur within springsheds for Springs C and D only (Figure 10). The development cycle begins two months prior to construction activities associated with any new development or redevelopment and ends one month after project completion. The presence/absence survey protocol during a development cycle is organized into predevelopment, during development, and post development. The presence/absence survey will be conducted as described in Section 9.1.2.1 above.

Predevelopment

Two months prior to the mobilization of any earthmoving equipment for future development or redevelopment, a USFWS permitted biologist will conduct presence/absence surveys for JPS at the impacted spring (either Spring C or D). For example, if development is to occur within the springshed for Spring C, then a survey will occur at Spring C prior to beginning construction activities.

During Development

Presence/absence surveys will follow the ***general JPS presence/absence*** schedule during construction of new development or redevelopment at Springs C and D.

Post Development

Within one month of the completion of development or redevelopment a USFWS permitted biologist will conduct presence/absence surveys for JPS at the spring within the impacted springshed (either Spring C or D).

The development or redevelopment will be considered complete following the termination of the SWP3 following the establishment of permanent BMPs at project closeout and removal of temporary BMPs.

9.2 *Reporting*

The current requirements include filing an annual report of the development activities conducted under this permit and the required GCWA survey reports by October 1 of each year with the Field Supervisor, U.S. Fish and Wildlife, 10711 Burnet Road, Suite 200, Austin, Texas 78758. Concordia will add to this report all development activities conducted within the Permit Area the previous year, all water quality and presence/absence survey data collected the previous year, and the establishment of any curriculum and other monitoring or studies that were conducted in the previous year. Additionally, any adaptive management activities that were initiated the prior year will be incorporated into the annual report.

9.3 *Adaptive Management*

Adaptive management is a tool to address uncertainty in the conservation of the species covered by the HCP. During the build out of the proposed project, construction needs of Concordia may change resulting in a modification of the agreed upon conservation measures. Should the construction needs change, Concordia will continue buildout in accordance with the Enhanced Measures. The Professional Engineer tasked with signing and sealing any development plans will confirm that the proposed development complies with the Enhanced Measures. As previously stated, the development activities will be described in the annual report.

Should Concordia be unable to continue the buildout of the Master Plan in accordance with the Enhanced Measures due to engineering or physical practicality, Concordia will reinitiate consultation with USFWS. No construction or development will take place outside of the standards agreed upon in this amended HCP without previously consulting with USFWS and determining what measures are necessary to offset any potential take.

During construction activities, if the monitoring determines that TSS levels have increased 20% since the initial pre-construction sample within Springs C or D, the following protocol will be followed to implement adaptive management:

1. Work will immediately stop;
2. The Director of Environmental Stewardship or Associate Vice President of Building Operations for Concordia, and the USFWS will be notified;
3. The Director of Environmental Stewardship or Associate Vice President of Building Operations for Concordia will coordinate with the construction superintendent to identify any failures in the stormwater BMPs associated with the construction activity. If any BMPs have failed, those BMPs will be repaired. Work will not begin until the BMPs have been repaired.
4. The Director of Environmental Stewardship or Associate Vice President of Building Operations for Concordia will compare the TSS concentrations at Springs C and D with the TSS concentration from one other spring within the Permit Area that is not located within a springshed that is being developed. If the other spring is also showing higher levels of TSS, then it will be logically concluded that the increased concentrations of TSS are being caused by something other than Concordia's actions and work will continue.

Changed circumstances may occur that result in temporary damaging effects to JPS habitat. Should a hazardous spill occur within JPS habitat, Concordia will implement its Spill Response Plan to remediate any impacts to JPS habitat. If a wildfire occurs, the preserve area will be allowed to revegetate based on natural succession. Should invasive or non-native species become established within JPS habitat, Concordia will remove the non-native or invasive vegetation. Should increased predation occur, Concordia will implement predator management systems in accordance with USFWS guidelines.

Concordia will coordinate internally for all adaptive management for these purposes.

10.0 FUNDING PLAN

Concordia has been in existence for more than 90 years. It has an endowment of approximately $25 million and an annual operating budget of approximately $40 million. Within its operating budget, Concordia designates funds annually for preserve management, conservation activities, and environmental stewardship. The primary conservation measures for the amendment will be avoidance and minimization, which have minimal cost associated with the conservation of the species. All funding methods for previously agreed upon conservation measures associated with the existing ITP will be maintained. All activities associated with development of the Master Plan and any

additional funding will be provided by Concordia through its endowment, annual operating budget, or charitable contributions.

The estimated cost of funding the activities will be based on the final, agreed upon measures. The following costs estimate the anticipated funding necessary to implement this HCP. Costs are associated with Concordia financing personnel and non-personnel activities. Table 7 depicts the anticipated funding necessary to implement the HCP.

Table 7: Anticipated Costs

Item	1-year Cost	Annual Inflation	30-yr w/ Inflation
Personnel			
Director of Environmental Stewardship	$37,126	2%	$1,506,131
Faculty	$8,800	2%	$356,999
Non-Personnel			
AASHE Membership	$1,160	4%	$65,059
AASHE STARS Program	$900	4%	$50,476
Fencing and Signage Maintenance & Monitoring	$500	4%	$28,042
Invasive Species Control	$5,000	4%	$280,425
Education and Training Materials	$1,000	4%	$56,085
Water Quality Monitoring Protocol (Equipment Purchase & Calibration)	$3,000	4%	$168,255
JPS-related Presentations (Scientific Conferences, or On-campus Symposia)	$750	4%	$42,064
Consultants	$3,000	4%	$168,255
Total	**$61,236**		**$ 2,721,790**

11.0 PERMIT AND PLAN DURATION

The permit and plan duration is 30 years from the date of issuance, which will cover the anticipated build out of the Concordia Master Plan.

12.0 CONCLUSION

Concordia seeks an amendment to the existing ITP, which will serve to help guide the implementation of Concordia's Master Plan over the next 30 years. The Property was originally developed in the 1980s by Schlumberger after which the USFWS listed the GCWA as endangered in 1990. In 1997 Schlumberger obtained an ITP covering the potential for impacts to GCWA from ongoing operations. The ITP included the creation of a 250-acre Preserve onsite.

In 2005, Concordia purchased the Property and moved campus operations onsite in 2007. In 2013, USFWS listed the JPS as threatened and designated critical habitat for the species. The Property includes known JPS springs and designated critical habitat. Concordia recently completed their Master Plan which envisions how their mission will be implemented onsite over the next 30 years. This amended HCP will guide Concordia's implementation of its Master Plan by compliance with specific avoidance, minimization, and mitigation measures including restricting access to all JPS springs by protecting them within the high fence surrounding the Preserve, committing to implement TCEQ's OEMs during the development and redevelopment onsite, and educational components, among others. These measures are anticipated to avoid all direct, lethal take of JPS onsite, however the potential exists for indirect harm of JPS onsite (specifically at Springs C and D). In consideration of this, Concordia is pursuing this amendment to ITP Permit # TE-827597-3.

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(USFWS) U.S. Fish and Wildlife Service. 1988. A final rule to determine 5 Texas cave invertebrates to be endangered species. Federal Register, vol. 53, p. 36029.

(USFWS) U.S. Fish and Wildlife Service. 1993. Endangered and threatened wildlife and plants: Coffin Cave mold beetle (*Batrisodes texanus*) and the Bone Cave harvestman (*Texella reyesi*) determined to be endangered. Federal Register, vol. 58, p. 43818.

(USFWS) U.S. Fish and Wildlife Service. 1995. Endangered and threatened wildlife and plants; Final rule to reclassify the bald eagle from endangered to threatened in all of the lower 48 states. Federal Register 60: 36001-36010.

(USFWS) U.S. Fish and Wildlife Service. 1999. Endangered and threatened wildlife and plants; Proposed rule to remove the bald eagle in the lower 48 states from the list of endangered and threatened wildlife. Federal Register vol. 64, p. 36454.

(USFWS) U.S. Fish and Wildlife Service. September 4, 2007a. To The Honorable Rick Perry - In Reply Refer To: R2/ES/032769. Ed. Benjamin Tuggle.

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(USFWS) U.S. Fish and Wildlife Service. 2009. Post-delisting monitoring plan for the bald eagle (*Haliaeetus leucocephalus*) in the contiguous 48 states. U.S. Fish and Wildlife Service, Midwest Regional Office: Twin Cities, MN. 75 pp.

(USFWS) U.S. Fish and Wildlife Service. 2011. Endangered and Threatened Wildlife and Plants; Review of Native Species that are Candidates for Listing as Endangered or Threatened; Annual notice of Findings on Resubmitted Petitions; Annual Description of Progress on Listing Actions. 76 FR 66370 66439.

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(USFWS) U.S. Fish and Wildlife Service. 2013a. Endangered and Threatened Wildlife and Plants; Determination of Endangered Species Status for the Austin Blind Salamander and Threatened Species Status for the Jollyville Plateau Salamander Throughout their Ranges; Final Rule. Federal Register, vol. 78, p. 51278.

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Appendix A:
Existing Section 10(a)(1)(B) Permit

Appendix B:
Original Schlumberger EA/HCP

Appendix C:
RG-348A
Complying with the Edwards Aquifer Rules:
Technical Guidance on Best Management Practices

Appendix D:
Engineering Summary of TSS Calculations

Appendix E:
Integrated Pest Management Plan

Appendix F:
Hazardous Material Plan

Appendix G:
Tier II A – Chapter 1
Land Management Plans and Guidelines

Appendix A:
Existing Section 10(a)(1)(B) Permit

3-201
(1/97)

DEPARTMENT OF THE INTERIOR
U.S. FISH AND WILDLIFE SERVICE

FEDERAL FISH AND WILDLIFE PERMIT

2. AUTHORITY-STATUTES
16 USC 1539(a)(1)(B)

REGULATIONS (Attached)
50 CFR §§ 13 & 17

3. NUMBER
TE-827597-3

1. PERMITTEE

Concordia University at Austin
3400 I-35 North
Austin, Texas 78705
Phone: 512486-1173

4. RENEWABLE	5. MAY COPY
[X] YES	[X] YES
[ ] NO	[ ] NO
6. EFFECTIVE 3/29/2007	7.EXPIRES 12/31/2027

8. NAME AND TITLE OF PRINCIPAL OFFICER (if #1 is a business)
Dr. David Kluth, Vice-President of University Services

9. TYPE OF PERMIT
Endangered Species – Incidental Take

10. LOCATION WHERE AUTHORIZED ACTIVITY MAY BE CONDUCTED
East of RM 620, approximately 1 miles north of RM 2222 on the northwest side of the city of Austin, approximately 12 miles from the downtown area. Lots 1, 2, 3 and 4, Schlumberger Subdivision, Travis County, a Resubdivision of Lot 1, Canyon Creek Section 2 , Travis County, Texas (the "***Project Property***")

11. CONDITIONS AND AUTHORIZATIONS:

A. GENERAL CONDITIONS SET OUT IN SUBPART D OF 50 CFR 13, AND SPECIFIC CONDITIONS CONTAINED IN FEDERAL REGULATIONS CITED IN BLOCK #2, ABOVE, ARE HEREBY MADE A PART OF THIS PERMIT. ALL ACTIVITIES AUTHORIZED HEREIN MUST BE CARRIED OUT IN ACCORDANCE WITH AND FOR THE PURPOSES DESCRIBED IN THE APPLICATION SUBMITTED. CONTINUED VALIDITY, OR RENEWAL, OF THIS PERMIT IS SUBJECT TO COMPLETE AND TIMELY COMPLIANCE WITH ALL APPLICABLE CONDITIONS, INCLUDING THE FILING OF ALL REQUIRED INFORMATION AND REPORTS.

B. THE VALIDITY OF THIS PERMIT IS ALSO CONDITIONED UPON STRICT OBSERVANCE OF ALL APPLICABLE FOREIGN, STATE, LOCAL OR OTHER FEDERAL LAW. THIS PERMIT DOES NOT WAIVE THE OBLIGATION TO ABIDE BY OTHER FOREIGN, STATE, LOCAL OR FEDERAL LAW IN CARRYING OUT AUTHORIZED ACTIVITIES.

C. VALID FOR USE BY PERMITTEES NAMED ABOVE.

D. ACCEPTANCE OF THIS PERMIT SERVES AS EVIDENCE THAT THE PERMITTEE UNDERSTANDS AND AGREES TO ABIDE BY THE "GENERAL CONDITIONS FOR NATIVE ENDANGERED AND THREATENED WILDLIFE SPECIES PERMITS" **(copy enclosed)**.

12. REPORTING REQUIREMENTS Written summary reports of the years activities, with regard to inspecting and monitoring, will be submitted by October 1 of each year.

ISSUED BY:	TITLE	DATE
Elizabeth Orr	for/ACTG Assistant Regional Director	5/21/07

E. Acceptance of this permit serves as evidence that the Permittee understands and agrees to abide by the terms and conditions of this permit and all Sections of Title 50 Code of Federal Regulations Parts 13, 17, and 21 (attached) pertinent to issued permits.

F. Terms and conditions of this permit are inclusive.

G. As contemplated by the Environmental Assessment/Habitat Conservation Plan (EA/HCP), the Permittee is allowed to develop Lots 1, 3, and 4, totaling approximately 143.6 acres of the Project Property ("***New Development Areas***"). The Permittee is further authorized to "take" (kill, harm, or harass) the golden-cheeked warbler on approximately 108 acres of habitat for the species located within the New Development Areas incidental to activities necessary for the construction of a light industrial development (including, research and development), office development, and such other activities and uses as may be permitted by the City of Austin so long as the New Development Areas do not encroach into the Mitigation Land (defined below) or otherwise alter the conditions set forth in this permit or the EA/HCP. As contemplated by the EA/HCP, the Permittee is also allowed to further develop and re-develop that portion of Lot 2 outside of the Mitigation Land, totaling approximately 44.55 acres ("***Existing Development Area***"). The Existing Development Area and New Development Areas are collectively referred to herein as the "***Development Areas***".

H. The authorization granted by the permit is subject to full and complete compliance with, and implementation of, the terms and conditions of the EA/HCP, Biological Opinion, and all specific terms and conditions contained in this permit. These permit terms and conditions shall supersede and take precedence over any inconsistent provisions in the EA/HCP, the Biological Opinion, or other permit documents.

I. The area of the Project Property to remain undeveloped comprises approximately 250.65 acres (of which approximately 195 acres is golden-cheeked warbler habitat), which area will be preserved and maintained in an undisturbed condition for the benefit of the golden-cheeked warbler. This area shall be known as the "***Mitigation Land***." The Mitigation Land and the Development Areas are more particularly described on **Exhibit "A"** attached hereto.

J. Prior to the commencement of development activities, the Permittee shall encumber the Mitigation Land with a perpetual conservation easement previously approved by the U.S. Fish and Wildlife Service (Service) and conveyed to Travis County or such other entity approved by the Service to be filed by the Permittee at its cost in the Official Public Records of Travis County, Texas, and a copy of the recorded instrument shall be provided to the Service. Alternatively, at Permittee's election, the underlying fee title of the Mitigation Land may be transferred, donated, sold, or otherwise conveyed to Travis County or such other public or private non-profit entity approved by the Service.

K. The Permittee shall manage or fund the operation and management of the Mitigation Land in perpetuity or as agreed to by Travis County if Travis County accepts conveyance of a conservation easement or fee title to the Mitigation Land.

L. Vegetation clearing activities on the Project Property will be conducted outside the golden-cheeked warbler breeding season (not during the period March 1 through June 30) to the extent possible and not after March 15 without Service approval unless surveys conducted consistent with Service guidelines immediately prior to such activities reveal no warbler territories are present within 300 feet of the activity. Clearing within the proposed Development Areas shall be consistent with the current practices recommended by the Texas Forest Service to prevent the spread of oak wilt.

M. Building construction, utility infrastructure, and street construction may be conducted year-round as long as the construction activities promptly follow the clearing activities and/or were initiated before March 1, therefore being a continuous activity before the breeding season began.

N. Clearing for construction of buildings, streets, and other areas of impervious cover will be minimized to the maximum extent practicable. Areas outside of construction zones that are disturbed during construction, but are not occupied by impervious surfaces, will be replanted with native oaks and other native vegetation.

O. Upon completion of construction, permanent fencing of a type agreed upon by the Permittee and the Service will be placed between the New Development Areas and Mitigation Land to preclude public access to preserve areas, as reasonably determined by the Service or Travis County, if Travis County has accepted an interest in the Mitigation Land. All fences will be marked with signs that identify the fenced areas as wildlife preserves. Signs will be placed at approximately 200-foot intervals and fences shall be maintained for the life of the permit.

P. Presence/absence surveys for golden-cheeked warblers will be conducted within the Mitigation Land annually or shall be conducted in such area and with such frequency as determined by Travis County to be appropriate (in the event Travis County has accepted an interest in the Mitigation Land).

Q. The use of herbicides and pesticides by the Permittee will be kept to a minimum and will fully comply with the label guidelines for application. No pesticides or herbicides will be used within the Mitigation Land without the prior approval of the Service or Travis County (in the event Travis County has accepted an interest in the Mitigation Land).

R. This permit and each of its terms and conditions shall be binding on and for the benefit of the Permittee(s) and its respective successors and assigns. If the permit requires an amendment because of change of ownership, the Service will process that amendment without the requirement of the Permittee preparing any new document or providing any mitigation over and above that required in the original permit. The construction activities proposed or in progress under the original permit would not be interrupted, provided the Permittee, its successors or assigns is in conformance with all required special conditions, of the issued permit.

S. The permit and appropriate attachments will be recorded with the County Clerk, Travis County, Texas, prior to the beginning of development related activities on the Project Property. A recorded copy of this action will be returned to the Service within 30 days of the date of recording.

T. The current "No Surprises" policy provides that additional mitigation lands or financial compensation shall not be required of the Permittee or their successors beyond the level of mitigation provided for in the identified HCP. With respect to this permit, the HCP and supporting documents adequately address the federally listed golden-cheeked warbler. For the Permittee or its successors to be fully covered by the "No Surprises" policy, all of the identified requirements in this permit and associated documents must be met.

U. Upon locating a dead, injured, or sick golden-cheeked warbler, or any other endangered or threatened species, the Permittee is required to contact the U.S. Fish and Wildlife Service's Law Enforcement Office, Austin, Texas, at (512) 863-5972, for care and disposition instructions. Extreme care should be taken in handling sick or injured individuals to ensure effective and proper treatment. Care should also be taken in handling dead specimens to preserve biological materials in the best possible state of analysis for cause of death. In conjunction with the care of sick or injured endangered/threatened species, or preservation of biological materials from a dead specimen, the Permittee and his contractor/subcontractor have the responsibility to ensure that evidence intrinsic to the specimen is not unnecessarily disturbed.

V. The Permittee is required to file an annual report of the development activities conducted under this permit and the required bird survey reports by October 1 of each year with the Field Supervisor, U.S. Fish and Wildlife Service, 10711 Burnet Road, Suite 200, Austin, Texas 78758.

W. The mitigation for this permit will fully support and accrue full benefits to the Balcones Canyonlands Conservation Plan Permit PRT - 788841.

X. It is expected that from time to time portions of Project Property will be sold and conveyed to third parties for their development, use, and occupation. In order to provide an efficient and effective means to assure that such third parties are obligated to comply with the relevant provisions of this permit and benefit from the authorizations granted in this permit, the Service agrees that the Permittee, may, at the Permittee's election, issue to purchasers or existing owners of portions of the Project Property "Agreements of Inclusion" whereby such purchaser or owner agrees to be bound by and comply with those terms and conditions of this permit applicable to the land they are purchasing or own within the Project Property. Sample forms of an Agreement of Inclusion and a Certificate of Inclusion are attached to this permit as Exhibit B and Exhibit C, respectively. A purchaser or owner signing an Agreement of Inclusion and receiving a Certificate of Inclusion in substantially the same forms as the samples provided in Exhibit B and Exhibit C shall be referred to as a "Participant." So long as this permit remains in effect and a Participant is in compliance with the Agreement of Inclusion, that Participant shall be deemed, with respect to that Participant's property within the Project Property, to have with respect to that Participant's property the full benefits and

authorities of this permit. In the event that the Service may seek to suspend, terminate, or revoke this permit for reasons not the fault of a Participant, and that Participant is in compliance with the terms of its Agreement of Inclusion, the Service shall seek to craft a remedy that does not affect that Participant's rights, benefits, and responsibilities under the permit prior to suspending, terminating, or revoking this permit. If it is not practicable to so craft a remedy and the Service suspends, terminates, or revokes this permit, the Service will process for issuance to such Participant a permit conferring the same rights, benefits, and responsibilities with respect to the Participant's property as provided under this permit, without additional requirements or conditions beyond those applicable to the Participant under its Agreement of Inclusion. The Service agrees that a breach by a Participant of its obligations under an Agreement of Inclusion will not be considered a violation by the Permittee or any other Participant of this permit. In the event a Participant has materially breached its Agreement of Inclusion and, after reasonable notice and opportunity to cure, such Participant fails to cure, remedy, rectify, or adequately mitigate the effects of such breach, then the Service may terminate that Participant's Agreement of Inclusion. The Permittee will submit copies of all Agreements of Inclusion and Certificates of Inclusion to the Service within 15 days after being executed by all parties thereto.

------End of Permit Terms and Conditions for Permit # TE-827597-3------

EXHIBIT "A"

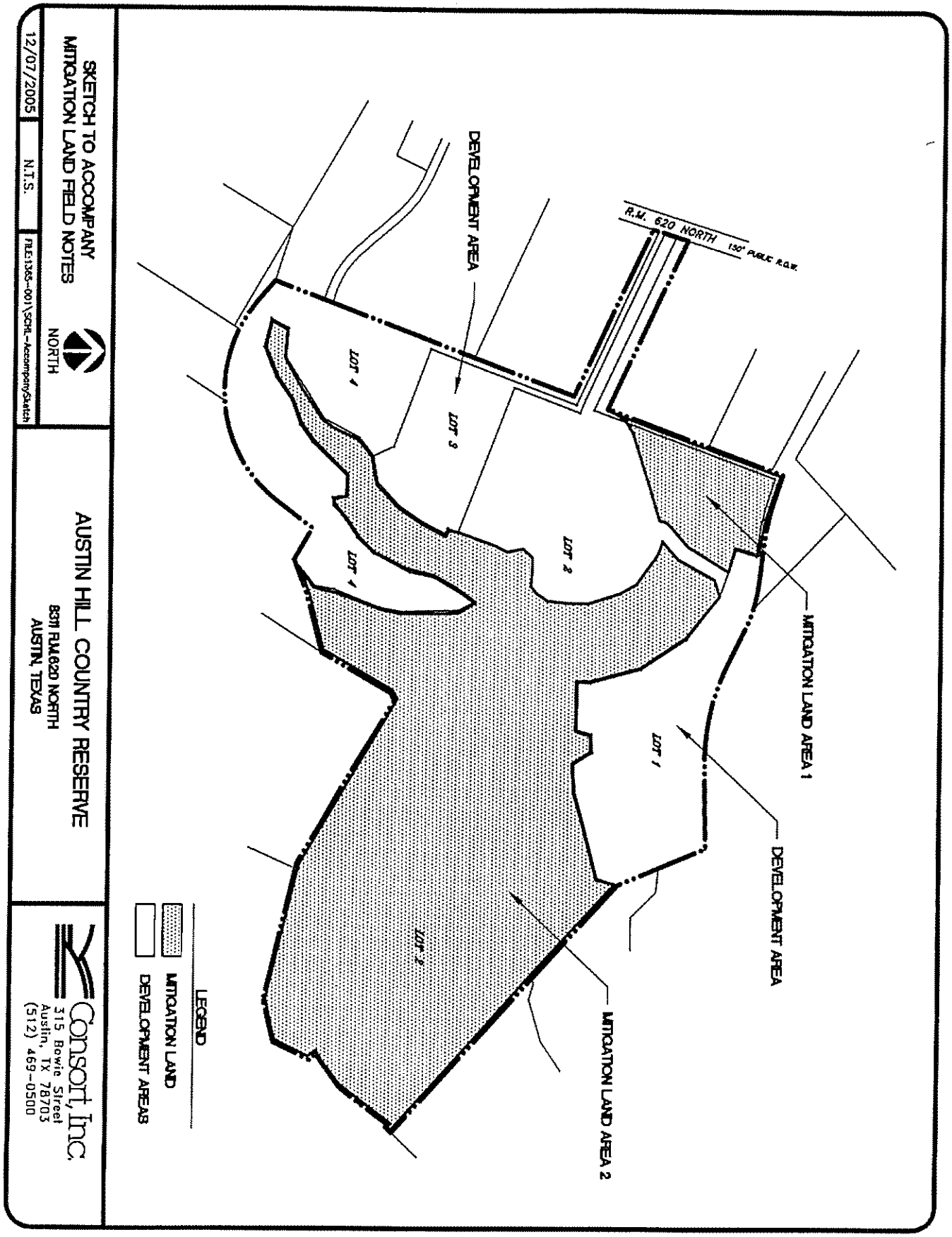
R.M. 620 NORTH
150' PUBLIC R.O.W.
MITIGATION LAND AREA 1
DEVELOPMENT AREA
MITIGATION LAND AREA 2
DEVELOPMENT AREA
LOT 1
LOT 2
LOT 3
LOT 4
LOT 5
LOT 6
LEGEND
MITIGATION LAND
DEVELOPMENT AREAS
SKETCH TO ACCOMPANY
MITIGATION LAND FIELD NOTES
NORTH
12/07/2005
N.T.S.
FILE:13365-001\SCHL-AccompanySketch
AUSTIN HILL COUNTRY RESERVE
8311 R.M.620 NORTH
AUSTIN, TEXAS
Consort, Inc.
315 Bowie Street
Austin, TX 78703
(512) 469-0500

EXHIBIT "B"

AGREEMENT OF INCLUSION

COUNTY OF TRAVIS §
§
STATE OF TEXAS §

RECITALS

The Travis County region of Central Texas is home to the golden-cheeked warbler listed as endangered under the federal Endangered Species Act of 1973, as amended, 16 U.S.C. § 1531, et seq. ("***ESA***").

In order to obtain authorization for potential impacts to the golden-cheeked warbler in connection with development, construction and operation of the Schlumberger Property in Travis County, Texas, Schlumberger Technology Corporation ("***Schlumberger***") applied for a permit under section 10(a)(1)(B) of the ESA. The United States Fish and Wildlife Service (the "***Service***") issued Permit Number TE-827 597 (as amended, the "***Permit***") to Schlumberger on December 12, 1997. The Permit was subsequently amended under (i) Permit Number TE-827597-1 issued to Schlumberger dated to be effective September 16, 2005, (ii) Permit Number TE-827 597-2 issued to USL Austin Reserve, LP dated to be effective May 17, 2006, and (iii) Permit Number TE-827597-3 issued to Concordia University at Austin ("***Concordia***") dated to be effective _____, 2007.

In exchange for committing to the implementation of various conservation measures described in the Permit and the associated Environmental Assessment/Habitat Conservation Plan (the "***HCP***"), Concordia is authorized to assign certain Permit inclusion rights (hereinafter referred to as "***Inclusion Rights***") to purchasers of land within the area covered by the Permit ("***Participants***"). Through inclusion in the HCP, Participants are considered covered by the Permit to the extent and as provided in the HCP.

AGREEMENT

This Agreement of Inclusion (this "***Agreement***") is entered into this ____ day of _____, 20___, by and between _____ (hereinafter referred to as "***Participant***") and Concordia.

For and in consideration of the mutual covenants and considerations set forth herein, Concordia and Participant hereby agree with respect to the assignment of certain Inclusion Rights as provided by the Permit and the HCP as follows:

ARTICLE I.
PARTICIPANT'S PROPERTY

Participant is the owner of a tract or tracts of land consisting of approximately _____ acres situated within the property covered by the Permit in Travis County, Texas, and more fully described and depicted in **Attachment A** (the "***Participant's Property***").

ARTICLE II.
ASSIGNMENT OF INCLUSION RIGHTS

Concordia hereby assigns unto Participant certain Inclusion Rights for the exclusive use and benefit of the Participant's Property. These Inclusion Rights are assigned to the Participant for their use and benefit only with respect to the Participant's Property and in connection with the issuance of the Permit for the HCP pursuant to section 10(a)(1)(B) of the Endangered Species Act, 16 U.S.C. § 1531, et seq. The term "***Inclusion Rights***" shall mean and refer to any and all authorizations, benefits, rights, credits, offsets, or other privileges or entitlements that may be utilized by Participants in conjunction with the HCP and the Permit relating to the existence, dedication, conservation, maintenance, or preservation of the golden-cheeked warbler covered by the Permit.

This assignment is expressly made subject to the provisions and requirements of the Endangered Species Act of 1973, as amended, 16 U.S.C. § 1531, et seq.; Title 50 of the Code of Federal Regulations, including Parts 13, 17, and 21; the Permit; and the HCP as provided by the Permit and including the conditions and requirements provided in the HCP and the HCP.

ARTICLE III.
CONSIDERATION

For and in consideration of its assignment of these Inclusion Rights, the Participant has paid to Concordia $10.00 and given other good and valuable consideration.

ARTICLE IV.
ADDITIONAL RESPONSIBILITIES OF PARTICIPANT; SPECIAL TERMS

For and in consideration of the assignment of Inclusion Rights, the Participant agrees that it shall comply with the terms and conditions of this Agreement and those special conditions approved by the Service and set forth in **Attachment B**, attached hereto and incorporated herein for all purposes. Participant shall provide any assistance to Concordia necessary or appropriate to allow Concordia to comply with the Permit, such as providing information relative to the Participant's Property that may be required for any reports to the Service.

ARTICLE V.
BREACH BY PARTICIPANT

In the event of any breach by Participant, and Participant fails to cure such breach or mitigate the effects thereof within ten (10) calendar days after delivery of notice of such breach to Participant, Concordia shall have the right (but not the obligation) to pursue any and all remedies that may be available to Concordia at law, in equity, or both, which remedies shall, in the case of a material breach of this Agreement by Participant, include the right to terminate this Agreement.

ARTICLE VI.
OBLIGATIONS OF CONCORDIA

Concordia shall comply with the terms of the Permit and take such actions as are necessary to maintain the effectiveness of the Permit.

Notwithstanding anything to the contrary herein, Concordia shall not be responsible to, nor liable to, Participant for any damages resulting from any rules, regulations, action(s), or inaction(s) by the U.S. Department of the Interior and/or Service promulgated, vacated, modified, or taken that would in any way impair or render ineffective, either partially or in its entirety, any or all benefits to the Participant's Property that accompany the assignment of the Inclusion Rights herein, except to the extent such damages result from a breach by Concordia in connection with its obligations under the Permit.

ARTICLE VII.
RIGHTS OF SERVICE

Nothing in this Agreement limits the authority of the Service to seek penalties or otherwise fulfill its responsibilities under the Endangered Species Act. Moreover, nothing in this Agreement limits or diminishes the legal obligations and responsibilities of the Service as an agency of the Federal government.

ARTICLE VIII.
COVENANTS RUN WITH THE LAND; RECORDATION

Participant agrees that promises and covenants provided herein, including, without limitation, the Special Conditions attached hereto, as amended from time to time, are intended to be binding upon any heirs, successors, and assigns in interest to the Participant's Property. Upon any transfer of any ownership rights to all or part of the Participant's Property, this Agreement shall not terminate as to the particular property transferred, but rather shall continue in full force and effect and shall be fully binding upon any heirs, successors, and assigns in interest to the Participant's Property, or any portion thereof. Upon execution of this Agreement by Concordia and Participant, this Agreement shall be acknowledged and recorded in the Real Property Records of Travis County, Texas.

ARTICLE IX.
VENUE AND CHOICE OF LAW

The obligations and undertakings of each of the parties to this Agreement shall be performable in Travis County, Texas, and this Agreement shall be governed by and construed in accordance with the laws of the State of Texas.

ARTICLE X.
MODIFICATION

Any oral representations or modifications concerning this Agreement shall be of no force or effect, excepting subsequent amendments or modifications from time to time in writing signed by the parties hereto, or their respective successors and assigns. Any such written amendments or modifications to this Agreement, including any amendment to the Special Conditions, shall amend the terms and conditions of this Agreement, including the terms and conditions of tbe Special Conditions herein, as set forth in any such amendment.

ARTICLE XI.
SUCCESSORS AND ASSIGNS

This Agreement, as amended from time to time, shall be binding upon and inure to the benefit of the successors and assigns of the respective parties hereto, where authorized pursuant to this Agreement.

ARTICLE XII.
NOTICE

Any notice to be given hereunder by either party to the other shall be in writing and may be effected by personal delivery in writing, or registered or certified mail, return receipt requested, when mailed to the proper party, at the following addresses:

PARTICIPANT:

_____
_____
_____
_____

CONCORDIA

_____
_____
_____
_____
_____

with a copy to:

_____
_____
_____
_____

Each party may change the address for notice to it by giving notice of such change in accordance with the provisions of this paragraph.

ARTICLE XIII.
TERM OF AGREEMENT

This Agreement shall terminate upon the expiration or termination of the Permit, whichever is sooner.

ARTICLE XIV.
HEADINGS

The headings at the beginning of the various provisions of this Agreement have been included only in order to make it easier to locate the subject covered by each provision and are not to be used in construing this Agreement.

ARTICLE XV.
NUMBER AND GENDER DEFINED

As used in this Agreement, whenever the context so indicates, the masculine, feminine, or neutral gender and the singular or plural number shall each be deemed to include the others.

ARTICLE XVI.
MULTIPLE COUNTERPARTS

This Agreement may be executed in multiple counterparts, each of which shall constitute a duplicate original hereof, but all of which together shall constitute one and the same instrument.

ARTICLE XVII.
TIME OF ESSENCE

Time is of the essence in this Agreement.

[SIGNATURES ON FOLLOWING PAGE]

EXECUTED AS OF THE LAST DAY SET FORTH BELOW.

CONCORDIA:	PARTICIPANT:
Concordia University at Austin	
By:_____	_____
Name:_____	Name:_____
Title:_____	Title:_____
Date:_____	Date:_____

ACKNOWLEDGEMENTS

STATE OF TEXAS §
§
COUNTY OF TRAVIS §

This instrument was acknowledged before me on this ____ day of _____, 200_, by _____, _____ of Concordia University at Austin, a Texas non-profit corporation, on behalf of such corporation.

_____
NOTARY PUBLIC

STATE OF TEXAS §
§
COUNTY OF TRAVIS §

This instrument was acknowledged before me on this ____ day of _____, 200_, by _____, of _____, on behalf of said person(s).

_____
NOTARY PUBLIC

Attachment A to this Agreement of Inclusion
(Legal Description of Participant's Property and Map)

Attachment B to this Agreement of Inclusion
(Special Conditions)

The following Special Conditions are taken from permit # TE-827597-3. For a full and accurate understanding of the meaning of these Special Conditions, reference should be made to the applicable provisions of the HCP and the figures included therewith.

1. Participant shall not initiate clearing of vegetation in or within 300 feet (91 meters) of GCWA habitat from March 1 through August 1 of any year unless breeding season surveys performed by biologist permitted by the Service indicate that no GCWAs are present within 300 feet of the desired activity.

2. Building, utility infrastructure, and street construction may be conducted year round as long as the construction activities promptly follow the clearing activities and/or were initiated before March 1, thereby being a continuous activity.

3. Clearing and construction by Participant within proposed development areas shall be consistent with the current practices recommended by the Texas Forest Service to prevent the spread of oak wilt.

4. The use of deer feeders and bird feeders other than thistle seed or hummingbird feeders on the Participant's Property is prohibited.

5. Dumping of material (including pool water), pesticides, herbicides, fertilizers, clearing of vegetation, or anything else that is not consistent with management for the golden-cheeked warbler is prohibited within the Preserve.

6. Upon locating a dead, injured, or sick GCWA or any other endangered or threatened species, the Permittee is required to contact the Service's Law Enforcement Office in Austin, Texas, at (512) 490-0948 or in San Antonio, Texas, at (210) 681-8419 for care and disposition instructions. Extreme care should be taken in handling sick or injured individuals to ensure effective and proper treatment. Care should also be taken in handling dead specimens to preserve biological materials in the best possible state for analysis of cause of death. In conjunction with the care of sick or injured endangered/threatened species, or preservation of biological materials from a dead specimen, Participant and its contractor/subcontractor have the responsibility to ensure that evidence intrinsic to the specimen is not unnecessarily disturbed.

7. Acceptance of this Agreement serves as evidence that Participant understands and agrees to abide by the terms of the permit and all applicable Sections of Title 50 Code of Federal Regulations Parts 13 and 17, pertinent to issued permits.

8. Conditions of the Permit shall be binding on, and for the benefit of, the Permittee and its respective successors and assigns.

EXHIBIT "C"

CERTIFICATE OF INCLUSION

The following tract or parcel of land _____ (tract address, tax parcel id #, and size of tract), has complied with requirements of the federal Endangered Species Act (16 U.S.C. §1531 et seq.) through participation under Endangered Species Act section 10(a)(1)(B) Permit Number TE-827597 issued by the U.S. Fish and Wildlife Service to Schlumberger Technology Corporation ("***Schlumberger***") dated to be effective December 12, 1997, and subsequently amended under (i) Permit Number TE-827597-1 issued to Schlumberger dated to be effective September 16, 2005, (ii) Permit Number TE-827 597-2 issued to USL Austin Reserve, LP dated to be effective May 17, 2006, and (iii) Permit Number TE-827597-3 issued to Concordia University at Austin ("***Concordia***") dated to be effective _____, 2007 as amended, (the "***Permit***"). _____ (owner's name) ("***Participant***") entered into an Agreement of Inclusion (the "***Agreement***") with Concordia dated _____ 20__. The Agreement is recorded in the Real Property Records of Travis County, Texas. Participation in the Habitat Conservation Plan dated December 12, 1997 and the Permit is subject to the terms and conditions of the Agreement.

This Certificate of Inclusion is issued by Concordia, to _____ on _____, 20__.

CONCORDIA UNIVERSITY AT AUSTIN

By: _____
Name: _____
Title: _____

This Certificate of Inclusion or a facsimile must be posted at the property from the time vegetation clearing begins until construction is completed. For residential development, completed construction is when all roads and utilities are completed to the extent that they meet the applicable acceptance criteria of Travis County. For more information about this Certificate, the Agreement, or the Permit contact: Concordia University of Austin, Attn: _____, _____, _____, Austin, TX 80111. For information about the participating tract contact:

_____

(On the line above, the Participant must provide the name, address, and telephone of the responsible party for the participating tract)

CERTIFICATE OF INCLUSION

The following tract or parcel of land _____ (tract address, tax parcel id #, and size of tract), has complied with requirements of the federal Endangered Species Act (16 U.S.C. §1531 et seq.) through participation under Endangered Species Act section 10(a)(1)(B) Permit Number TE-827597 issued by the U.S. Fish and Wildlife Service to Schlumberger Technology Corporation ("***Schlumberger***") dated to be effective December 12, 1997, and subsequently amended under (i) Permit Number TE-827597-1 issued to Schlumberger dated to be effective September 16, 2005, (ii) Permit Number TE-827 597-2 issued to USL Austin Reserve, LP dated to be effective May 17, 2006, and (iii) Permit Number TE-827597-3 issued to Concordia University at Austin ("***Concordia***") dated to be effective _____, 2007 as amended, (the "***Permit***"). _____ (owner's name) ("***Participant***") entered into an Agreement of Inclusion (the "***Agreement***") with Concordia dated _____ 20__. The Agreement is recorded in the Real Property Records of Travis County, Texas. Participation in the Habitat Conservation Plan dated December 12, 1997 and the Permit is subject to the terms and conditions of the Agreement.

This Certificate of Inclusion is issued by Concordia, to _____ on _____, 20__.

CONCORDIA UNIVERSITY AT AUSTIN

By: _____
Name: _____
Title: _____

This Certificate of Inclusion or a facsimile must be posted at the property from the time vegetation clearing begins until construction is completed. For residential development, completed construction is when all roads and utilities are completed to the extent that they meet the applicable acceptance criteria of Travis County. For more information about this Certificate, the Agreement, or the Permit contact: Concordia University of Austin, Attn: _____, _____, _____, Austin, TX 80111. For information about the participating tract contact:

_____

(On the line above, the Participant must provide the name, address, and telephone of the responsible party for the participating tract)

Appendix B:
Original Schlumberger EA/HCP

Environmental Assessment/Habitat Conservation Plan
For Issuance of an Endangered Species Act Section 10(a)(1)(B) Permit
for Incidental Take of the Golden-cheeked Warbler (*Dendroica chyrsoparial*)
During Construction and Operation of Light Industrial Development on the Portions of the
440-acres SCHLUMBERGER PROPERTY, Austin, Texas

U.S. Fish and Wildlife Service
10711 Burnet Road, Suite 200
Austin, Texas 78758

August 11, 1997

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COVER SHEET

Title for Proposed Action: Issuance of an Endangered Species Act Section 10(a)(1)(B) permit for the incidental take of the endangered golden-cheeked warbler (*Dendroica chrysoparia*) during construction and operation of light industrial development on approximately 143.6 acres of the 440-acre Schlumberger Property, Austin, Texas.

Unit of the U.S. Fish and Wildlife Service Proposing the Action: Regional Director, Region 2, U.S. Fish and Wildlife Service, Albuquerque, New Mexico.

Legal Mandate for Proposed Action: Endangered Species Act of 1973, as amended, section 10(a)(1)(B), as implemented by 50 CFR 17.22.

Document Author: Sybil Vosler, Fish and Wildlife Biologist, Ecological Services, U.S. Fish and Wildlife Service, 10711 Burnet Road, Suite 200, Austin, Texas 78758.

1.0 INTRODUCTION

Schlumberger Technology Corporation (Applicant) has filed an application under Section 10(a)(1)(B) of the Endangered Species Act (Act) to allow the incidental take of the listed endangered golden-cheeked warbler (*Dendroica chrysoparia*) associated with the otherwise lawful development of light industrial development, with associated streets and utilities, on approximately 143.6 acres of the roughly 440-acre Schlumberger property. The Schlumberger property is located east of R.M. 620 approximately one mile north of RM 2222 on the northwest side of the City of Austin roughly 12 miles from the downtown area (Figure 1). A habitat conservation plan has been included in the proposed development that will avoid, minimize, and mitigate the potential impacts to the golden-cheeked warbler to the greatest extent practicable (Section 6.0).

2.0 PURPOSE AND NEED FOR ACTION

The purpose of the Environmental Assessment/Habitat Conservation Plan (EA/HCP) is to evaluate the environmental impacts of the issuance of a Section 10(a)(1)(B) permit that will authorize the development of portions of the Schlumberger property and to establish the conditions under which the Applicant will meet the requirements for a permit under the Act. The need for the permit is so that otherwise lawful development may proceed.

3.0 DESCRIPTION OF AFFECTED ENVIRONMENT

3.1 VEGETATION

The Schlumberger property, located within the upper Bull Creek watershed on the Jollyville Plateau, possesses terrain typical of the region. Upland areas are relatively flat and incised by steep-sided drainages. An eastward trending Y-shaped drainage (also referred to as the "main canyon") is present in the central portion of the property and divides the uplands into three areas, hereafter referred to as the "north," "south," and "west" plateaus. Another drainage is present just off the property to the south; the southern edge of the property lies on the north slope of this drainage.

Approximately 39.7 acres on the west plateau have been disturbed and contain a Schlumberger research and development facility that was constructed in the early 1980s. Vegetation on the remainder of the west plateau consists of dense Ashe juniper (*Juniperus ashei*)/live oak (*Quercus virginiana*) woodland. Texas oak (*Quercus texana*) trees are scattered throughout this area. Tree heights average approximately 20 to 24 feet. Percent canopy closure in the woodland is high and understory vegetation is generally sparse.

Large portions of the north and south plateaus were cleared of woody vegetation at some time in the past, at least prior to 1970 (SCS 1974). An approximately 5-acre recreational park is present in the southwest corner of the south mesa and roughly 11 acres of the north plateau are used for spray irrigation of treated wastewater that originates from operation of the Schlumberger facility. Other disturbances on the south and north plateaus include a small number of unimproved roads and trails.

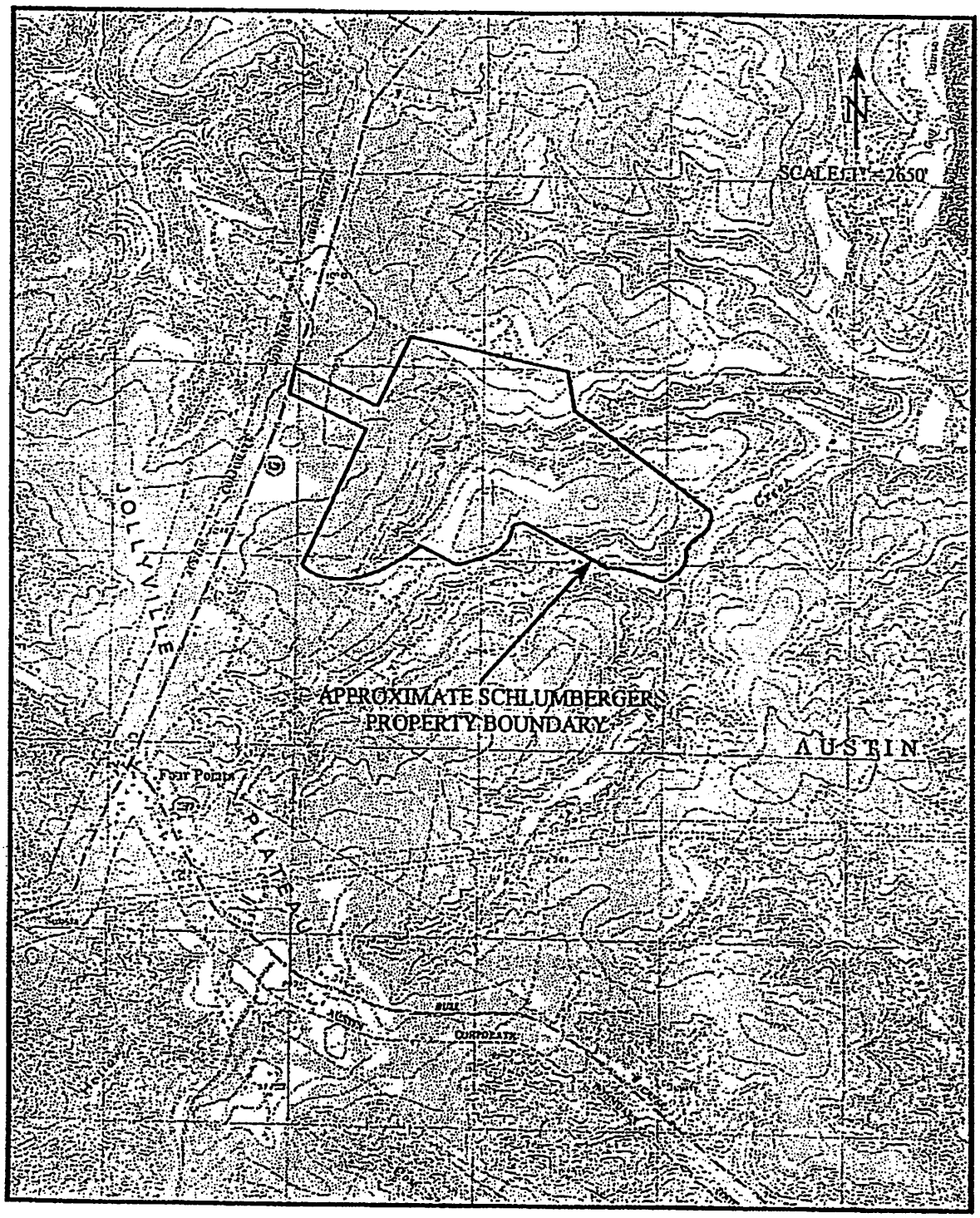


FIGURE 1. PROJECT LOCATION MAP

BASE MAP: JOLLYVILLE, TEX. U.S.G.S QUADRANGLE

Due to the past clearing, vegetation on the north plateau consists primarily of low open Ashe juniper woodland. Ashe juniper trees average 10 to 13 feet tall and generally occur as isolated individuals separated by grassy clearings. Persimmon (*Diospyros texana*) shrubs and prickly pear (*Opuntia lindheimeri*) cactus are present in low to moderate densities within the grassy areas. A few large live oak trees are also scattered across the open portions of the plateau. A patch of nearly closed canopy juniper/oak woodland is present on the north edge of the plateau.

Approximately one-half of the south plateau was historically cleared of vegetation. This area now supports open juniper woodland similar to that found on the north plateau. Juniper/oak woodland that is generally similar to that found on the west plateau is present on the undisturbed portions of the south plateau and on the slope along the southern boundary of the property. On the eastern end of the south plateau, the woodland is broken and interspersed with thickets of smaller juniper and persimmon.

The main canyon supports a mix of Ashe juniper and deciduous trees, including Texas oak, cedar elm (*Ulmus crassifolia*), sycamore (*Platanus occidentalis*), cherry (*Prunus serotina*), and walnut (*Juglans* sp.). Percent canopy closure in the two tributaries that form the "Y" is relatively high, but is only moderate below their confluence. A few large grassy clearings are present below the confluence on the floor of the drainage. Vegetation on the slopes of the drainage primarily consists of juniper/live oak woodland. Deciduous trees, primarily Texas oak, are locally common, especially along the minor ravines that incise these slopes.

3.2 WILDLIFE

Bird surveys specifically designed to determine the status of black-capped vireo (*Vireo atricapillus*) and golden-cheeked warbler were conducted on Schlumberger in 1993 and 1996. No specific surveys for any other animals have been made on the property, but wildlife is expected to be typical of the area.

Common mammals on the property are expected to include opossum (*Didelphis virginiana*), eastern cottontail (*Sylvilagus floridanus*), eastern fox squirrel (*Sciurus niger*), Texas mouse (*Peromyscus attwateri*), white-ankled mouse (*Peromyscus pectoralis*), raccoon (*Procyon lotor*), and white-tailed deer (*Odocoileus virginianus*). Common permanent resident bird species include Carolina chickadee (*Parus carolinensis*), tufted titmouse (*Parus bicolor*), Bewick's Wren (*Thyromanes bewickii*), and northern cardinal (*Cardinalis cardinalis*). Lists of wildlife species known to have occurred or expected to regularly occur on the Schlumberger property are provided as Appendix A to this document.

3.3 LISTED, PROPOSED, AND SPECIES OF CONCERN

Fifteen special-interest species, 3 plants and 12 animals, occur within the general project region. Ten of the animals are currently listed as endangered by the U.S. Fish and Wildlife Service (USFWS). Two of these 10 are birds, the black-capped vireo and golden-cheeked warbler. Seven are cave-dwelling invertebrates: the Tooth Cave pseudoscorpion

(*Tartarocreagris texana*), Tooth Cave spider (*Neoleptoneta myopica*), Tooth Cave ground beetle (*Rhadine persephone*), Kretschmarr Cave mold beetle (*Texamaurops reddelli*), Coffin Cave mold beetle (*Batrisodes texanus*), Bee Creek Cave harvestman (*Texella reddelli*), and Bone Cave harvestman (*Texella reyesi*). The tenth is an amphibian, the Barton Springs salamander (*Eurycea sosorum*).

The remaining five special-interest species are listed as species of concern by USFWS, including Jollyville Plateau salamander (*Eurycea* sp.), Texas salamander (*Eurycea neotenes*), bracted twistflower (*Streptanthus bracteatus*), canyon mock-orange (*Philadelphus ernestii*), and Texabama croton (*Croton alabamensis texensis*).

The black-capped vireo was listed in September 1987. Vegetation on the Schlumberger property differs significantly from that in areas where black-capped vireos occur regularly and no black-capped vireos were observed on the property during the bird surveys conducted in 1993 and 1996. Therefore, the occurrence of breeding black-capped vireos on the Schlumberger property is considered highly unlikely.

The golden-cheeked warbler was listed under emergency listing procedures in May 1990 and normal listing procedures in December of that same year. Golden-cheeked warblers are known to occur on the densely wooded portions of the Schlumberger property.

All of the cave invertebrates were listed in September 1988 except for Bone Cave harvestman and Coffin Cave mold beetle, which were described from specimens previously attributed to Bee Creek Cave harvestman and Kretschmarr Cave mold beetle, respectively, subsequent to the 1988 listing (USFWS 1994). The Schlumberger property was surveyed for karst terrain features in 1993. No karst features were found on the property that were considered to have the potential to provide habitat for any of the listed invertebrates. The 55-acre Stove Pipe Cave Preserve is located adjacent to the proposed entrance road to the Schlumberger property. Stovepipe supports five of the seven listed invertebrates. It is not believed the proposed development will affect Stovepipe Cave. However, it should be noted that if during development karst features are encountered, the Service should be notified and the feature evaluated.

The Barton Springs salamander was listed as endangered in May 1997. This species is known from 3 springs in a city park near downtown Austin (Chippindale et. al. 1993) that is located approximately 11.5 miles south-southeast of the subject property. These springs are fed by flow from the southern Edwards aquifer. The Schlumberger property lies outside of the recharge and contributing zones for this aquifer (Slade et al. 1986); therefore, activities on the Schlumberger property do not have the potential to adversely affect habitat quality for the Barton Springs salamander.

Jollyville Plateau salamander is known to occur at springs and in spring-fed creeks in areas underlain by Edwards Limestone and north of the Colorado River in Travis and Williamson Counties. This species is known to occur in appropriate habitat within the main canyon.

Texas salamander is known to occur in Travis County only in its southwest corner approximately 19 miles southwest of Schlumberger. The property lies outside the known range of this species and runoff from the property does not contribute to water flow at the springs known to contain Texas salamanders. Therefore, surface water runoff from the Schlumberger property does not have the potential to adversely affect Texas salamander.

Bracted twistflower typically occurs on thin clay soils overlying limestone in dense brushy areas and mostly dominated by woodland, i.e. oak/juniper, oak/ash/black cherry or juniper. Most locations of this plant in Travis County are on ridgetops or upper slopes of hillsides. But, because the habitat characteristics are so variable, the area of potential habitat is quite large.

Canyon mock-orange occurs on steep and extensive outcrops of limestone. The known distribution of this species in Travis County is very limited; however, the species appears tolerant of a relatively wide range of sun exposure and is found in a variety of types of woodland.

The Schlumberger property was identified in McNeal's 1989 status report to have an area of potential habitat for the canyon mock-orange within and on the upper slopes of the main canyon and its northern tributary. The property was not surveyed and delineated areas represented areas where the plant was most likely to occur. Property west of 620 was also identified as potential habitat for both the Canyon mock-orange and bracted twistflower. Because both species use similar habitat it may be possible the bracted twistflower may also occur on the property.

In Travis County, Texabama croton is known from only a small number of scattered localities, most of which are in the Post Oak Ridge area roughly 13 miles northwest of the property. Habitat requirements for this species are poorly understood; most occurrences in Travis County are within deep alluvial soils in drainage bottoms. The nearest known occurrence of this plant to Schlumberger is an isolated locality in the Cypress Creek watershed approximately 3 miles northwest of the property. This species is considered unlikely to occur on the Schlumberger property.

Information on the known distribution, life history, status and potential threats to these species is summarized in the Habitat Conservation Plan and Environmental Impact Statement for the Balcones Canyonlands Preserve (RECON and USFWS 1996) and its supporting documentation, and in the recovery plans for black-capped vireo (USFWS 1991), golden-cheeked warbler (USFWS 1992), and the karst invertebrates (USFWS 1994).

3.4 WETLANDS

No wetland areas are known to occur on the Schlumberger property..

3.5 GEOLOGY AND SOILS

Surface geology on upland portions of the Schlumberger property consists of the basal unit of the Edwards Limestone Formation. This lower Cretaceous formation consists primarily of limestone and dolomite, the basal unit of which is typically conducive to the formation of karst features. A limited amount of the Walnut Formation crops out along the slopes of the main canyon. The Walnut Formation consists mainly of limestone, marl, and dolomite; this formation is typically not conducive to the formation of karst features.

Soils on the Schlumberger property are classified within the Brackett and Tarrant Associations (SCS 1974). The soils on upland portions of the property consist of the Tarrant and Speck and the Tarrant (rolling) series. Soils on the sides of the main canyon and on the slopes on the southern edge of the property consist of the Tarrant soils and rock outcrop (steep) series. Tarrant soils typically consist of shallow, stony, and clayey soils; large limestone rocks are often common at the surface.

Soils on the floor of the main canyon consist of the Volente series. Volente soils typically consist of deep, well-drained soils that develop in slope alluvium.

3.6 LAND USE

The Schlumberger property lies within an urbanizing area that contains a mosaic of large scale residential developments, scattered commercial and light industrial sites, planned residential and commercial developments on currently undeveloped woodland and ranchland, and mostly wooded Balcones Conservation Preserve (BCP) preserve tracts owned by the City of Austin.

Schlumberger is separated from R.M. 620 to the west by two tracts of land divided by the Schlumberger access road. The southern tract is proposed for commercial development; the northern tract was set aside by the landowner as a karst invertebrate preserve (the "Stovepipe Cave Preserve"). Multi-family housing is planned to be constructed on the land immediately northwest of Schlumberger as part of the Canyon Creek development which was authorized to proceed under Section 7 of the Endangered Species Act. Adjacent lands to the north and east of Schlumberger have been preserved and are owned by the City of Austin. Roughly the western two-fifths of the land that lies to the south of Schlumberger is planned to be developed. Remaining land south of Schlumberger is City of Austin preserve land.

3.7 AIR QUALITY

Travis County and the Austin metropolitan area are currently full attainment areas for all air quality criteria pollutants of the Texas Air Control Board and the Environmental Protection Agency. However, degradation of air quality from automobile exhaust is a potential problem in the Austin area and has been a consideration over the past 10 years.

3.8 WATER QUALITY

The main canyon of the Schlumberger property is one of the headwater tributaries of Bull Creek and the entire property lies within this watershed. A spring, probably perennial, is present near the head of the northern tributary of the main canyon; flow within the canyon is intermittent elsewhere on the property. A man-made pond is present in the southern tributary of the main canyon below the existing development.

The quality of the water at the spring on Schlumberger is unknown but presumed to be relatively good. Quality of surface water runoff is presumed good due to the presence of a well-developed vegetative cover. The property drains into Bull Creek, which in turn drains into Lake Austin.

3.9 CULTURAL RESOURCES

Prewitt and Associates, Inc. conducted an archaeological survey on the Schlumberger property between 23 February and 27 March 1984 as part of investigations conducted for the Canyon Creek development. Lone Star Archeological Services surveyed the property in July 1990. SWCA archaeologists spent 12 days between 5 and 18 May 1993 conducting a field survey of the Schlumberger property. SWCA also examined records at the Texas Archeological Resources Laboratory (TARL) to determine if any other sites had been identified on the property that were not included in the Prewitt and Associates and Lone Star Archeological Services reports.

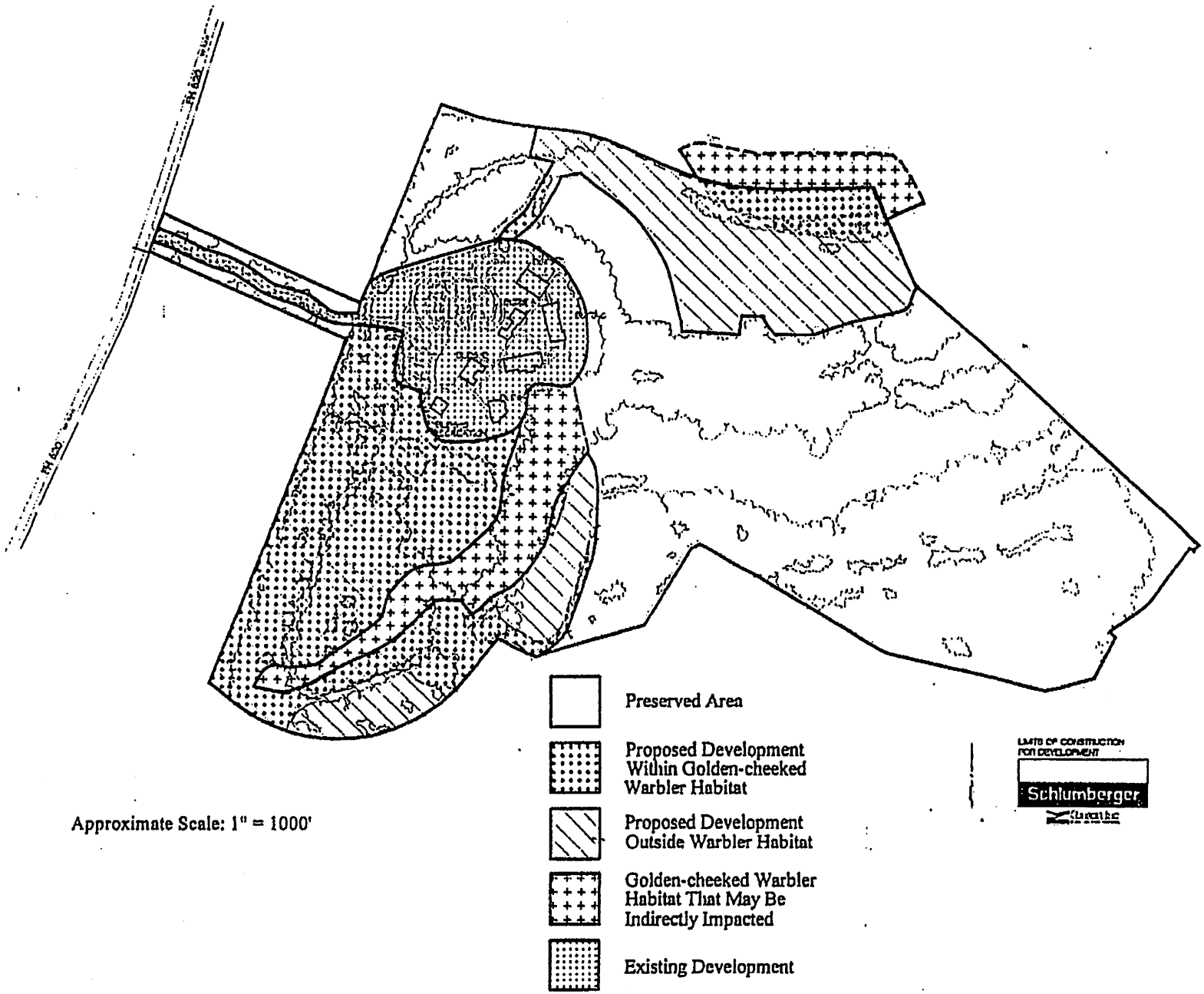
A total of 28 archaeological sites are known to occur on the Schlumberger property. Of these, 13 sites are included on the National Register of Historic Places (NRHP). Ten of the NRHP sites are rock shelters, two are open terrace sites, and one is a burned rock midden. All of these sites, except the rock midden, are located within the main canyon. The burned rock midden is located on the west plateau.

4.0 ALTERNATIVES INCLUDING THE PROPOSED ACTION

This section presents details of the proposed action and the reasonably practicable alternatives that have been considered. The alternatives include: 1) proposed (preferred) action, 2) an alternate project design, 3) a second alternate project design, 4) a development plan with existing City of Austin approvals, and 5) no action. The environmental consequences of each of these alternatives are presented in Section 5.0.

4.1 ALTERNATIVE 1 - PROPOSED (PREFERRED) ACTION

The Proposed Action would consist of light industrial development, with attendant roads and utilities, on approximately 143.6 acres (Figure 2). Final configuration of buildings and parking lots within the envelopes shown as proposed for development on Figure 2 has not been determined. It is contemplated that the proposed development will include parking lots and pads for buildings which will be "carved" out of naturally vegetated areas instead of


FM 620
Preserved Area
Proposed Development Within Golden-cheeked Warbler Habitat
Proposed Development Outside Warbler Habitat
Golden-cheeked Warbler Habitat That May Be Indirectly Impacted
Existing Development
LIMITS OF CONSTRUCTION FOR DEVELOPMENT
Schlumberger
Approximate Scale: 1" = 1000'

being built with the more typical method of clearing all the land to be developed and then landscaping it after construction is completed. The planned style of construction results in a minimum of disturbance and utilizes the undisturbed native vegetation as "landscaping." The remaining 256 acres of the property would remain in a generally undisturbed condition and be contiguous with City of Austin preserve land to the east and south.

A road and right-of-way would be constructed to connect the existing development to the proposed development area on the north plateau. The road would meander slightly through the 100-foot wide envelope shown on Figure 2, but the actual cleared width would not exceed the minimum width of 50 to 60 feet required by national roadway standards and health and safety concerns. The actual alignment of the proposed road is not able to be shown because it is expected that the final configuration would be determined during the construction process. The location for this road was chosen in coordination with the USFWS; the proposed alignment follows an existing caliche road used to service the Schlumberger wastewater spray irrigation field. This route was chosen to minimize new disturbance to woodland vegetation.

All new utility, water, and wastewater lines in locations outside the proposed development areas would be placed within road rights-of-way. Water service would be provided by the City of Austin. Wastewater, which is currently treated on-site, would be disposed of via a connection to a City of Austin line being constructed by the Canyon Creek development. Surface water quality mitigation would be designed in accordance with the applicable City of Austin watersheds ordinance.

The proposed development plan resulted from discussions with the USFWS and includes active measures to avoid, minimize, and mitigate for potential impacts to the federally endangered golden-cheeked warbler and the Canyon mock orange and bracted twistflower listed as species of concern. These include:

Reduction of Proposed Development Areas. The development area as originally proposed on the north plateau encompassed all land that does not currently contain golden-cheeked warbler habitat and included the wooded northwest corner of the property, which does contain warbler habitat. The proposed development area on the north plateau has since been reduced by about 13 acres to maintain a minimum width of at least 650 feet of undisturbed land between existing development and the proposed development area; development of another 5 acres in the northwest corner of the property was abandoned. The 650-foot wide undeveloped area is intended to maintain a broad, naturally vegetated connection between the patch of warbler habitat in the Stovepipe Cave Preserve (and the northwest corner of the property) and habitat in the main canyon to the east.

Avoidance of Direct Impacts to Warblers. Clearing in occupied warbler habitat would not be initiated during times of year when birds are nesting (March 1-July 31).

Preservation of Golden-cheeked Warbler Habitat. Most of the undeveloped acreage of the property, including a minimum of approximately 185 acres of golden-cheeked warbler habitat, would be set aside and maintained in an undisturbed condition.

Canyon mock orange and bracted twistflower. The area delineated by McNeal is outside the areas proposed for development; the occurrence of canyon-mock orange within areas of proposed for development are minimal. However, if prior to construction either species is identified, the Service would be notified and if possible allowed time to collect seed from this population to be stored at the National Seed Bank in Fort Collins, Colorado.

4.2 ALTERNATIVE 2 - ALTERNATE PROJECT DESIGN I

This alternative would consist of light industrial development on approximately 196 acres (Figure 3). Differences between this alternative and the Proposed Action are the development of roughly an additional 19 acres on the north plateau and 33 acres on the south plateau.

As with Alternative 1, new utilities outside of the proposed development areas would be placed in road rights-of-way and construction techniques would be similar to that of the existing development on the property. Development on the north plateau would constrict the naturally vegetated area between the Stovepipe Cave Preserve and the main canyon to an average width of approximately 400 feet.

Initiation of new construction would be limited to those times of the year when golden-cheeked warblers are not nesting. Undeveloped portions of the property, including approximately 166 acres of golden-cheeked warbler habitat, would be left in an undisturbed condition.

4.3 ALTERNATIVE 3 - ALTERNATE PROJECT DESIGN II

Development under this alternative would be similar to that of Alternative 1, except that the naturally vegetated area separating the existing development and development on the north plateau would have a minimum width of 500 feet. This would result in the development of approximately 6 more acres on the north plateau than the Proposed Action.

Placement of utilities, construction techniques, and measures to minimize, avoid, and mitigate for impacts to golden-cheeked warblers would be similar to those of the Proposed Action. A total of approximately 250 acres, including 179 acres of warbler habitat, would be left undisturbed.

4.4 ALTERNATIVE 4 - APPROVED PDA

A development plan for the Schlumberger property was approved by the City of Austin in January 1985. Under this plan, development would occur on approximately 203 acres and cover most upland portions of the property (Figure 4).

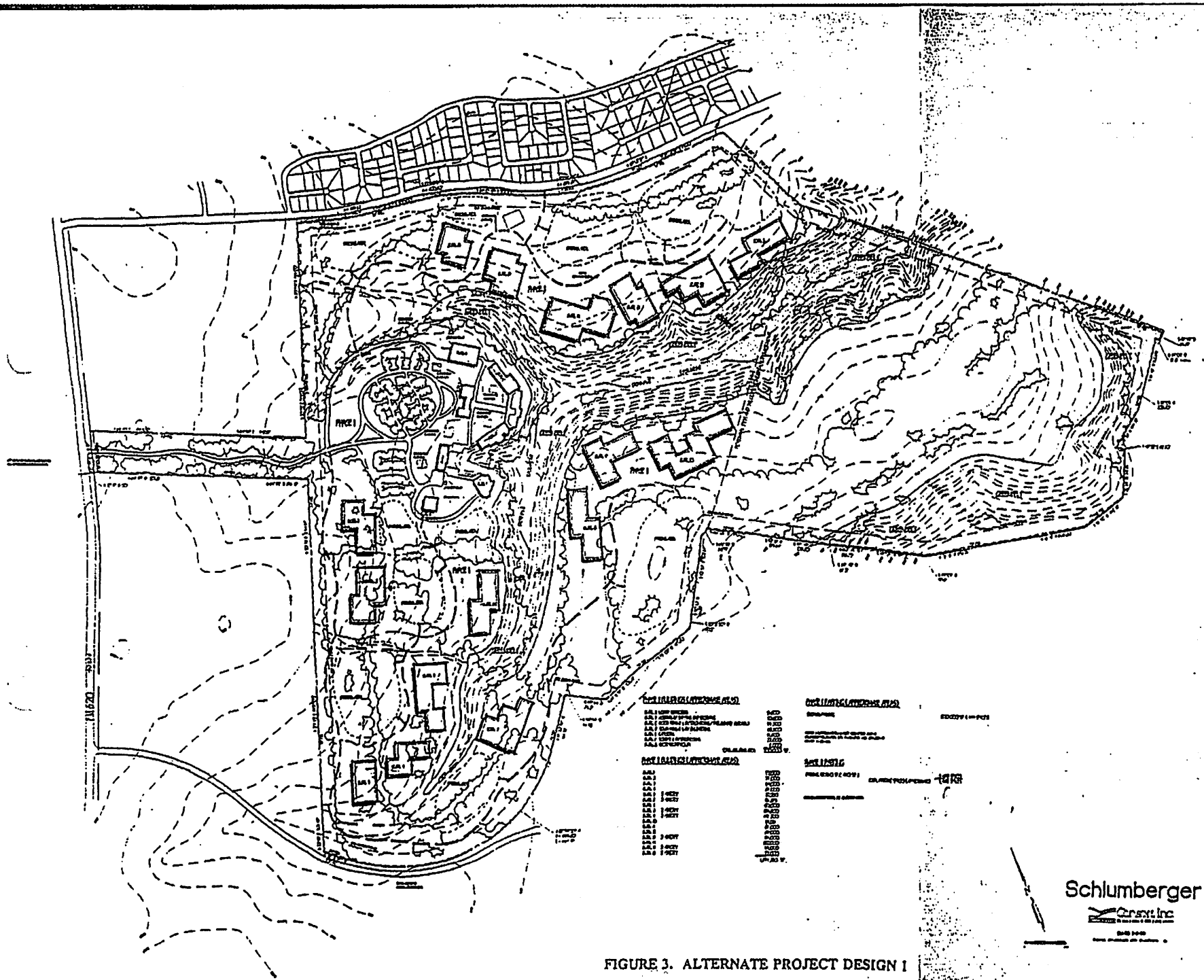


FIGURE 3. ALTERNATE PROJECT DESIGN I

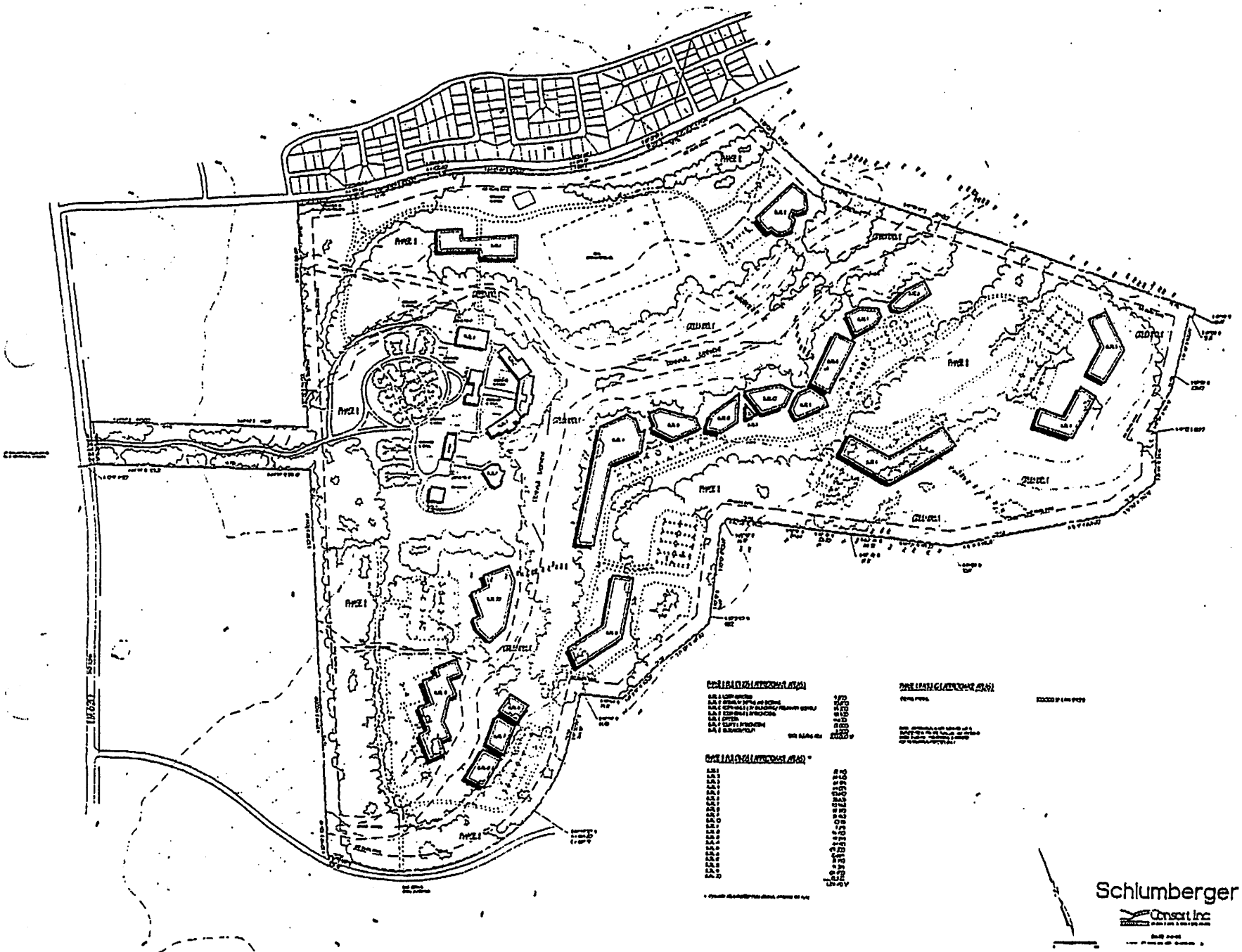


FIGURE 4. APPROVED PDA

New development in this alternative would include 20 buildings with a total of approximately 1,236,910 square-feet. This plan would result in more buildings and far more site disturbance than any of the other alternatives and the buildings would be much further apart. Construction techniques and utility arrangements would be similar to that of the existing development and previous alternatives.

4.5 ALTERNATIVE 5 - NO ACTION

The No Action alternative would involve abandonment of the proposed project. No changes in the existing conditions of the property would occur as a result of this alternative.

5.0 ENVIRONMENTAL CONSEQUENCES

5.1 ALTERNATIVE 1 - PROPOSED (PREFERRED) ACTION

5.1.1 On-site Impacts

5.1.1.1 Vegetation

The area of disturbance for development under this alternative would consist of approximately 140 acres. Proposed development on the west plateau would occur in areas that currently support relatively dense juniper/oak woodland. Development on the south and north plateaus would occur in areas that primarily support open juniper-dominated woodland, but would also include some denser juniper/oak woodland. Such vegetation types are common and widespread in western Travis County, but large, unfragmented blocks are rapidly being depleted by urban development.

5.1.1.2 Wildlife

Wildlife within those areas planned for development would largely be displaced to adjacent areas during the construction process. Following construction, landscape vegetation and preserved trees will provide habitat for those species tolerant of development. Significant portions of the property, specifically canyon slopes and bottoms that support vegetation with the greatest wildlife value on the tract, will remain undisturbed and continue to provide habitat for the wildlife species that currently utilize the area. Direct and indirect effects of development on the plateau areas may result in slight negative or positive impacts to the populations of some species on the property.

5.1.1.3 Threatened and Endangered Species

One listed endangered species, golden-cheeked warbler, is known to occur on wooded portions of the Schlumberger property. No species proposed for listing occur in the area. A special-interest amphibian, the Jollyville Plateau salamander, occurs in aquatic habitats within

the main canyon. The potential impacts of the Proposed Action to each of these special-interest species are discussed below.

Approximately 296 acres of golden-cheeked warbler habitat are present on the Schlumberger property (Figure 5). Areas identified as warbler habitat support juniper/oak woodland with a high percentage of canopy closure.

All or portions of an estimated 13 to 15 warbler territories were present on the Schlumberger property in 1993; another 2 to 4 territories were present adjacent to the property. It was estimated that 15 male golden-cheeked warblers were present on the property in 1996. An estimated additional 4 warblers were detected adjacent to the property. Locations of warbler territories in 1996 were generally similar to those of 1993.

Approximately 84 acres of golden-cheeked warbler habitat would be directly modified by the proposed development (Figure 6). Other possible effects to warblers include indirect impacts within physically unmodified habitat resulting from development of adjacent areas.

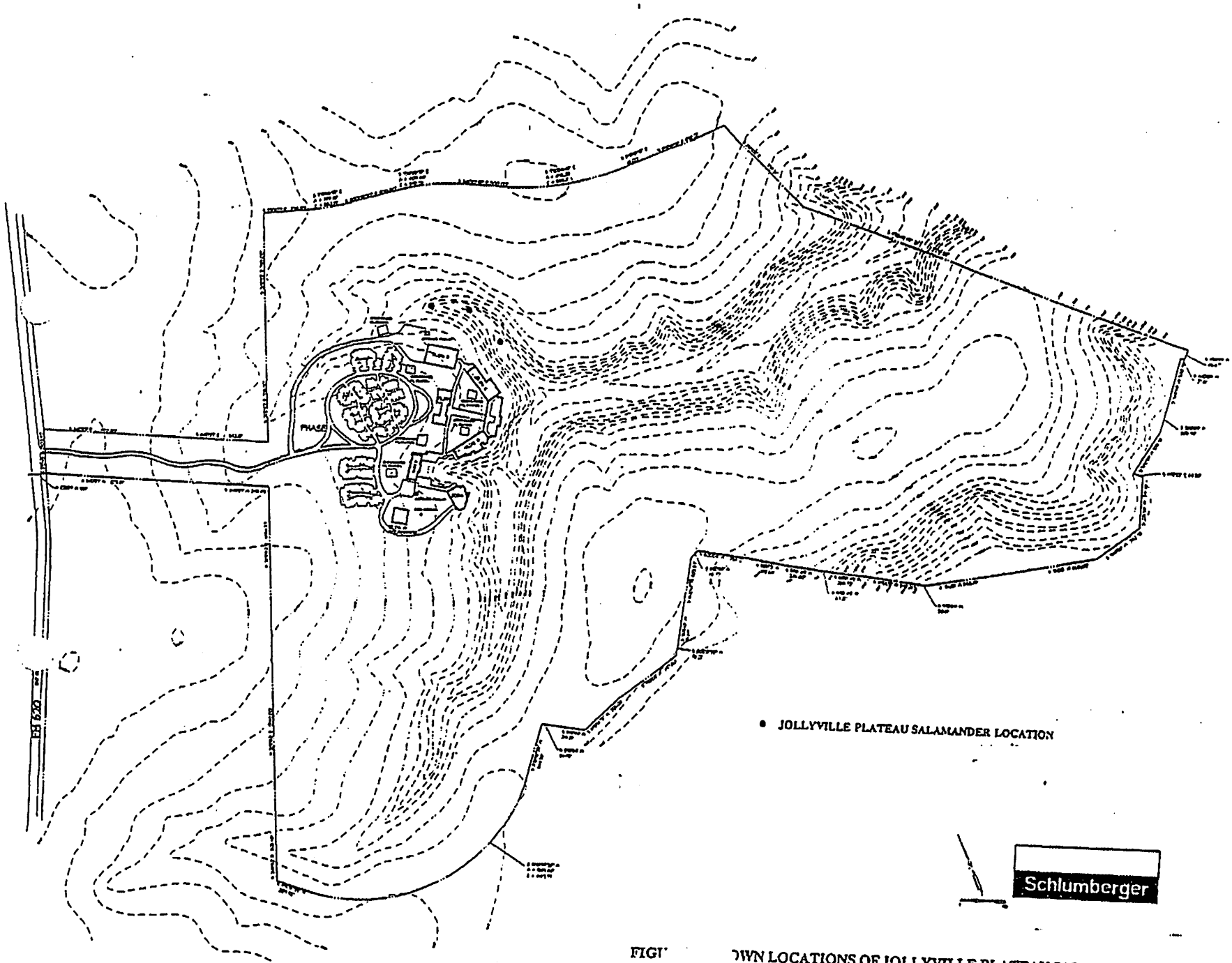
Jollyville Plateau salamanders occur on the Schlumberger property at Schlumberger Springs, which is located near the head of the northern tributary of the main canyon, and have been observed in pools below the springs, but above the confluence of the two tributaries (Figure 5).

Proposed development is limited to plateau areas; therefore, no direct impacts to Jollyville Plateau salamanders or their habitat are expected to occur as a result of completion of the Proposed Action. However, the possible indirect effects are unknown, but could include water quality degradation due to runoff. The potential for the proposed development to cause significant indirect impacts to the quality of the habitat available to salamanders is considered to be extremely low based on the persistence of Jollyville Plateau salamanders at several urbanized localities and the relatively low amount of development proposed for areas considered likely to lie within the recharge zone of Schlumberger Springs.

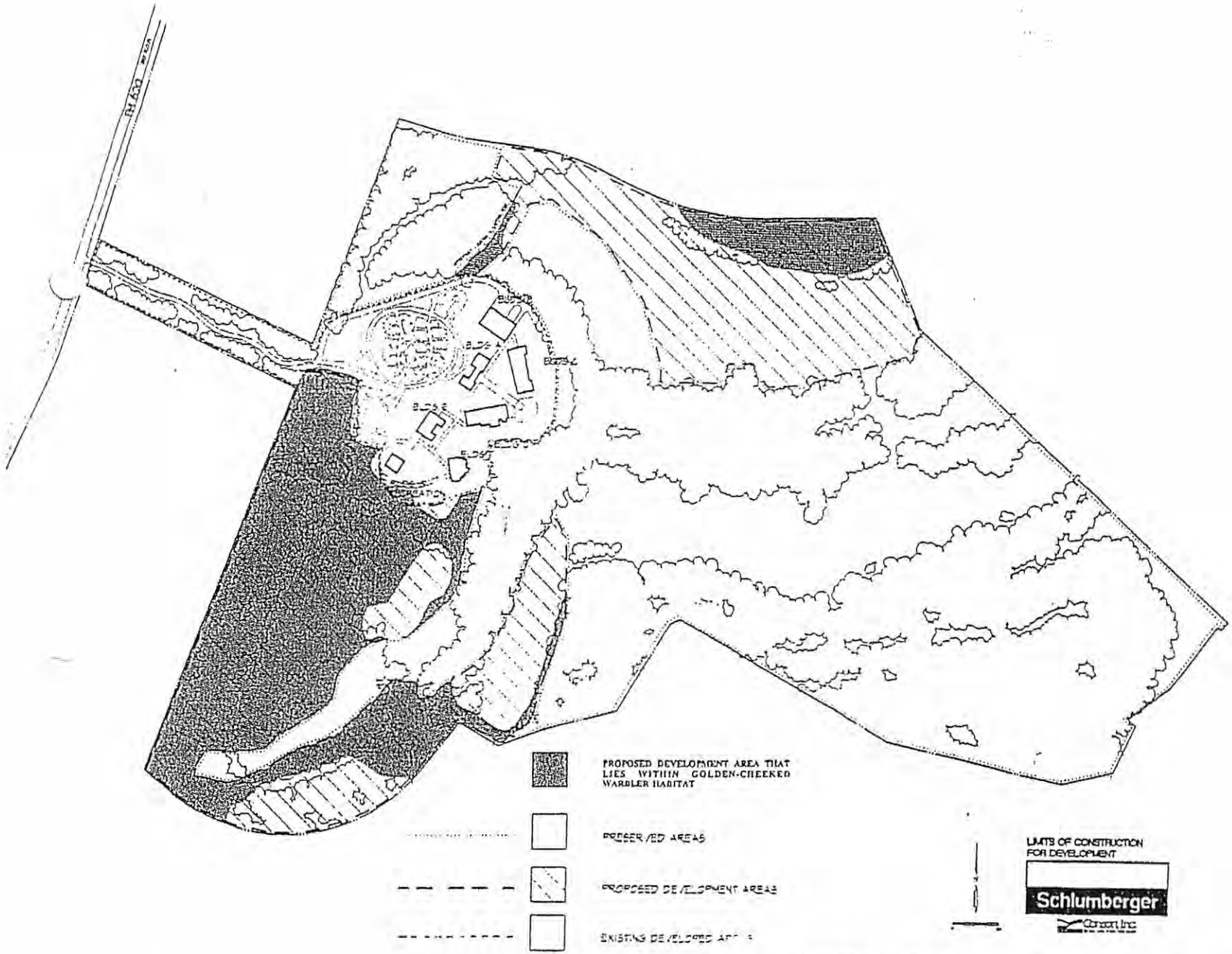
Potential habitat for the canyon mock-orange has been identified on the property. Most of the habitat lies outside of areas proposed for development, however the area has not been surveyed and plants may be directly destroyed during construction. The bracted twistflower uses similar habitat and may also be located within this area of potential habitat and may also be impacted by the proposed development. (Figure 7)

5.1.1.4 Assessment of Take

Based on the distribution of golden-cheeked warbler habitat on the Schlumberger property, approximately 84 acres of habitat would be directly modified by completion of the proposed development, with the possibility of up to an additional 24 acres being rendered unsuitable for use by warblers due to indirect impacts associated with urbanization. Based on 1996 survey data, the proposed development plan would result in the modification of vegetation within portions of 6 golden-cheeked warbler territories. As part of the proposed action, a



FIGU[illegible]OWN LOCATIONS OF JOLLYVILLE PLATEAU SALAMANDER



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CHE IMPACT OF PROPOSED ALTERNATIVE ON GOLDEN-WARBLER HABITAT

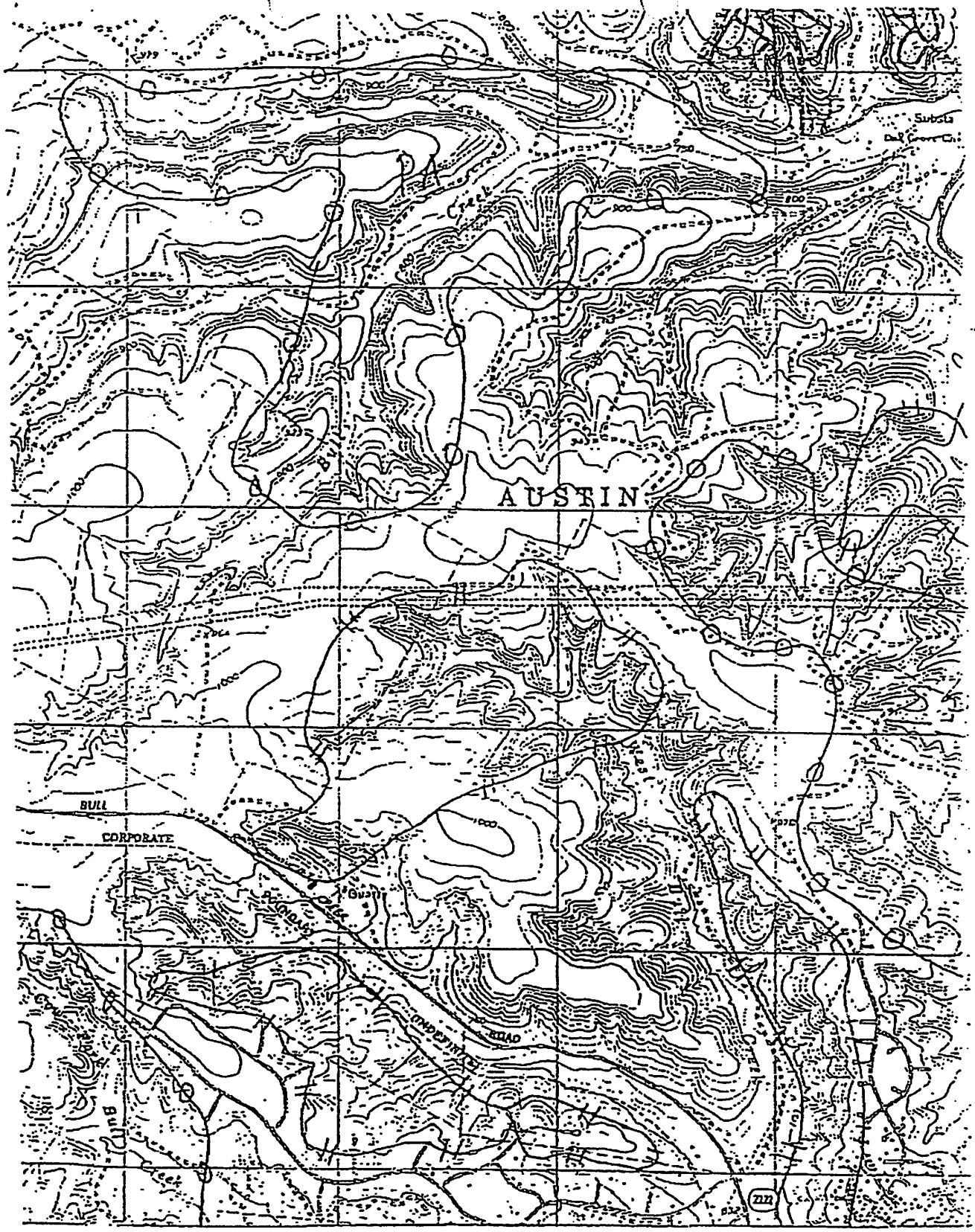


Figure .7 - Jollyville 7.5' quadrangle (south central section)

Probable habitat for Amorpha roemerana and Philadelphus ernestii

habitat conservation plan (HCP) has been proposed to minimize the potential adverse modification of habitat described above and assure that this action does not reduce the potential for survival and recovery of the golden-cheeked warbler in the wild, as mandated by requirements of 50 CFR Part 17.22(b)(1)(iii). The HCP is detailed in Section 6.0. No take is anticipated for any other federally listed or proposed species.

5.1.1.5 Wetlands

No wetlands are present within areas proposed for development; therefore, none would be impacted by the Proposed Action.

5.1.1.6 Geology and Soils

Areas proposed for development are underlain by the basal member of the Edwards Limestone Formation. The maximum area of disturbance for the project covers approximately 140 acres; however, grading for new construction is not expected to result in significant geologic alterations.

Surface soil alterations will be minimal and will comply with all applicable City of Austin and Travis County construction codes for erosion and sedimentation control during the construction process.

5.1.1.7 Land Use

The proposed action is fully comparable and compatible with current land use in the area. A Schlumberger research and development facility is currently present on the property and similar operations are present nearby to the west on the Grandview Hills property. Moderate to high density residential developments are present nearby to the north and additional residential and commercial development is planned for lands immediately west of Schlumberger. Undisturbed portions of the property would buffer the proposed development from City of Austin preserve land to the east.

5.1.1.8 Air Quality

Development of the property may contribute to local traffic noise and exhaust emissions by increasing the number of people operating vehicles in the area, although these increases are expected to be very small. A reduction in the number of trees on the property may slightly reduce local air filtering capabilities. A temporary increase in noise and dust levels is expected during the construction process.

5.1.1.9 Water Quality

Because surface water quality mitigation would be designed in accordance with applicable watershed ordinances, no significant impacts to local water quality are expected to occur as a result of the proposed project.

5.1.1.10 Cultural Resources

Of the 13 archaeological sites on the NRHP, all but one are located in the main canyon and outside of areas proposed for development. The one NRHP site located within a proposed development area, a burned rock midden, is located on the west plateau.

5.1.2 Off-site Impacts

5.1.2.1 Vegetation

No direct off-site impacts to vegetation are expected. Indirect impacts may occur because of: 1) introduction and spread of non-native plant species; and, 2) increased likelihood of infestation of oak wilt.

This property is known to contain probable habitat for canyon mock-orange plants, and potentially for the same for the bracted twistflower, but the habitat appears to occur outside the development areas.

5.1.2.2 Wildlife

Displacement of certain wildlife species is expected to occur from the development site to the adjacent areas which could result in increased competition for nesting, foraging, breeding, and feeding areas. Landscape vegetation will provide habitat for those species of wildlife suited for coexistence with urban development. The undevelopable portions of the canyon system are expected to remain in their natural vegetational state and would continue to provide habitat for the wildlife species that currently utilize this area. Undetermined negative or positive effects associated with the promotion of urban wildlife species and human activities associated with the planned development may result in negative impacts to certain species while others may be unaffected or positively affected from this development.

5.1.2.3 Threatened and Endangered Species

Negative impacts to the golden-cheeked warbler may occur in the immediate vicinity of the proposed project. The warbler may exhibit a decline in population because of increase pressure from brown-headed cowbirds, other predators, and oak wilt.

Approximately 10 acres of off-site golden-cheeked warbler habitat adjacent to the proposed development area on the north plateau may be rendered unsuitable for use by warblers due to indirect impacts associated with urbanization.

Pre-application discussions of this project with USFWS indicated the agency had concerns that too narrow a corridor between the existing development and the proposed development area on the north plateau could reduce the viability of warbler habitat preserved on the adjacent Stovepipe Cave preserve. The 650-foot wide corridor proposed in this alternative

was approved by USFWS as adequate to protect the viability of warbler habitat on the cave preserve.

5.1.2.4 Wetlands

No off-site impacts to wetlands are expected as a result of the Proposed Action.

5.1.2.5 Geology and Soils

No off-site impacts to geology or soils are expected to occur as a result of the proposed project.

5.1.2.6 Land Use

Population growth has continued in the Austin metropolitan area. This has created an on-going demand for public services, such as utilities, police, and hospitals. Minor off-site impacts to adjacent land use are expected.

5.1.2.7 Air Quality

Development of the property may contribute to local traffic noise and exhaust emissions by increasing the number of people operating vehicles in the area, although these increases are expected to be very small. A reduction in the number of trees on the property may slightly reduce local air filtering capabilities. A temporary increase in noise and dust levels is expected during the construction process. These impacts can be mitigated by prudent construction management practices.

5.1.2.8 Water Quality

No significant impacts to local water quality are expected as a result of off-site impacts.

5.1.2.9 Cultural Resources

No off-site impacts to cultural resources are expected to occur.

5.1.3 Cumulative Impacts Analysis

This section considers the past, present, and future projects, authorized or under review, that are considered to contribute to the cumulative loss of species of concern.

5.1.3.1 Vegetation

As the proposed action would result in disturbance of 140 acres of vegetation, primarily juniper-live oak woodland, it would cumulatively contribute to disturbance of this vegetation type in Travis County resulting from development, road construction, and other land use

projects increasing the loss of large unfragmented blocks of vegetation by urban development.

5.1.3.2 Wildlife

The proposed action will contribute to a cumulative reduction of habitat for some wildlife species when added to impacts resulting from other development, road construction, and other land use projects in Travis County. Wildlife species associated with urban and suburban settings would likely increase while species intolerant of development would locally decrease. No significant cumulative impacts to wildlife species currently occurring in Travis County or the region would be expected.

5.1.3.3 Threatened or Endangered Species

The proposed action will contribute to "take" of golden-cheeked warblers and/or their habitat in the region when added to section 10(a)(1)(B) incidental take permits that have been or will be issued by the Service for other projects. To date, 94 incidental take permits have been issued in the Austin area. These permits cover approximately 7,050 acres a portion of which included warbler habitat. There are currently 8 active incidental take permit applications being considered by the Service in the Austin area. These permits cover in excess of 4,544 acres, of which a portion is suitable warbler habitat. The level of impacts resulting from projects for which permits are currently being considered is dependent on the amount of take resulting from the actual number of these permits issued by the Service. Cumulatively, the known activities would significantly reduce the probability of survival of the warbler and each activity is being evaluated with respect to its impact on the warbler's population in recovery unit number 5.

5.1.3.4 Wetlands

There are not impacts to wetlands as a result of this project. Therefore, no cumulative impacts are anticipated.

5.1.3.5 Geology and Soils

No significant cumulative impacts to geology and soils would occur as a result of the proposed action.

5.1.3.6 Land Use

The proposed action contributes to the conversion of undeveloped land to developed land in the Austin area. Past, present, and future developments must comply with all development codes and cumulative impacts will be the same for all alternatives.

5.1.3.7 Air and Water Quality

The proposed action will contribute to limited degradation of air quality in the Austin area, primarily through a slight increase in automobile exhaust emissions. The significance of the impact will depend upon air quality requirements for construction activities and automobiles. The continued development of the area could result in a significant cumulative impact on air quality.

The proposed action, complying with local water quality codes, will cause some change in existing water quality. However, this change will not result in a significant cumulative impact from the single family residential lots that are anticipated to undergo this process. However, uncontrolled development in areas that do not have adequate water quality standards will result in a significant cumulative impact on the water quality.

5.1.3.8 Cultural Resources

This project, because of its limited scope, will not result in cumulative impacts to sites eligible for the National Register of Historic Places.

5.2 ALTERNATIVE 2 - ALTERNATE PROJECT DESIGN I

This alternative was rejected because it would have resulted in the direct modification of approximately 19 more acres of golden-cheeked warbler habitat than the Proposed Action.

5.3 ALTERNATIVE 3 - ALTERNATE PROJECT DESIGN II

This alternative was rejected because it had greater potential to result in the loss of warbler habitat viability off-site due to the decreased width of a naturally vegetated corridor between existing development on the Schlumberger property and the area proposed for development on the north plateau.

5.4 ALTERNATIVE 4 - APPROVED PDA

This alternative was rejected because it would have resulted in the direct modification of 14 more acres of warbler habitat than the Proposed Action, would have affected up to 10 warbler territories, and would have increased the potential for indirect impacts in undisturbed habitat on- and off-site.

5.5 ALTERNATIVE 5 - NO ACTION

The No Action Alternative would result in abandonment of the Proposed Action. This alternative was rejected because abandonment of the proposed project would result in the loss of significant monies invested in the property and in project planning and would result in severe economic hardship to the Applicant.

6.0 PROPOSED HABITAT CONSERVATION PLAN

This section contains the Applicant's specific conservation proposals for the proposed project. The proposed development plan, Alternative 1, consists of light industrial development, with attendant roads and utilities, on approximately 143.6 acres. Some of the proposed development area lies within golden-cheeked warbler habitat. Incidental indirect take of warblers is expected to result from the loss of habitat resultant from the proposed project. Therefore, the HCP proposal includes the following provisions to avoid, minimize, and mitigate for take of golden-cheeked warblers:

Reduction of Area Proposed for Development. The development area as originally proposed on the north plateau encompassed all land that does not currently contain golden-cheeked warbler habitat and included the wooded northwest corner of the property, which does contain warbler habitat. Following discussions with the USFWS, the proposed development area on the north plateau was reduced by about 13 acres to maintain a minimum width of at least 650 feet of undisturbed land between existing development and the proposed development area; development of another 5 acres in the northwest corner of the property was abandoned. The 650-foot wide undeveloped area is intended to maintain a broad, naturally vegetated connection between the patch of warbler habitat in the Stovepipe Cave Preserve (and the northwest corner of the Schlumberger property) and habitat in the main canyon to the east.

Avoidance of Direct Impacts to Warblers. Clearing in occupied warbler habitat would not be initiated during times of year when birds are nesting (March 1 through July 31).

Preservation of Golden-cheeked Warbler Habitat. Most of the undeveloped acreage of the property, including a minimum of approximately 195 acres of golden-cheeked warbler habitat, would be set aside and maintained in an undisturbed condition. This land will be preserved as a conservation easement held by a non-profit conservation organization or governmental agency acceptable to the USFWS. This conservation easement will be granted in perpetuity or until the golden-cheeked warbler is de-listed and USFWS approves termination of the easement.

Fencing of Preserve Areas. Upon completion of construction, permanent fencing of a type agreed upon by the Applicant and the Service will be placed at the perimeter of the developed area. All fences will be marked with signs that identify the fenced areas as wildlife preserves. Signs will be placed at approximately 200-foot intervals. All fences will be maintained for the life of the permit.

Periodic Cedar Control. After consultation and agreement between the Applicant and the USFWS, removal of Ashe Juniper (cedar) trees, for the purpose of promoting the regeneration of hardwood trees, may occur to the extent reasonable and practicable.

Restricted Use of Pesticides and Herbicides. The natural landscaping used within developed portions of the Schlumberger property minimizes the need for use of pesticides

and herbicides. No pesticides or herbicides will be used in preserved portions of the Schlumberger property. Any pesticides and herbicides used within proposed development areas will be applied according to the EPA guidelines provided for those specific chemicals and included on their respective packaging.

Golden-cheeked Warbler Monitoring Surveys. Surveys for golden-cheeked warblers will be conducted on the Schlumberger property within areas proposed for development and in preserve areas within 500 feet of proposed development in the first three years following commencement of construction and every third year thereafter through project buildout (95% completion). Presence/absence surveys shall be conducted in the first two years; territorial mapping surveys shall be conducted in all other years. A final territorial mapping survey will be conducted in the third year following project buildout.

The Service recommends the following conservation recommendations be followed:

> *If populations of canyon mock-orange and bracted twistflower are found to occur on the property, the Service requests to be notified. We would appreciate the opportunity to collect seed from such plants to be stored in the National Seed Bank in Fort Collins, Colorado.*

In addition the Service would include the following conditions in any issued permit:

Any change in ownership of the property or management of lands preserved as mitigation will be approved by the Service.

The permit, appropriate attachments, and deed to the preserve management entity will be recorded with the County Clerk, Travis County, Texas prior to the beginning of development related activities on the Schlumberger property. A recorded copy of this action will be returned to the Service within 30 days of the date of recording.

The Applicant will implement the above mitigative measures and will be responsible for providing all necessary funding. Funding will be per agreement between the Applicant and managing entity.

Written summary reports of the years activities, with regard to inspecting and monitoring, will be submitted by October 1 of each year to the Service Field Office 10711 Burnet, Suite 200, Austin, Texas 78758.

Upon locating a dead, injured, or sick golden-cheeked warbler, or any other endangered or threatened species, permittee is required to contact the U.S. fish and Wildlife Service's Law Enforcement Office, Austin, Texas, (512)490-0948, for care and disposition instruction. Extreme care should be taken in handling sick or injured individuals to ensure effective and proper treatment. Care should also be taken in handling dead specimens to preserve biological materials in the best possible state for analysis of cause of death. In conjunction

with the care of sick or injured endangered/threatened species, or preservation of biological materials from a dead specimen, the Permittee and its contractor/subcontractor have the responsibility to ensure that evidence intrinsic to the specimen is not unnecessarily disturbed.

Conditions of any permit shall be binding on and for the benefit of the Permittee and their respective successors and assigns. If a permit requires an amendment because of change of ownership, the Service will process that amendment without the requirement of the applicant preparing any new documents or providing any mitigation over and above that required in the original permit. The construction activities proposed under an original permit would not be interrupted provided the required special conditions of an issued permit are being followed.

The mitigation will fully support and accrue full benefits to the Balcones Canyonlands Conservation Plan Permit PRT-788841.

The authorization granted by the permit will be subject to full and complete compliance with and implementation of, the terms and conditions of the Environmental Assessment/Habitat Conservation Plan (EA/HCP), Biological Opinion, and all specific conditions contained EA/HCP, the Biological Opinion, or other permit documents.

The current "No Surprises" policy of the Service provides that additional mitigation land or financial compensation shall not be required for the Applicant or their successors beyond the level of mitigation provided for the identified EA/HCP. With respect to a permit, the EA/HCP and supporting documents should adequately address the federally listed golden-cheeked warbler.

Clearing and construction within the proposed development area shall be consistent with the current practices recommended by the Texas Forest Service to prevent the spread of oak wilt.

Clearing for construction of buildings, streets and other areas of impervious cover will be minimized to the greatest extent possible. Areas disturbed during construction, but not occupied by buildings or impervious surface, will be replanted with native plant species.

New construction on site will not be initiated during the warbler breeding/nesting period, between March 1 and August 1, within 300 feet of the edge of a documented warbler territory. Building construction may be conducted year round as long as the vegetation clearing activities associated with building are completed outside the warbler breeding season, or when surveys conducted immediately prior to such activities reveal no warbler territories are present within 300 feet of the construction activities.

If during the tenure of this permit, the amount or extent of the habitat impact described in the habitat conservation plan is exceeded all construction and/or other activities related to the incidental take permit must be stopped and the permittee is required to immediately contact the Service to avoid violation of Section 9, of the Endangered Species Act.

This conservation plan is intended to minimize the potential impact to the warbler and provide for its continued existence.

6.1 AMENDMENT PROCEDURE

It is necessary to establish a procedure whereby the Section 10(a)(1)(B) Permit and the Implementation Agreement can be amended. However, it is extremely important that the cumulative effect of amendments will not jeopardize any endangered species or other species of concern. Amendments must be evaluated based on their effect on the habitat as a whole. The Service must be consulted on all proposed amendments. The types of proposed amendments and the applicable amendment procedures are as follows:

6.2 AMENDMENTS TO LOCALLY APPROVED DEVELOPMENT PLANS

It is acknowledged that upon the written request of the Applicant, the local agency having land use regulatory jurisdiction is authorized in accordance with applicable law to approve amendments to development plans for the subject development area that do not encroach on any endangered species habitat that is not presently contemplated to be taken as a consequence of the development, and which do not alter the conditions set forth in the HCP or the Implementation Agreement.

6.3 MINOR AMENDMENTS TO THE HCP

Minor amendments involve routine administrative revisions or changes to the operation and management program and which do not diminish the level or means of mitigation. Such minor amendments do not alter the terms of the Section 10(a)(1)(B) permit.

Upon the written request of the Applicant, the Service is authorized to approve minor amendments to the HCP upon information notice sent to the parties to the Implementation Agreement if the amendment does not conflict with the primary purpose of this HCP as stated in Section 2.0.

6.4 ALL OTHER AMENDMENTS

All other amendments will be considered an amendment to the Section 10(a)(1)(B) permit, subject to any other procedural requirements of federal law or regulation which may be applicable to amendment of such a permit.

7.0 PUBLIC AND AGENCY COORDINATION

The Applicant has been actively pursuing public and agency acceptance of the proposed development for several years, and is continuing to make significant efforts through numerous meetings with concerned groups, individuals, public officials, and agencies, to properly coordinate this proposed action with all potentially concerned entities.

The following agencies, organizations, and individuals were consulted or coordinated with during the process of addressing endangered species concerns for the Schlumberger property.

Consort, Inc. – Austin, Texas
Mike Warton & Associates – Austin, Texas
SWCA, Inc. – Austin, Texas
U.S. Fish and Wildlife Service – Austin, Texas
U.S. Fish and Wildlife Service – Albuquerque, New Mexico

This document was originally prepared by SWCA, Inc. Environmental Consultants on behalf of the Applicant. The Service has modified portions of the document, except for the proposed HCP in Section 6. Any statements where the Service differed with the proposal was noted in italics and enclosed brackets.

Publication notification of the availability of the Draft EA/HCP was published in the Federal Register. All concerned agencies and entities were provided a copy for review comment.

8.0 LITERATURE CITED

Chippindale, P.T., A.H. Price, and D.M. Hillis. 1993. A new species of perennibranchiate salamander (*Eurycea*; Plethodontidae) from Austin, Texas. Herpetologica 49(2):248-259.

McNeal, P. 1989. Status of *Streptanthus bracteatus*, *Philadelphus ernestii* and *Amorpha roemerana* in Travis County: a report for the Balcones Canyonlands Habitat Conservation Plan. Unpubl. report to the Biological Advisory Team.

RECON and USFWS. 1996. Final Environmental Impact Statement/Habitat Conservation Plan for proposed issuance of a permit to allow incidental take of the golden-cheeked warbler, black-capped vireo, and six karst invertebrates in Travis County, Texas. USFWS Regional Office, Albuquerque, New Mexico.

Slade, R.M., M.E. Dorsey, and S.L. Stewart. 1986. Hydrology and water quality of the Edwards Aquifer associated with Barton Springs in the Austin area, Texas. U.S. Geological Survey Water-Resources Investigations Report 86-4036.

Soil Conservation Service. 1974. Soil Survey of Travis County, Texas. United States Department of Agriculture. Texas Agriculture Experiment Station.

United States Fish and Wildlife Service. 1991. Black-capped vireo (*Vireo atricapillus*) recovery plan. Austin, Texas.

United States Fish and Wildlife Service. 1992. Golden-cheeked warbler (*Dendroica chrysoparia*) recovery plan. Austin, Texas.

United States Fish and Wildlife Service. 1994. Recovery plan for endangered karst invertebrates in Travis and Williamson Counties, Texas. Albuquerque, New Mexico. 154 pp.

ENVIRONMENTAL ACTION STATEMENT (EAS)

Within the spirit and intent of the Council on Environmental Quality's regulations for implementing the National Environmental Policy Act (NEPA), and other statutes, orders, and policies that protect fish and wildlife resources, I have established the following administrative record and have determined that the action of constructing a light industrial development and associated roads and utilities on 143.6 acres of the 440-acre Schlumberger Property, Austin, Travis County, Texas:

____ is a categorical exclusion as provided by 516 DM 2, Appendix 1 and 516 DM 6, Appendix 1 and no further NEPA documentation will be made.

_XX_ is found not to have significant environmental effects as determined by the attached Environmental Assessment and Finding of No Significant Impact.

____ is found to have significant effects, and therefore further consideration of this action will require a notice of intent to be published in the *Federal Register* announcing the decision to prepare an EIS.

____ is not approved because of unacceptable environmental damage, or violation of Fish and Wildlife Service mandates, policies, regulations, or procedures.

____ is an emergency action within the context of 40 CFR 1506.11. Only those actions necessary to control the immediate impacts of the emergency will be taken. Other related actions remain subject to NEPA review.

Other supporting documents:

__x__ Environmental Assessment and FONSI
__x__ Biological Opinion
_____ Findings Document
__x__ Conservation strategy and recovery plan for golden-cheeked warbler

Acting Regional HCP Coordinator — Date: 8/18/05

Regional NEPA Coordinator — Date: 8/19/05

Assistant Regional Director — Date: 8/25/05

ACTING Regional Director — Date: 8/31/05

Biological Opinion for Schlumberger Property TE-827597-0

This provides the U.S. Fish and Wildlife Service's (Service) biological opinion regarding the proposed issuance of an Endangered Species Act (Act) section 10(a)(1)(B) permit. The Federal action under consideration is the issuance of a permit authorizing the incidental take of the endangered golden-cheeked warbler (warbler) (*Dendroica chrysoparia*) under the authority of sections 10(a)(1)(B) and 10(a)(2) of the Act. Schlumberger Technology Corporation (Applicant) has submitted an application for an incidental take permit under the Act to take the Federally-listed endangered warbler. Along with their application, the Applicant submitted a Environmental Assessment/Habitat Conservation Plan (EA/HCP) which has been reviewed for mitigation acceptability. The implementing regulations for section 10(a)(1)(B) of the Act, as provided for by 50 CFR 17.22, specify the criteria by which a permit allowing the incidental "take" of listed endangered species pursuant to otherwise lawful activities may be obtained. The purpose and need for the section 10(a)(1)(B) permit is to ensure that the incidental take resulting from the proposed construction of a light industrial development with associated streets and utilities will be minimized and mitigated to the maximum extent practicable, and will not appreciably reduce the likelihood of the survival and recovery of this Federally-listed endangered species in the wild.

Consultation History

On October 29, 1996, the consultants for and representatives of Schlumberger Technology Corporation (SWCA Inc.) met with the Service to discuss their development plans, application for a 10(a)(1)(B) permit, and possible mitigation. Service biologists visited the site on November 6, 1996. Another pre-application coordination meeting was held December 6, 1996. On February 28, 1997, Schlumberger submitted an application for a 10(a)(1)(B) permit. SWCA submitted a revised EA/HCP on May 3, 1997, April 15, 1997, and another revision on June 25, 1997. Notice of availability of the HCP was printed on September 11, 1997. No public comments were received.

This biological opinion is based on information provided in the EA/HCP for the 440-acres Schlumberger Property, dated August 11, 1997.

BIOLOGICAL OPINION

Description of the Proposed Action

The action involves the issuance of a section 10(a)(1)(B) permit for 30 years to Schlumberger Technology Corporation for the construction of a light industrial development and associated roads and utilities on approximately 143.6 acres of the 440-acre Schlumberger property. As part of the development plan, most of the undeveloped acreage of the property, including a minimum of approximately 195 acres of warbler habitat, will be preserved in an undisturbed condition by conservation easement conveyed to an entity approved by the Service and maintained in perpetuity. A 650-foot wide area of undisturbed land between existing

development and the proposed development area will also be maintained as a broad naturally vegetated connection between the patch of warbler habitat in the Stovepipe Cave Preserve (and the northwest corner of the Schlumberger Property) and habitat in the main canyon to the east. In addition, to further reduce significant direct and indirect impacts to the golden-cheeked warbler and the Jollyville Plateau salamander, the applicant has reduced commercial development by 100,000 square feet of buildings. This avoidance strategy will enhance the viability of the on-site mitigation preserve. The proposed action is explained in detail in the EA/HCP.

Status of the Species:

Golden-cheeked warbler. The golden-cheeked warbler breeds only in the mixed evergreen-deciduous woodlands of central Texas (Figure 1) and winters in the highland pine-oak woodlands of southern Mexico and northern Central America. Human activities have eliminated much warbler habitat within parts of the warbler's range. Recent surveys suggest that the rate of habitat loss is accelerating as suburban developments spread into prime warbler habitat along the Balcones Escarpment, especially in the growth corridor from Austin to San Antonio. The estimated population size of the warbler as of 1990 was 13,800 territories. The warbler was listed as endangered on December 27, 1990. Additional information on the status of the species can be found in the Golden-cheeked Warbler Recovery Plan (USFWS, 1992).

Bracted Twistflower. The bracted twistflower (*Streptanthus bracteatus*) is a Species of Concern covered by the Balcones Canyonlands Preserve Habitat Conservation Plan. The known distribution of bracted twistflower includes 15 occurrences in south-central Texas within Medina, Travis and Uvalde counties, and a questionable identification in Caldwell County. According to current field data, the Travis County population represents a significant percentage of the total population. Six sites, which together include eleven populations and approximately 277 individuals, were located in Travis County in 1989. Two sites contained 10 or fewer individuals, the remaining four sites each contained 49 plants or more. The area of each population is very small and densities of plants are high. During 1990, field surveys for this plant were conducted by Espey, Huston & Associates on approximately 1300 acres identified as probably habitat in Travis County. No new occurrences were found. Bracted twistflower typically occurs on this clay soils overlying limestone in dense brushy areas and mostly dominated by woodland, i.e. oak/juniper, oak/ash/black cherry or juniper. Most locations of this plant in Travis County are on ridgetops or upper slopes of hillsides. But, because the habitat characteristics are so variable, the area of potential habitat is quite large.

Canyon Mock-orange. Canyon mock-orange (*Philadelphus ernestii*) is a Species of Concern covered by the Balcones Canyonlands Preserve Habitat Conservation Plan. This plant is a rare endemic of the Edwards Plateau. It is known from 11 populations in Blanco, Hays, Kendall and Travis counties. Within Travis County, known populations consist of only 3 localized concentrations. No isolated individuals are known. One of the populations occurs in the Bull Creek and West Bull Creek basin. McNeal (1989) estimates that there are several thousand individuals in this population. The Schlumberger property was identified in the McNeal status report to have an area of potential habitat for the canyon mock-orange within and on the upper

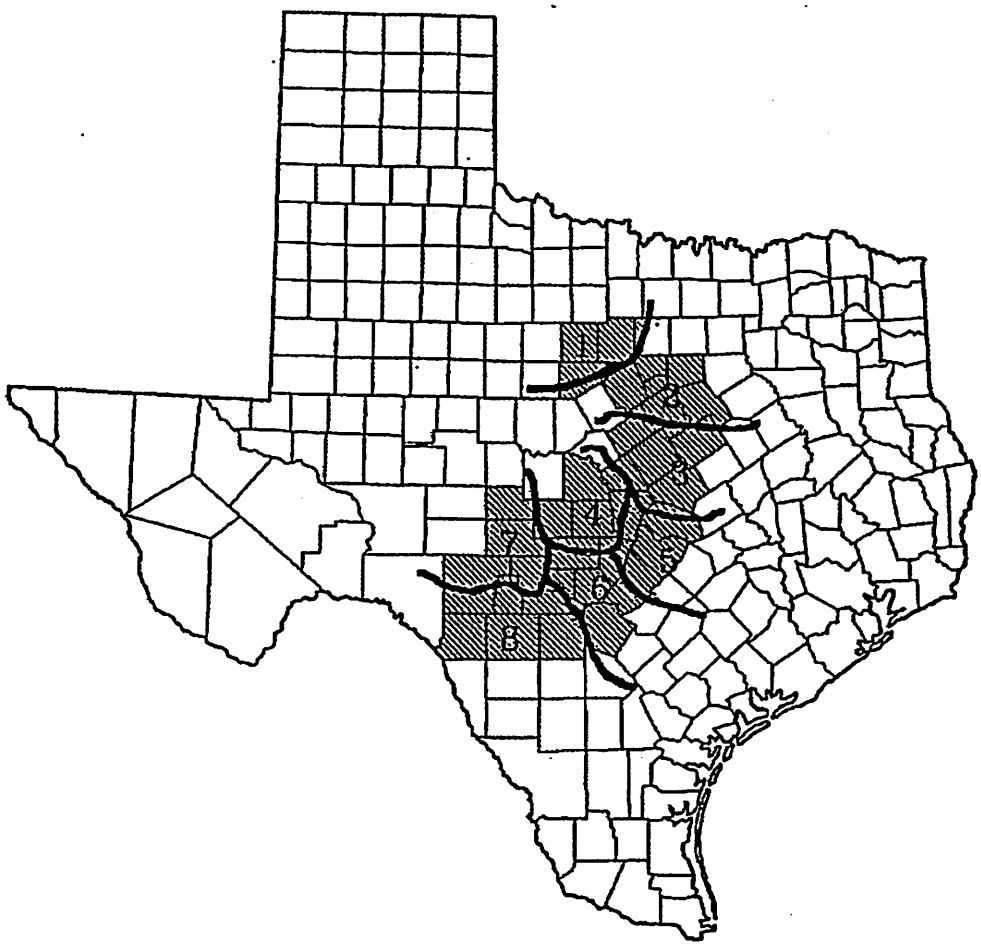


FIGURE 1. Golden-cheeked breeding range and recovery units.

slopes of the main canyon and its northern tributary. The property was not surveyed and delineated areas represented areas where the plant was most likely to occur. Surveys by SWCA Inc. (1997) were conducted in 1993. No canyon mock-orange or bracted twistflower specimens were located during the survey. Property west of 620 was also identified as potential habitat for both the Canyon mock-orange and bracted twistflower. Because both species use similar habitat it may be possible the bracted twistflower may also occur on the property.

Environmental Baseline:

The environmental baseline is described in the EA/HCP, Section 3.0.

Effects of the Action:

The anticipated effects of the proposed action are described in the EA/HCP, Section 5.0.

Cumulative Effects:

The cumulative effects of the proposed action are described in the EA/HCP, Section 5.1.3. Paragraph 5.1.3.3 of the EA/HCP is revised as follows:

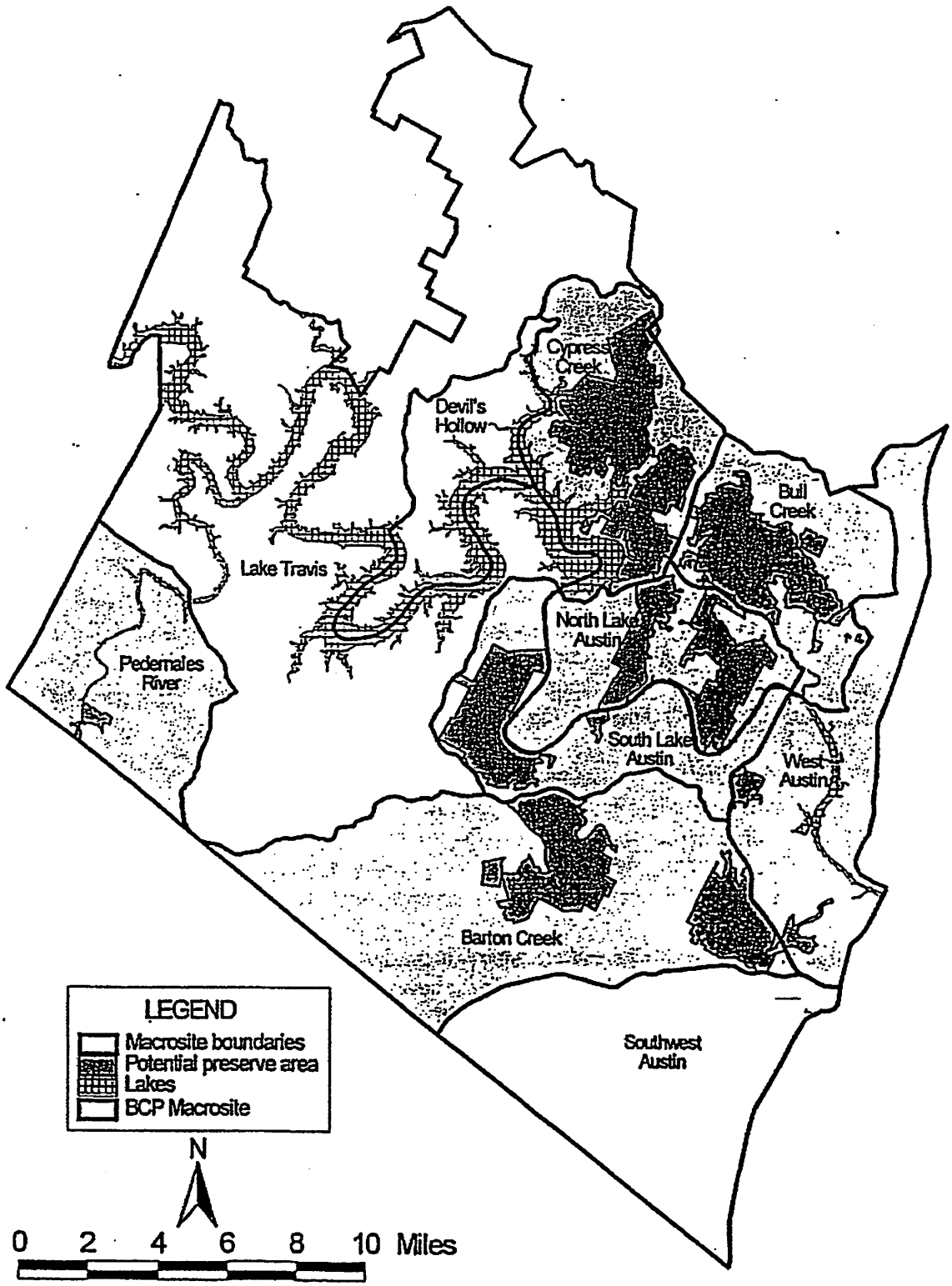
To date 96 incidental take permits have been issued in the Austin area. These permits cover approximately 7358 acres, a portion of which includes warbler habitat. There are currently 4 active incidental take permit applications being considered by the Service in the Austin area. These permits cover in excess of 2079 acres, of which a portion is suitable warbler habitat.

In addition the Balcones Canyonlands Preserve regional habitat conservation plan (BCCP) was signed on May 2, 1996, and may cover up to 633,000 acres in Travis County. This permit allows 70% of the potential habitat in Travis County to be destroyed provided that the permittees acquire and preserve 30,428 acres within designated macrosites (Figure 2). This project is in the Bull Creek macrosite. Two 10(a)(1)(B) permits have been issued within this macrosite to date totalling 34.6 acres and the Service is currently evaluating another project covering 740 acres within the macrosite.

Biological Opinion:

After reviewing the current status of the golden-cheeked warbler, at the recovery unit level and rangewide, the environmental baseline for the action area, the direct and indirect effects of the proposed action and the cumulative effects, it is the Service's biological opinion that the issuance of a §10(a)(1)(B) permit for fulfillment of PRT-827597 as proposed, is not likely to jeopardize the continued existence of the golden-cheeked warbler. Critical habitat has not been designated for these species, therefore, none will be affected.

INCIDENTAL TAKE STATEMENT



Travis County- TNR

	BCCP Permit Area	Date: 4/15/97
	Balcones Canyonlands Preserve Macrosites	Figure 2

Terms and Conditions:

In order to be exempt from the prohibitions of §9 of the Act, the following non-discretionary terms and conditions,which implement the reasonable and prudent measure described above, must be complied with:

The authorization granted by the permit is subject to full and complete compliance with, and implementation of, the terms and conditions of the Habitat Conservation Plan and all specific conditions contained in the issued permit, including the following:

A. Standard wording

B. Standard wording

C. Standard wording

D. Acceptance of this Permit serves as evidence that the Permittee and its authorized agents understand and agree to abide by the terms of this permit and all sections of Title 50 Code of Federal Regulations, Parts 13 and 17, pertinent to issued permits. Section 11 of the Endangered Species Act of 1973, as amended, provides for civil and criminal penalties for failure to comply with permit conditions.

E. The permittee is authorized to "take" (kill, harm, or harass) the golden-cheeked warbler at known location (Schlumberger, east of R.M. 620 approximately one mile north of R.M. 2222, Austin, Travis County, Texas) 108 acres of habitat for the species incidental to activities necessary for the construction of a light industrial development as described in the permittee's application.

F. The authorization granted by the permit is subject to full and complete compliance with, and implementation of, the terms and conditions of the Environmental Assessment/Habitat Conservation Plan (EA/HCP), Biological Opinion, and all specific conditions contained in this permit. These permit terms and conditions shall supersede and take precedence over any inconsistent provisions in the EA/HCP, the Biological Opinion, or other permit documents.

G. The undeveloped acres of the project comprise a minimum of approximately 195 acres of warbler habitat which will be preserved and maintained in an undisturbed condition for the benefit of the golden-cheeked warbler. This land shall be known as the mitigation land.

H. Prior to the commencement of development activities, the permittee shall encumber the mitigation land with a perpetual conservation easement previously approved by the Service and conveyed to an entity approved by the Service to be filed by the permittee at its cost in the Travis County Records, and a copy of the recorded instrument shall be provided to the Service. The underlying fee title of the mitigation land may be transferred, donated, sold, or otherwise conveyed to a public or private non-profit entity with the written approval of such disposition of the land by the Service.

I. The permittee shall manage or fund the operation and management of the mitigation land in perpetuity.

J. Vegetation clearing activities on the Schlumberger tract will be conducted outside the warbler breeding season (i.e. not during the period March 1 through June 30) to the extent possible and not after March 15 without Service approval unless surveys conducted consistent with Service Guidelines immediately prior to such activities reveal no warbler territories are present within 300 feet of the activity. Clearing within the proposed development areas shall be consistent with the current practices recommended by the Texas Forest Service to prevent the spread of oak wilt.

K. Building construction, utility infrastructure and street construction may be conducted year round as long as the construction activities promptly follow the clearing activities and/or were initiated before March 1 therefore being a continuous activity before the breeding season began.

L. Clearing for construction of buildings, streets, and other areas of impervious cover will be minimized to the greatest extent practicable. Areas outside of construction zones that are disturbed during construction, but are not occupied by impervious surfaces, will be replanted with native oaks and other native vegetation.

M. Upon completion of construction, permanent fencing of a type agreed upon by the Applicant and the Service will be placed at the perimeter of the developed area to preclude public access to preserve areas. All fences will be marked with signs that identify the fenced areas as wildlife preserves. Signs will be placed at approximately 200-foot intervals and fences maintained for the life of the permit.

N. Surveys for golden-cheeked warblers will be conducted on the Schlumberger property within areas proposed for development and in preserve areas within 500 feet of proposed development in the first three years following commencement of construction and every third year thereafter through project buildout (95% completion). Presence/absence surveys shall be conducted in the first two years; territorial mapping surveys shall be conducted in all other years. A final

territorial mapping survey will be conducted in the third year following project buildout.

O. The use of herbicides and pesticides by the Applicant will be kept to a minimum and will fully comply with the label guidelines for application. No pesticides or herbicides will be used in preserved portions of the Schlumberger property.

P. This permit and each of its conditions shall be binding on the Permittee and its successors and assigns. If this permit requires an amendment because of change of ownership, the Service will process that amendment without the requirement of the applicant preparing any new documents or providing any mitigation over and above that required in the original permit. The construction activities proposed or in progress under the original permit would not be interrupted, provided the permittee, its successors or assigns is in conformance with all required special conditions of the issued permit.

Q. The permit and appropriate attachments will be recorded with the County Clerk, Travis County, Texas, prior to the beginning of development related activities on the Schlumberger property. A recorded copy of this action will be returned to the Service within 30 days of the date of recording.

R. The current "No Surprises" policy of the U. S. Fish and Wildlife Service provides that additional mitigation lands or financial compensation shall not be required of the Applicant or their successors beyond the level of mitigation provided for in the identified HCP. With respect to this permit, the HCP and supporting documents adequately addresses only the federally listed golden-cheeked warbler. For the applicant or its successors and assigns to be fully covered by the "No Surprises" policy as to only the golden-cheeked warbler, all of the identified requirements in this permit and associated documents must be met.

S. Upon locating a dead, injured, or sick golden-cheeked warbler, or any other endangered or threatened species, permittee is required to contact the U.S. Fish and Wildlife Service's Law Enforcement Office, Austin, Texas, at (512)490-0948, for care and disposition instruction. Extreme care should be taken in handling sick or injured individuals to ensure effective and proper treatment. Care should also be taken in handling dead specimens to preserve biological materials in the best possible state of analysis of cause of death. In conjunction with the care of sick or injured endangered/threatened species, or preservation of biological materials from a dead specimen, the permittee and his contractor/subcontractor have the responsibility to ensure that evidence intrinsic to the specimen is not unnecessarily disturbed.

T. The permittee is required to file an annual report of the development activities conducted under this permit and the bird survey reports by October 1 of each year with the Field Supervisor, U.S. Fish and Wildlife Service, 10711 Burnet Rd., Austin, TX 78758.

U. The mitigation for this permit will fully support and accrue full benefits to the Balcones Canyonlands Conservation Plan Permit PRT-788841.

The incidental take statement provided in this opinion satisfies requirements of the Act. This statement does not constitute an authorization for take of migratory birds under the Migratory Bird Treaty Act, the Bald Eagle Protection Act, or any other federal statute.

CONSERVATION RECOMMENDATIONS

§2(b), §2(c), and §7(a)(1) of the Act mandate that federal agencies use their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. The term "conservation recommendations" has been defined as suggestions from the Service regarding discretionary measures to minimize or avoid adverse effects of a proposed action on listed species or critical habitat or regarding the development of information. We recommend the following additional actions for the listed species:

The Service should coordinate all future §10(a)(1)(B) mitigation activities dealing with any or all of the species involved in this action with the mitigation program of this §10(a)(1)(B) permit.

The Service should request notification if populations of canyon mock-orange and bracted twistflower are found to occur on the property and request permission to collect seed from such plants to be stored in the National Seed Bank in Fort Collins, CO.

REINITIATION NOTICE

This concludes our formal consultation on the issuance of a permit pursuant to §10(a)1(B) of the Act to allow the incidental take of the golden-cheeked warbler during and following the fulfillment of PRT-827597 in Travis County, Texas. Reinitiation of formal consultation is required if: 1) the amount or extent of incidental take identified in the initial permit is exceeded; 2) new information reveals effects of the action that may impact listed species or critical habitat in a manner or to an extent not considered in this opinion; 3) the action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in this opinion; or, 4) a new species is listed or critical habitat designated that may be affected by the action.

REINITIATION NOTICE

This concludes formal consultation on the issuance of a permit pursuant to section 10(a)(1)(B) of the Act to allow incidental take of the golden-cheeked warbler during and following the fulfillment of the terms and conditions of permit number TE-827597 in Travis County, Texas. As required in 50 CFR Section 402.16, reinitiation of formal consultation is required where discretionary federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat designated not considered in this opinion; (4) a new species is listed or critical habitat designated that may be affected by the action; or, (5) if take occurs outside the confines of the lot. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease, pending reinitiation.

In future correspondence concerning this project, refer to permit number TE-827597. Please contact Sybil Vosler at the Service's Austin Office at 512-490-0057 if you have any questions or would like to discuss any part of this biological opinion.

Approved:

ACTING Regional Director, Southwest Region

8/31/05
Date

LITERATURE CITED

McNeal, P. 1989. Status of *Streptanthus bracteatus*, *Philadelphus ernestii*, and *Amorpha roemeriana* in Travis County: a report for the Austin Regional Habitat Conservation Plan. Texas Natural Heritage Program, resource Protection Division, Texas Parks and Wildlife Department, Austin, Texas.

USFWS. 1992. Golden-cheeked Warbler (*Dendroica chrysoparia*) Recovery Plan. U.S. Fish and Wildlife Service, Albuquerque, New Mexico.

USFWS. 1994. Recovery Plan for Endangered Karst Invertebrates in Travis and Williamson Counties, Texas. U.S. Fish and Wildlife Service, Albuquerque, New Mexico.

USFWS. 1997. Environmental Assessment/Habitat Conservation Plan for the issuance of an Endangered Species Act section 10(a)(1)(B) permit for the incidental take of the golden-cheeked warbler (*Dendroica chrysoparia*), during the construction and operation of a light industrial development of portions of the 440-acre Schlumberger Property, Austin, Texas.

DEPARTMENT OF THE INTERIOR
U.S. FISH AND WILDLIFE SERVICE
10711 BURNET ROAD, SUITE 200
AUSTIN, TEXAS 78758

FINDING OF NO SIGNIFICANT IMPACT

ISSUANCE OF AN ENDANGERED SPECIES SECTION 10(a)(1)(B) PERMIT FOR INCIDENTAL TAKE OF THE GOLDEN-CHEEKED WARBLER (*Dendroica chrysoparia*) DURING CONSTRUCTION AND OPERATION OF A LIGHT INDUSTRIAL DEVELOPMENT LOCATED IN AUSTIN, TRAVIS COUNTY, TEXAS

The U.S. Fish and Wildlife Service (Service) prepared an environmental assessment for the issuance of a Section 10(a)(1)(B) permit for incidental take of the golden-cheeked warbler (*Dendroica chrysoparia*), a Federally-listed endangered species, during the construction of a light industrial development in Travis County, Texas. Such an action will allow the development to proceed, as well as provide additional preserve acreage for the golden-cheeked warbler.

Proposed Action

The proposed action is the issuance of a permit (TE-827597) under Section 10(a)(1)(B) of the Endangered Species Act to authorize the incidental take of the golden-cheeked warbler during construction of an industrial development on the Schlumberger Property.

The proposed construction and operation of approximately 143.6 acres of industrial development, with attendant roads and utilities on the approximately 440-acres Schlumberger Property, Austin, Travis County, Texas, will comply with all local, State, and Federal environmental regulations addressing environmental impacts associated with this type of development.

A Habitat Conservation Plan that specifies what steps the Permittee will take to minimize and mitigate for the incidental taking of the golden-cheeked warbler and its habitat. This plan includes the following features:

- The Applicant will maintain a minimum width of at least 650 feet of undisturbed land between existing development and the proposed development areas; to maintain a broad, naturally vegetated connection between the patch of warbler habitat in the Stovepipe Cave Preserve and habitat in the main canyon to the east.

- Clearing in occupied warbler habitat will not be initiated during times of the year when birds are nesting (March 1 through July 31).

- Preserving most of the undeveloped acreage of the property, including a minimum of approximately 195 acres of golden-cheeked warbler habitat in an undisturbed condition as a conservation easement held by a non-profit conservation organization or governmental agency approved by the Service. The conservation easement will be granted in perpetuity.

- The Applicant will minimize its clearing in connection with development of the project where practicable and will, to the extent practicable, revegetate areas (other than road rights-of-way and utility easements) with native plants.

- Clearing and construction by the Applicant within the proposed development areas shall be consistent with the current practices recommended by the Texas Forest Service to prevent the spread of oak wilt.

- Upon completion of construction permanent fencing of a type agreed upon by the Applicant and the Service will be placed at the perimeter of the developed area. All fences will be marked with signs that identify the fenced areas as wildlife preserves. Signs will be placed at approximately 200-foot intervals and fences maintained for the life of the permit.

- The use of herbicides and pesticides by the Applicant will be kept to a minimum and will fully comply with the label guidelines for application. No pesticides or herbicides will be used in preserved portions of the Schlumberger property.

- As the Applicant implements these conservation measures, the Applicant will provide copies of the implementing documentation to the Service.

Details of the mitigation proposal are provided in the Environmental Assessment/Habitat Conservation Plan prepared for this action. These conservation plan actions ensure that the criteria established for issuance of an incidental take permit will be fully satisfied.

Alternatives Considered

1. (Preferred Alternative) Construction and operation of approximately 143.6 acres of industrial development for the approximately 440-acre Schlumberger Property, Austin, Texas.

2. (Alternate Site Location) The sale of this property and the purchase of another parcel to develop which would not result in the take of the golden-cheeked warbler.

3. (Alternate Site Design) Reduced development plans that would not result in the take of the golden-cheeked warbler.

4. (Participate in a Regional Permit) Participate in a regional section 10(a)(1)(B) permit.

5. No action.

Determination

Based upon information contained in the Environmental Assessment/Habitat Conservation Plan, and supporting data in the Service's files, the U.S. Fish and Wildlife Service has determined that this action is not a major Federal action which would significantly affect the quality of the human environment within the meaning of section 102 (2)(c) of the National Environmental Policy Act of 1969. Accordingly, the preparation of an Environmental Impact Statement on the proposed action is not warranted.

It is my decision to issue the section 10(a)(1)(B) permit for the construction of a light industrial development on the Schlumberger Property, in Austin, Travis County, Texas.

ACTING Regional Director

8/31/05
Date

Appendix C:
RG-348A
Complying with the Edwards Aquifer Rules:
Technical Guidance on Best Management Practices

September 2007
RG-348A

Optional Enhanced Measures for the Protection of Water Quality in the Edwards Aquifer (Revised)

Appendix A to RG-348—
Complying with the Edwards Aquifer Rules: Technical Guidance on Best Management Practices

Prepared by the
Chief Engineer's Office, Water Programs
TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

Optional Enhanced Measures for the Protection of Water Quality in the Edwards Aquifer (Revised)

Appendix A to RG-348— Complying with the Edwards Aquifer Rules: Technical Guidance on Best Management Practices

Prepared by
Chief Engineer's Office, Water Programs

RG-348A
September 2007

Texas Commission on Environmental Quality
H.S. Buddy Garcia, *Chairman*
Larry R. Soward, *Commissioner*

Glenn Shankle, *Executive Director*

Texas Commission on Environmental Quality
P.O. Box 13087, MC-203
Austin, Texas 78711-3087

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1. Introduction

One of the goals of the Texas Commission on Environmental Quality (TCEQ) Edwards Aquifer Rules is "the existing quality of groundwater not be degraded, consistent with the protection of public health and welfare, propagation and protection of terrestrial and aquatic life, the protection of the environment, the operation of existing industries, and the maintenance and enhancement of long-term economic health of the state" (Title 30 Texas Administrative Code §213.1(1)). This document presents optional water quality protection measures that may be implemented in areas subject to the TCEQ Edwards Aquifer Rules (30 TAC Chapter 213).

The optional water quality measures and best management practices (BMPs) contained in this document have been reviewed by the United States Fish and Wildlife Service (USFWS), which has issued a concurrence that these voluntary enhanced water quality measures will protect endangered and candidate species from impacts due to water quality degradation. USFWS approved the predecessor document to this revised appendix on February 14, 2005. This revised and updated appendix was approved by correspondence from Dr. Benjamin N. Tuggle, USFWS Regional 2 Director to Governor Rick Perry dated September 4, 2007. This letter identified the following species as being included under this "no take" concurrence:

- Barton Springs salamander *(Eurycea sosorum)*,
- fountain darter *(Etheostoma fonticola)*,
- Georgetown salamander *(Eurycea naufragia)*,
- San Marcos salamander *(Eurycean nana)*, and
- San Marcos gambusia *(Gambusia georgei)*.

This concurrence is not a delegation of the USFWS's responsibilities under the Endangered Species Act (ESA), but rather an acknowledgement that the TCEQ Edwards Aquifer Protection Program with these enhanced water quality measures addresses known threats to the identified species.

If these practices contained in this document are used, they are expected to result in "no take" of these species from degradation of water quality by non-Federal landowners and other non-Federal managers.[1] This "no take" concurrence does not cover projects that: (1) occur outside the area regulated under the Edwards Aquifer Rules; (2) result in water quality impacts that may affect Federally-listed species not specifically named above; (3) result in impacts to Federally-listed species that are not water quality related; or (4) occur within one mile of spring openings that provide habitat for Federally-listed species.

It is the responsibility of the applicant to determine the potential for impacting endangered species and take appropriate action based upon this information. The USFWS maintains a county-by-county list of endangered species on its web site at <www.fws.gov/southwest/es/Endangered Species/lists/>. This list is subject to change as new biological information is gathered and should NOT be used as the sole and final source for identifying species that may be impacted by a project. Please contact the appropriate USFWS field office(s) to get additional information.

[1] Section 9 of the Endangered Species Act (Act) and Federal regulations adopted under section 4(d) of the Act prohibit the "take" of endangered and threatened species without special exemption. Take of listed species is defined as harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in such conduct. Harass is further defined as an intentional or negligent act or omission that creates the likelihood of injury to a listed species by annoying it to such an extent as to significantly disrupt normal behavioral patterns. Harm includes significant habitat modification or degradation that results in death or injury to listed species.

These optional measures are designed to enhance the protection of the species covered under this document by providing for a higher level of water quality protection and can be used by those who wish to avoid harming listed species from water quality impacts. It is the responsibility of the applicant to determine whether the optional water quality measures and best management practices described in this document are appropriate for their project.

While these measures are not mandatory under the Edwards Aquifer Protection Program, they may be submitted to the TCEQ for review as part of an Edwards Aquifer Protection Plan or a Contributing Zone Plan. An applicant who chooses to implement the measures and best management practices contained in this document will still have to comply with all other applicable requirements for the development of land under the Edwards Aquifer Protection Program and rules.

The TCEQ cannot grant variances to the measures and best management practices contained in this document. If the applicant wishes to implement these water quality measures to fulfill the "no take" concurrence by USFWS, variances from the water quality measures and best management practices under the TCEQ Edwards Aquifer Protection Program will not be allowed as part of the approved plan. If the applicant wishes a variance, the TCEQ cannot issue a plan approval letter which indicates the plan is in compliance with the measures contained in this document. If the water quality measures required to be in compliance with this document cannot be implemented fully, the applicant may initiate direct consultation with USFWS to determine if their development will result in "no take" thereby ensuring that the requirements of the Endangered Species Act have been met.

The optional water quality measures contained in this document may be implemented by applicants conducting regulated activities in the areas subject to the TCEQ Edwards Aquifer Protection Program as delineated in the rules found in Title 30 Texas Administrative Code Chapter 213 Edwards Aquifer at <www.tceq.state.tx.us/rules/index.html> and on maps available at <www.tceq.state.tx.us/compliance/field_ops/eapp/program.html>.

Activities within the Contributing Zone that disturb less than five acres, or are not part of a larger common plan of development or sale with the potential to disturb cumulatively five or more acres, are not subject to regulation under Subchapter B of the Edwards Aquifer Rules. Therefore, these activities are not eligible to be reviewed by the TCEQ.

The following sections describe the process and requirements for implementing the optional enhanced measures and best management practices. Section 2 describes the site planning process and the need for a Geological Assessment early in the project development phase. BMPs are described for sensitive features identified during the assessment or after construction has begun. Section 3 presents the sizing requirements for sediment basins used to manage construction runoff and Section 4 covers hazardous material traps and the calculations used to size storm water treatment systems for post construction runoff management. Section 5 describes the requirements for managing runoff volume to help preserve stream morphology and prevent channel erosion. Finally, Section 6 presents the additional maintenance requirements to comply with these optional measures.

2. Site Planning

In many cases in the past large tracts have been subdivided and roads and lots laid out before considering requirements for storm water treatment. This historical procedure will result in numerous difficulties when implementing these optional measures due to requirements for setbacks from creeks, streams, and sensitive features. Consequently, two steps should proceed any work to layout the subdivision or other development. These are the geological assessment and identification of stream buffers as described below.

2.1. Sensitive Features

Sensitive features comprise a large variety of types including caves, solution cavities, solution enlarged fractures, sinkholes or other karst surface expression that meet the definition for sensitive feature in the Edwards Aquifer Rules and identified using the "Instructions to Geologists for Geological Assessments" (TCEQ-0585). Sensitive features must be identified before the tract is subdivided and proposed locations for roads defined so that they may be avoided. A geological assessment must be conducted for all proposed developments including residential subdivisions that are built on less than 10 acres. A geologic assessment must also be conducted for projects on the contributing zone of the aquifer for which the applicant desires coverage under this document.

> Isolated sensitive features identified in the Geological Assessment may not be sealed, but instead must be protected by natural buffer areas from the potential impacts of storm water runoff from any new development in the area. The configuration of the buffer areas are described on the following page. Sealing of sensitive features will only be permitted where they are numerous, extensive, and impossible to avoid. Sealing of surface sensitive features will require approval from the Executive Director of the TCEQ.

These sensitive features are analogous to icebergs in that the surface expression represents only a fraction of the spatial extent of the feature that exists just below the soil profile. Because these features can accept recharge over a substantial area providing treatment of runoff only within the depression may lead to degradation of water quality in the aquifer.

Consequently, the best protection of these features is provided by a natural buffer area sized based on the drainage area for the feature. The drainage area for a cave or sinkhole frequently will include a well-defined bowl-shaped depression, which may be a few feet to many yards across and which represents the local collapse zone over a subterranean cavity. The top of the sharp slope break present at the perimeter of such a collapse zone should constitute the edge of the feature for the purposes of calculating setbacks, since the steep slopes within such a bowl usually provide little or no water quality filtration.

> The natural buffer around a feature should extend a minimum of 150 feet in all directions. Where the boundary of the drainage area to the feature lies more than 150 feet from the feature, the buffer should extend to the boundary of the drainage area or 300 feet, whichever is less.

In some cases where several point recharge features occur in close proximity setback provisions may be applied collectively or setbacks may overlap, provided that the minimum standard setback for each feature is retained. No storm water conveyance systems (storm drains, roadside swales,

etc.) that would bring runoff from outside the existing drainage area should have outfalls where the runoff would be directed to a sensitive feature by the natural topography.

The "natural state" of a buffer will typically be a combination of dense native grasses and forbs in a mosaic of shrubs and trees. Native vegetation, particularly live oak trees, should be preserved within the catchment area of caves or sinkholes. Stream flow occurring along the branches and trunks of large trees may enhance infiltration by channeling rainfall to the root zone (Thurow et al., 1987). Introduction of ornamental turf or landscaping within the catchment area is not recommended because it will probably require soil amendments, frequent maintenance, and application of fertilizers, pesticides, and herbicides. The existing soil structure and vegetation are compatible with pre-existing recharge conditions and should require little maintenance.

It is recommended that the buffers around a point recharge feature or cluster of contiguous point recharge features be maintained in a natural state to the maximum practical extent. This implies a construction-free zone. Activities and structures allowed within buffer zones are limited. Residential yards and hiking trails may be located in buffer zones as long as they are at least 50 feet from the feature. The allowance of "yards" within a buffer zone should not be taken to imply that regular landscaping is appropriate for buffers. In addition, pesticides and fertilizers should not be applied within the buffer area.

Temporary runoff protection measures should be installed according to the recommendations presented in RG-348 during any construction activities within drainage area of the feature. Temporary erosion control measures should be placed as near the construction as possible to minimize disturbance within the buffer zones and drainage areas.

Where extenuating circumstances exist and development over a significant point recharge feature and its catchment is proposed, the developer can consider demonstrating that **no feasible alternatives to construction over the sensitive feature exist.** Feasibility of alternatives should be based primarily on technical, engineering, and environmental criteria. Feasibility should not be based predominantly on marketing or economic considerations or special or unique conditions which are created as a result of the method by which a person voluntarily subdivides or develops land. An example of a situation where sealing a sensitive feature might be warranted is when the number and distribution of features is such that access is precluded to a substantial portion of the tract that might otherwise be developable.

2.2. Sensitive Features Identified During Construction

Many sensitive features, such as solution cavities and caves, are not identified during the Geological Assessment, but are discovered by excavation during the construction phase of a project. This is especially common during utility trenching. The features encountered at this phase of a project must be protected to ensure that water quality and the stability of the utility installation are protected. Rerouting of the utility is always an option and realignment of the line should be considered.

Features discovered during construction of roads, houses, or other facilities, which do not involve below grade utility installation, shall be filled with concrete. Gravel to “fist sized” rock or sacks of gravel may be placed in feature prior to placement of the concrete as long as a minimum of eighteen (18) inches of concrete is used to close the feature.

Table 2-1 describes the various types of features and the minimum treatment required when constructing sewers, storm drains or other underground utilities. There are two main strategies for

dealing with these features depending on their extent. Small, isolated solution cavities may be completely filled with concrete. An example of the proper method of dealing with this type of feature is shown in Figure 2-1. The feature is completely filled with concrete and typical bedding and backfill material is used in the trench.

Table 2-1. Minimum Protective Standards for Sewer and Storm Drain Trenches

(from Table 5-1 Edwards Aquifer Guidance Document RG-348, Revised July 2005)

Case	Description	Concern	Treatment	Notification/ Approval
1	Sensitive feature is less than or equal to six (6) inches in all directions and is located above the embedment of the pipe. All rock within and surrounding the feature is sound.	Not environmental nor pipe integrity	No abatement required.	None required.
2	Sensitive feature is either larger than six (6) inches in at least one direction or is located within the level of the pipe embedment. No portion of the sensitive feature may intersect the plane of trench floor. All rock within and surrounding the feature is sound.	Environmental	The sensitive feature shall be filled with concrete. Gravel to "fist sized" rock or sacks of gravel may be placed in feature prior to placement of the concrete as long as a minimum of eighteen (18) inches of concrete is used to close the feature).	Requires notification and prior **written** approval from the TCEQ.
3	Sensitive feature intersects the plane of the trench floor is less than four (4) feet in any direction. All rock within and surrounding the feature is sound.	Environmental	Sensitive feature shall be filled with concrete. Gravel to "fist sized" rock or sacks of gravel may be placed in feature prior to placement of concrete at least eighteen (18) inches of concrete is used to close the feature. The sewer line or storm sewer lines shall be concrete encased for width of the sensitive feature plus a minimum of five (5) feet on either end. The encasement shall provide a minimum of six (6) inches of concrete on all sides of the pipe and shall have compression strength of at least 2,500 psi (28-day strength). The concrete may be steel reinforced.	Requires notification and prior **written** approval from the TCEQ.
4	Sensitive feature intersects the plane of the trench floor and any opening in trench floor is greater than four (4) feet in any direction or the trench floor is unstable.	Environmental & Structural	Requires an engineered resolution at least as protective as Case 3 above. Additional protective measures, including rerouting of line, may be required.	Requires notification and prior **written** approval from the TCEQ.

All plans submitted to the TCEQ regional office shall have a signed and dated seal of a Texas licensed Professional Engineer. All plans will be reviewed on a case-by-case basis and additional protective measures or additional information may be required.

Other features discovered during trenching operations are much more extensive and filling of the feature is neither possible nor desirable. In cases where there does not appear to be substantial, active flow in the feature, it may be possible to isolate the section in the vicinity of the trench from the rest of the cave system. An example of this type of installation is shown in Figure 2-2. Sand bags are installed to restrict fill to the vicinity of the trench and concrete is used to fill the lower part of the trench and support the pipe.

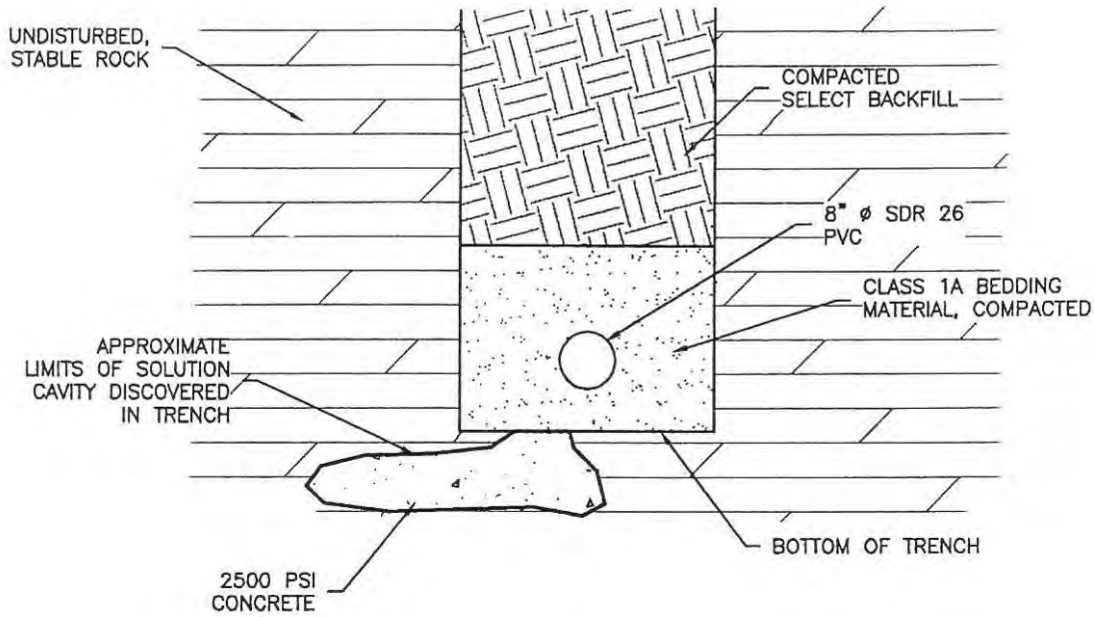


Figure 2-1. Filled Solution Feature (courtesy Kathryn Woodlee)

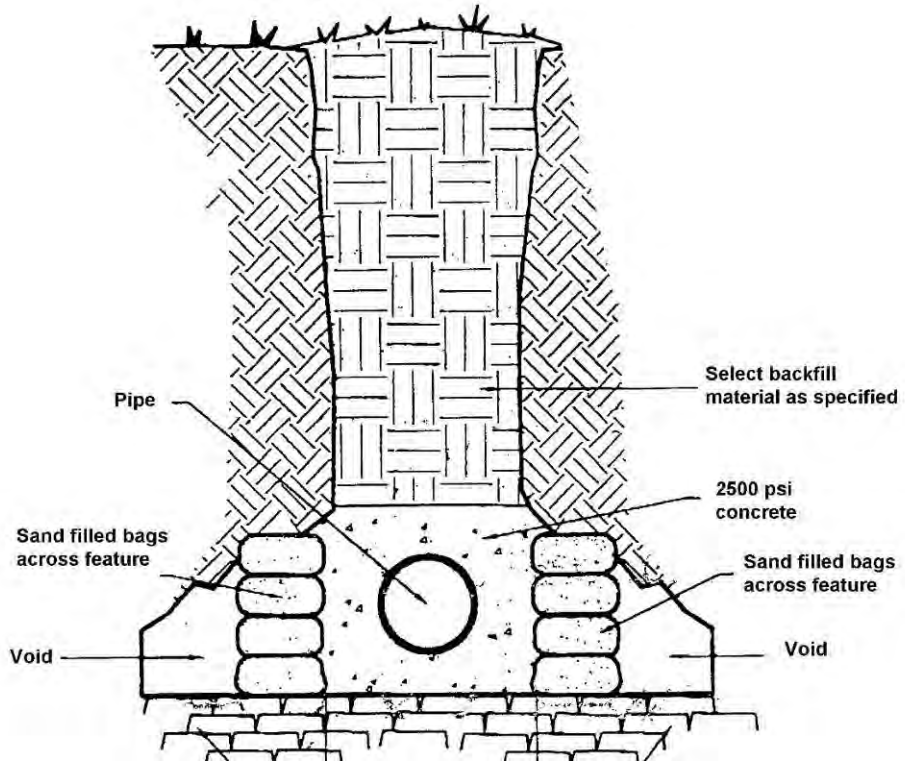


Figure 2-2. Example of Filled Void in Trench Excavation (courtesy Donald Bayes)

In some cases, it might not be desirable to permanently encase the utility pipe in concrete, especially where the pipe may need to be removed for repair or replacement. In those circumstances an outer steel encasement pipe can be installed and the utility pipe installed inside of it. Section and profile views of this type of installation are shown in Figure 2-3 and Figure 2-4.

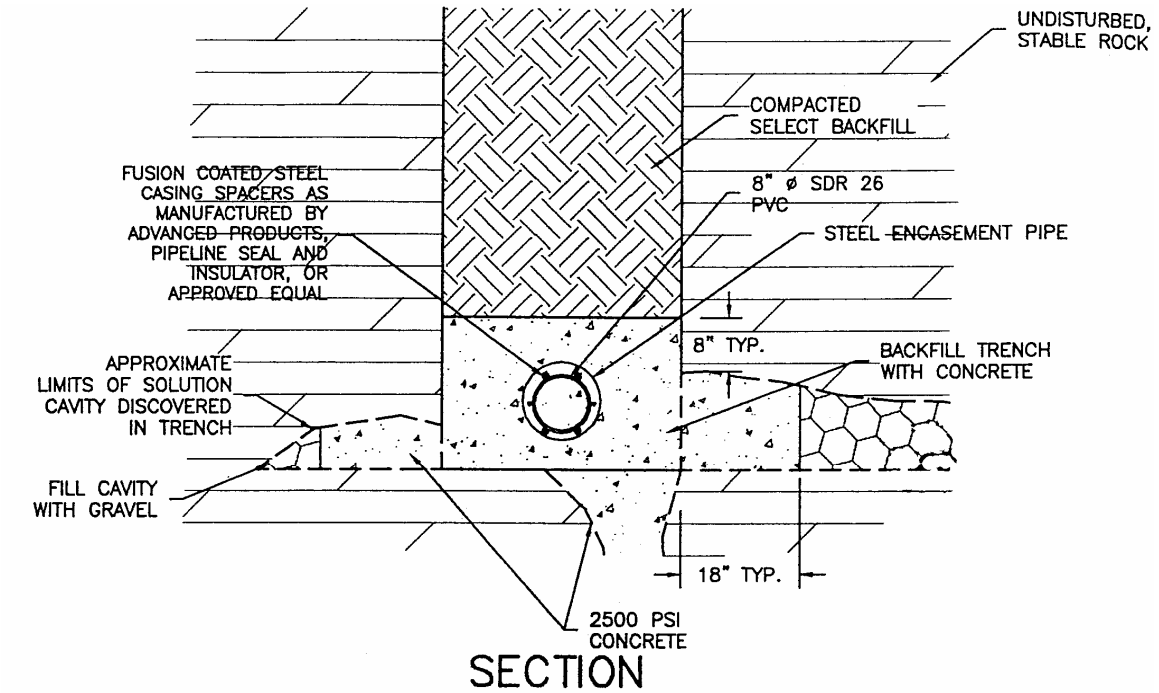


Figure 2-3. Utility Pipe Encased in External Steel Pipe (courtesy of Kathryn Woodlee)

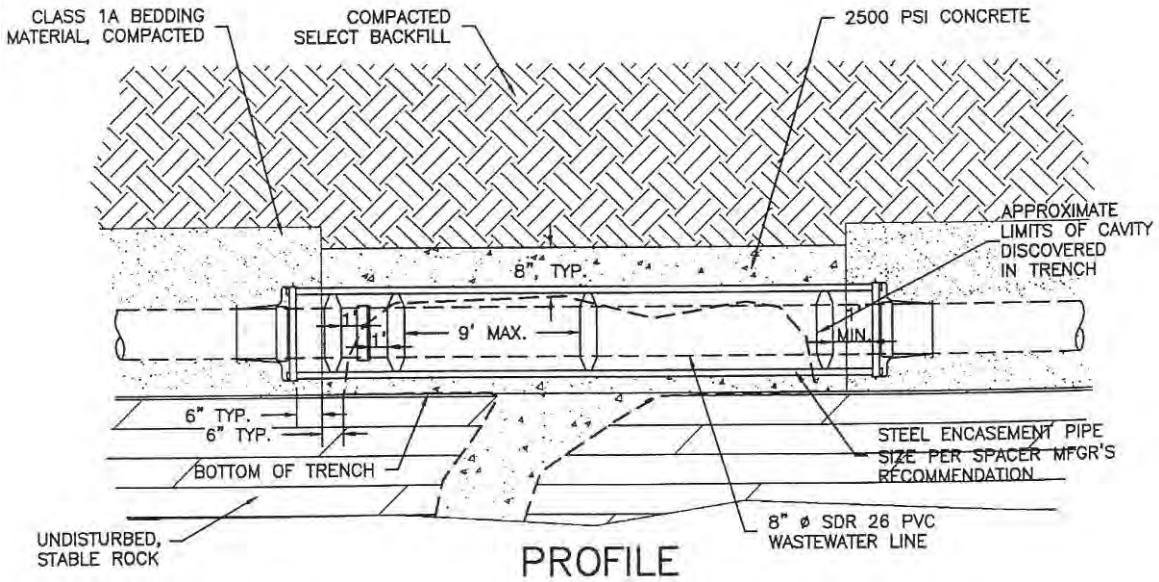


Figure 2-4. Profile View of Encased Utility Pipe (courtesy of Kathryn Woodlee)

When a larger feature appears be an active conduit for flow, it may be appropriate to maintain hydrologic connectivity across the trench excavation. This can be accomplished by installing a 3-inch Schedule 40 PVC pipe between the two isolated cave sections. An example of this type of installation is shown in Figure 2-5.

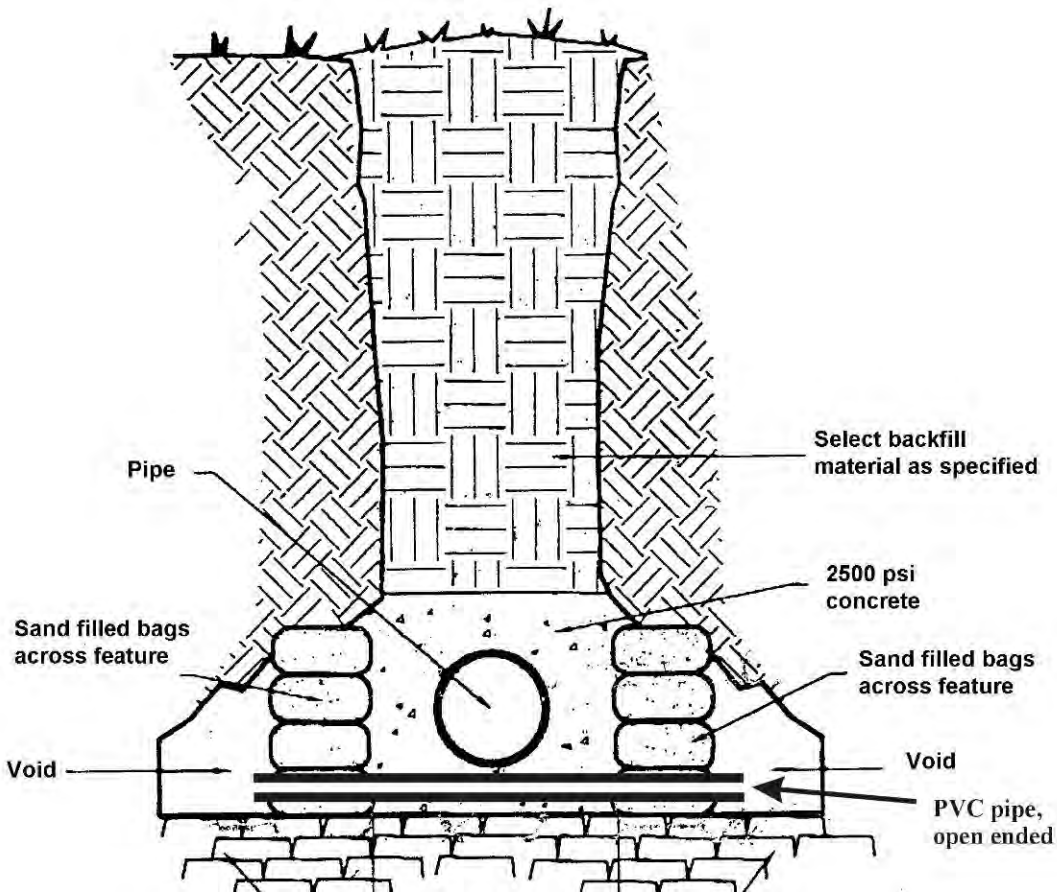


Figure 2-5. Cavity Fill with Pipe to Preserve Hydrologic Connectivity

Temporary covering of voids when construction activities are halted can be accomplished by covering with filter fabric and then plywood weighted with concrete blocks. This will prevent sediment from the trench being inadvertently introduced into the cavity.

2.3. Caves

Openings of caves are sensitive features that should have natural buffers as described above. In addition, the size of the opening creates the opportunities for other pollutants to enter the aquifer. Many caves in the Edwards were historically used for trash, debris, and garbage disposal. The material found in caves often includes paint, solvents, and other toxic/hazardous materials. Run-off entering the caves can leach toxic compounds and convey them to the aquifer. Consequently, caves that are identified in the geological assessment and that have openings large enough to accommodate a person must be fitted with a cave gate such as the one shown in Figure 2-6.

The gate has two main purposes. The first is to reduce access to the cave and prevent the disposal of wastes in these sensitive features. The second purpose is to prevent untrained individuals from accessing the cave where they might potentially become trapped. The gate should also provide a lockable access for qualified individuals to perform hydrogeological or biological studies. The discussion of cave gates below is modified from Warton (2002).

Many of these caves are habitat for endangered species; consequently, the gate should provide for free exchange of air, water, organic debris, and small mammals that are important components of the cave ecosystem. If caves or other sensitive features contain Federally-listed endangered species, such as karst invertebrates, project planners should contact the USFWS to ensure that their activities will not "take" a listed species. The applicant may also wish to consult the TCEQ's *Optional Enhanced Measures for the Protection of Water Quality in the Edwards Aquifer and Related Karst Features that may be Habitat for Karst Dwelling Invertebrates: Appendix B to RG-348.*

Figure 2-6. Typical Cave Gate with Secure Entrance (Mike Warton, PBS&J)

In Central Texas, the most common type of cave entrance occurs as a sinkhole, often found along rock joints. Entrance openings are usually positioned on semi-flat ground or along hillside slopes. The orientation of entrance openings is usually vertical. Horizontal development within caves may occur at shallow depths. In this type of cave structure, the key position of a prospective cave gate is usually horizontal, with some degree of recess in to the entrance.

The concept of gate "transparency" implies specifically that the gate is a non-solid covering that will not impede, block, or prevent the vertical fall of air, water, or natural organic materials from entering the cave similar to what occurs naturally. Thus, the transparent gate is semi-open for these functions. In the cave entrance ecosystem, surface related and nocturnal invertebrate species may regularly pass through the gate in a manner not significantly altered by the presence of the gate. In Texas, endangered invertebrate species are troglobitic in nature, never leave the cave environment, and never use or access the gate. They are critically dependent on the gate's ability to allow un-impeded wash-in, or transport of organic food source materials to enter and replenish the cave. Up to seven common types of ground mammals also frequent Texas caves and have important natural roles in the cave ecosystem. Their points of access and egress through the cave gate are specific in location. The gate must facilitate their easiest points of access. The access portal design and size are set to an eight-inch diameter or square opening as shown in Figure 2-7.

Figure 2-7. Mammal Access Portals along Edge of Gate

2.3.1. Gate Construction

Prior to gate construction, the cave's entrance may require certain preparations for acceptance of the gate. In welded construction where gates are custom built and fitted on site, commercially made welding blanket mats should be draped across the entrance opening in basket position in order to prevent contamination of the cave by slag and welding residues. The gate is a level horizontal grid cover constructed from 2-inch by 2-inch by 3/8-inch steel angle. The most important structural component is the supporting sub-structured arrangement of cross beams and drilled anchor points. Anchors are usually 1/4-inch to 1-inch diameter rebar from 8-inches to 10-inches in length (Figure 2-8).

Horizontal beam supports are built by welding together two pieces of angle iron to form a box-shaped beam that is solid welded to the point set anchors. Once the substructure is completed, the grid panel arrangement of bar angles may begin. The bar angles are placed on their edge sides,

with angle peak pointed either to the left or to the right (all pointed in the same direction throughout the gate). By placing the angles on their edge side, the barrier thickness aspect of the gate panel becomes almost three inches thick, instead of the 3/8-inch thickness of the angle. Bar spacing throughout the gate and across the panel are set to provide a clear opening of 1.5 inches if the cave is not used by bats, otherwise the opening should be 5.75 inches. The direction of airflow exchange to and from the cave's entrance may determine the left or right pointing positions of angle peaks. The angle shape would be turned to such a position that "cups" and promotes the best airflow exchange. It should provide the level of airflow conductivity that is a substantial or prominent characteristic of the cave. In this construction, the location and position of the gate's access and egress door is pre-determined. The access door assembly is: (1) typically 30 inches square; (2) transparent in design; (3) a hinged door; and (4) contains a concealed lock mechanism and access point as shown in Figure 2-9. The round hole in the gate is sized so that a person can reach through the gate to access the lock with is concealed below the gate. The concealed lock box location in these gates prevents any direct attack. The lock box is designed to house a 2-inch wide lock with 3/8-inch shackle.

After the access door is installed, the last stage of the construction is usually the placement of horizontal stiffeners across angle expanses. One-inch or 2-inch wide by 3/8-inch thick flat bar stock is used for the stiffeners. Stiffener spacing usually does not exceed a distance of five feet. Following the completion of all welding, the last stage of gate completion is to apply a protective metal coating with a high quality rust inhibitive paint. This is carefully hand brushed on instead of sprayed. Following gate completion, the under hanging blanket basket is removed and the site should be thoroughly cleaned of any foreign materials.

Figure 2-8. Example of Anchor Rebar

2.4. Stream Buffers

Natural buffer areas adjacent to streams and natural drainage ways play an important role in maintaining predevelopment water quality. The riparian vegetation stabilizes stream channels and

Figure 2-9. Example Cave Gate Access

floodplain areas, reducing erosion. In addition, they provide an area to filter overland flow from adjacent development. Consequently, all streams should have an undisturbed native vegetation buffer on each side as follows:

- Streams draining 640 acres (one square mile) or greater should have a minimum buffer of 300 feet from the centerline on each side of the stream.
- Streams draining less than 640 acres but 320 or more acres should have a minimum buffer of 200 feet from the centerline on each side of the stream.
- Streams draining less than 320 acres but 128 or more acres should have a minimum buffer of 100 feet from the centerline on each side of the stream.
- Streams or swales draining less than 128 acres but 40 or more acres should have a minimum buffer of 50 feet from the centerline on each side of the drainage.
- Streams or swales draining less than 40 acres but 5 or more acres should have a minimum buffer of 25 feet from the centerline on each side of the drainage.

Site plans submitted for TCEQ review must show the location of all stream buffers in addition to the plan elements required by the Edwards Aquifer Rules. If the area within the designated buffer has been altered by clearing, construction, or other activities, then USFWS must be consulted.

Buffer zones should generally remain free of construction, development, or other alterations, although storm water treatment systems can be constructed there if the natural drainage to the site is less than 128 acres. The number of roadways crossing through the buffer zones should be minimized and constructed only when necessary, such as when a significant portion of the site can only be reached by crossing a buffer zone. An example of a situation when a road crossing was necessary is shown in Figure 2-11. Note that there is only a single crossing of each buffer.

Other alterations within buffer zones could include utility crossings, but only when necessary, fences, low impact parks, and open space. Roadways and utilities crossings should be approximately perpendicular to the buffer zone. Low impact park development within the buffer zone should be limited to trails, picnic facilities, and similar construction that do not significantly alter the existing vegetation. Parking lots and roads significantly alter existing vegetation and are not considered low impact. Neither golf course development nor wastewater effluent irrigation shall take place in the buffer zone.

These restrictions are an important reason why buffer zones must be identified before the tract is subdivided. Various types of development are consistent with stream buffers as demonstrated below. One type is a typical suburban single-family development with a lot density, three to four lots per acre that necessitates the use of curb and gutter. In this scenario essentially all the impervious cover is connected. Storm water runoff drains directly to the street where it is captured in an inlet and conveyed by storm sewer in a system that requires larger pipe diameters as more and more area contributes. Discharge is then directed to a creek at the lower end of the development or to a constructed trapezoidal channel.

The conventional design philosophy has been to convey the storm water runoff quickly and safely away from the subdivision. Depending upon local requirements, a water quality pond may be constructed just prior to discharge to the creek. Even if a pond is provided, little or no utilization of buffers occurs. Figure 2-10 provides an example of a 144-lot single-family subdivision bound on one side by a creek with 150 feet of buffer width on each side. In this case a sedimentation-filtration pond is provided at the downstream end. For this example, approximately 39 acres of development are conveyed to the pond, totally bypassing the buffer.

Figure 2-11 is an example of small, clustered single-family lots situated around stream buffers. This clustering leaves large undisturbed areas of land as well as setbacks from the creeks. These small lots, 60 – 80 feet of frontage, require storm sewers, but with the creek setbacks, sufficient area is available for frequent storm sewer discharges up-gradient from the creek buffer. While it is difficult to completely offset the hydrologic impact of a development of this density, the setbacks and maximizing of sheet flow minimizes the impacts. In-stream ponds are provided in this example to supplement the vegetative measures for water quality and provide peak flow control.

Figure 2-12 is an example of a larger, rural lot subdivision (individual lots larger than one acre) with buffers meeting the criteria described in this document. These size lots offer an opportunity to maximize sheet flow and reduce the area contributing to a concentrated discharge that must then be returned to sheet flow by the methods discussed previously. Traditionally, the roadways would have a roadside ditch on both sides. However, in a design maximizing sheet flow, the half of the roadway draining to the low side of the right-of-way is allowed to continue as sheet flow into the large single-family lot (Figure 2-13). Also note that the limit of disturbance is only a fraction of the lot size (Figure 2-14).

Greater building setbacks allow the builder to easily route any drainage around the house. Drainage or conservation easements must be shown on approved plats and deed restrictions provided to the home buyer limit landscaping to native or native adapted plants that require little or no fertilizers and are disease resistant. With these simple design features, the effective buffer width along streams is increased and unconnected impervious cover is maximized. On the uphill side of the roadway, the roadside swale has multiple points of discharge under the roadway, much as a storm sewer in a more dense development. This drainage is then conveyed in an easement along lot lines and then returned to sheet flow at the buffer.

Figure 2-10. Traditional Development Adjacent to Stream Buffer (courtesy Murfee Engineering)

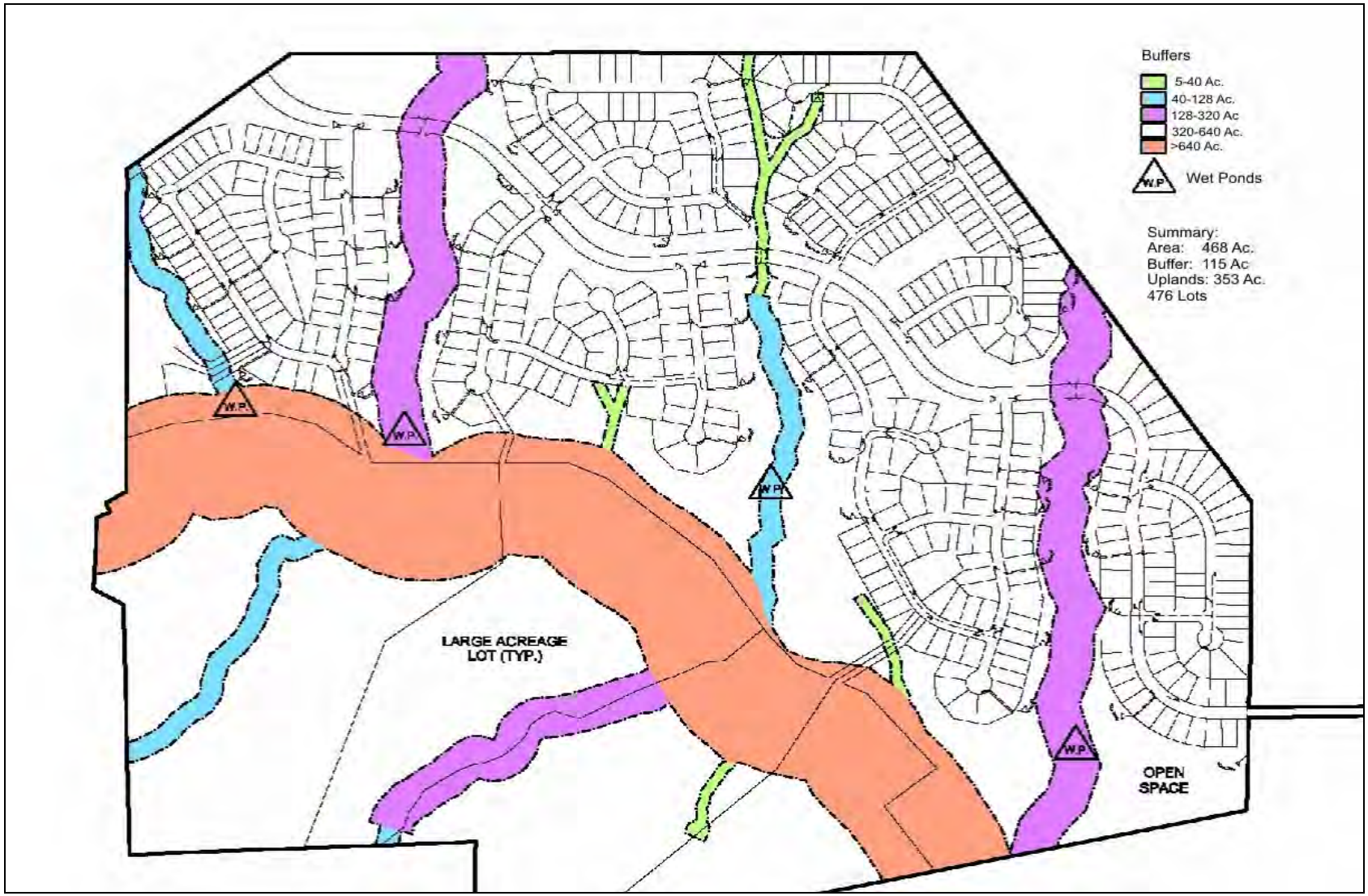


Figure 2-11. Example of Small Lot Cluster Type Development (courtesy Murfee Engineering)

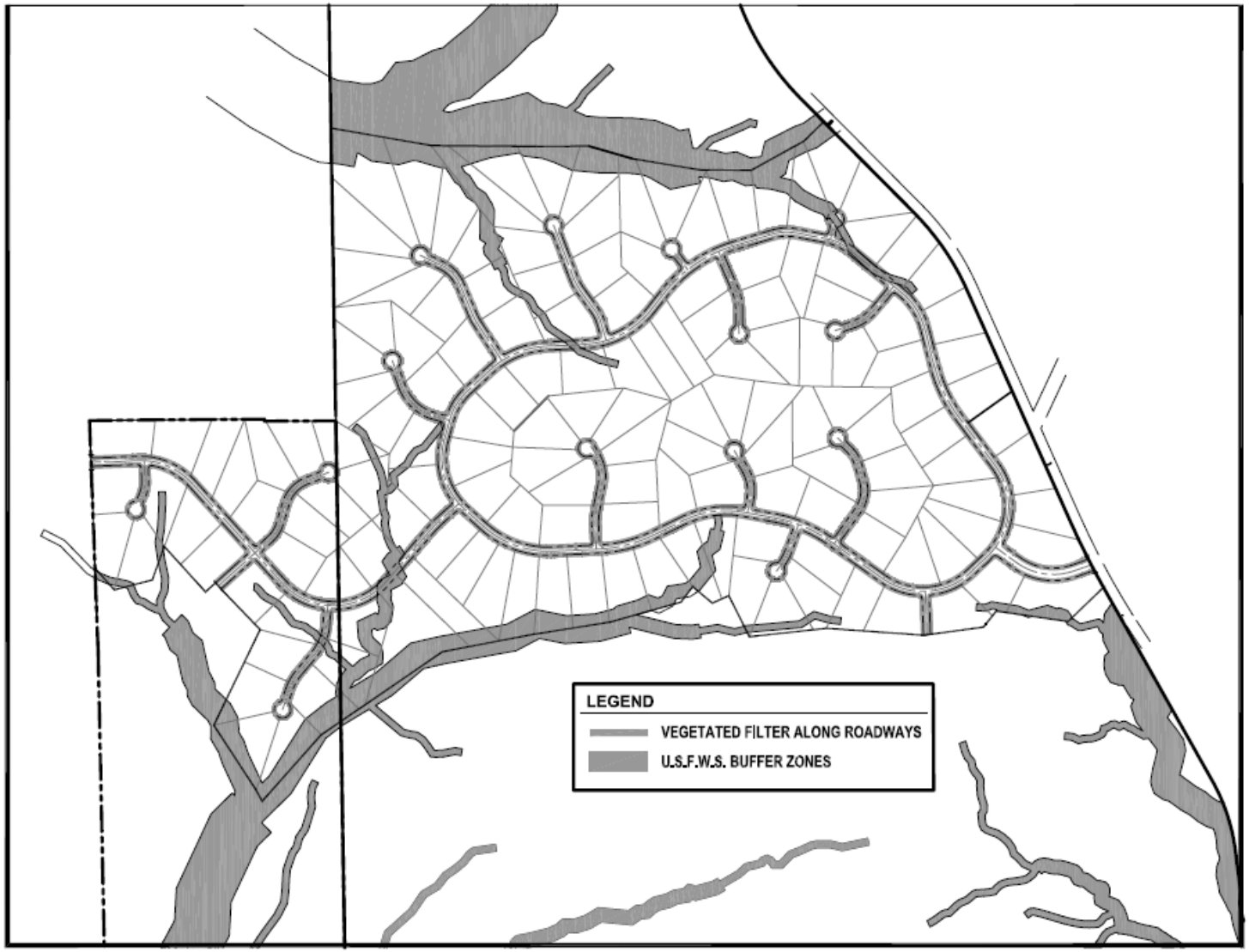


Figure 2-12. Example of Large Lot Low Density Development (courtesy Murfee Engineering)

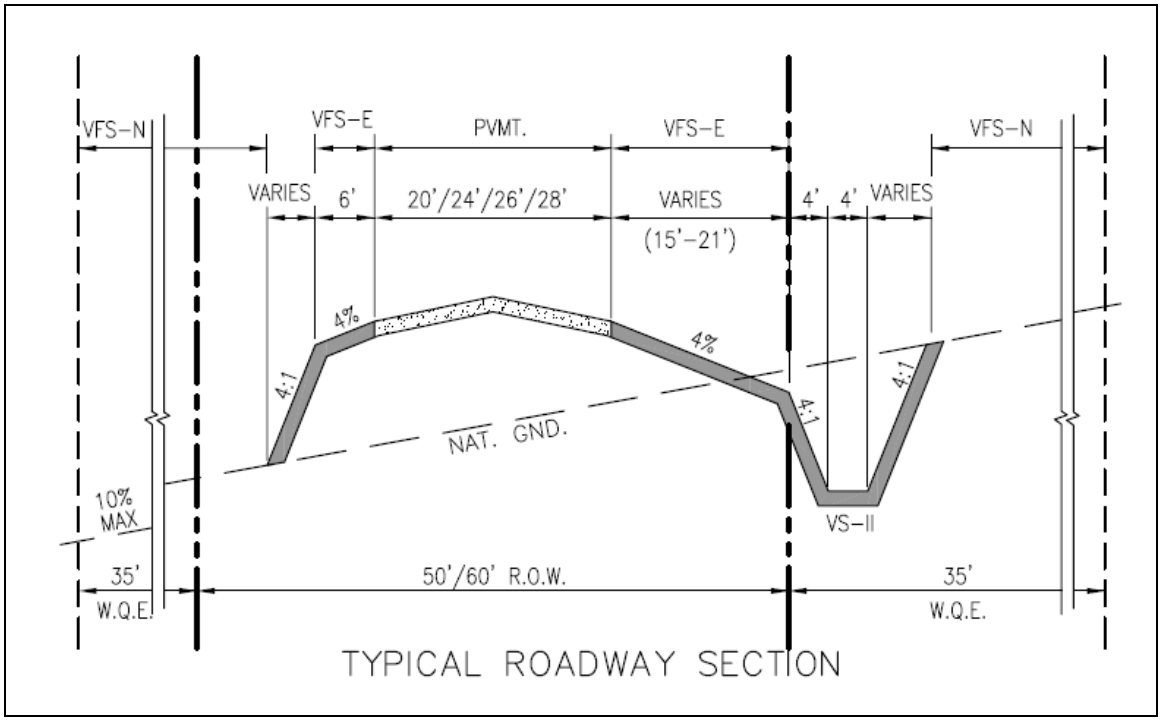


Figure 2-13. Detail of Road Section Showing Vegetated Treatment Areas

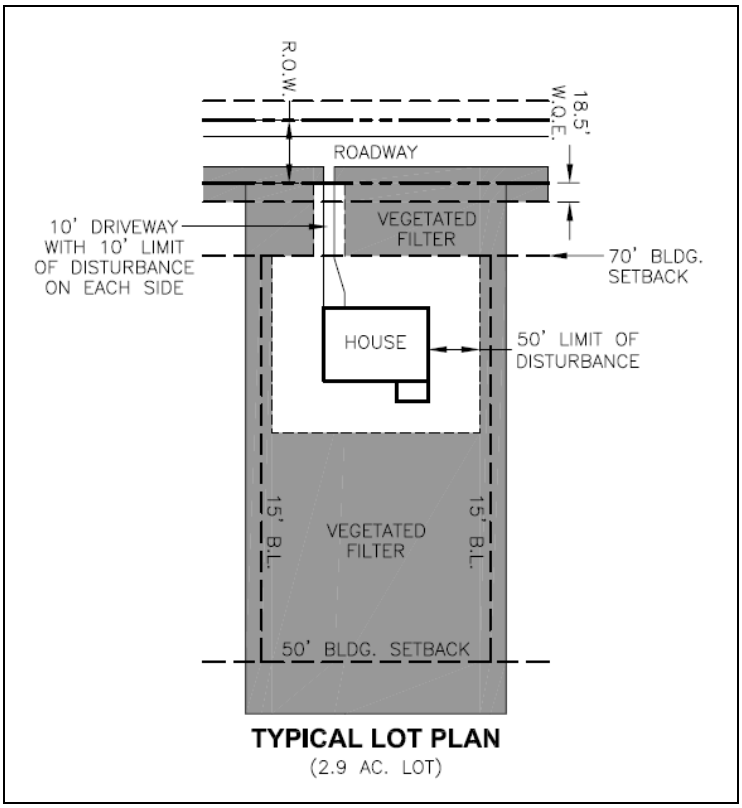


Figure 2-14. Detail of Lot Layout with Water Quality Easements

3. Construction

Erosion and control measures for construction activities are described in RG-348. These measures also apply to construction activities conducted in compliance with these enhanced protection measures with the following additional requirements.

1) Sediment basins and traps, which are required for common drainage areas serving at least 10 acres, will be designed to capture the runoff from the 2-yr, 24-hour storm. These volumes area shown in Table 3-1.

Table 3-1. Capture Volumes for Sediment Basins

County	Cubic Feet/Acre
Bexar	8,000
Comal	8,000
Hays	8,000
Kinney	7,250
Medina	8,000
Travis	8,000
Uvalde	8,000
Williamson	8,000

2) Temporary sediment basins and traps must not be installed in the buffer areas of natural drainages with a tributary area of more than 128 acres.

4. Permanent BMP Implementation

This section describes the configuration and sizing of permanent best management practices (BMPs) to meet the requirements of these optional measures. Additional information regarding design criteria and maintenance of BMPs is contained in RG-348.

4.1. Hazardous Material Traps (HMT)

Roadways capable of conveying at least 25,000 vehicles a day must include a hazardous material trap (HMT). These HMTs must be designed to retain a spill of 10,000 gallons of liquid hazardous material. These may be of a variety of designs including those used previously by the Texas Department of Transportation (TxDOT). Figure 4-1 demonstrates how an HMT can be sited within the footprint of the storm water control (a sand filter in this case) to achieve both objectives without increasing the land or hydraulic head required. Note that the invert of the openings from the splitter box to the HMT is set slightly lower than those into the sedimentation basin. This allows any hazardous spills as well as the first flush of runoff to be captured by the HMT. Once the HMT is full the backwater level rises and allows the remaining runoff to enter the sedimentation basin directly.

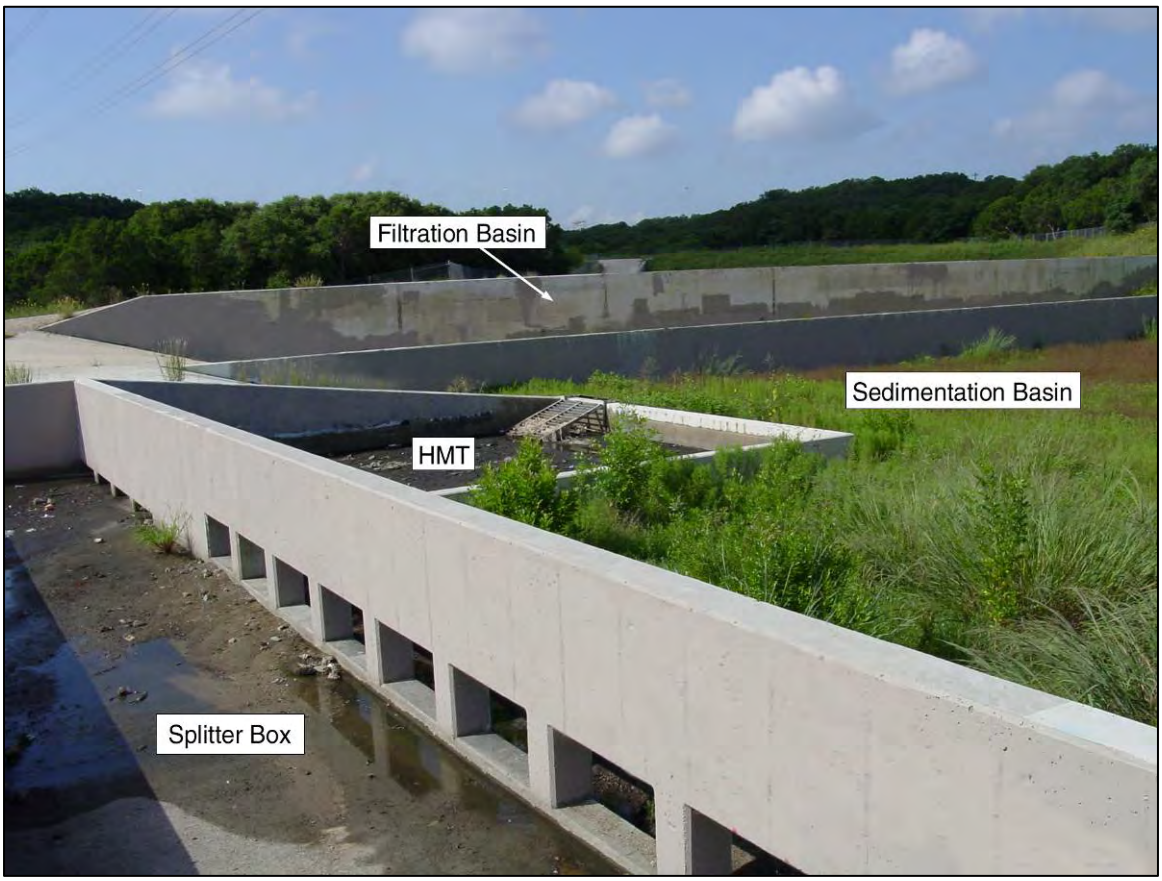


Figure 4-1. Hazardous Material Trap inside Sand Filter

To eliminate the need for manual draining of a hazardous material trap after a rain event, TxDOT developed an automatic siphon system to drain the HMT when it fills with rainwater. Figure 4-2 shows a typical siphon detail from a set of TxDOT construction plans.

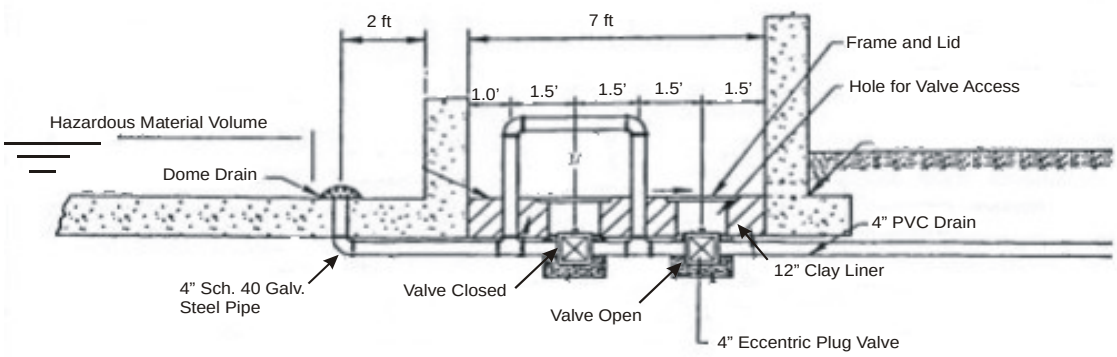


Figure 4-2. Typical TxDOT Automatic Siphon Detail

The siphon device is designed to drain the trap after it becomes full from a rain event, but is installed at an elevation above the full capacity of the trap. Therefore, as long as a hazardous material spill does not occur during a rain event the system should contain the spill. The siphon is provided with bypass and shutoff valves so that alert on-scene responders can shutoff the automatic siphon and thereby maintain some containment even in the event of a concurrent rain/spill. Other options for spill containment are presented in the main section of RG-348.

4.2. Total Suspended Solids (TSS) Removal

4.2.1. Step 1: Required TSS Removal

> Reduction of 80% of the annual TSS load in storm water runoff from a site is required for all new development, without regard to the proposed level of impervious cover. On redevelopment projects that involve major changes to existing impervious cover and include modification of the drainage system, 80% TSS removal must be achieved for the entire project.

Examples of redevelopment projects where the entire site must be treated include highway widening projects, a change in land use from single family residential to multifamily or commercial, and substantial expansion of impervious cover on an existing commercial development.

All the TSS load calculations are based on Equation 4.1

Equation 4.1 $$L = A \times P \times Rv \times C \times 0.226$$

Where:

L = annual pollutant load (pounds)
A = Contributing drainage area (acres)
P = Average annual precipitation (inches)
Rv = Appropriate runoff coefficient
C = Average TSS concentration (mg/L)
0.226 = units conversion factor

Monitoring data from the City of Austin indicates that the TSS concentration from developed areas is 170 mg/L and that from natural areas is 80 mg/L. Consequently, the required 80% load reduction is calculated as:

Equation 4.2 $$L_M = (0.8 \times 0.226)(A \times P \times 0.9 \times 170)$$

Where:

L_M = Required TSS removal (pounds)
A = Impervious area (acres)
P = Average annual precipitation (inches)

This equation simplifies to:

Equation 4.3 $$L = 27.7(A \times P)$$

Where:

L = Required TSS removal (pounds)
A = Impervious area (acres)
P = Average annual precipitation (inches)

Imperviousness is the percent, or decimal fraction, of the total site area covered by the sum of roads, parking lots, sidewalks, rooftops and other impermeable surfaces. Roof areas directed to rainwater harvesting systems are exempt from the treatment requirement. When calculating the impervious area of a residential development the assumptions shown in Table 4-1 will apply to impervious area on each lot to the lot size, unless the actual future impervious cover is known to be greater. Annual precipitation by county is shown in Table 4-2.

Table 4-1. Impervious Cover Assumptions for Residential Tracts

Lot Size	Assumed Impervious Cover (ft^2)
> 3 acres	10,000
Between 1 and 3 acres	7,000
Between 15,000 ft^2 and 1 acre	5,000
Between 10,000 and 15,000 ft^2	3,500
<10,000 ft^2	2,500

Table 4-2. Average Annual Rainfall by County

County	Average Annual Precipitation (inches)
Bexar	30
Comal	33
Hays	33
Kinney	22
Medina	28
Travis	32
Uvalde	25
Williamson	32

4.2.2. Step 2: Select an Appropriate BMP

Select a BMP or series of BMPs that will achieve at least an 80% reduction in TSS. The higher the efficiency of the BMP, the less runoff that will need to be treated to achieve the required reduction. The TSS removal efficiency for each approved BMP is shown in Table 4-3.

Table 4-3. Approved BMPs and TSS Removal Efficiency

BMP	TSS Reduction (%)
Retention/Irrigation	100
AquaLogic™ Cartridge Filter System	95
Wet Basins	93
Constructed Wetlands	93
Sand Filters	89
Bioretention	89
Vegetated Filter Strips	85
Ext. Detention Basin	75
Grassy Swales	70
Wet Vault	See Section 3.3 of RG-348, Revised July 2005

4.2.3. Step 3: Calculate TSS Load Removed by BMPs

The following section describes how to determine the load removed by a proposed BMP(s). The load removed depends on the amount of TSS entering the BMP(s) and its effectiveness.

The load entering each BMP is calculated from the sum of the contribution of the impervious and pervious areas with their respective storm water concentrations for the BMP catchment area. This calculation assumes that no runoff bypasses the treatment facility and assigns the appropriate runoff coefficient and TSS concentrations to the pervious and impervious areas.

Equation 4.4 LR = (BMP efficiency) x 0.226 x P x (AI x 0.9 x 170 mg/L + AP x 0.03 x 80 mg/L)

Where:

LR = Load removed by BMP
BMP = TSS removal efficiency (expressed as a decimal fraction from)
AI = impervious tributary area to the BMP (ac)
AP = pervious tributary area (ac)
P = average annual precipitation (inches, Table 4-2)

Which simplifies to:

Equation 4.5 LR = (BMP efficiency) x P x (AI x 34.6 + AP x 0.54)

4.2.4. Step 4: Calculate Fraction of Annual Runoff to Be Treated

Based on the load reduction calculated above for each of the BMPs installed at the site and the required load reduction, calculate the fraction of annual runoff to be treated using Equation 4.6. This calculation assumes a constant concentration of TSS in the runoff.

Equation 4.6 $$F = \frac{L}{\sum L_R}$$

Where:

F = Fraction of the annual rainfall treated by the BMP
L_R = Load removed for each BMP from Step 3 calculation (pounds)
L = Required load reduction from Step 1 (pounds)

4.2.5. Step 5: Calculate Capture Volume

This step relates the statistical properties of storm size and flow rate in the regulated area to the total volume of runoff. These calculations depend on whether the BMP is a capture and treat device, such as a sand filter system, or a flow through BMP such as a swale or wet vault.

For flow through type devices (swales and wet vaults), the size is calculated using a rainfall intensity of 1.1 inches/hour. Capture volume for capture-and-treat devices is developed from Table 4.4, which relates rainfall depth to the percentage of annual rainfall that occurs in storms less than or equal to this depth—i.e., 100% of the annual rainfall occurs in storms of 4 inches or less on average, while 78% of the annual runoff occurs in storms of an inch or less. For BMPs designed to capture and treat the runoff, the value, F, calculated in Step 4 is used to enter Table 4-4and find the rainfall depth associated with this fraction.

Once the appropriate rainfall depth has been determined from Table 4-4, the water quality volume for each BMP can be calculated from:

Equation 4.7 WQV = Rainfall depth x Runoff Coefficient x Area

Where the rainfall depth is determined from Table 4-4, the runoff coefficient comes from Figure 4-3 or is calculated using Equation 4.8, and the area is the portion of site contributing runoff to the BMP.

Equation 4.8 $Rv = 0.05 + 0.0085(IC)$

Where:

IC = Percent impervious cover

Table 4-4. Relationship between Fraction of Annual Rainfall and Rainfall Depth (inches)

F	Rainfall Depth	F	Rainfall Depth	F	Rainfall Depth	F	Rainfall Depth
1.00	4.00	0.80	1.08	0.60	0.58	0.40	0.29
0.99	3.66	0.79	1.04	0.59	0.56	0.39	0.28
0.98	3.33	0.78	1.00	0.58	0.54	0.38	0.27
0.97	3.00	0.77	0.97	0.57	0.52	0.37	0.25
0.96	2.80	0.76	0.94	0.56	0.50	0.36	0.24
0.95	2.60	0.75	0.92	0.55	0.49	0.35	0.23
0.94	2.40	0.74	0.89	0.54	0.47	0.34	0.23
0.93	2.20	0.73	0.86	0.53	0.46	0.33	0.22
0.92	2.00	0.72	0.83	0.52	0.45	0.32	0.21
0.91	1.91	0.71	0.80	0.51	0.44	0.31	0.20
0.90	1.82	0.70	0.78	0.50	0.42	0.30	0.19
0.89	1.73	0.69	0.75	0.49	0.41	0.29	0.18
0.88	1.64	0.68	0.73	0.48	0.40	0.28	0.18
0.87	1.55	0.67	0.71	0.47	0.38	0.27	0.17
0.86	1.46	0.66	0.69	0.46	0.37	0.26	0.16
0.85	1.37	0.65	0.67	0.45	0.36	0.25	0.15
0.84	1.28	0.64	0.66	0.44	0.34		
0.83	1.20	0.63	0.64	0.43	0.33		
0.82	1.16	0.62	0.62	0.42	0.32		
0.81	1.12	0.61	0.60	0.41	0.31		
0.80	1.08	0.60	0.58	0.40	0.29		

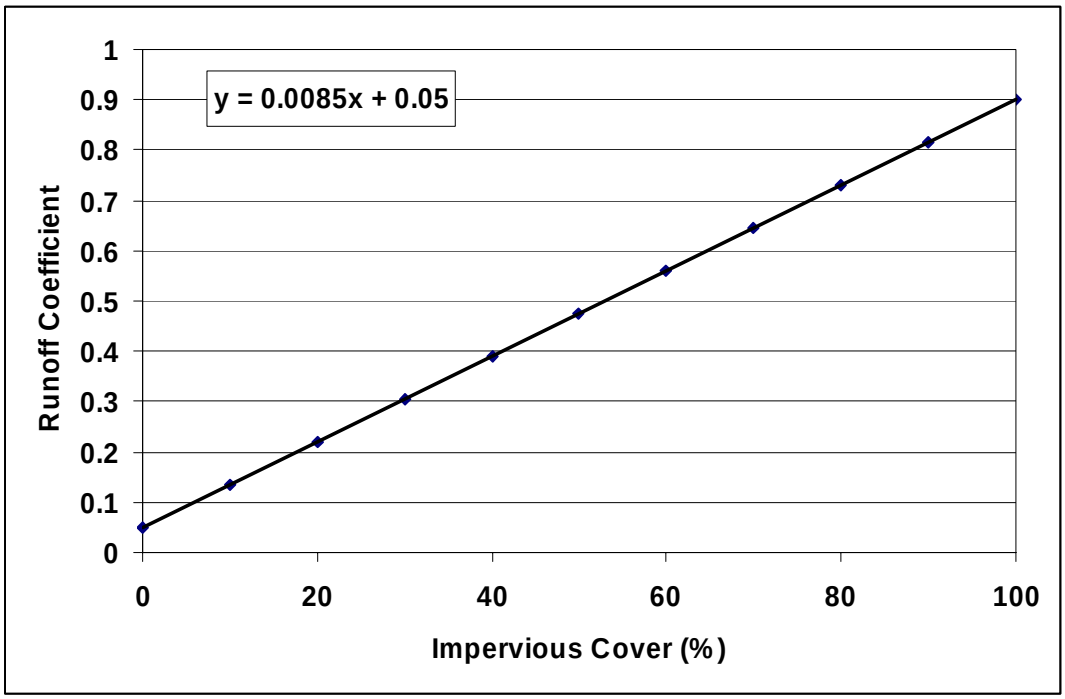


Figure 4-3. Relationship between Runoff Coefficient and Impervious Cover

5. Measures to Protect Stream Morphology

As much as 90% of the sediment and other pollutants carried in urban waterways are derived from the accelerated rate of channel erosion caused by the increase in rate and volume of storm water runoff from impervious cover associated with development (Osborne et al., 2000). In addition, channel degradation also eliminates much of the riparian habitat required for certain species. To reduce the rate of channel erosion, restrictions on the rate of discharge are necessary for storms likely to impact channel morphology as described below.

Flow control is not required for all discharges to surface waters because flow control is not always needed to protect stream morphology. The exemptions listed below are provided to assist in determining which projects should be subjected to this requirement. Any project may be subject to local requirements for flow control to prevent flooding. The following projects and discharges are exempt from flow control requirements to protect stream morphology.

1) Any project able to disperse, without discharge to surface waters, the total 2-year, 24-hour runoff volume for the proposed development condition on site.
2) A road project able to disperse, without discharge to surface waters, the total 2-year, 24-hour runoff volume for the proposed development condition on site.
3) A project constructing less than 10,000 square feet of total impervious surfaces.
4) A project with impervious cover of less than 15% in all subwatersheds on the site.
5) A project discharging directly to the main stem of the:
   a) Blanco River
   b) Frio River
   c) Guadalupe River
   d) Medina River
   e) Nueces River

or

   f) Canyon Lake
   g) Medina Lake

6) In order to be exempted, the discharge must meet all of the following requirements:
   a) The conveyance system must extend to the ordinary high water line of the receiving water, or (in order to avoid construction activities in sensitive areas) flows are properly dispersed before reaching the buffer zone of the stream sufficient to prevent erosion.
   b) Any erodible elements of the conveyance system for the project area must be adequately stabilized to prevent erosion.
   c) Surface water from the project area must not be increased to an existing wetland, stream, or near-shore habitat sufficient to cause a significant adverse impact.
   d) The discharge will not cause negative impacts to habitat along the rivers that support rare or candidate species.

A project that does not meet the criteria above shall construct storm water flow control facilities for any discharge of storm water directly, or through a conveyance system, into surface water. These facilities are only required in subwatersheds on the project site with proposed impervious cover of greater than 15%. Detention is not required in subwatersheds less than 15% impervious

cover. The requirements below apply to projects which discharge into a water body other than those listed in Item 5 above, either directly or indirectly, through a natural or man-made conveyance system. In order to prevent localized erosion, energy dissipation at the point of discharge is required for all projects unless site-specific conditions warrant an exception.

> To protect stream morphology, projects shall limit the peak rate of runoff for the 2-year, 24-hour storm to 50% of the undeveloped rate for that event and limit the 10-year, 24-hour storm peak runoff rate to that calculated for the undeveloped condition for the same storm conditions.

Undeveloped and proposed developed condition runoff volumes and flow rates shall be estimated using TR-55, HEC-1, HEC-HMS, or equivalent software. The design storm for determining both volumes and flow rates is the SCS Type II hyetograph with the storm depths presented in Table 5-1. Projects that extend across a county line should use the average rainfall depths of the two counties. In cases where a local jurisdiction also imposes detention requirement for the 2- and 10-year storm events (e.g. City of Austin), software specified above is used in the calculation, and the rainfall distribution is centered weighted (such as produced by the alternating block method), parameters and methodologies specified by the local authority can be used to calculated runoff volumes and rates.

An agency or local jurisdiction also may require detention basins to be designed to match another return-interval (e.g. 25-year, 50-year, or 100-year) peak flow rate in addition to the 2- and 10-year peak flow rate. In all cases where the discharge is to non-exempt streams, detention basins must be designed to release the 2-year storm at no more than 50% of the 2-year peak flow rate in the undeveloped condition.

If runoff from the subwatershed that will be controlled extends beyond the boundary of the site and the runoff from the offsite portion of the watershed will enter the detention facility, then the detention facility must be sized to control runoff from the offsite portion. When configuring the model for estimating peak runoff rates, use either the current level of development of the offsite portion or assume that the ultimate impervious cover of the offsite portion will be equal to the impervious cover of the subwatershed within the site boundaries, and use whichever is greater.

Table 5-1. Average Annual Rainfall by County (Asquith and Roussel, 2004)

County	2-yr, 24-hour rainfall	10-yr, 24-hour rainfall
Bexar	3.5	6.0
Comal	3.5	6.0
Hays	3.5	6.0
Kinney	3.3	5.5
Medina	3.5	6.0
Travis	3.4	5.5
Uvalde	3.4	6.0
Williamson	3.4	5.5

A typical configuration of storm water treatment and detention to prevent channel erosion would consist of two components. The required water quality volume as calculated according to the methodology in Section 4 is directed to a treatment control such as a wet basin or sand filter. Sand filters should be constructed offline so that runoff in excess of the water quality volume is

bypassed to the detention facility for peak runoff control. On the other hand additional detention can be incorporated into a wet basin with the appropriate outlet configuration to provide the required peak shaving.

6. Maintenance Requirements

Lack of maintenance can be one of the primary causes of BMP failure. Although the current guidelines in RG-348 include recommendations for maintenance, there is currently no system to document when and what type of maintenance was last performed. Consequently, a system needs to be implemented that would facilitate documentation of maintenance activities described in the WPAP or CZP.

> The owner or operator of a BMP constructed to comply with the TSS removal requirement is obligated to provide all the maintenance activities required to maintain the function of the facility and other activities as described in the WPAP and CZP. The owner/operator must maintain records of all maintenance activities for the most recent 3 years. These records must be made available to the TCEQ upon request.

To facilitate inspections and reporting of BMPs that are not functioning correctly, a legible sign must be placed at all ponds, sand filters, detention basins, and bioretention areas. The sign shall be located in plain view of the public and shall provide the name of the owner or operator, the Edwards Aquifer program ID for the project, and a telephone number where the party responsible for the maintenance of the BMP can be contacted.

Equally important to the correct functioning of BMPs is the proper construction of the approved structure. The Edwards Aquifer Rules require that the owners of permanent BMPs or measures must insure that they are constructed and function as designed. A Texas licensed professional engineer must certify in writing that the permanent BMPs or measures were constructed as designed. A copy of this certification must be kept by the owner and made available to the TCEQ upon request.

An important component of water quality protection on the Edwards Aquifer is routine inspection of sewer lines. TCEQ rules in Title 30 TAC Chapter 213 Edwards Aquifer require owners of sewage collection systems to ensure that all existing sewer lines having a diameter greater than or equal to six inches, including private service laterals, manholes, and connections, are tested to determine types and locations of structural damage and defects such as offsets, open joints, or cracked or crushed lines that would allow exfiltration to occur. Existing manholes and lift-station wet wells must be tested using methods for new structures that are approved by the executive director.

The testing of all sewage collection systems must be conducted every five years after being put into use to determine types and locations of structural damage and defects such as offsets, open joints, or cracked or crushed lines that would allow exfiltration to occur. These test results must be certified by a Texas licensed professional engineer. The test results must be retained by the plan holder for five years and made available to the executive director upon request.

In addition, private service lateral connections must be inspected after installing, and prior to covering and connecting to, an organized sewage collection system. A Texas licensed professional engineer, Texas registered sanitarian, or appropriate city inspector must inspect the private service lateral and the connection to the collection system and certify that construction conforms with the applicable provisions of this guidance document, RG-348 (Revised July 2005), and local plumbing codes.

7. References

Asquith, W.H., and Roussel, M.C., 2004, Atlas of depth-duration frequency of precipitation annual maxima for Texas: U.S. Geological Survey Scientific Investigations Report 2004-5041, 106 pp.

Osborne, K.G., Barrett, M., and Maidment, D., 2000, A water quality GIS tool for the City of Austin incorporating non point sources and best management practices, Center for Research in Water Resources Online Report 2000-10 <www.crwr.utexas.edu/reports>, University of Texas at Austin.

Thurow, T.L., Blackburn, W., Warren, S.D., and Taylor, C.A., Jr., 1987, "Rainfall interception by midgrass, shortgrass, and live oak mottes," *Journal of Range Management*, Vol. 40, No. 5, pp. 455-460.

Warton, Mike, 2002, "Solid and Invertebrate Cave Gate Options," in Proceedings of Bat Cave Gate Design: A Technical Interactive Forum, edited by Vories, K. Throgmorton, D., and Harrington, A., Austin, Texas, March 4-6, 2002.

Appendix D:
Engineering Summary of TSS Calculations

February 5th, 2018

U.S. Fish and Wildlife Service
Austin Ecological Services Field Office
10711 Burnet Road, Suite 200
Austin, Texas 78758

Re: ***Engineering Summary Letter – Existing TSS Removal & JPS Enhanced Measures***
Concordia University Texas – 10A Permit Amendment and Extension
11400 Concordia University Drive
Austin, Texas 78726

Dear U.S. Fish and Wildlife Service,

Please accept this as our engineer's summary letter to accompany the proposed 10A Permit Amendment and Extension for the Concordia University Texas property and master plan. The Concordia University Texas Master Plan encompasses approximately 437 acres of land located within Travis County and the City of Austin full-purpose city limits and is located along several upstream tributaries of Bull Creek (the "Project"). The Project is proposed as an expansion of the existing University facilities including dormitories, administrative and teaching buildings, and sports and recreation related facilities.

The Project has been analyzed to understand the existing level of water quality treatment and TSS removal provided upstream of the 10 Jollyville Plateau Salamander Occupied Springs (the "Occupied Springs") located within the site. The analysis was completed based upon the calculations and methodology presented within the TCEQ's "*Complying with the Edwards Aquifer Rules Technical Guidance on Best Management Practices*" (RG-348 – July 2005). An exhibit delineating the existing drainage areas to each of the Occupied Springs, as well as the locations of the existing ponds and BMPs providing current water quality treatment within those drainage areas is included as **Exhibit A**. Hard copies of the TCEQ design spreadsheets for the individual existing BMPs analyzed for the Project and a TSS removal summary table are included as **Exhibit D**. Below is a description of each of the springshed drainage areas and the existing BMPs providing water quality treatment within them.

In the springshed drainage area for Spring "A", runoff from the existing entrance road into the Project is captured and treated within Ponds A1 and A2, which are both bioretention ponds. In addition, runoff from a portion of the internal access driveways within the Project's northeast corner is conveyed to Pond A3, a bioretention pond, and a large portion of the Project's existing eastern parking lot is captured and treated within Ponds A4 and A5, which are also both bioretention ponds. The net result of the current TSS removal for areas draining to Spring "A" is 33.9%.

In the springshed drainage area for Spring "B", runoff from a small portion of the existing drive aisles and Student Center building within the Project's southeast corner is captured and treated within Pond B1, which is a bioretention pond. Spring "B" also receives the runoff from the same areas that drain to Spring "A" upstream of it, as described in the above paragraph. The net result of the current TSS removal for areas draining to Spring "B" is 40.5%.

In the springshed drainage area for Spring "C", runoff from a portion of the Project's existing eastern parking lot and eastern buildings is conveyed and treated within Pond C1, which is a bioretention pond. The net result of the current TSS removal for areas draining to Spring "C" is 55.2%.

In the springshed drainage area for Spring "D", runoff from a portion of the Project's existing eastern parking lot and several central access roads is captured and treated within Ponds D1 and D2, which are both bioretention ponds. The net result of the current TSS removal for areas draining to Spring "D" is 59.6%.

In the springshed drainage area for Spring "E", runoff from the recently constructed softball field is conveyed and treated within Pond E1, which is a bioretention pond. In addition, runoff from the parking lot serving the softball field is conveyed through the existing Grassy Swale E2 to Pond E3, which is a sand filter pond. The net result of the current TSS removal for areas draining to Spring "E" is 83.9%.

Spring "F" receives the runoff from the same areas that drain to Spring "E" upstream of it, as described in the above paragraph, as well as a small portion of the existing parking lot that serves the student housing in the center of the site. The net result of the current TSS removal for areas draining to Spring "F" is 83.5%.

In the springshed drainage area for Spring "G", runoff from the recently constructed baseball field and student housing, as well as the related parking lots and access drives in the center of the Project is captured and treated within Pond G1, which is a sand filter pond. Spring "G" also receives the runoff from the same areas that drain to Springs "E" and "F" upstream of it, as described in the above paragraphs. The net result of the current TSS removal for area draining to Spring "G" is 83.9%.

In the springshed drainage area for Spring "H", runoff from the central parking lot is routed to and treated within Pond H1, which is a sand filter pond. In addition, runoff from several central access drives are captured and treated within Pond H2, which is a bioretention pond. Spring "H" also receives the runoff from the same areas that drain to Springs "A", "B", "C", "D", "E", "F" and "G", upstream of it, as described in the above paragraphs. The net result of the current TSS removal for areas draining to Spring "H" is 64.9%.

Springs "I" and "J" receive additional undeveloped runoff, but have no additional BMPs providing water quality treatment. They receive the runoff from the same areas that drain to Springs "A" through "H" upstream of them, as described in the above paragraphs. The net result of the current TSS removals for areas draining to Springs "I" and "J" are both 64.9%.

The total developed pollutant load generated by the Project in its current developed form (as of the date of this letter) is 33,959 pounds. The total amount of pollutants removed by the various BMP's currently existing within the Project is 22,025 pounds, or 64.9 percent total removal.

The Project has also been analyzed to provide additional Jollyville Plateau Salamander Enhanced Measures (the "JPS Enhanced Measures") that will help protect the quality of the runoff from the site. Stream Buffers have been delineated along all existing streams within the Project's boundary based upon the recommendations within the TCEQ's "*Optional Enhanced Measures for the Protection of Water Quality in the Edwards Aquifer*" (RG-348A – September 2007). The stream buffers were delineated based upon the following from RG-348A.

- Streams draining from 5-acres to 40-acres shall have a buffer of 25-ft from the centerline on each side of the drainage channel
- Streams draining from 40-acres to 128-acres shall have a buffer of 50-ft from the centerline on each side of the drainage channel
- Streams draining from 128-acres to 320-acres shall have a buffer of 100-ft from the centerline on each side of the drainage channel

- Streams draining from 320-acres to 640-acres shall have a buffer of 200-ft from the centerline on each side of the drainage channel
- Streams draining 640-acres or more shall have a buffer of 300-ft from the centerline on each side of the drainage channel

In addition to proposed stream buffers, the JPS Enhanced Measures will also provide buffers around sensitive features that are identified with a Geological Assessment. A natural buffer of a minimum of 150-feet will be provided in all directions from an identified sensitive feature. Where the boundary of the drainage area to the feature lies more than 150-feet from the feature, the buffer will extend to the boundary of the drainage area or 300-feet, whichever is less.

An exhibit delineating the existing drainage areas to the streams within the Project, as well as the proposed Stream Buffers and Sensitive Features Buffers based upon the setbacks described above is included as **Exhibit B**.

An exhibit overlaying the proposed Stream Buffers and Sensitive Features Buffers on top of the proposed Concordia University Texas Master Plan is included as **Exhibit C**.

If you have any questions or need any additional information, please contact me at 512-418-1771.

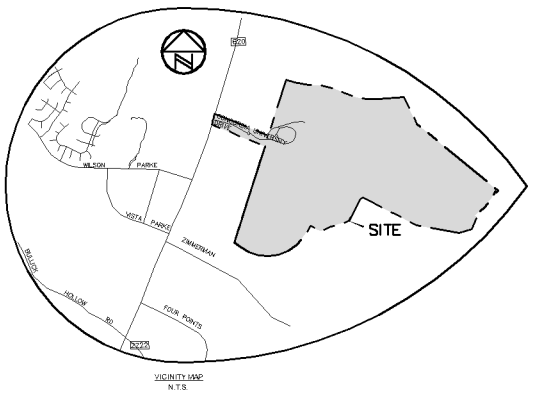
Sincerely,

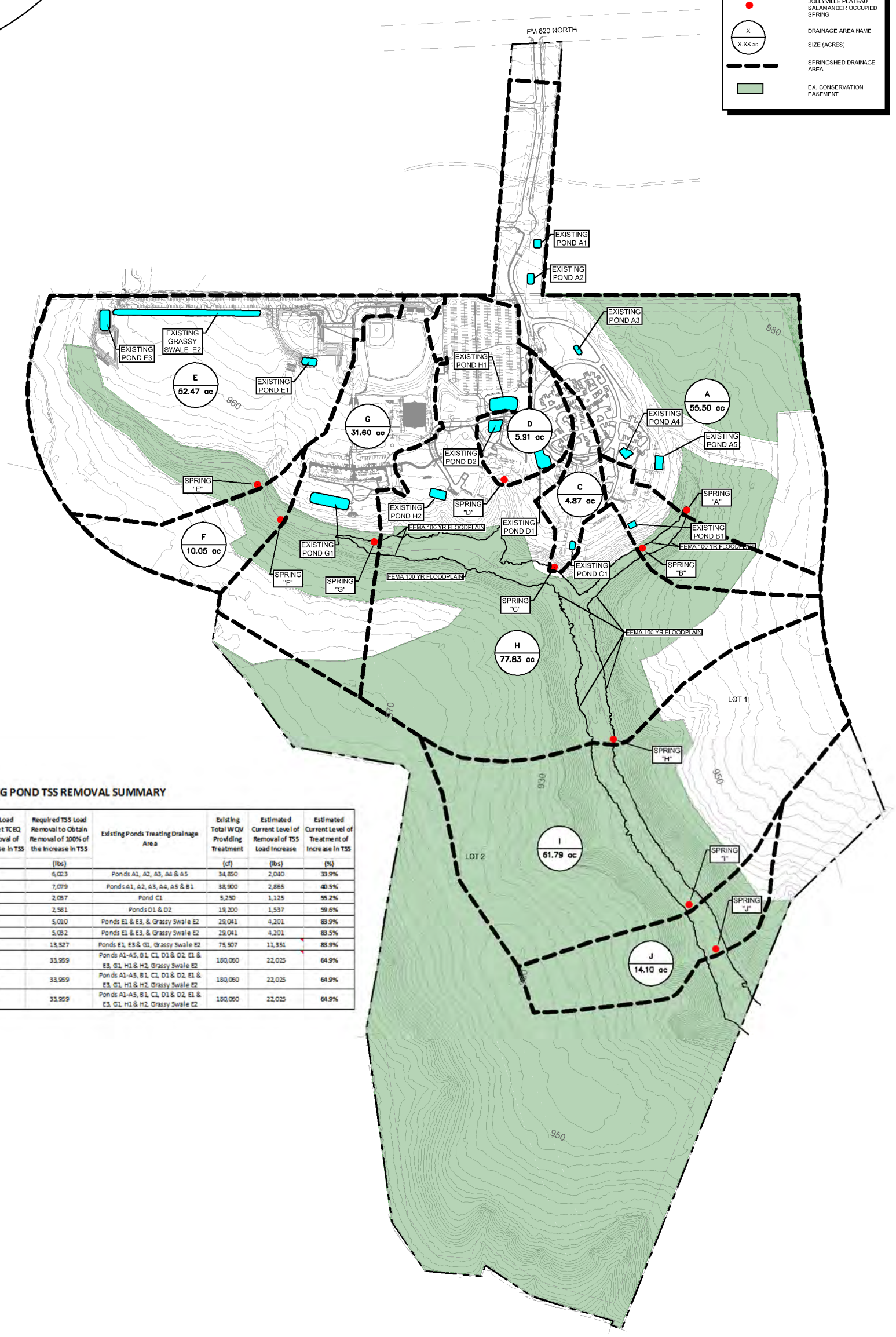
KIMLEY-HORN AND ASSOCIATES, INC.

Joshua W. Miksch, P.E.
Project Manager

Attachments

STATE OF TEXAS
JOSHUA W. MIKSCH
122089
LICENSED
PROFESSIONAL ENGINEER
02/05/2018





EXISTING POND TSS REMOVAL SUMMARY

Existing Spring	Existing Drainage Area	Existing Impervious Cover	Existing Impervious Cover	Required TSS Load Removal to Meet TCEQ Minimum Removal of 80% of the Increase in TSS	Required TSS Load Removal to Obtain Removal of 100% of the Increase in TSS	Existing Ponds Treating Drainage Area	Existing Total WQV Providing Treatment	Estimated Current Level of Removal of TSS Load Increase	Estimated Current Level of Treatment of Increase in TSS
	(Acres)	(Acres)	(%)	(lbs)	(lbs)		(cf)	(lbs)	(%)
Spring "A"	55.50	5.53	10.0%	4,813	6,023	Ponds A1, A2, A3, A4 & A5	34,850	2,040	33.9%
Spring "B"	65.15	6.50	10.0%	5,658	7,079	Ponds A1, A2, A3, A4, A5 & B1	38,900	2,865	40.5%
Spring "C"	4.87	1.87	38.4%	1,628	2,037	Pond C1	5,250	1,125	55.2%
Spring "D"	5.91	2.37	40.1%	2,063	2,581	Ponds D1 & D2	19,200	1,537	59.6%
Spring "E"	52.47	4.60	8.8%	4,004	5,010	Ponds E1 & E3, & Grassy Swale E2	29,041	4,201	83.9%
Spring "F"	62.52	4.62	7.4%	4,021	5,032	Ponds E1 & E3, & Grassy Swale E2	29,041	4,201	83.5%
Spring "G"	94.12	12.42	13.2%	10,810	13,527	Ponds E1, E3 & G1, Grassy Swale E2	75,507	11,351	83.9%
Spring "H"	247.88	31.18	12.6%	27,139	33,959	Ponds A1-A5, B1, C1, D1 & D2, E1 & E3, G1, H1 & H2, Grassy Swale E2	180,060	22,025	64.9%
Spring "I"	309.67	31.18	10.1%	27,139	33,959	Ponds A1-A5, B1, C1, D1 & D2, E1 & E3, G1, H1 & H2, Grassy Swale E2	180,060	22,025	64.9%
Spring "J"	323.77	31.18	9.6%	27,139	33,959	Ponds A1-A5, B1, C1, D1 & D2, E1 & E3, G1, H1 & H2, Grassy Swale E2	180,060	22,025	64.9%

EXHIBIT A

CONCORDIA UNIVERSITY TEXAS
EXISTING DEVELOPMENT
SPRINGSHED DRAINAGE AREAS

AUSTIN, TEXAS
JANUARY 2018

DWG NAME: K:\AUS_CIVIL\069229503 CONCORDIA MASTER PLAN\10A PERMIT\CAD\EXHIBITS\PLANSHEETS\EXHIBIT A - EXISTING SPRINGSHED DRAINAGE AREAS.DWG
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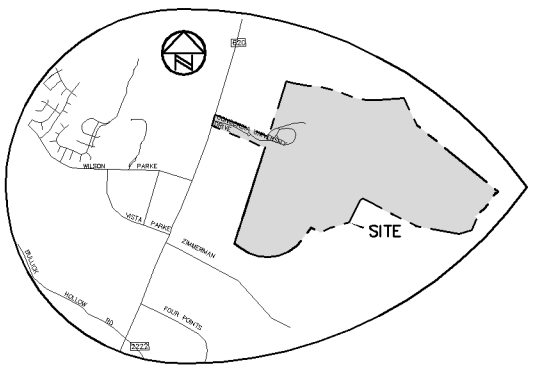
Kimley»Horn
18014 JOLLYVILLE RD
AVALLON IV, SUITE 300
AUSTIN, TEXAS
512-418-1771
STATE OF TEXAS REGISTRATION NO. F-928

NOTE: THIS PLAN IS CONCEPTUAL IN NATURE AND HAS BEEN PRODUCED WITHOUT THE BENEFIT OF A SURVEY, TOPOGRAPHY, UTILITIES, CONTACT WITH THE CITY, ETC.



LEGEND

- PROPERTY LINE
- EXISTING DRAINAGE AREA
- CREEK CENTERLINE
- STREAM BUFFER
- SENSITIVE FEATURES BUFFER*
- OCCUPIED SALAMANDER SITE**
- PROPOSED CONTOUR
- EXISTING CONTOUR
- EX. CONSERVATION EASEMENT

*MINIMUM 150-FT SETBACK REQUIRED
**PER CITY OF AUSTIN 2017 STUDY DATA

CONCORDIA PROPERTY: 437.23 AC
CONSERVATION EASEMENT: 250.62 AC
STREAM BUFFER AREA: 62.70 AC
MAX. ALLOWABLE IMP. COVER: 174.30 AC

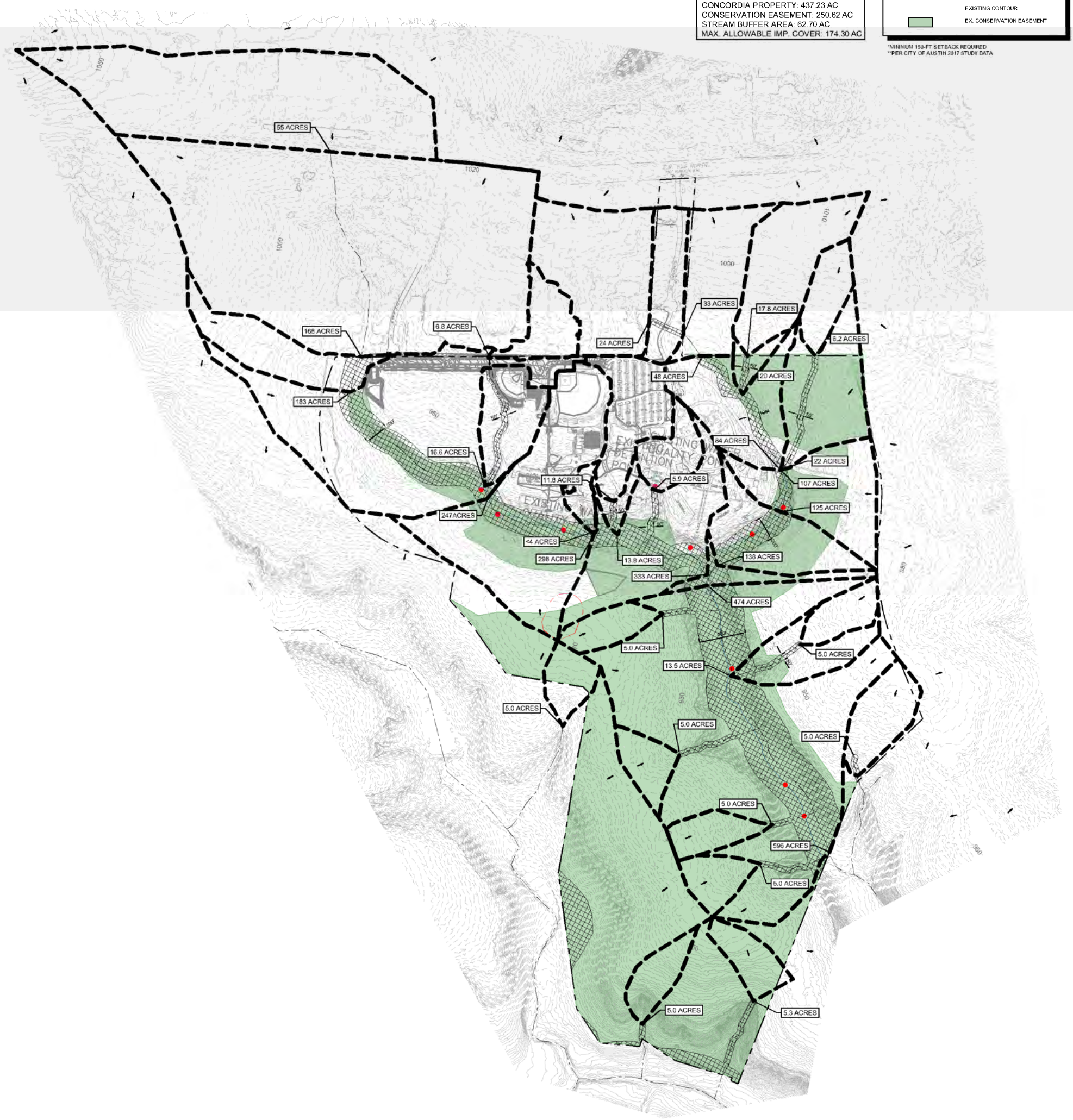


EXHIBIT B

CONCORDIA UNIVERSITY TEXAS PROPOSED

JPS ENHANCED MEASURES

AUSTIN, TEXAS
JANUARY 2018

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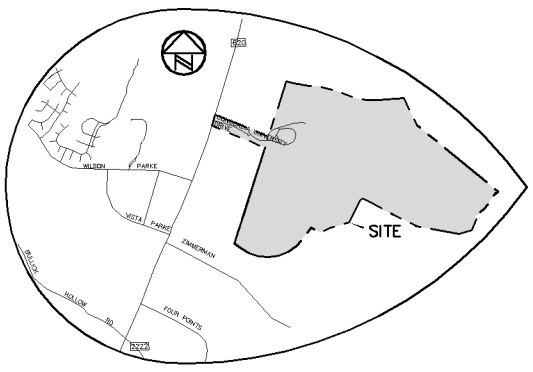

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CONSERVATION EASEMENT: 250.62 AC
STREAM BUFFER AREA: 62.70 AC
MAX. ALLOWABLE IMP. COVER: 174.30 AC

LEGEND

- PROPERTY LINE
- CREEK CENTERLINE
- STREAM BUFFER
- SENSITIVE FEATURES BUFFER*
- OCCUPIED SALAMANDER SITE**
- PROPOSED CONTOUR
- EXISTING CONTOUR
- EX. CONSERVATION EASEMENT

*MINIMUM 150-FT SETBACK REQUIRED
**PER CITY OF AUSTIN 2017 STUDY DATA

EXHIBIT C

CONCORDIA UNIVERSITY TEXAS
PROPOSED MASTER DEVELOPMENT PLAN
JPS ENHANCED MEASURES OVERLAY

AUSTIN, TEXAS
JANUARY 2018

DWG NAME K:\AUS_CIVIL\069229503 CONCORDIA MASTER PLAN\10A PERMIT\CAD\EXHIBITS\PLANSHEETS\EXHIBIT C - JPS ENHANCED MEASURES OVERLAY.DWG
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EXHIBIT D

EXISTING TSS REMOVAL SUMMARY TABLE

AND

TCEQ TSS LOAD REMOVAL CALCULATIONS FOR

EACH SPRINGSHED DRAINAGE AREA

EXISTING POND TSS REMOVAL SUMMARY

Existing Spring	Existing Drainage Area (Acres)	Existing Impervious Cover (Acres)	Existing Impervious Cover (%)	Required TSS Load Removal to Meet TCEQ Minimum Removal of 80% of the Increase in TSS (lbs)	Required TSS Load Removal to Obtain Removal of 100% of the Increase in TSS (lbs)	Existing Ponds Treating Drainage Area	Existing Total WQV Providing Treatment (cf)	Estimated Current Level of Removal of TSS Load Increase (lbs)	Estimated Current Level of Treatment of Increase in TSS (%)
Spring "A"	55.50	5.53	10.0%	4,813	6,023	Ponds A1, A2, A3, A4 & A5	34,850	2,040	**33.9%**
Spring "B"	65.15	6.50	10.0%	5,658	7,079	Ponds A1, A2, A3, A4, A5 & B1	38,900	2,865	**40.5%**
Spring "C"	4.87	1.87	38.4%	1,628	2,037	Pond C1	5,250	1,125	**55.2%**
Spring "D"	5.91	2.37	40.1%	2,063	2,581	Ponds D1 & D2	19,200	1,537	**59.6%**
Spring "E"	52.47	4.60	8.8%	4,004	5,010	Ponds E1 & E3, & Grassy Swale E2	29,041	4,201	**83.9%**
Spring "F"	62.52	4.62	7.4%	4,021	5,032	Ponds E1 & E3, & Grassy Swale E2	29,041	4,201	**83.5%**
Spring "G"	94.12	12.42	13.2%	10,810	13,527	Ponds E1, E3 & G1, Grassy Swale E2	75,507	11,351	**83.9%**
Spring "H"	247.88	31.18	12.6%	27,139	33,959	Ponds A1-A5, B1, C1, D1 & D2, E1 & E3, G1, H1 & H2, Grassy Swale E2	180,060	22,025	**64.9%**
Spring "I"	309.67	31.18	10.1%	27,139	33,959	Ponds A1-A5, B1, C1, D1 & D2, E1 & E3, G1, H1 & H2, Grassy Swale E2	180,060	22,025	**64.9%**
Spring "J"	323.77	31.18	9.6%	27,139	33,959	Ponds A1-A5, B1, C1, D1 & D2, E1 & E3, G1, H1 & H2, Grassy Swale E2	180,060	22,025	**64.9%**

Texas Commission on Environmental Quality

TSS Removal Calculations 04-20-2009

Project Name: **Concordia University**
Date Prepared: **12/13/2017**

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Characters shown in red are data entry fields.
Characters shown in black (Bold) are calculated fields. Changes to these fields will remove the equations used in the spreadsheet.

1. The Required Load Reduction for the total project: Calculations from RG-348 Pages 3-27 to 3-30

Page 3-29 Equation 3.3: $L_M = 27.2(A_N \times P)$

where:

$L_{M\ TOTAL\ PROJECT}$ = Required TSS removal resulting from the proposed development = 80% of increased load
A_N = Net increase in impervious area for the project
P = Average annual precipitation, inches

Spring "A" - Pond A1

Site Data: Determine Required Load Removal Based on the Entire Project

County =	Travis	
Total project area included in plan * =	55.50	acres
Predevelopment impervious area within the limits of the plan * =	0.00	acres
Total post-development impervious area within the limits of the plan* =	5.53	acres
Total post-development impervious cover fraction * =	0.10	
P =	32	inches
$L_{M\ TOTAL\ PROJECT}$ =	4,813	lbs.

6,023 lbs. for 100% TSS Load Increase Removal

*** The values entered in these fields should be for the total project area.**

Number of drainage basins / outfalls areas leaving the plan area = 5

2. Drainage Basin Parameters (This information should be provided for each basin):

Drainage Basin/Outfall Area No. = EXISTING RAIN GARDEN/BIORETENTION POND A1

Total drainage basin/outfall area =	6.60	acres
Predevelopment impervious area within drainage basin/outfall area =	0.00	acres
Post-development impervious area within drainage basin/outfall area =	1.29	acres
Post-development impervious fraction within drainage basin/outfall area =	0.20	
$L_{M\ THIS\ BASIN}$ =	1,123	lbs.

3. Indicate the proposed BMP Code for this basin.

Proposed BMP =	Bioretention	
Removal efficiency =	89	percent

Aqualogic Cartridge Filter
Bioretention
Contech StormFilter
Constructed Wetland
Extended Detention
Grassy Swale
Retention / Irrigation
Sand Filter
Stormceptor
Vegetated Filter Strips
Vortechs
Wet Basin
Wet Vault

4. Calculate Maximum TSS Load Removed (L_R) for this Drainage Basin by the selected BMP Type.

RG-348 Page 3-33 Equation 3.7: $L_R = (\text{BMP efficiency}) \times P \times (A_I \times 34.6 + A_P \times 0.54)$

where:

A_C = Total On-Site drainage area in the BMP catchment area
A_I = Impervious area proposed in the BMP catchment area
A_P = Pervious area remaining in the BMP catchment area
L_R = TSS Load removed from this catchment area by the proposed BMP

A_C =	6.60	acres
A_I =	1.29	acres

A_P =	**5.31**	acres
L_R =	**1,353**	lbs

5. Calculate Fraction of Annual Runoff to Treat the drainage basin / outfall area

Desired $L_{M\ THIS\ BASIN}$ =	**1,110**	lbs.
F =	**0.82**	

6. Calculate Capture Volume required by the BMP Type for this drainage basin / outfall area. Calculations from RG-348 Pages 3-34 to 3-36

Rainfall Depth =	**1.16**	inches
Post Development Runoff Coefficient =	**0.20**	
On-site Water Quality Volume =	**5,502**	cubic feet

Calculations from RG-348 Pages 3-36 to 3-37

Off-site area draining to BMP =	**0.00**	acres
Off-site Impervious cover draining to BMP =	**0.00**	acres
Impervious fraction of off-site area =	**0**	
Off-site Runoff Coefficient =	**0.00**	
Off-site Water Quality Volume =	**0**	cubic feet
Storage for Sediment =	**1100**	
Total Capture Volume (required water quality volume(s) x 1.20) =	**6,603**	cubic feet

The following sections are used to calculate the required water quality volume(s) for the selected BMP.
The values for BMP Types not selected in cell C45 will show NA.

10. Bioretention System Designed as Required in RG-348 Pages 3-63 to 3-65

Required Water Quality Volume for Bioretention Basin =	**6,603**	cubic feet

Texas Commission on Environmental Quality

TSS Removal Calculations 04-20-2009

Project Name: **Concordia University**
Date Prepared: **12/13/2017**

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1. The Required Load Reduction for the total project: Calculations from RG-348 Pages 3-27 to 3-30

Page 3-29 Equation 3.3: $L_M = 27.2(A_N \times P)$

where:

$L_{M\ TOTAL\ PROJECT}$ = Required TSS removal resulting from the proposed development = 80% of increased load
A_N = Net increase in impervious area for the project
P = Average annual precipitation, inches

Spring "A" - Pond A2

Site Data: Determine Required Load Removal Based on the Entire Project

County =	Travis	
Total project area included in plan * =	55.50	acres
Predevelopment impervious area within the limits of the plan * =	0.00	acres
Total post-development impervious area within the limits of the plan* =	5.53	acres
Total post-development impervious cover fraction * =	0.10	
P =	32	inches
$L_{M\ TOTAL\ PROJECT}$ =	4,813	lbs.

6,023 lbs. for 100% TSS Load Increase Removal

*** The values entered in these fields should be for the total project area.**

Number of drainage basins / outfalls areas leaving the plan area = 5

2. Drainage Basin Parameters (This information should be provided for each basin):

Drainage Basin/Outfall Area No. = **EXISTING RAIN GARDEN/BIORETENTION POND A2**

Total drainage basin/outfall area =	0.84	acres
Predevelopment impervious area within drainage basin/outfall area =	0.00	acres
Post-development impervious area within drainage basin/outfall area =	0.21	acres
Post-development impervious fraction within drainage basin/outfall area =	0.25	
$L_{M\ THIS\ BASIN}$ =	183	lbs.

3. Indicate the proposed BMP Code for this basin.

Proposed BMP = Bioretention
Removal efficiency = 89 percent

Aqualogic Cartridge Filter
Bioretention
Contech StormFilter
Constructed Wetland
Extended Detention
Grassy Swale
Retention / Irrigation
Sand Filter
Stormceptor
Vegetated Filter Strips
Vortechs
Wet Basin
Wet Vault

4. Calculate Maximum TSS Load Removed (L_R) for this Drainage Basin by the selected BMP Type.

RG-348 Page 3-33 Equation 3.7: $L_R = (\text{BMP efficiency}) \times P \times (A_I \times 34.6 + A_P \times 0.54)$

where:

A_C = Total On-Site drainage area in the BMP catchment area
A_I = Impervious area proposed in the BMP catchment area
A_P = Pervious area remaining in the BMP catchment area
L_R = TSS Load removed from this catchment area by the proposed BMP

A_C = 0.84 acres
A_I = 0.21 acres

A_P =	**0.63**	acres
L_R =	**217**	lbs

5. Calculate Fraction of Annual Runoff to Treat the drainage basin / outfall area

Desired $L_{M\ THIS\ BASIN}$ =	**217**	lbs.
F =	**1.00**	

6. Calculate Capture Volume required by the BMP Type for this drainage basin / outfall area. Calculations from RG-348 Pages 3-34 to 3-36

Rainfall Depth =	**4.00**	inches
Post Development Runoff Coefficient =	**0.23**	
On-site Water Quality Volume =	**2,821**	cubic feet

Calculations from RG-348 Pages 3-36 to 3-37

Off-site area draining to BMP =	**0.00**	acres
Off-site Impervious cover draining to BMP =	**0.00**	acres
Impervious fraction of off-site area =	**0**	
Off-site Runoff Coefficient =	**0.00**	
Off-site Water Quality Volume =	**0**	cubic feet
Storage for Sediment =	**564**	
Total Capture Volume (required water quality volume(s) x 1.20) =	**3,385**	cubic feet

The following sections are used to calculate the required water quality volume(s) for the selected BMP.
The values for BMP Types not selected in cell C45 will show NA.

10. Bioretention System Designed as Required in RG-348 Pages 3-63 to 3-65

Required Water Quality Volume for Bioretention Basin =	**3,385**	cubic feet

Texas Commission on Environmental Quality

TSS Removal Calculations 04-20-2009

Project Name: **Concordia University**
Date Prepared: **12/13/2017**

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1. The Required Load Reduction for the total project: Calculations from RG-348 Pages 3-27 to 3-30

Page 3-29 Equation 3.3: $L_M = 27.2(A_N \times P)$

where:

$L_{M\ TOTAL\ PROJECT}$ = Required TSS removal resulting from the proposed development = 80% of increased load
A_N = Net increase in impervious area for the project
P = Average annual precipitation, inches

Spring "A" - Pond A3

Site Data: Determine Required Load Removal Based on the Entire Project

County =	Travis	
Total project area included in plan * =	55.50	acres
Predevelopment impervious area within the limits of the plan * =	0.00	acres
Total post-development impervious area within the limits of the plan* =	5.53	acres
Total post-development impervious cover fraction * =	0.10	
P =	32	inches

$L_{M\ TOTAL\ PROJECT}$ = **4,813** lbs. **6,023 lbs. for 100% TSS Load Increase Removal**

*** The values entered in these fields should be for the total project area.**

Number of drainage basins / outfalls areas leaving the plan area = **5**

2. Drainage Basin Parameters (This information should be provided for each basin):

Drainage Basin/Outfall Area No. = **EXISTING RAIN GARDEN/BIORETENTION POND A3**

Total drainage basin/outfall area =	1.08	acres
Predevelopment impervious area within drainage basin/outfall area =	0.00	acres
Post-development impervious area within drainage basin/outfall area =	0.23	acres
Post-development impervious fraction within drainage basin/outfall area =	0.21	
$L_{M\ THIS\ BASIN}$ =	199	lbs.

3. Indicate the proposed BMP Code for this basin.

Proposed BMP = **Bioretention**
Removal efficiency = **89** percent

Aqualogic Cartridge Filter
Bioretention
Contech StormFilter
Constructed Wetland
Extended Detention
Grassy Swale
Retention / Irrigation
Sand Filter
Stormceptor
Vegetated Filter Strips
Vortechs
Wet Basin
Wet Vault

4. Calculate Maximum TSS Load Removed (L_R) for this Drainage Basin by the selected BMP Type.

RG-348 Page 3-33 Equation 3.7: $L_R = (\text{BMP efficiency}) \times P \times (A_I \times 34.6 + A_P \times 0.54)$

where:

A_C = Total On-Site drainage area in the BMP catchment area
A_I = Impervious area proposed in the BMP catchment area
A_P = Pervious area remaining in the BMP catchment area
L_R = TSS Load removed from this catchment area by the proposed BMP

A_C = 1.08 acres
A_I = 0.23 acres

A_P =	**0.85**	acres
L_R =	**238**	lbs

5. Calculate Fraction of Annual Runoff to Treat the drainage basin / outfall area

Desired $L_{M\ THIS\ BASIN}$ =	**238**	lbs.
F =	**1.00**	

6. Calculate Capture Volume required by the BMP Type for this drainage basin / outfall area. Calculations from RG-348 Pages 3-34 to 3-36

Rainfall Depth =	**4.00**	inches
Post Development Runoff Coefficient =	**0.21**	
On-site Water Quality Volume =	**3,264**	cubic feet

Calculations from RG-348 Pages 3-36 to 3-37

Off-site area draining to BMP =	**0.00**	acres
Off-site Impervious cover draining to BMP =	**0.00**	acres
Impervious fraction of off-site area =	**0**	
Off-site Runoff Coefficient =	**0.00**	
Off-site Water Quality Volume =	**0**	cubic feet
Storage for Sediment =	**653**	
Total Capture Volume (required water quality volume(s) x 1.20) =	**3,917**	cubic feet

The following sections are used to calculate the required water quality volume(s) for the selected BMP.
The values for BMP Types not selected in cell C45 will show NA.

10. Bioretention System Designed as Required in RG-348 Pages 3-63 to 3-65

Required Water Quality Volume for Bioretention Basin =	**3,917**	cubic feet

Texas Commission on Environmental Quality

TSS Removal Calculations 04-20-2009

Project Name: **Concordia University**
Date Prepared: **12/14/2017**

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1. The Required Load Reduction for the total project: Calculations from RG-348 Pages 3-27 to 3-30

Page 3-29 Equation 3.3: $L_M = 27.2(A_N \times P)$

where:

$L_{M\ TOTAL\ PROJECT}$ = Required TSS removal resulting from the proposed development = 80% of increased load
A_N = Net increase in impervious area for the project
P = Average annual precipitation, inches

Spring "A" - Pond A4

Site Data: Determine Required Load Removal Based on the Entire Project

County =	Travis	
Total project area included in plan * =	55.50	acres
Predevelopment impervious area within the limits of the plan * =	0.00	acres
Total post-development impervious area within the limits of the plan* =	5.53	acres
Total post-development impervious cover fraction * =	**0.10**	
P =	**32**	inches
$L_{M\ TOTAL\ PROJECT}$ =	**4,813**	lbs.

6,023 lbs. for 100% TSS Load Increase Removal

*** The values entered in these fields should be for the total project area.**

Number of drainage basins / outfalls areas leaving the plan area = **5**

2. Drainage Basin Parameters (This information should be provided for each basin):

Drainage Basin/Outfall Area No. = **EXISTING RAIN GARDEN/BIORETENTION POND A4**

Total drainage basin/outfall area =	0.63	acres
Predevelopment impervious area within drainage basin/outfall area =	0.00	acres
Post-development impervious area within drainage basin/outfall area =	0.29	acres
Post-development impervious fraction within drainage basin/outfall area =	**0.46**	
$L_{M\ THIS\ BASIN}$ =	**251**	lbs.

3. Indicate the proposed BMP Code for this basin.

Proposed BMP = **Bioretention**
Removal efficiency = **89** percent

Aqualogic Cartridge Filter
Bioretention
Contech StormFilter
Constructed Wetland
Extended Detention
Grassy Swale
Retention / Irrigation
Sand Filter
Stormceptor
Vegetated Filter Strips
Vortechs
Wet Basin
Wet Vault

4. Calculate Maximum TSS Load Removed (L_R) for this Drainage Basin by the selected BMP Type.

RG-348 Page 3-33 Equation 3.7: $L_R = (\text{BMP efficiency}) \times P \times (A_I \times 34.6 + A_P \times 0.54)$

where:

A_C = Total On-Site drainage area in the BMP catchment area
A_I = Impervious area proposed in the BMP catchment area
A_P = Pervious area remaining in the BMP catchment area
L_R = TSS Load removed from this catchment area by the proposed BMP

A_C =	0.63	acres
A_I =	0.29	acres

A_P =	**0.34**	acres
L_R =	**289**	lbs

5. Calculate Fraction of Annual Runoff to Treat the drainage basin / outfall area

Desired $L_{M\ THIS\ BASIN}$ =	**280**	lbs.
F =	**0.97**	

6. Calculate Capture Volume required by the BMP Type for this drainage basin / outfall area. Calculations from RG-348 Pages 3-34 to 3-36

Rainfall Depth =	**3.00**	inches
Post Development Runoff Coefficient =	**0.33**	
On-site Water Quality Volume =	**2,297**	cubic feet

Calculations from RG-348 Pages 3-36 to 3-37

Off-site area draining to BMP =	**0.00**	acres
Off-site Impervious cover draining to BMP =	**0.00**	acres
Impervious fraction of off-site area =	**0**	
Off-site Runoff Coefficient =	**0.00**	
Off-site Water Quality Volume =	**0**	cubic feet
Storage for Sediment =	**459**	
Total Capture Volume (required water quality volume(s) x 1.20) =	**2,756**	cubic feet

The following sections are used to calculate the required water quality volume(s) for the selected BMP.
The values for BMP Types not selected in cell C45 will show NA.

10. Bioretention System Designed as Required in RG-348 Pages 3-63 to 3-65

Required Water Quality Volume for Bioretention Basin =	**2,756**	cubic feet

Texas Commission on Environmental Quality

TSS Removal Calculations 04-20-2009

Project Name: **Concordia University**
Date Prepared: **12/14/2017**

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1. The Required Load Reduction for the total project: Calculations from RG-348 Pages 3-27 to 3-30

Page 3-29 Equation 3.3: $L_M = 27.2(A_N \times P)$

where:

$L_{M\ TOTAL\ PROJECT}$ = Required TSS removal resulting from the proposed development = 80% of increased load
A_N = Net increase in impervious area for the project
P = Average annual precipitation, inches

Spring "A" - Pond A5

Site Data: Determine Required Load Removal Based on the Entire Project

County =	Travis	
Total project area included in plan * =	55.50	acres
Predevelopment impervious area within the limits of the plan * =	0.00	acres
Total post-development impervious area within the limits of the plan* =	5.53	acres
Total post-development impervious cover fraction * =	**0.10**	
P =	**32**	inches
$L_{M\ TOTAL\ PROJECT}$ =	**4,813**	lbs.

6,023 lbs. for 100% TSS Load Increase Removal

*** The values entered in these fields should be for the total project area.**

Number of drainage basins / outfalls areas leaving the plan area = **5**

2. Drainage Basin Parameters (This information should be provided for each basin):

Drainage Basin/Outfall Area No. = **EXISTING RAIN GARDEN/BIORETENTION POND A5**

Total drainage basin/outfall area =	0.81	acres
Predevelopment impervious area within drainage basin/outfall area =	0.00	acres
Post-development impervious area within drainage basin/outfall area =	0.19	acres
Post-development impervious fraction within drainage basin/outfall area =	**0.23**	
$L_{M\ THIS\ BASIN}$ =	**163**	lbs.

3. Indicate the proposed BMP Code for this basin.

Proposed BMP = **Bioretention**
Removal efficiency = **89** percent

Aqualogic Cartridge Filter
Bioretention
Contech StormFilter
Constructed Wetland
Extended Detention
Grassy Swale
Retention / Irrigation
Sand Filter
Stormceptor
Vegetated Filter Strips
Vortechs
Wet Basin
Wet Vault

4. Calculate Maximum TSS Load Removed (L_R) for this Drainage Basin by the selected BMP Type.

RG-348 Page 3-33 Equation 3.7: $L_R = (\text{BMP efficiency}) \times P \times (A_I \times 34.6 + A_P \times 0.54)$

where:

A_C = Total On-Site drainage area in the BMP catchment area
A_I = Impervious area proposed in the BMP catchment area
A_P = Pervious area remaining in the BMP catchment area
L_R = TSS Load removed from this catchment area by the proposed BMP

A_C =	0.81	acres
A_I =	0.19	acres

A_P =	**0.62**	acres
L_R =	**195**	lbs

5. Calculate Fraction of Annual Runoff to Treat the drainage basin / outfall area

Desired $L_{M\ THIS\ BASIN}$ =	**195**	lbs.
F =	**1.00**	

6. Calculate Capture Volume required by the BMP Type for this drainage basin / outfall area. Calculations from RG-348 Pages 3-34 to 3-36

Rainfall Depth =	**4.00**	inches
Post Development Runoff Coefficient =	**0.22**	
On-site Water Quality Volume =	**2,596**	cubic feet

Calculations from RG-348 Pages 3-36 to 3-37

Off-site area draining to BMP =	**0.00**	acres
Off-site Impervious cover draining to BMP =	**0.00**	acres
Impervious fraction of off-site area =	**0**	
Off-site Runoff Coefficient =	**0.00**	
Off-site Water Quality Volume =	**0**	cubic feet
Storage for Sediment =	**519**	
Total Capture Volume (required water quality volume(s) x 1.20) =	**3,115**	cubic feet

The following sections are used to calculate the required water quality volume(s) for the selected BMP.
The values for BMP Types not selected in cell C45 will show NA.

10. Bioretention System Designed as Required in RG-348 Pages 3-63 to 3-65

Required Water Quality Volume for Bioretention Basin =	**3,115**	cubic feet

Texas Commission on Environmental Quality

TSS Removal Calculations 04-20-2009

Project Name: **Concordia University**
Date Prepared: **12/14/2017**

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1. The Required Load Reduction for the total project: Calculations from RG-348 Pages 3-27 to 3-30

Page 3-29 Equation 3.3: $L_M = 27.2(A_N \times P)$

where:

$L_{M\ TOTAL\ PROJECT}$ = Required TSS removal resulting from the proposed development = 80% of increased load
A_N = Net increase in impervious area for the project
P = Average annual precipitation, inches

Spring "B" - Pond B1

Site Data: Determine Required Load Removal Based on the Entire Project

County =	Travis	
Total project area included in plan * =	65.15	acres
Predevelopment impervious area within the limits of the plan * =	0.00	acres
Total post-development impervious area within the limits of the plan* =	6.50	acres
Total post-development impervious cover fraction * =	0.10	
P =	32	inches

$L_{M\ TOTAL\ PROJECT}$ = **5,658** lbs. **7,079 lbs. for 100% TSS Load Increase Removal**

*** The values entered in these fields should be for the total project area.**

Number of drainage basins / outfalls areas leaving the plan area = **1**

2. Drainage Basin Parameters (This information should be provided for each basin):

Drainage Basin/Outfall Area No. = **EXISTING RAIN GARDEN/BIORETENTION POND B1**

Total drainage basin/outfall area =	1.98	acres
Predevelopment impervious area within drainage basin/outfall area =	0.00	acres
Post-development impervious area within drainage basin/outfall area =	0.97	acres
Post-development impervious fraction within drainage basin/outfall area =	0.49	
$L_{M\ THIS\ BASIN}$ =	841	lbs.

3. Indicate the proposed BMP Code for this basin.

Proposed BMP = **Bioretention**
Removal efficiency = **89** percent

Aqualogic Cartridge Filter
Bioretention
Contech StormFilter
Constructed Wetland
Extended Detention
Grassy Swale
Retention / Irrigation
Sand Filter
Stormceptor
Vegetated Filter Strips
Vortechs
Wet Basin
Wet Vault

4. Calculate Maximum TSS Load Removed (L_R) for this Drainage Basin by the selected BMP Type.

RG-348 Page 3-33 Equation 3.7: $L_R = (\text{BMP efficiency}) \times P \times (A_I \times 34.6 + A_P \times 0.54)$

where:

A_C = Total On-Site drainage area in the BMP catchment area
A_I = Impervious area proposed in the BMP catchment area
A_P = Pervious area remaining in the BMP catchment area
L_R = TSS Load removed from this catchment area by the proposed BMP

A_C = **1.98** acres
A_I = **0.97** acres

A_P =	**1.01**	acres
L_R =	**968**	lbs

5. Calculate Fraction of Annual Runoff to Treat the drainage basin / outfall area

Desired $L_{M\ THIS\ BASIN}$ =	**825**	lbs.
F =	**0.85**	

6. Calculate Capture Volume required by the BMP Type for this drainage basin / outfall area. Calculations from RG-348 Pages 3-34 to 3-36

Rainfall Depth =	**1.32**	inches
Post Development Runoff Coefficient =	**0.35**	
On-site Water Quality Volume =	**3,331**	cubic feet

Calculations from RG-348 Pages 3-36 to 3-37

Off-site area draining to BMP =	**0.00**	acres
Off-site Impervious cover draining to BMP =	**0.00**	acres
Impervious fraction of off-site area =	**0**	
Off-site Runoff Coefficient =	**0.00**	
Off-site Water Quality Volume =	**0**	cubic feet
Storage for Sediment =	**666**	
Total Capture Volume (required water quality volume(s) x 1.20) =	**3,997**	cubic feet

The following sections are used to calculate the required water quality volume(s) for the selected BMP.
The values for BMP Types not selected in cell C45 will show NA.

10. Bioretention System Designed as Required in RG-348 Pages 3-63 to 3-65

Required Water Quality Volume for Bioretention Basin =	**3,997**	cubic feet

Texas Commission on Environmental Quality

TSS Removal Calculations 04-20-2009

Project Name: **Concordia University**
Date Prepared: **12/13/2017**

Additional information is provided for cells with a red triangle in the upper right corner. Place the cursor over the cell.
Text shown in blue indicate location of instructions in the Technical Guidance Manual - RG-348.
Characters shown in red are data entry fields.
Characters shown in black (Bold) are calculated fields. Changes to these fields will remove the equations used in the spreadsheet.

1. The Required Load Reduction for the total project: Calculations from RG-348 Pages 3-27 to 3-30

Page 3-29 Equation 3.3: $L_M = 27.2(A_N \times P)$

where:

$L_{M\ TOTAL\ PROJECT}$ = Required TSS removal resulting from the proposed development = 80% of increased load
A_N = Net increase in impervious area for the project
P = Average annual precipitation, inches

Concordia Spring Y (Spring "C") - Pond C1

Site Data: Determine Required Load Removal Based on the Entire Project

County =	Travis	
Total project area included in plan * =	4.87	acres
Predevelopment impervious area within the limits of the plan * =	0.00	acres
Total post-development impervious area within the limits of the plan* =	1.87	acres
Total post-development impervious cover fraction * =	0.38	
P =	32	inches
$L_{M\ TOTAL\ PROJECT}$ =	1,628	lbs.

2,037 lbs. for 100% TSS Load Increase Removal

*** The values entered in these fields should be for the total project area.**

Number of drainage basins / outfalls areas leaving the plan area = 1

2. Drainage Basin Parameters (This information should be provided for each basin):

Drainage Basin/Outfall Area No. = **EXISTING RAIN GARDEN/BIORETENTION POND C1**

Total drainage basin/outfall area =	3.27	acres
Predevelopment impervious area within drainage basin/outfall area =	0.00	acres
Post-development impervious area within drainage basin/outfall area =	1.36	acres
Post-development impervious fraction within drainage basin/outfall area =	0.42	
$L_{M\ THIS\ BASIN}$ =	1,182	lbs.

3. Indicate the proposed BMP Code for this basin.

Proposed BMP = Bioretention
Removal efficiency = 89 percent

Aqualogic Cartridge Filter
Bioretention
Contech StormFilter
Constructed Wetland
Extended Detention
Grassy Swale
Retention / Irrigation
Sand Filter
Stormceptor
Vegetated Filter Strips
Vortechs
Wet Basin
Wet Vault

4. Calculate Maximum TSS Load Removed (L_R) for this Drainage Basin by the selected BMP Type.

RG-348 Page 3-33 Equation 3.7: $L_R = (\text{BMP efficiency}) \times P \times (A_I \times 34.6 + A_P \times 0.54)$

where:

A_C = Total On-Site drainage area in the BMP catchment area
A_I = Impervious area proposed in the BMP catchment area
A_P = Pervious area remaining in the BMP catchment area
L_R = TSS Load removed from this catchment area by the proposed BMP

A_C = 3.27 acres
A_I = 1.36 acres

A_P =	**1.91**	acres
L_R =	**1,368**	lbs

5. Calculate Fraction of Annual Runoff to Treat the drainage basin / outfall area

Desired $L_{M\ THIS\ BASIN}$ =	**1,125**	lbs.
F =	**0.82**	

6. Calculate Capture Volume required by the BMP Type for this drainage basin / outfall area. Calculations from RG-348 Pages 3-34 to 3-36

Rainfall Depth =	**1.16**	inches
Post Development Runoff Coefficient =	**0.31**	
On-site Water Quality Volume =	**4,327**	cubic feet

Calculations from RG-348 Pages 3-36 to 3-37

Off-site area draining to BMP =	**0.00**	acres
Off-site Impervious cover draining to BMP =	**0.00**	acres
Impervious fraction of off-site area =	**0**	
Off-site Runoff Coefficient =	**0.00**	
Off-site Water Quality Volume =	**0**	cubic feet
Storage for Sediment =	**865**	
Total Capture Volume (required water quality volume(s) x 1.20) =	**5,193**	cubic feet

The following sections are used to calculate the required water quality volume(s) for the selected BMP.
The values for BMP Types not selected in cell C45 will show NA.

10. Bioretention System Designed as Required in RG-348 Pages 3-63 to 3-65

Required Water Quality Volume for Bioretention Basin =	**5,193**	cubic feet

Texas Commission on Environmental Quality

TSS Removal Calculations 04-20-2009

Project Name: **Concordia University**
Date Prepared: **12/13/2017**

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Characters shown in black (Bold) are calculated fields. Changes to these fields will remove the equations used in the spreadsheet.

1. The Required Load Reduction for the total project: Calculations from RG-348 Pages 3-27 to 3-30

Page 3-29 Equation 3.3: $L_M = 27.2(A_N \times P)$

where:

$L_{M\ TOTAL\ PROJECT}$ = Required TSS removal resulting from the proposed development = 80% of increased load
A_N = Net increase in impervious area for the project
P = Average annual precipitation, inches

Spring "D" - Pond D1

Site Data: Determine Required Load Removal Based on the Entire Project

County =	Travis	
Total project area included in plan * =	5.91	acres
Predevelopment impervious area within the limits of the plan * =	0.00	acres
Total post-development impervious area within the limits of the plan* =	2.37	acres
Total post-development impervious cover fraction * =	0.40	
P =	32	inches

$L_{M\ TOTAL\ PROJECT}$ = **2,063** lbs. **2,581 lbs. for 100% TSS Load Increase Removal**

*** The values entered in these fields should be for the total project area.**

Number of drainage basins / outfalls areas leaving the plan area = **2**

2. Drainage Basin Parameters (This information should be provided for each basin):

Drainage Basin/Outfall Area No. = EXISTING RAIN GARDEN/BIORETENTION POND D1

Total drainage basin/outfall area =	1.96	acres
Predevelopment impervious area within drainage basin/outfall area =	0.00	acres
Post-development impervious area within drainage basin/outfall area =	0.78	acres
Post-development impervious fraction within drainage basin/outfall area =	0.40	
$L_{M\ THIS\ BASIN}$ =	675	lbs.

3. Indicate the proposed BMP Code for this basin.

Proposed BMP = **Bioretention**
Removal efficiency = **89** percent

Aqualogic Cartridge Filter
Bioretention
Contech StormFilter
Constructed Wetland
Extended Detention
Grassy Swale
Retention / Irrigation
Sand Filter
Stormceptor
Vegetated Filter Strips
Vortechs
Wet Basin
Wet Vault

4. Calculate Maximum TSS Load Removed (L_R) for this Drainage Basin by the selected BMP Type.

RG-348 Page 3-33 Equation 3.7: $L_R = (\text{BMP efficiency}) \times P \times (A_I \times 34.6 + A_P \times 0.54)$

where:

A_C = Total On-Site drainage area in the BMP catchment area
A_I = Impervious area proposed in the BMP catchment area
A_P = Pervious area remaining in the BMP catchment area
L_R = TSS Load removed from this catchment area by the proposed BMP

A_C = **1.96** acres
A_I = **0.78** acres

A_P =	**1.18**	acres
L_R =	**782**	lbs

5. Calculate Fraction of Annual Runoff to Treat the drainage basin / outfall area

Desired $L_{M\ THIS\ BASIN}$ =	**782**	lbs.
F =	**1.00**	

6. Calculate Capture Volume required by the BMP Type for this drainage basin / outfall area. Calculations from RG-348 Pages 3-34 to 3-36

Rainfall Depth =	**4.00**	inches
Post Development Runoff Coefficient =	**0.30**	
On-site Water Quality Volume =	**8,672**	cubic feet

Calculations from RG-348 Pages 3-36 to 3-37

Off-site area draining to BMP =	**0.00**	acres
Off-site Impervious cover draining to BMP =	**0.00**	acres
Impervious fraction of off-site area =	**0**	
Off-site Runoff Coefficient =	**0.00**	
Off-site Water Quality Volume =	**0**	cubic feet
Storage for Sediment =	**1734**	
Total Capture Volume (required water quality volume(s) x 1.20) =	**10,406**	cubic feet

The following sections are used to calculate the required water quality volume(s) for the selected BMP.
The values for BMP Types not selected in cell C45 will show NA.

10. Bioretention System Designed as Required in RG-348 Pages 3-63 to 3-65

Required Water Quality Volume for Bioretention Basin =	**10,406**	cubic feet

Texas Commission on Environmental Quality

TSS Removal Calculations 04-20-2009

Project Name: **Concordia University**
Date Prepared: **12/13/2017**

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1. The Required Load Reduction for the total project: Calculations from RG-348 Pages 3-27 to 3-30

Page 3-29 Equation 3.3: $L_M = 27.2(A_N \times P)$

where:

$L_{M\ TOTAL\ PROJECT}$ = Required TSS removal resulting from the proposed development = 80% of increased load
A_N = Net increase in impervious area for the project
P = Average annual precipitation, inches

Spring "D" - Pond D2

Site Data: Determine Required Load Removal Based on the Entire Project

County =	Travis	
Total project area included in plan * =	5.91	acres
Predevelopment impervious area within the limits of the plan * =	0.00	acres
Total post-development impervious area within the limits of the plan* =	2.37	acres
Total post-development impervious cover fraction * =	0.40	
P =	32	inches

$L_{M\ TOTAL\ PROJECT}$ = **2,063** lbs. **2,581 lbs. for 100% TSS Load Increase Removal**

*** The values entered in these fields should be for the total project area.**

Number of drainage basins / outfalls areas leaving the plan area = **2**

2. Drainage Basin Parameters (This information should be provided for each basin):

Drainage Basin/Outfall Area No. = EXISTING RAIN GARDEN/BIORETENTION POND D2

Total drainage basin/outfall area =	1.55	acres
Predevelopment impervious area within drainage basin/outfall area =	0.00	acres
Post-development impervious area within drainage basin/outfall area =	0.78	acres
Post-development impervious fraction within drainage basin/outfall area =	0.50	
$L_{M\ THIS\ BASIN}$ =	677	lbs.

3. Indicate the proposed BMP Code for this basin.

Proposed BMP = **Bioretention**
Removal efficiency = **89** percent

Aqualogic Cartridge Filter
Bioretention
Contech StormFilter
Constructed Wetland
Extended Detention
Grassy Swale
Retention / Irrigation
Sand Filter
Stormceptor
Vegetated Filter Strips
Vortechs
Wet Basin
Wet Vault

4. Calculate Maximum TSS Load Removed (L_R) for this Drainage Basin by the selected BMP Type.

RG-348 Page 3-33 Equation 3.7: $L_R = (\text{BMP efficiency}) \times P \times (A_I \times 34.6 + A_P \times 0.54)$

where:

A_C = Total On-Site drainage area in the BMP catchment area
A_I = Impervious area proposed in the BMP catchment area
A_P = Pervious area remaining in the BMP catchment area
L_R = TSS Load removed from this catchment area by the proposed BMP

A_C =	1.55	acres
A_I =	0.78	acres

A_P =	**0.77**	acres
L_R =	**778**	lbs

5. Calculate Fraction of Annual Runoff to Treat the drainage basin / outfall area

Desired $L_{M\ THIS\ BASIN}$ =	**755**	lbs.
F =	**0.97**	

6. Calculate Capture Volume required by the BMP Type for this drainage basin / outfall area. Calculations from RG-348 Pages 3-34 to 3-36

Rainfall Depth =	**3.00**	inches
Post Development Runoff Coefficient =	**0.36**	
On-site Water Quality Volume =	**6,050**	cubic feet

Calculations from RG-348 Pages 3-36 to 3-37

Off-site area draining to BMP =	**0.00**	acres
Off-site Impervious cover draining to BMP =	**0.00**	acres
Impervious fraction of off-site area =	**0**	
Off-site Runoff Coefficient =	**0.00**	
Off-site Water Quality Volume =	**0**	cubic feet
Storage for Sediment =	**1210**	
Total Capture Volume (required water quality volume(s) x 1.20) =	**7,260**	cubic feet

The following sections are used to calculate the required water quality volume(s) for the selected BMP.
The values for BMP Types not selected in cell C45 will show NA.

10. Bioretention System Designed as Required in RG-348 Pages 3-63 to 3-65

Required Water Quality Volume for Bioretention Basin =	**7,260**	cubic feet

Texas Commission on Environmental Quality

TSS Removal Calculations 04-20-2009

Project Name: **Concordia University**
Date Prepared: **12/13/2017**

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1. The Required Load Reduction for the total project: Calculations from RG-348 Pages 3-27 to 3-30

Page 3-29 Equation 3.3: $L_M = 27.2(A_N \times P)$

where:

$L_{M\ TOTAL\ PROJECT}$ = Required TSS removal resulting from the proposed development = 80% of increased load
A_N = Net increase in impervious area for the project
P = Average annual precipitation, inches

Spring "E" - Pond E1

Site Data: Determine Required Load Removal Based on the Entire Project

County =	Travis	
Total project area included in plan * =	52.47	acres
Predevelopment impervious area within the limits of the plan * =	0.00	acres
Total post-development impervious area within the limits of the plan* =	4.60	acres
Total post-development impervious cover fraction * =	0.09	
P =	32	inches
$L_{M\ TOTAL\ PROJECT}$ =	**4,004**	lbs.

5,010 lbs. for 100% TSS Load Increase Removal

*** The values entered in these fields should be for the total project area.**

Number of drainage basins / outfalls areas leaving the plan area = **3**

2. Drainage Basin Parameters (This information should be provided for each basin):

Drainage Basin/Outfall Area No. = **EXISTING BIORETENTION POND E1**

Total drainage basin/outfall area =	1.73	acres
Predevelopment impervious area within drainage basin/outfall area =	0.00	acres
Post-development impervious area within drainage basin/outfall area =	1.33	acres
Post-development impervious fraction within drainage basin/outfall area =	**0.769**	
$L_{M\ THIS\ BASIN}$ =	**1,158**	lbs.

3. Indicate the proposed BMP Code for this basin.

Proposed BMP = **Bioretention**
Removal efficiency = **89** percent

Aqualogic Cartridge Filter
Bioretention
Contech StormFilter
Constructed Wetland
Extended Detention
Grassy Swale
Retention / Irrigation
Sand Filter
Stormceptor
Vegetated Filter Strips
Vortechs
Wet Basin
Wet Vault

4. Calculate Maximum TSS Load Removed (L_R) for this Drainage Basin by the selected BMP Type.

RG-348 Page 3-33 Equation 3.7: $L_R = (\text{BMP efficiency}) \times P \times (A_I \times 34.6 + A_P \times 0.54)$

where:

A_C = Total On-Site drainage area in the BMP catchment area
A_I = Impervious area proposed in the BMP catchment area
A_P = Pervious area remaining in the BMP catchment area
L_R = TSS Load removed from this catchment area by the proposed BMP

A_C =	1.73	acres
A_I =	1.33	acres

A_P =	**0.40**	acres
L_R =	**1,317**	lbs

5. Calculate Fraction of Annual Runoff to Treat the drainage basin / outfall area

Desired $L_{M\ THIS\ BASIN}$ =	**1,165**	lbs.
F =	**0.88**	

6. Calculate Capture Volume required by the BMP Type for this drainage basin / outfall area. Calculations from RG-348 Pages 3-34 to 3-36

Rainfall Depth =	**1.50**	inches
Post Development Runoff Coefficient =	**0.58**	
On-site Water Quality Volume =	**5,492**	cubic feet

Calculations from RG-348 Pages 3-36 to 3-37

Off-site area draining to BMP =	**0.00**	acres
Off-site Impervious cover draining to BMP =	**0.00**	acres
Impervious fraction of off-site area =	**0**	
Off-site Runoff Coefficient =	**0.00**	
Off-site Water Quality Volume =	**0**	cubic feet
Storage for Sediment =	**1098**	
Total Capture Volume (required water quality volume(s) x 1.20) =	**6,591**	cubic feet

The following sections are used to calculate the required water quality volume(s) for the selected BMP.
The values for BMP Types not selected in cell C45 will show NA.

10. Bioretention System Designed as Required in RG-348 Pages 3-63 to 3-65

Required Water Quality Volume for Bioretention Basin =	**6,591**	cubic feet

Texas Commission on Environmental Quality

TSS Removal Calculations 04-20-2009

Project Name: **Concordia University**
Date Prepared: **12/13/2017**

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1. The Required Load Reduction for the total project: Calculations from RG-348 Pages 3-27 to 3-30

Page 3-29 Equation 3.3: $L_M = 27.2(A_N \times P)$

where:

$L_{M\ TOTAL\ PROJECT}$ = Required TSS removal resulting from the proposed development = 80% of increased load
A_N = Net increase in impervious area for the project
P = Average annual precipitation, inches

Spring "E" - Swale E2

Site Data: Determine Required Load Removal Based on the Entire Project

County =	Travis	
Total project area included in plan * =	52.47	acres
Predevelopment impervious area within the limits of the plan * =	0.00	acres
Total post-development impervious area within the limits of the plan* =	4.60	acres
Total post-development impervious cover fraction * =	0.09	
P =	32	inches
$L_{M\ TOTAL\ PROJECT}$ =	**4,004**	lbs.

5,010 lbs. for 100% TSS Load Increase Removal

*** The values entered in these fields should be for the total project area.**

Number of drainage basins / outfalls areas leaving the plan area = 3

2. Drainage Basin Parameters (This information should be provided for each basin):

Drainage Basin/Outfall Area No. = EXISTING GRASSY SWALE E2

Total drainage basin/outfall area =	4.18	acres
Predevelopment impervious area within drainage basin/outfall area =	0.00	acres
Post-development impervious area within drainage basin/outfall area =	3.27	acres
Post-development impervious fraction within drainage basin/outfall area =	**0.78**	
$L_{M\ THIS\ BASIN}$ =	**2,846**	lbs.

3. Indicate the proposed BMP Code for this basin.

Proposed BMP = Grassy Swale
Removal efficiency = **83.35** percent

Aqualogic Cartridge Filter
Bioretention
Contech StormFilter
Constructed Wetland
Extended Detention
Grassy Swale
Retention / Irrigation
Sand Filter
Stormceptor
Vegetated Filter Strips
Vortechs
Wet Basin
Wet Vault

4. Calculate Maximum TSS Load Removed (L_R) for this Drainage Basin by the selected BMP Type.

RG-348 Page 3-33 Equation 3.7: $L_R = (\text{BMP efficiency}) \times P \times (A_I \times 34.6 + A_P \times 0.54)$

where:

A_C = Total On-Site drainage area in the BMP catchment area
A_I = Impervious area proposed in the BMP catchment area
A_P = Pervious area remaining in the BMP catchment area
L_R = TSS Load removed from this catchment area by the proposed BMP

A_C = 4.18 acres
A_I = 3.27 acres

A_P = **0.91** acres
L_R = **3,031** lbs

5. Calculate Fraction of Annual Runoff to Treat the drainage basin / outfall area

Desired $L_{M\ THIS\ BASIN}$ = **3,031** lbs. **<== THIS IS USED FOR BOTH THE GRASSY SWALE AND SAND FILTER POND, COMBINED**

F = **1.00**

THE SIZING REQUIREMENTS FOR THE FOLLOWING BMPs / LOAD REMOVALS ARE BASED UPON FLOW RATES - NOT CALCULATED WATER QUALITY VOLUI

15. Grassy Swales Designed as Required in RG-348 Pages 3-51 to 3-54

Design parameters for the swale:

Drainage Area to be Treated by the Swale = A =	4.18	acres
Impervious Cover in Drainage Area =	3.27	acres
Rainfall intensity = i =	1.1	in/hr
Swale Slope =	0.01	ft/ft
Side Slope (z) =	3	
Design Water Depth = y =	0.65	ft
Weighted Runoff Coefficient = C =	0.65	
A_{CS} = cross-sectional area of flow in Swale =	5.35	sf
P_W = Wetted Perimeter =	10.39	feet
R_H = hydraulic radius of flow cross-section = A_{CS}/P_W =	0.51	feet
n = Manning's roughness coefficient =	0.2	

15A. Using the Method Described in the RG-348

Manning's Equation: $Q = \frac{1.49}{n} A_{CS} R_H^{2/3} S^{0.5}$

$b = \frac{0.134 \times Q}{y^{1.67} S^{0.5}} - zy$ = 6.28 feet

Q = CiA = 2.99 cfs

To calculate the flow velocity in the swale:

V (Velocity of Flow in the swale) = Q/A_{CS} = 0.56 ft/sec

To calculate the resulting swale length:

L = Minimum Swale Length = V (ft/sec) * 300 (sec) = 167.75 feet

If any of the resulting values do not meet the design requirement set forth in RG-348, the design parameters must be modified and the solver rerun.

Texas Commission on Environmental Quality

TSS Removal Calculations 04-20-2009

Project Name: Concordia University
Date Prepared: 12/13/2017

Additional information is provided for cells with a red triangle in the upper right corner. Place the cursor over the cell.
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1. The Required Load Reduction for the total project: Calculations from RG-348 Pages 3-27 to 3-30

Page 3-29 Equation 3.3: $L_M = 27.2(A_N \times P)$

where:

$L_{M\ TOTAL\ PROJECT}$ = Required TSS removal resulting from the proposed development = 80% of increased load
A_N = Net increase in impervious area for the project
P = Average annual precipitation, inches

Spring "E" - Pond E3

Site Data: Determine Required Load Removal Based on the Entire Project

County =	Travis	
Total project area included in plan * =	52.47	acres
Predevelopment impervious area within the limits of the plan * =	0.00	acres
Total post-development impervious area within the limits of the plan* =	4.60	acres
Total post-development impervious cover fraction * =	0.09	
P =	32	inches

$L_{M\ TOTAL\ PROJECT}$ = **4,004** lbs. **5,010 lbs. for 100% TSS Load Increase Removal**

*** The values entered in these fields should be for the total project area.**

Number of drainage basins / outfalls areas leaving the plan area = 3

2. Drainage Basin Parameters (This information should be provided for each basin):

Drainage Basin/Outfall Area No. = EXISTING SAND FILTER POND E3

Total drainage basin/outfall area =	4.56	acres
Predevelopment impervious area within drainage basin/outfall area =	0.00	acres
Post-development impervious area within drainage basin/outfall area =	3.27	acres
Post-development impervious fraction within drainage basin/outfall area =	0.717	
$L_{M\ THIS\ BASIN}$ =	2,846	lbs.

3. Indicate the proposed BMP Code for this basin.

Proposed BMP = Sand Filter
Removal efficiency = 83.35 percent

Aqualogic Cartridge Filter
Bioretention
Contech StormFilter
Constructed Wetland
Extended Detention
Grassy Swale
Retention / Irrigation
Sand Filter
Stormceptor
Vegetated Filter Strips
Vortechs
Wet Basin
Wet Vault

4. Calculate Maximum TSS Load Removed (L_R) for this Drainage Basin by the selected BMP Type.

RG-348 Page 3-33 Equation 3.7: $L_R = (\text{BMP efficiency}) \times P \times (A_I \times 34.6 + A_P \times 0.54)$

where:

A_C = Total On-Site drainage area in the BMP catchment area
A_I = Impervious area proposed in the BMP catchment area
A_P = Pervious area remaining in the BMP catchment area
L_R = TSS Load removed from this catchment area by the proposed BMP

A_C = 4.56 acres
A_I = 3.27 acres

A_P =	**1.29**	acres
L_R =	**3,036**	lbs

5. Calculate Fraction of Annual Runoff to Treat the drainage basin / outfall area

Desired $L_{M\ THIS\ BASIN}$ =	**3,036**	lbs.	**<== THIS IS USED FOR BOTH THE GRASSY SWALE AND SAND FILTER POND, COMBINED**
F =	**1.00**		

6. Calculate Capture Volume required by the BMP Type for this drainage basin / outfall area. Calculations from RG-348 Pages 3-34 to 3-36

Rainfall Depth =	**4.00**	inches
Post Development Runoff Coefficient =	**0.52**	
On-site Water Quality Volume =	**34,638**	cubic feet

Calculations from RG-348 Pages 3-36 to 3-37

Off-site area draining to BMP =	**0.00**	acres
Off-site Impervious cover draining to BMP =	**0.00**	acres
Impervious fraction of off-site area =	**0**	
Off-site Runoff Coefficient =	**0.00**	
Off-site Water Quality Volume =	**0**	cubic feet
Storage for Sediment =	**6928**	
Total Capture Volume (required water quality volume(s) x 1.20) =	**41,566**	cubic feet

The following sections are used to calculate the required water quality volume(s) for the selected BMP.
The values for BMP Types not selected in cell C45 will show NA.

9. Filter area for Sand Filters Designed as Required in RG-348 Pages 3-58 to 3-63

9B. Partial Sedimentation and Filtration System

Water Quality Volume for combined basins =	**41566**	cubic feet	
Minimum filter basin area =	**3464**	square feet	
Maximum sedimentation basin area =	**13855**	square feet	**For minimum water depth of 2 feet**
Minimum sedimentation basin area =	**866**	square feet	**For maximum water depth of 8 feet**

Texas Commission on Environmental Quality

TSS Removal Calculations 04-20-2009

Project Name: **Concordia University**
Date Prepared: **12/13/2017**

Additional information is provided for cells with a red triangle in the upper right corner. Place the cursor over the cell.
Text shown in blue indicate location of instructions in the Technical Guidance Manual - RG-348.
Characters shown in red are data entry fields.
Characters shown in black (Bold) are calculated fields. Changes to these fields will remove the equations used in the spreadsheet.

1. The Required Load Reduction for the total project: Calculations from RG-348 Pages 3-27 to 3-30

Page 3-29 Equation 3.3: $L_M = 27.2(A_N \times P)$

where:

$L_{M\ TOTAL\ PROJECT}$ = Required TSS removal resulting from the proposed development = 80% of increased load
A_N = Net increase in impervious area for the project
P = Average annual precipitation, inches

Spring "F" - ADDITIONAL IMPERVIOUS COVER FOR TSS LOAD ONLY

Site Data: Determine Required Load Removal Based on the Entire Project

County =	**Travis**	
Total project area included in plan * =	**62.52**	acres
Predevelopment impervious area within the limits of the plan * =	**0.00**	acres
Total post-development impervious area within the limits of the plan* =	**4.62**	acres
Total post-development impervious cover fraction * =	**0.07**	
P =	**32**	inches

$L_{M\ TOTAL\ PROJECT}$ = **4,021** lbs. **5,032 lbs. for 100% TSS Load Increase Removal**

*** The values entered in these fields should be for the total project area.**

Number of drainage basins / outfalls areas leaving the plan area = **1**

Texas Commission on Environmental Quality

TSS Removal Calculations 04-20-2009

Project Name: **Concordia University**
Date Prepared: **12/13/2017**

Additional information is provided for cells with a red triangle in the upper right corner. Place the cursor over the cell.
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1. The Required Load Reduction for the total project: Calculations from RG-348 Pages 3-27 to 3-30

Page 3-29 Equation 3.3: $L_M = 27.2(A_N \times P)$

where:

$L_{M\ TOTAL\ PROJECT}$ = Required TSS removal resulting from the proposed development = 80% of increased load
A_N = Net increase in impervious area for the project
P = Average annual precipitation, inches

Spring "G" - Pond G1

Site Data: Determine Required Load Removal Based on the Entire Project

County =	Travis	
Total project area included in plan * =	94.12	acres
Predevelopment impervious area within the limits of the plan * =	0.00	acres
Total post-development impervious area within the limits of the plan* =	12.42	acres
Total post-development impervious cover fraction * =	0.13	
P =	32	inches

$L_{M\ TOTAL\ PROJECT}$ = **10,810** lbs. **13,527 lbs. for 100% TSS Load Increase Removal**

*** The values entered in these fields should be for the total project area.**

Number of drainage basins / outfalls areas leaving the plan area = **1**

2. Drainage Basin Parameters (This information should be provided for each basin):

Drainage Basin/Outfall Area No. = **EXISTING SAND FILTER POND G1**

Total drainage basin/outfall area =	17.18	acres
Predevelopment impervious area within drainage basin/outfall area =	0.00	acres
Post-development impervious area within drainage basin/outfall area =	7.79	acres
Post-development impervious fraction within drainage basin/outfall area =	0.454	
$L_{M\ THIS\ BASIN}$ =	6,785	lbs.

3. Indicate the proposed BMP Code for this basin.

Proposed BMP = **Sand Filter**
Removal efficiency = **89** percent

Aqualogic Cartridge Filter
Bioretention
Contech StormFilter
Constructed Wetland
Extended Detention
Grassy Swale
Retention / Irrigation
Sand Filter
Stormceptor
Vegetated Filter Strips
Vortechs
Wet Basin
Wet Vault

4. Calculate Maximum TSS Load Removed (L_R) for this Drainage Basin by the selected BMP Type.

RG-348 Page 3-33 Equation 3.7: $L_R = (\text{BMP efficiency}) \times P \times (A_I \times 34.6 + A_P \times 0.54)$

where:

A_C = Total On-Site drainage area in the BMP catchment area
A_I = Impervious area proposed in the BMP catchment area
A_P = Pervious area remaining in the BMP catchment area
L_R = TSS Load removed from this catchment area by the proposed BMP

A_C = **17.18** acres
A_I = **7.79** acres

A_P =	**9.39**	acres
L_R =	**7,826**	lbs

5. Calculate Fraction of Annual Runoff to Treat the drainage basin / outfall area

Desired $L_{M\ THIS\ BASIN}$ =	**7,150**	lbs.
F =	**0.91**	

6. Calculate Capture Volume required by the BMP Type for this drainage basin / outfall area. Calculations from RG-348 Pages 3-34 to 3-36

Rainfall Depth =	**1.80**	inches
Post Development Runoff Coefficient =	**0.33**	
On-site Water Quality Volume =	**37,403**	cubic feet

Calculations from RG-348 Pages 3-36 to 3-37

Off-site area draining to BMP =	**0.00**	acres
Off-site Impervious cover draining to BMP =	**0.00**	acres
Impervious fraction of off-site area =	**0**	
Off-site Runoff Coefficient =	**0.00**	
Off-site Water Quality Volume =	**0**	cubic feet
Storage for Sediment =	**7481**	
Total Capture Volume (required water quality volume(s) x 1.20) =	**44,883**	cubic feet

The following sections are used to calculate the required water quality volume(s) for the selected BMP.
The values for BMP Types not selected in cell C45 will show NA.

9. Filter area for Sand Filters Designed as Required in RG-348 Pages 3-58 to 3-63

9B. Partial Sedimentation and Filtration System

Water Quality Volume for combined basins =	**44,883**	cubic feet	
Minimum filter basin area =	**3,740**	square feet	
Maximum sedimentation basin area =	**14,961**	square feet	**For minimum water depth of 2 feet**
Minimum sedimentation basin area =	**935**	square feet	**For maximum water depth of 8 feet**

Texas Commission on Environmental Quality

TSS Removal Calculations 04-20-2009

Project Name: **Concordia University**
Date Prepared: **12/14/2017**

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1. The Required Load Reduction for the total project: Calculations from RG-348 Pages 3-27 to 3-30

Page 3-29 Equation 3.3: $L_M = 27.2(A_N \times P)$

where:

$L_{M\ TOTAL\ PROJECT}$ = Required TSS removal resulting from the proposed development = 80% of increased load
A_N = Net increase in impervious area for the project
P = Average annual precipitation, inches

Spring "H" - Pond H1

Site Data: Determine Required Load Removal Based on the Entire Project

County =	Travis	
Total project area included in plan * =	247.88	acres
Predevelopment impervious area within the limits of the plan * =	0.00	acres
Total post-development impervious area within the limits of the plan* =	31.18	acres
Total post-development impervious cover fraction * =	0.13	
P =	32	inches

$L_{M\ TOTAL\ PROJECT}$ = **27,139** lbs. **33,959 lbs. for 100% TSS Load Increase Removal**

*** The values entered in these fields should be for the total project area.**

Number of drainage basins / outfalls areas leaving the plan area = **2**

2. Drainage Basin Parameters (This information should be provided for each basin):

Drainage Basin/Outfall Area No. = EXISTING SAND FILTER POND H1

Total drainage basin/outfall area =	8.64	acres
Predevelopment impervious area within drainage basin/outfall area =	0.00	acres
Post-development impervious area within drainage basin/outfall area =	5.45	acres
Post-development impervious fraction within drainage basin/outfall area =	0.631	
$L_{M\ THIS\ BASIN}$ =	4,746	lbs.

3. Indicate the proposed BMP Code for this basin.

Proposed BMP = **Sand Filter**
Removal efficiency = **89** percent

Aqualogic Cartridge Filter
Bioretention
Contech StormFilter
Constructed Wetland
Extended Detention
Grassy Swale
Retention / Irrigation
Sand Filter
Stormceptor
Vegetated Filter Strips
Vortechs
Wet Basin
Wet Vault

4. Calculate Maximum TSS Load Removed (L_R) for this Drainage Basin by the selected BMP Type.

RG-348 Page 3-33 Equation 3.7: $L_R = (\text{BMP efficiency}) \times P \times (A_I \times 34.6 + A_P \times 0.54)$

where:

A_C = Total On-Site drainage area in the BMP catchment area
A_I = Impervious area proposed in the BMP catchment area
A_P = Pervious area remaining in the BMP catchment area
L_R = TSS Load removed from this catchment area by the proposed BMP

A_C = **8.64** acres
A_I = **5.45** acres

A_P =	**3.19**	acres
L_R =	**5,422**	lbs

5. Calculate Fraction of Annual Runoff to Treat the drainage basin / outfall area

Desired $L_{M\ THIS\ BASIN}$ =	**4,900**	lbs.
F =	**0.90**	

6. Calculate Capture Volume required by the BMP Type for this drainage basin / outfall area. Calculations from RG-348 Pages 3-34 to 3-36

Rainfall Depth =	**1.70**	inches
Post Development Runoff Coefficient =	**0.44**	
On-site Water Quality Volume =	**23,668**	cubic feet

Calculations from RG-348 Pages 3-36 to 3-37

Off-site area draining to BMP =	**0.00**	acres
Off-site Impervious cover draining to BMP =	**0.00**	acres
Impervious fraction of off-site area =	**0**	
Off-site Runoff Coefficient =	**0.00**	
Off-site Water Quality Volume =	**0**	cubic feet
Storage for Sediment =	**4734**	
Total Capture Volume (required water quality volume(s) x 1.20) =	**28,402**	cubic feet

The following sections are used to calculate the required water quality volume(s) for the selected BMP.
The values for BMP Types not selected in cell C45 will show NA.

9. Filter area for Sand Filters Designed as Required in RG-348 Pages 3-58 to 3-63

9B. Partial Sedimentation and Filtration System

Water Quality Volume for combined basins =	**28,402**	cubic feet	
Minimum filter basin area =	**2,367**	square feet	
Maximum sedimentation basin area =	**9,467**	square feet	**For minimum water depth of 2 feet**
Minimum sedimentation basin area =	**592**	square feet	**For maximum water depth of 8 feet**

Texas Commission on Environmental Quality

TSS Removal Calculations 04-20-2009

Project Name: **Concordia University**
Date Prepared: **12/14/2017**

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1. The Required Load Reduction for the total project: Calculations from RG-348 Pages 3-27 to 3-30

Page 3-29 Equation 3.3: $L_M = 27.2(A_N \times P)$

where:

$L_{M\ TOTAL\ PROJECT}$ = Required TSS removal resulting from the proposed development = 80% of increased load
A_N = Net increase in impervious area for the project
P = Average annual precipitation, inches

Spring "H" - Pond H2

Site Data: Determine Required Load Removal Based on the Entire Project

County =	Travis	
Total project area included in plan * =	247.88	acres
Predevelopment impervious area within the limits of the plan * =	0.00	acres
Total post-development impervious area within the limits of the plan* =	31.18	acres
Total post-development impervious cover fraction * =	0.13	
P =	32	inches

$L_{M\ TOTAL\ PROJECT}$ = **27,139** lbs. **33,959 lbs. for 100% TSS Load Increase Removal**

*** The values entered in these fields should be for the total project area.**

Number of drainage basins / outfalls areas leaving the plan area = **2**

2. Drainage Basin Parameters (This information should be provided for each basin):

Drainage Basin/Outfall Area No. = EXISTING SAND FILTER POND H2

Total drainage basin/outfall area =	1.31	acres
Predevelopment impervious area within drainage basin/outfall area =	0.00	acres
Post-development impervious area within drainage basin/outfall area =	0.23	acres
Post-development impervious fraction within drainage basin/outfall area =	0.178	
$L_{M\ THIS\ BASIN}$ =	203	lbs.

3. Indicate the proposed BMP Code for this basin.

Proposed BMP = **Sand Filter**
Removal efficiency = **89** percent

Aqualogic Cartridge Filter
Bioretention
Contech StormFilter
Constructed Wetland
Extended Detention
Grassy Swale
Retention / Irrigation
Sand Filter
Stormceptor
Vegetated Filter Strips
Vortechs
Wet Basin
Wet Vault

4. Calculate Maximum TSS Load Removed (L_R) for this Drainage Basin by the selected BMP Type.

RG-348 Page 3-33 Equation 3.7: $L_R = (\text{BMP efficiency}) \times P \times (A_I \times 34.6 + A_P \times 0.54)$

where:

A_C = Total On-Site drainage area in the BMP catchment area
A_I = Impervious area proposed in the BMP catchment area
A_P = Pervious area remaining in the BMP catchment area
L_R = TSS Load removed from this catchment area by the proposed BMP

A_C = **1.31** acres
A_I = **0.23** acres

A_P =	**1.08**	acres
L_R =	**247**	lbs

5. Calculate Fraction of Annual Runoff to Treat the drainage basin / outfall area

Desired $L_{M\ THIS\ BASIN}$ =	**247**	lbs.
F =	**1.00**	

6. Calculate Capture Volume required by the BMP Type for this drainage basin / outfall area. Calculations from RG-348 Pages 3-34 to 3-36

Rainfall Depth =	**4.00**	inches
Post Development Runoff Coefficient =	**0.19**	
On-site Water Quality Volume =	**3,545**	cubic feet

Calculations from RG-348 Pages 3-36 to 3-37

Off-site area draining to BMP =	**0.00**	acres
Off-site Impervious cover draining to BMP =	**0.00**	acres
Impervious fraction of off-site area =	**0**	
Off-site Runoff Coefficient =	**0.00**	
Off-site Water Quality Volume =	**0**	cubic feet
Storage for Sediment =	**709**	
Total Capture Volume (required water quality volume(s) x 1.20) =	**4,254**	cubic feet

The following sections are used to calculate the required water quality volume(s) for the selected BMP.
The values for BMP Types not selected in cell C45 will show NA.

9. Filter area for Sand Filters Designed as Required in RG-348 Pages 3-58 to 3-63

9B. Partial Sedimentation and Filtration System

Water Quality Volume for combined basins =	**4,254**	cubic feet	
Minimum filter basin area =	**355**	square feet	
Maximum sedimentation basin area =	**1,418**	square feet	**For minimum water depth of 2 feet**
Minimum sedimentation basin area =	**89**	square feet	**For maximum water depth of 8 feet**

Appendix E:
Integrated Pest Management Plan

Integrated Pest Management (IPM) Plan

Concordia University Texas

Michael Cattau – Senior Director of Facilities & Capital Projects

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Concordia University Texas recognizes the potentially serious risks inherent in using chemical pesticides on the campus – especially in an environmentally sensitive setting. It is committed to implementing a comprehensive Integrated Pest Management Plan (IPM) for all maintained vegetated areas on its campus. The IPM plan is defined as the coordinated use of physical, biological and cultural controls, and in the face of any public health threat or substantial property damage, the use of least-toxic pest control chemicals.

The objectives for using an IPM plan for the Concordia University Texas main campus are to:

- ✓ Maintain a safe and sustainable campus environment;
- ✓ Protect the health of students, faculty, staff and visitors by controlling or eliminating pests that pose an imminent threat to public health and safety;
- ✓ Reduce or eliminate human exposure to pesticides through use of least-risk management practices;
- ✓ Reduce or prevent pest damage to campus property, especially athletic playing areas;
- ✓ Reduce or eliminate environmental pollution and degradation;
- ✓ Maintain economically sound practices for pest management;
- ✓ Protect all threatened and endangered species and their habitats; and
- ✓ Enhance the overall quality of life for those who work at, live in or use campus athletic fields.

Integrated Pest Management is understood to involve monitoring of pest populations, establishment of tolerance thresholds, modifications of habitats (to eliminate sources of food, water and harborage and entry), utilization of least-toxic controls, keeping records and evaluation of performance on an ongoing basis on the campus. It is the responsibility of the Director of Facilities Management and athletic personnel to ensure that any maintenance and pest control services hired by Concordia University comply with the best practices listed in this IPM plan to minimize the use of fertilizers, pesticides and herbicides.

A *pesticide* is defined as any insecticide, rodenticide, herbicide, algaecide, disinfectant or other chemical utilized to kill or repel a pest. Any use of chemicals will be in compliance with federal and state laws.

PART A – PROJECT DESCRIPTION

I. **Project name:** *Concordia University Texas – Campus IPM*

II. **Project type:** *Ongoing campus operations*

III. **Project address:** *11400 Concordia University Drive, Austin, TX 78726*

IV. **Responsible party:** *Concordia University Texas, c/o Michael Cattau (Senior Director of Facilities & Capital Projects), 512-313-4064*

V. **Reason for IPM requirement:** *BMP, Integration into revised HCP (2018)*

VI. **Water Quality Reviewer:**

VII. **IPM Plan Reviewer:**

VIII. **Landscape:**
- A. **Playing field turf acreage:** *none (all athletic turf is artificial)*
- B. **Ornamental acreage:** *3*
- C. **Native landscaped area:** *27*
- D. **Total Campus acreage** *30*

IX. **Built Structures:**
- A. **Estimated floor area:** *Approximately 600,000-800,000 square feet (at full build-out)*
- B. **Estimated pavement / sidewalks:** *See master plan*

X. **Site plan:** *A copy of the 2016 Campus Master Plan is attached showing the future build out for the campus. Note: The construction of playing fields, buildings and other facilities will be phases over several years.*

PART B – ANTICIPATED PEST PROBLEMS

Concordia University Texas' campus in northwest Austin is located in an environmentally sensitive area adjacent to tracts of the Balcones Canyonlands Preserve. Much of the developable property is populated by a mixture of cedar and live oak trees with the land heavily covered with a wide range of rocks. All areas, whether intentionally landscaped or naturally managed feature native plant species and very minimal irrigation.

<u>Potential Pests of intentionally landscaped areas and trails</u>: The treatment strategies for these pests are described in Part C of this document.

A. Lawn weeds:
Any plant other than the desired turf grass or ornamental plants, shrubs or trees may be considered a weed. Specific weeds that are commonly encountered in lawns, landscaped beds, and granite pathways include crab grass, dallis grass, annual bluegrass, spurge, goose grass and many others, including annual and perennial species.

Crab grass

Dallis grass

Bluegrass

Spurge

Goose grass

B. Landscaping diseases:
Leaf spot (Helminthosporium spp.), brown patch (Rhizoctonia spp.), rust (Puccinia spp.), spring dead spot (Leptosphaeria korrae), pythium (Pythium spp.), dollar spot (Sclerotonia homoeocarpa) and take-all patch (Gaeumannomyces graminis).

Leaf spot

Brown patch

Dollar spot

C. Landscaping Insects:
Fire ants (Solenopsis invicta), mole crickets (Scapteriscus borellia), sod webworms (Herpetogramma phaeopteralis), armyworms (Spodoptera spp.), grubs (Phyllophaga crinita and others), and chinch bugs (Blissus leucopterus).

D. Other Landscaping Problems:
Drought stress, soil compaction, iron chlorosis and shade stress

PART C – TREATMENT STRATEGY

<u>Pests and other Lawn Problems of Landscaping Areas</u>

The following treatment strategies address pests and problems of the maintained landscaped areas including beds, paths and lawn areas.

I. PEST DESCRIPTION:

A. Pests and problems as listed in Part B of this IPM Plan and as identified by a professional landscape maintenance company.

II. TOLERANCE THRESHOLD:

A. **Weeds:** *The goal for the managed landscape areas is not to eliminate all weeds; it is to keep weed numbers low enough to prevent significant visual damage. B*eds, paths and lawn areas *are very dynamic ecosystems, and even under optimum growing conditions some weeds will become established. Treatment for weeds are considered necessary if weed growth causes the lawn surface to be too uneven, trails and beds unnecessarily infested to the point of unaesthetic affect and/or danger to users or health of intended plant species.*

B. **Diseases:** *Lawn diseases, if encountered, are managed quickly after discovery to minimize the spread of disease.*

C. **Insects:** *The presence of an infestation is verified prior to treatment. Treatment for insect infestation is considered necessary when damage is noticeable, unsightly and/or impacting use of affected areas or areas nearby – particularly built structures. Positive identification of the insect pest is made prior to the use of a chemical control and only applied in or around built structures and not as broad-spectrum treatment of beds, paths and lawn areas. Several treatment thresholds is noted in the following information.*

1. **Armyworms**: *identified by a professional and treated at 5 per square foot.*

2. **Chinch bugs**: *identified by flushing with water and treated when characteristic damage is evident.*

3. **Fire ants**: *identified by characteristic mound, aggressive behavior or biting; treated when at least one colony exists in a sensitive area, or several colonies exist in a non-sensitive area.*

4. **Grubs**: *verified by digging, and treated at a minimum o 5 per square foot.*

5. **Mole crickets**: *identified by a professional and treated at 3 per square foot.*

6. **Sod webworms**: *identified by a professional and treated at 5 per square foot.*

Note: The thresholds described above are minimum thresholds for potential action. Depending on the affected area, it's location and proximity to built structures, the nature of the infestation and the potential hazard to people and/or endangered or protected species, Concordia may allow the threshold to be much greater before action is taken.

D. **Other lawn problems**: Concordia University Texas will use the *Grow Green's Earth-wise* guides to *Lawn Problems* to identify miscellaneous turf issues. Treatment will occur when damage becomes intolerable.

III. PREVENTATIVE MEASURES AND TREATMENT:

A. Concordia University Texas uses the following management techniques will be employed, with preference given to using the least-toxic methods first.

B. **Physical**: Physical measures include the use of set backs and buffer zones adjacent to environmentally sensitive areas surrounding beds, paths and lawn areas. Buffer zones receive no pesticide, herbicide or fertilizer applications.

1. **Weeds**: *Pulling or weed-eating will be used to remove rank growth before weeds have flowered and set to seed.*
2. **Diseases**: *Physical removal of diseased turf may be possible if the disease is discovered early enough.*
3. **Insects**: *When possible, pest insects will be physically eradicated.*
4. **Other lawn problems**: *Shade stress will be managed by pruning tree branches to minimize shade whenever appropriate, or turf will*

be removed and replaced with groundcover. Stress from compaction will be minimized in the following ways:

a) Use of pavement in pedestrian pathways

b) Physical barriers or signs to prevent foot traffic on landscaped areas

C. **Cultural**: Consistent use of the following cultural lawn care practices will provide high quality turf and successfully limit weed, disease, insect and other lawn problems. The presence of weeds and other pests can often be correlated to stressful lawn maintenance practices. A professional landscape maintenance company will monitor all lawn maintenance on beds, paths and lawn areas, as coordinated by the Senior Director of Facilities & Capital Projects. The following cultural methods will be utilized at Concordia University Texas:

1. **Automatic irrigation**: *An automatic irrigation system with a rain sensor will be utilized for some turf areas. Irrigation will be monitored and scheduled to prevent over and under watering.*

2. **Mowing**: *Regular mowing before weeds can set to seed will be practiced. Grass clippings will not be removed.*

3. **Aeration**: *Lawns will be aerated regularly, as needed. Aeration will occur more frequently in areas that are compacted by frequent foot traffic or athletic play.*

D. **Biological**: Biological control tactics for weeds, insects, diseases and other lawn issues will be employed when possible.

1. **Weeds**: *There are no biological controls proposed for weeds at this time.*

2. **Diseases**: *There are no biological controls proposed for diseases at this time.*

3. **Insects**: *Biological control of caterpillars, such as armyworms and sod webworms, shall include the use of the bacteria Bacillus thuringiensis (Bt). More information about Bt can be found in Grow Green's Earth-wise Guide to Caterpillars.*

Table 1 – Biological Controls for Specific Insect Pests

PEST		CONTROL	
Common Name	**Scientific Name**	**Active Ingredient**	**Product Name**
Armyworms	Spodoptera spp.	Bacillus thuringiensis	*Dipel ®*
Sod webworms	Herpetogramma phaeopteralis	Bacillus thuringiensis	*Dipel ®*

IV. **Chemical**: Chemical controls will only be employed on an "as-needed" basis when problems exist that have not been or cannot be addressed by physical, cultural or biological practices.

A. **Weeds**: *Initial spot treatment will be with acetic acid / horticultural grade vinegar ('CedarCide RidAWeed' and 'Burnout'). If required, spot treatment with glyphosate ('Roundup') will be used. Minimal pre-emergent herbicide use will be practiced. For nutgrass, Manage (halosulfuron) will be used, if necessary.*

B. **Diseases**: *Least toxic chemical controls for brown patch and take-all patch include corn gluten meal (Concern ® Weed Prevention Plus) and Thiophanate methyl (Green Light ® Systemic Fungicide Disease Control).*

C. **Insects**: Positive identification of the insect pest will be made prior to the use of a chemical control and only applied in or around built structures and not as broad spectrum treatment of beds, paths and lawn areas.

Table 2 – Chemical Controls for Specific Insect Pests

PEST		CONTROL	
Common Name	**Scientific Name**	**Active Ingredient**	**Product Name**
Chinch bugs	Blissus leucopterus	Potassium salts of fatty acids	*Safer ® Insecticidal Soap*
Grubs	Phyllophaga spp.	Halofenozide	*Ortho ® Grub-B-Gone*

V. USE OF THIS IPM PLAN

Pesticide products change on a regular basis, and those listed in this plan are provided for reference only. Listing of a specific product trade name does not constitute an endorsement of its use. Many pesticide products other than those listed in this plan are available and may be suitable for use. If a pest problem occurs that is not addressed by this management plan, or if the Director of Facilities Management desires to use pesticides of greater toxicity than those listed, the director shall alert the City of Austin IPM coordinator.

VI. APPLICATION OF PESTICIDES OR CHEMICALS

When it is determined that pesticides or chemicals are needed for pest management on campus athletic fields, only products registered for use in the State of Texas will be applied with strict adherence to label directions. Applications will be undertaken only by personnel from a licensed pest control company or qualified university staff.

VII. NOTIFICATION

Appropriate signs and notifications are posted on or around beds, paths and lawn areas notifying faculty, staff and students prior to pest management activities that involve application of pesticides, herbicides or other potential chemical applications that could be harmful to humans. Appropriate efforts are made to eliminate individuals coming in contact with any such applications to beds, paths and lawn areas within manufacturer specifications.

VIII. RECORDKEEPING

A log book of all pest sightings and pest management activities on campus are kept in the office of the Senior Director of Facilities & Capital Projects, 11400 Concordia University Drive, Austin, TX 78726 (Building B). This log is kept current by the Senior Director of Facilities & Capital Projects and will be available for public viewing upon request. Additionally, any time a pesticide is used for pest management purposes, a copy of the pesticide label, as well as the pesticide's Safety Data Sheet (SDS) is kept on record in an easily accessible location as a reference for applicators on proper use, storage and safety.

Appendix F:
Hazardous Material Plan

Spill Containment

Meeting Objectives

To review the procedures for responding to and containing spills. The result should be immediate and correct response in the event of a spill.

Suggested Materials to Have on Hand

- Material safety data sheets
- Spill containment materials (dike-building materials, absorbents, etc.)
- Personal protective equipment.

Introduction/Overview

When you work with hazardous and flammable substances, leaks and spills are always a concern. We take many steps to prevent leaks and spills: using the proper containers, inspecting them regularly to make sure they're in good condition, and following proper procedures when using and transferring substances. But sometimes accidents still happen.

Our training program includes procedures to follow when there's a spill, and we have people trained for the task. But even if you're not on a spill response team, you have a role to play in handling these accidents quickly and properly. We're going to review the procedures today, along with an overview of what's actually done to handle a spill.

Since spills don't occur often, it's important that we regularly remind ourselves of how to handle them so that if a spill does occur, we'll know just what to do to keep it from getting out of hand.

EPA Regulations

The Resource Conservation and Recovery Act (RCRA) requires companies that create or handle hazardous wastes to have contingency plans for emergencies, including spills. We have such a plan and it's the source of most of the information we'll be discussing today.

RCRA also requires spills to be reported to the EPA. Many spills also have to be reported to representatives of the local community according to the provisions of the Emergency Planning and Community Right to Know Act of 1986. That act basically gives communities similar rights to yours: the right to know about hazards to which they could possibly be exposed and what they can do about them.

You don't have to be concerned with the actual reporting requirements of these

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regulations, but they do underline the importance of spills. A large release of toxic chemicals into the air and water can have serious effects not just on people who work here but on people who live and work in the area. All of them, including our families, are depending on us to prevent spills and, if they do occur, to keep them from harming people.

General Hazards

A spill may present a number of hazards; the specific hazards depend, of course, on the substance or substances involved. Among the possibilities are:

- Fire
- Explosion
- Hazardous substances released in the air
- Hazardous substances entering the water supply
- Contamination of individuals who come in contact with the spilled substance

Our spill response procedures are designed to minimize the risk of any of these things happening as a result of a spill or, at the very least, reducing the degree of hazard.

Identifying Hazards

The hazards posed by a spill of a particular substance are detailed on the material safety data sheet. In some cases, the MSDS will even tell you what to use, or not to use, to contain or clean up the substance.

As with all work with hazardous materials, depend on the labels and material safety data sheets to keep you informed about potential hazards and protective measures. When there's a possibility of a spill, you have to be especially alert to reactions: what could happen if the particular substance comes in contact with another chemical or with air or water. As you know, some substances that aren't too high-risk on their own can be real disasters if they react with the wrong thing.

Protection Against Hazards

The first important point about spill containment is to stop it before it gets serious. If you see a leak or even a damp spot on the floor in an area that contains hazardous chemicals, report it to me immediately. If, of course, you see something even bigger, report that immediately, too. Then our basic spill-handling procedures will go into gear.

Safety Procedures

If you're on a spill containment response team, you've been trained to act quickly to clean up the spill and keep it from spreading. You are also provided with the protective

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clothing and equipment you need to do the job safely: boots, gloves, chemical-resistant suits, goggles, and, when necessary, respirators.

The special team may not always be needed for very small spills, but the same overall procedures always apply.

1 . Notify the emergency coordinator immediately if you see a spill. Report what is leaking and where, as well as the size of the spill and rate of flow. The coordinator will tell you whether you can clean it up or if it should be left to trained people. The coordinator will call that special team if needed and will also notify the appropriate state, federal, and local authorities and fire or police departments or other specialists who might be needed.

2 . Evacuate the area if you're not trained for and assigned to spill containment. Alert other workers in the area to get out, too.

If you are part of the spill containment team, you'll get your protective equipment and assemble to get the spill under control. The spill team will look at the MSDS to be sure that they understand what they're working with, what its hazards are, and what to do to contain it.

3 . Contain the spill. This is, of course, the most important part, and the faster the containment starts, the better. This activity has several steps, which happen quickly, and often overlap.

- Stop the source of the leak. Close the valves, pumps, or whatever may be allowing the material out.
- Cover drains or other possible escape routes.
- Patch holes with patch kits, valve pluggers, or whatever is needed.
- Contain the spill by the best method. That might be:
  — Building a dike to keep spilled liquid from getting into water.
  — Repairing the container or putting it in a container that won't leak.
  — Channeling the spill to a place where it won't spread, by diking or pumping, or opening a trench to a secure spot.
  — Placing an empty container under the leak.
  — Rotating or shifting the container's position to stop the leak.
- Use absorbent materials to soak up the spill or to solidify it.
- Push the absorbent-liquid mixture into an EPA-approved container for proper disposal.

4 . Decontaminate. Your protective clothing, as well as any brooms, shovels, or other tools used for the job have to be decontaminated or disposed of in an EPA-approved container. If the material spilled was hazardous, then anything that touched it is hazardous, too.

It's really important to prevent the contaminated materials from spreading into clean

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areas. With some chemicals, just the amount that sticks to the soles of the shoes could contaminate an entire water supply.

So if you or anything you're wearing or using was contaminated, remove it according to company decontamination procedures before you go into a clean area. Some items will have to be disposed of, not cleaned. But be sure to dispose of them properly. Just throwing them in the trash will spread the problem far and wide.

5 . Keep records. This may not be your job, but it is an important part of the process. The measures taken and the materials used to contain the spill will have to be written down, as well as notes on who did what when.

6. Have a medical examination if exposed. That's important, too.

We don't want anything to happen to you, and if there's any question of exposure, it's best to be checked out right at the beginning.

Suggested Discussion Questions

1. What are some of the things that could happen if a hazardous substance spills?
2. How do you find out the hazards of an individual substance?
3. Who is the emergency coordinator here?
4. What should you do if you are the first to notice a spill?
5. What should you do next if you're not on the spill cleanup team?
6. Once they're informed about the spill's specifics and outfitted with protective gear, what does the response team do first?
7. What are some of the possible ways to contain a spill?
8. Why is it important to decontaminate thoroughly after spill cleanup?
9. Are there any other questions?

Wrap-Up

We are all responsible for doing everything possible to prevent spills: making sure containers are intact and handling them carefully. But if there is a spill, we all have responsibilities, too. A hazardous spill can cause a fire or explosion, or release toxic substances into the air or water that can affect not just us, but the people in the surrounding community. So it's vital that we know exactly what to do and that we do it as quickly as possible. The faster the spill is brought under control, the better the chance that it will not harm anyone. That's everyone's goal.

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Sample Handout

Spill Response Checklist	
☐	Report spills immediately.
☐	Evacuate the area if you're not responsible for spill cleanup.
If you are responsible for cleaning up a spill:	
☐	Check the substance's material safety data sheet for hazards, reactivity, proper protective equipment, etc.
☐	Put on protective clothing.
☐	Stop the source of the spill, if possible.
☐	Cover drains or other possible escape routes.
☐	Patch holes.
☐	Contain the spill by:
	—Building a dike
	—Repairing the leaking container
	—Putting the leaking container in one that won't leak
	—Channeling the spill to a place where it won't spread
	—Placing an empty container under the leak
	—Rotating or shifting the container's position to stop the leak.
☐	Soak up or solidify the spill with absorbent materials.
☐	Push the absorbent-liquid mixture into an EPA-approved container for proper disposal.
☐	Decontaminate exposed tools or equipment or dispose of them properly.
☐	Decontaminate protective clothing or dispose of it properly before going into clean area.
☐	Take notes or help a notetaker assemble information on spill containment measures.
☐	Get a medical examination if exposed to a hazardous substance.

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CHEMICAL SPILL CLEAN-UP

Hazardous Chemical Spill Cleanup Guidelines

Chemical spills or hazardous materials emergency situations should be handled as **RESCUE, CONFINE, REPORT, SECURE, AND CLEANUP.**

Rescue
Just as you are not to re-enter a burning building, **DO NOT** go back into an area where a chemical spill has occurred. In many documented cases, rescuers not wearing proper protective equipment have been overcome by toxic or asphyxiating fumes trying to rescue other victims and died as a result. Do not make this mistake.

As you leave an area involved in a chemical spill, assist people exiting the area.

- Evacuate personnel from the spill area.
- Direct personnel to nearest fire exit.
- Alert neighbors.
- Attend to victims.

First Aid

- Remove victim from spill area to fresh air (but do not endanger your own life by entering areas with a toxic atmosphere).
- Immediately remove contaminated clothing.
- Wash skin with soap and water.
- Flush skin and/or eyes with water for a least 15 minutes. (You may not feel any immediate effect from chemical spills, but it is very important to wash quickly and thoroughly as many chemicals can cause severe tissue damage which is not apparent until hours later.)
- Get medical attention for victims.

Chemical spills over large body areas

- Have someone nearby contact emergency personnel for assistance.
- Remove contaminated clothing while under a safety shower.
- Flood affected body area in cool water for at least fifteen minutes.
- Wash off chemicals with mild detergent and water; do not use neutralizing chemicals, unguents, creams, lotions or salves.
- Make sure medical personnel understand exactly what chemicals are involved.

Victims of Hydrogen Fluoride (HF) spills

- Have someone nearby contact emergency medical personnel for assistance.
- Flush with cool water until any whitening of tissue disappears.
- Swath injured areas with soaking wet, iced cloths.
- Get <u>immediate</u> medical help and start Calcium Gluconate Injections immediately

Confine

- Close fire doors.
- Isolate area.
- Establish exhaust ventilation if possible.
- Vent fumes only to outside of building.
- If fumes are in a room, which is not vented to outside of building, close off room.

Report
Contact Emergency Services first when:

- Spills involve injury requiring medical treatment.
- Spills involve fire or explosion hazards.
- Spills are potentially life threatening.

Contact Hazardous Waste Management or Jesse Alcorta at the McMurdo Station when:

- One gallon of a chemical or more or <u>any</u> quantity of a highly reactive or toxic material is spilled.
- An unknown chemical is spilled.
- You do not have proper training or proper protective equipment to perform the cleanup.
- You have any questions or doubts about your ability to clean up the spill.

When contacting Emergency Services, indicate a chemical spill has occurred. Be prepared to provide the following information:

- The name, telephone number, and location of the reporter.
- Location of the incident.
- Time and type of incident.
- Name and quantity of material involved, to the extent known.
- The extent of injuries, if any.
- The possible hazards to human health or the environment outside the facility.
- The safest route to approach the spill.

Warn emergency responders of any other hazards they may encounter, such as large quantities of stored chemicals (particularly flammables, oxidizers, and air-born toxic or irritant materials), radioactive materials or biohazards, etc., on site.

Secure
Until Emergency Responders arrive on the scene, you and your staff will need to block off entrances to the spill site and prevent people from entering the contaminated area.

Cleanup
If you are going to do the cleanup, follow the procedures listed in the "What To Do When You Clean Up A Chemical Spill" section.

What To Do When You Clean Up A Chemical Spill

If you have the proper training, proper personal protective equipment and the proper material to absorb and clean up your chemical spill, and no one has been injured, the spill is contained, and the spill is not life threatening or a fire or explosion hazard, follow these procedures:

1. **Perform all the procedures in the RESCUE, CONFINE, REPORT, and SECURE sections above**, with the exception that you do not need to report the incident to Emergency Services.
2. When cleaning a spill yourself, **locate the spill kit**.
3. **Choose appropriate personal protection**.
    - Always wear protective gloves and eye protection.
    - If there is a chance of body contact, wear an apron and coveralls.
    - If the spill is on the floor, wear rubber or plastic boots (NOT leather).
4. **Remove ignition sources**.
    - Turn off hot plates, stirring motors, flame sources.
    - Shut down all equipment.
    - If unable to shut off sources of ignition, notify emergency responders.
5. **Confine or contain the spill**.
    - Cover with an absorbent mixture.
    - Clean up minor spills with paper towels or sponge if they won't react.
    - Sweep solid materials into a dust pan, place in sealed container.
    - If acid/base, first add a neutralizing agent; sodium bicarbonate for acids, sodium bisulfate for bases.
    - Small amounts of inorganic acids/bases: use neutralizing agent and absorbent material.
    - Small amounts of other materials: absorb with non-reactive material (e.g. vermiculite, sand, towels, Floor-Dri).
    - Large amounts of inorganic acids/bases: neutralize and call for help.
    - Large amounts of other materials: make a judgment call; depending on the amount, toxicity or what the substance can run into or react with, you may handle it yourself or call for help.
6. **Spills that require special handling:**
   Mercury: Small contained spills can be collected for EHS disposal. Other spills should be cleaned up by EHS.
7. **Remove absorbent material with a broom and dust pan.**
    - Place in plastic bag or other appropriate container.
    - Dispose of the material through Hazardous Waste Management as a chemical waste.
8. **Wet mop the spill area**.

Chemical Spill Planning and Response

Planning For Chemical Spill Emergencies

1. Designate two people in your lab or service area to be on-site emergency coordinator and back-up emergency coordinator. These people should know what hazards exist in your area and how to implement the spill response plan (contingency plan) for the area. They will act as advisors to available emergency response personnel.
2. Prepare an Emergency Contingency Plan and post it in an easily-visible area of your laboratory (preferably near the telephone and exit way).
3. Ensure all laboratory personnel receive annual Chemical Hygiene training and all non-laboratory personnel receive annual Hazard Communication training. This training covers general chemical safety including spill response procedures. Train all of your personnel in chemical spill procedures for your specific area when they are first hired and yearly thereafter. Document the training and have both the employee and supervisor sign the documentation form to certify that the training was given.
4. Draw a map of your lab or service area and clearly labeling where chemicals and waste chemicals are stored and the total quantity of chemical types in a room (e.g. 5 gallons flammables, 2 pounds oxidizers, 5 cylinders of compressed non-flammable gas, etc.) would be helpful to emergency response personnel. Fire extinguishers, eyewashes, spill kits, exit routes and other safety equipment or hazards should be clearly marked. Keep a copy of the map at the exit way. Update these maps whenever chemical management practices change in the room.
5. Purchase spill cleanup materials and personal protective equipment (gloves, safety goggles, etc.) as needed and note their locations on an Emergency Contingency Plan. Know the limitations of the personal protective equipment.

Questions arise as to what constitutes a large spill requiring a chemical cleanup team and what the limitations of the spill kits commonly purchased for laboratories.

A "large" spill can be as small as a few milliliters if the material is a highly volatile or toxic compound spilled in a confined space. Many times you will have to make a professional judgment as to the severity of the spill.

Chemical spill cleanup kits are helpful to have in the laboratory and other service areas which use chemicals. The kits are useful if you and your fellow workers know how to use them properly. Chemical absorbent or neutralizing powder pads can be used to quickly contain a spill. Use these items if your personal safety is not jeopardized. Often the best use of such a kit is to put the absorbent on the spill to contain the material, then leave the room and secure the area until the emergency response team arrives and finishes the cleanup.

Minimally, a chemical spill kit should contain:

- splash resistant goggles
- chemical resistant gloves
- plastic bags
- multi-chemical absorbent (enough for a 2 gallon spill)
- acid/caustic neutralizers
- plastic scoop and dust pan

Any area using hydrofluoric acid (HF) must have a spill kit specifically made for HF spills available.

- **Be aware of the fact that while you may be in a well ventilated room, the Lower Explosive Limit (LEL) of a chemical may be reached at the surface of the spill and you want to avoid any sparks of sources of ignition when doing the clean up.**
- **The protective equipment in the spill kit will not protect you from a flash fire. Many times, the best way to handle the spill of a highly volatile compound, such as diethyl ether or chloroform, is to open windows and fume hoods, leave the room, close and lock the door and let the room air out.**
- **In these cases, contact emergency services so the situation can be monitored.**
- **If in your professional judgment, there is a strong risk of a flash fire or explosion, pull the nearest**

fire alarm and evacuate the building. Then contact Emergency Services.

- **In most cases of a chemical bottle breaking in a laboratory, however, the emergency services will not need to be called as the lab ventilation system is usually designed to handle such situations.**

Environmental Management System

Monthly SPCC Inspection Form

Inspection Instructions

- ✓ **What?** A Spill Prevention, Control and Countermeasure (SPCC) Plan includes requirements for spill prevention, preparedness and response to prevent discharges to navigable waters and adjoining shorelines. The EPA requires a monthly inspection of all above ground storage tanks (AST), oil-containing equipment and spill management equipment that assesses possible leaks, identifies preventative maintenance measures and ensures the appropriate levels of spill response preparedness.
- ✓ **How?** With the aid of this form, the inspector is to personally make an assessment of each piece of equipment and answer the questions pertaining to each piece of equipment. The inspector is to file the completed form in the designated repository and notify the Facilities Planning and Compliance Officer in writing of completion of the inspection. All items from the inspection form requiring notes in the comments section are to be reported to the Director of Facilities Management in the form of a work order within one (1) business day of filing the completed inspection form. A set of drawings articulating the exact locations of each item on this inspection sheet is kept in designated inspection repository.
- ✓ **When?** The SPCC inspection is to be performed once per calendar month with no less than ten (10) business days in between inspections.

***SAFETY FIRST!* Never conduct an inspection if conditions are not safe!**

Inspection Checklist

1. Electrical Transformer (Guard Station)

Are there visible signs of leaks or spills? If yes, describe in the comments section.	YES	NO	N/A
Is any repair or preventative maintenance required? If yes, describe in the comments section.	YES	NO	N/A

2. Electrical Transformer #8 (Bldg. G)

Are there visible signs of leaks or spills? If yes, describe in the comments section.	YES	NO	N/A
Is any repair or preventative maintenance required? If yes, describe in the comments section.	YES	NO	N/A

3. Electrical Transformer #10 (Baseball Field)

Are there visible signs of leaks or spills? If yes, describe in the comments section.	YES	NO	N/A
Is any repair or preventative maintenance required? If yes, describe in the comments section.	YES	NO	N/A

4. Electrical Transformer #7 (Bldg. H2)

Are there visible signs of leaks or spills? If yes, describe in the comments section.	YES	NO	N/A
Is any repair or preventative maintenance required? If yes, describe in the comments section.	YES	NO	N/A

5. Elevator H – Hydraulic System (Bldg. H)

Are there visible signs of leaks or spills? If yes, describe in the comments section.	YES	NO	N/A
Is there visible corrosion, wear or damage to the tanks? If yes, describe in the comments section.	YES	NO	N/A
Is there visible corrosion, wear or damage to piping associated with the tanks? If yes, describe in the comments section.	YES	NO	N/A
Is a spill kit present and serviceable? If no, describe in the comments section.	YES	NO	N/A
Is any repair or preventative maintenance required? If yes, describe in the comments section.	YES	NO	N/A

Inspector Initials _____

Submit completed inspection form to designated repository and notify Facilities Planning and Compliance Officer.
All inspection records must be retained for five (5) years.

Environmental Management System

Monthly SPCC Inspection Form

EMS Training

- ✓ A Spill Prevention, Control and Countermeasure (SPCC) Plan includes requirements for spill prevention, preparedness and response to prevent discharges to navigable waters and adjoining shorelines. The EPA requires a monthly inspection of all above ground storage tanks (AST), oil-containing equipment and spill management equipment that assesses possible leaks, identifies preventative maintenance measures and ensures the appropriate levels of spill response preparedness.

Training must be complete before performing inspections, inventories or reports.

SPCC Inspection Instructions

Inspection Frequency

- An SPCC inspection is to be performed once per calendar month with no less than ten (10) business days between inspections.
- The inspection must be done in daylight hours in dry conditions in order to properly inspect each item. An inspection must not be done during or recently after rainfall. All surface water must be evaporated in order to properly inspect each item.

Tools

- A set of maps/floor plans is available to assist with locating each item on the inspection list.
- A set of pictures is available to assist with identifying each item on the inspection list.
- Some items on this inspection form require keys to limited access areas. Keys are provided by Facilities Management.

Performing the Inspection

Each question is to be answered to the best of the inspector's ability. If there is any confusion as to how to answer a question, it is to be noted in the comments section. When making recommendations for repairs, the notes may be as simple or complex as the inspector wishes. The note may simply be for a technician to look at it, or the corrective action can be more specifically articulated. *If something needs to be done, it should be noted, even if the inspector does not know exactly what that something is.*

- Checking for Leaks
  - ✓ The inspector is to look for liquids on the equipment and the surfaces around it.
  - ✓ She/he is to look for signs of dried liquid highlighted by discoloration and watermarks, rust or calcified material – particularly around piping and points of adjoining metal
  - ✓ She/he should be cognizant of chemical smells.
- Inspecting Spill Kits
  - ✓ The inspector should look for signs of damage or prior use.
- Inspecting Effluent/Bioxide Tanks
  - ✓ The inspector should check the bioxide levels using the markers on the side of the tanks. The liquid should be within 500-2500 gallons If levels are outside of that range, typically lower, they should be noted in the comments section.
  - ✓ To ensure that the pumps are working properly, the inspector should look for signs of leaks, listen for sounds of laboring equipment.
  - ✓ To assess if the lift tank needs to be pumped out, the inspector should assess whether or not effluent levels are above the marked line.
- Inspecting Diesel Generator AST
  - ✓ The inspector should check the diesel levels by viewing the gauge. The diesel should be at least ½ full. If levels are outside of that range, typically lower, they should be noted in the comments section.
  - ✓ The inspector should ensure that the secondary containment inlet is locked by observing the valve handle and checking whether the valve is perpendicular or parallel to its pipe. Parallel means that the inlet is unlocked and perpendicular means that it is locked.
  - ✓ To check whether water in the secondary containment needs to be removed, inspector should view water levels and check for oily sheen.
- Inspecting the Diesel Generator Valves
  - ✓ Piping supports: check for corrosion or leaks.
  - ✓ Valves: check for corrosion or leaks.

Filing the Inspection

- Upon completion of the inspection, the inspector is to sign the form. This signifies her/his assertion of the completeness and accuracy of the inspection. If the inspection form has more than one page, the inspector is to initial each page as it is completed.
- Upon completion of the inspection, the inspector is to notify the Facilities Planning and Compliance Officer of completion of the inspection in writing within one (1) business day.
- Upon completion of the initial inspection, the inspector is to convert all comments produced in the inspection form into a Facilities Management work request.

TRAINEE NAME: **DATE:**

Inspector Initials _____

Submit completed inspection form to designated repository and notify Facilities Planning and Compliance Officer.
All inspection records must be retained for five (5) years.

Environmental Management System

Monthly SPCC Inspection Form

6. Electric Transformer #3 (Bldg. H Boiler House)

Are there visible signs of leaks or spills? If yes, describe in the comments section.	YES	NO	N/A
Is any repair or preventative maintenance required? If yes, describe in the comments section.	YES	NO	N/A

7. Electric Transformer #4 (Bldg. H1)

Are there visible signs of leaks or spills? If yes, describe in the comments section.	YES	NO	N/A
Is any repair or preventative maintenance required? If yes, describe in the comments section.	YES	NO	N/A

8. Electric Transformer #5 (Bldg. H1)

Are there visible signs of leaks or spills? If yes, describe in the comments section.	YES	NO	N/A
Is any repair or preventative maintenance required? If yes, describe in the comments section.	YES	NO	N/A

9. Electric Transformer #6 (Bldg. H1)

Are there visible signs of leaks or spills? If yes, describe in the comments section.	YES	NO	N/A
Is any repair or preventative maintenance required If yes, describe in the comments section.	YES	NO	N/A

10. Lift Station/Effluent Tank (Bldg. H1-H2)

Are there visible signs of leaks or spills? If yes, describe in the comments section.	YES	NO	N/A
Is bioxide level within acceptable range? If no, describe in the comments section. **(NEED DEFINITION)**	YES	NO	N/A
Are pumps working correctly? If no, describe in the comments section. **(NEED DEFINITION AND INSTRUCTION)**	YES	NO	N/A
Does the lift tank need to be pumped out? If yes, describe in the comments section. **(NEED DEFINITION)**	YES	NO	N/A
Is any repair or preventative maintenance required? If yes, describe in the comments section.	YES	NO	N/A

11. Diesel Generator AST (Bldg. H1-H2)

Are there visible signs of leaks or spills? If yes, describe in the comments section.	YES	NO	N/A
Is diesel level within acceptable range? If no, describe in the comments section. **(NEED DEFINITION)**	YES	NO	N/A
Is the secondary containment inlet locked? If no, lock it and note it in the comments section. **(NEED INSTRUCTION)**	YES	NO	N/A
Is there visible corrosion, wear or damage to lines or tank? If yes, describe in the comments section.	YES	NO	N/A
Does water in secondary containment need to be removed? If yes, describe in the comments section. **(NEED DEFINITION)**	YES	NO	N/A
Is there an oily sheen on any surfaces (including water) in the secondary containment? If yes, describe in the comments section.	YES	NO	N/A
Is a spill kit present and serviceable? If no, describe in the comments section.	YES	NO	N/A
Is any repair or preventative maintenance required? If yes, describe in the comments section.	YES	NO	N/A

Inspector Initials _____

Submit completed inspection form to designated repository and notify Facilities Planning and Compliance Officer.
All inspection records must be retained for five (5) years.

Environmental Management System

Monthly SPCC Inspection Form

12. Diesel Generator Valves (Bldg. H1-H2)

Are there visible signs of leaks or spills? If yes, describe in the comments section.	YES	NO	N/A
Are piping supports in good condition? If no, describe in the comments section. **(CONFIRM EXISTENCE OF SUPPORTS AND DEFINE)**	YES	NO	N/A
Is there visible corrosion, wear or damage to the valves? If yes, describe in the comments section. **(NEED INSTRUCTION)**	YES	NO	N/A
Is a spill kit present and serviceable? If no, describe in the comments section.	YES	NO	N/A
Is any repair or preventative maintenance required? If yes, describe in the comments section.	YES	NO	N/A

13. Elevator G – Hydraulic System (Bldg. G)

Are there visible signs of leaks or spills? If yes, describe in the comments section.	YES	NO	N/A
Is there visible corrosion, wear or damage to the tanks? If yes, describe in the comments section.	YES	NO	N/A
Is there visible corrosion, wear or damage to piping associated with the tanks? If yes, describe in the comments section.	YES	NO	N/A
Is a spill kit present and serviceable? If no, describe in the comments section.	YES	NO	N/A
Is any repair or preventative maintenance required? If yes, describe in the comments section.	YES	NO	N/A

14. Elevator F – Hydraulic System (Bldg. F)

Are there visible signs of leaks or spills? If yes, describe in the comments section.	YES	NO	N/A
Is there visible corrosion, wear or damage to the tanks? If yes, describe in the comments section.	YES	NO	N/A
Is there visible corrosion, wear or damage to piping associated with the tanks? If yes, describe in the comments section.	YES	NO	N/A
Is a spill kit present and serviceable? If no, describe in the comments section.	YES	NO	N/A
Is any repair or preventative maintenance required? If yes, describe in the comments section.	YES	NO	N/A

15. Electric Transformer #2 (Bldg. E)

Are there visible signs of leaks or spills? If yes, describe in the comments section.	YES	NO	N/A
Is any repair or preventative maintenance required? If yes, describe in the comments section.	YES	NO	N/A

16. Elevator D – Hydraulic System (Bldg. D)

Are there visible signs of leaks or spills? If yes, describe in the comments section.	YES	NO	N/A
Is there visible corrosion, wear or damage to the tanks? If yes, describe in the comments section.	YES	NO	N/A
Is there visible corrosion, wear or damage to piping associated with the tanks? If yes, describe in the comments section.	YES	NO	N/A
Is a spill kit present and serviceable? If no, describe in the comments section.	YES	NO	N/A
Is any repair or preventative maintenance required? If yes, describe in the comments section.	YES	NO	N/A

Inspector Initials _____

Submit completed inspection form to designated repository and notify Facilities Planning and Compliance Officer.
All inspection records must be retained for five (5) years.

Environmental Management System

Monthly SPCC Inspection Form

17. Elevator C – Hydraulic System (Bldg. C)

Are there visible signs of leaks or spills? If yes, describe in the comments section.	YES	NO	N/A
Is there visible corrosion, wear or damage to the tanks? If yes, describe in the comments section.	YES	NO	N/A
Is there visible corrosion, wear or damage to piping associated with the tanks? If yes, describe in the comments section.	YES	NO	N/A
Is a spill kit present and serviceable? If no, describe in the comments section.	YES	NO	N/A
Is any repair or preventative maintenance required? If yes, describe in the comments section.	YES	NO	N/A

18. Elevator B – Hydraulic System (Bldg. B)

Are there visible signs of leaks or spills? If yes, describe in the comments section.	YES	NO	N/A
Is there visible corrosion, wear or damage to the tanks? If yes, describe in the comments section.	YES	NO	N/A
Is there visible corrosion, wear or damage to piping associated with the tanks? If yes, describe in the comments section.	YES	NO	N/A
Is a spill kit present and serviceable? If no, describe in the comments section.	YES	NO	N/A
Is any repair or preventative maintenance required? If yes, describe in the comments section.	YES	NO	N/A

19. Electric Transformer #1 (Bldg. B)

Are there visible signs of leaks or spills? If yes, describe in the comments section.	YES	NO	N/A
Is any repair or preventative maintenance required? I If yes, describe in the comments section.	YES	NO	N/A

20. Lift Station/Effluent Tank (Bldg. B)

Are there visible signs of leaks or spills? If yes, describe in the comments section.	YES	NO	N/A
Is bioxide level within acceptable range? If no, describe in the comments section. **(NEED DEFINITION)**	YES	NO	N/A
Are pumps working correctly? If no, describe in the comments section. **(NEED DEFINITION AND INSTRUCTION)**	YES	NO	N/A
Does the lift tank need to be pumped out? If yes, describe in the comments section. **(NEED DEFINITION)**	YES	NO	N/A
Is any repair or preventative maintenance required? If yes, describe in the comments section.	YES	NO	N/A

Inspector Initials _____

Submit completed inspection form to designated repository and notify Facilities Planning and Compliance Officer.
All inspection records must be retained for five (5) years.

Environmental Management System

Monthly SPCC Inspection Form

COMMENTS

Describe any repairs, preventative maintenance and/or corrective action required. Reference item number.

COMMENTS

INSPECTOR NAME: **DATE:**

Inspector Initials _____

Submit completed inspection form to designated repository and notify Facilities Planning and Compliance Officer.
All inspection records must be retained for five (5) years.

Appendix G:
Tier II A – Chapter 1
Land Management Plans and Guidelines

BALCONES CANYONLANDS PRESERVE
LAND MANAGEMENT PLAN

TIER II A

CHAPTER 1
LAND MANAGEMENT PLANS AND GUIDELINES

Document reprinted from:

U. S. Fish and Wildlife Service. 1996. Final Environmental Impact Statement/Habitat Conservation Plan for Proposed Issuance of a Permit to Allow Incidental Take of the Golden-cheeked Warbler, Black-capped Vireo, and Six Karst Invertebrates in Travis County, Texas. U. S. Fish and Wildlife Service, Albuquerque, N. M.

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1.0 LAND MANAGEMENT PLANS AND GUIDELINES

The BCCP preserve system is to be managed to permanently conserve and facilitate the recovery of the populations of target endangered species inhabiting western Travis County. This priority objective will govern preserve management activities to improve target species habitat, while protecting preserves against degradation caused by urbanization of surrounding lands and increased public demand for recreation usage within preserves.

The welfare of target species (species of concern) will be the overriding influence on all decisions regarding activities on preserve lands. Decisions about activities within preserves should be made cautiously, so as to meet biological objectives to protect and enhance target species and minimize risk of damage to their habitat.

2.0 LAND MANAGEMENT PLANS

Because individual tracts will have varying types of habitat and may offer varying degrees of public access, each preserve manager will be required to obtain Coordinating Committee Secretary approval of a land management plan for each tract within one year after issuance of the Permit, or within one year after land acquisition, whichever is later.

2.1 Tract Land Management Plans

A tract Land Management Plan will describe both short-term and long-term management objectives and will serve as the primary document for reference and justification for all operations on that preserve. Each plan will identify major operational needs, issues, problems, and strategies, with sufficient information to serve as a complete guidance document. The plan should be written to cover a period of five years, but revisions to the Plan during these five years can be made as appropriate. Management plans for existing parks and preserves which will be included in the BCCP preserve system will need to conform with BCCP management guidelines, goals and policies. Management plans for contiguous or adjacent tracts will be reviewed for compatibility with one another. If such tracts are operated by different managing partners, the land management plans for each tract should be coordinated with the respective preserve managers.

Management Plans will contain the following information: (1) tract descriptions, (2) a management program, and (3) a system for monitoring management activities.

The Tract Descriptions section will provide the location of the tract with acreages and a graphical representation of the tract boundaries. It will also include descriptive information (historical, archeological, administrative, legal, financial, social, physical, ecological) and any other relevant information affecting the preserve to provide the basis for successful and efficient management of the preserve.

The Management Program section will identify any specific goals for the tract and will set priorities based on these goals. It will discuss all current and proposed future activities for the tract and give an analysis of the impact of these activities on the tract and on the endangered species and species of concern located on the tract. No activity will be allowed which results in a "take" of an endangered species, or which degrades or in any way harms the preserve. The management activities will be designed so that observation and monitoring efforts can be used to increase the efficiency of future management activities. The Management Program will also identify the resources that will be needed for these activities.

When writing land management plans, consideration should be given to restoration and enhancement of endangered species habitat, including vegetation restoration and control of browsing pressure. Consideration should also be given to management and control of fire ants, oak wilt, cowbirds, nest predators, and other problem species, if they occur on the tract. Each tract should have a fire management plan, including sufficient details to guide decisions on whether to suppress or allow natural fires and/or controlled burns. A multiple-use management approach may be appropriate on some tracts, whereby other uses may be compatible with the primary habitat protection and species management goals, as long as these uses either benefit or have no negative effects on the species of concern and do not significantly compete with other management efforts for personnel or financial resources. Examples of such uses which may be compatible under certain circumstances include recreation, environmental education, scientific uses, watershed protection, and non-endangered wildlife species management.

Since portions of each preserve component may be uninhabited, continually inhabited, or only seasonally inhabited by target species, specific access and management prescriptions may vary within each preserve and may include a variety of access options: year-round unrestricted access; year-round restricted access; or seasonally restricted access. Despite the potential for variability in individual management plans for preserve components, the design and implementation of land management plans must follow the guidelines set forth in the following section. In particular, habitat for target species in

BCCP preserves should be managed for existing and expanding populations and for re-colonization when local populations decline or are extirpated.

The Management Monitoring section will state what process will be used to monitor and evaluate the progress of management on the preserves and the effects of the management program on the species of concern and their habitats. This evaluation and monitoring will form the basis for management plan revisions.

2.2 Interim Land Management Responsibilities

Prior to the submittal to the Coordinating Committing Secretary of a land management plan for a specific tract, the preserve land will be managed per the Land Management Guidelines in the following section. Issues that each managing partner must address during this interim period are controlling access, protecting habitats, law enforcement, and fire control.

2.3 Annual Reports

Overall land management activities will be reviewed annually by the Coordinating Committee Secretary. To facilitate this process, preserve managers must submit annual reports to the Coordinating Committee Secretary, documenting compliance with individual land management plans and summarizing any monitoring efforts. Managing partners shall provide reasonable access to preserve system lands to Coordinating Committee representatives and preserve land managers for inspection, monitoring, or other functions consistent with preserve system goals.

3.0 LAND MANAGEMENT GUIDELINES

The following land management guidelines, a modification of TPWD draft 1993 Balcones Canyonlands Conservation Plan: Management Standards and Guidelines, attempt to achieve the biological objectives of the Permit by means of relatively standard land-use methodologies in coordination with monitoring programs (TPWD 1993). They generally adhere to the recommendations of the Biological Advisory Teams report (1990) with regard to suitable protective measures and compatible recreational uses of preserve lands. As other land management practices become available, they may be incorporated into the land management guidelines as appropriate.

Long-term monitoring of both the environmental quality of the preserve and the health of its populations of endangered species is a necessary part of this endeavor. This is primarily because the basic biology of most local federally listed species is not

sufficiently well understood to allow prediction of the impact on those species of specific management activities or use-intensity levels for public recreation. Consequently, management practices should be prescribed and monitored with an appropriate multi-species emphasis and overall ecosystem approach.

In accordance with the habitat preserve objectives, the following land management guidelines have been prepared for on-site vegetation management alternatives, management browsing pressure, control of public access, problem animal control, management of springs and associated watercourses, research and monitoring, and species-specific management.

3.1 Vegetation Management

Each of the following techniques may be used only in accordance with individual land management plans approved by the Coordinating Committee and USFWS.

3.2 Prescribed Fire

This practice is likely to be an effective tool for creation or maintenance of black-capped vireo habitat. Since uncontrolled hot fires have the capacity to destroy golden-cheeked warbler habitat and sensitive plant areas, use of prescribed burns should be undertaken with proper caution. The proposed location of fire lanes should not increase internal woodland edges or fragment woodland communities in golden-cheeked warbler habitat. A fire lane construction in occupied habitat should not be constructed during the season that migratory birds are in residence.

3.3 Mechanical Control

If mowing of grassed areas is necessary (i.e., for control of fires), tired tractors with shredders are permitted. Brush cutting with hand tools or with push brush-hogs is also permitted. Heavy equipment techniques such as chaining, grubbing, root plowing, blading, and hydro-axing have a greater potential for long-term soil erosion damage. Unless specifically authorized by the Coordinating Committee Secretary as part of a site-specific land management plan, including individual projects, the practice of vegetation removal by heavy equipment is prohibited.

3.4 Chemical Control

Applications of herbicides for specific purposes such as control of stands of exotic, invasive, or nuisance plants, and vegetation management at human access points may be permitted, upon review by the Coordinating Committee Secretary. All applications of

chemical herbicides must be performed by licensed applicators. Documentation of all applications must be kept on file by the preserve manager and made available to the Coordinating Committee Secretary upon request.

3.5 Grazing

Grazing, when approved by both the Coordinating Committee Secretary and the USFWS, may be employed on preserve lands as a limited vegetation management tool. Use of cattle grazing will be restricted to locales where other practices are difficult or impossible to use. If used, grazing intensity must not lead to degradation of water quality or increased cowbird populations. A cowbird-trapping program should be considered whenever livestock grazing as a management practice is employed.

3.6 Control of Oak-Wilt

Treatment of oak wilt is encouraged and should follow oak-wilt guidelines as established by the Texas Forest Service Oak Wilt Suppression Project, and must be approved by both the Coordinating Committee Secretary and the USFWS.

3.7 Management of Browsing Pressure

Browsers are herbivorous animals, such as native/feral/exotic deer, goats, and sheep, and sometimes cattle, which forage on understory plant growth (i.e., forbs and deciduous and evergreen trees and shrubs).

3.8 Fenced Enclosures to Exclude Browsers

Sensitive plant sites may be protected from excessive plant loss through over-browsing by placement of effective fenced enclosures that keep browsing animals out.

3.9 Browsing Animal Populations

In some cases, over-browsing may suppress the abundance and distribution of tree and shrub species in plant communities preferred by golden-cheeked warblers and black-capped vireos. Management of browsing pressure within these vegetation communities is a complex task that may require perimeter fencing of preserve tracts (when possible), long-term monitoring, hunting programs and intensive control efforts of browsing-animal populations. Browsing-animal control efforts should be instituted when declines in important vegetation components have been documented at a particular site. Appropriate deer population objectives should be set after consideration of deer and vegetation data from each site. Introduction of browsing animals must be approved by the USFWS.

3.9.1 Indirect Control

Practices designed to increase deer populations are prohibited. This refers to manipulation of vegetation, placement and maintenance of mineral blocks, or establishment of supplemental animal feeding areas. Restrictions on placement of deer feeding stations may be relaxed if such stations are essential for approved population control programs.

3.9.2 Direct Control

Approved deer control efforts should be designed to remove unnecessary animals as quickly, safely, and humanely as possible. Because most preserve tracts will become increasingly surrounded by suburban developments and experience higher recreational use, application of the latest non-lethal population control technologies may be considered.

3.10 Public Access

The preserve system may offer public access and recreational opportunities within the Austin and Travis County area where possible and manageable. Public access may be allowed where and when such access does not threaten the welfare of the target species of concern, which is the overriding goal of the preserve system, nor cause the degradation of soil, vegetation, or water resources.

The key to allowing public access that is non-threatening and non-damaging to preserve lands is implementation of effective management strategies to control such access and use. These management strategies must be specified in the individual land management plans and implemented by the preserve tract managers. Demonstration over time of effectively implemented management strategies on a preserve tract may justify increased public access opportunities. Demonstrated non-effectiveness or habitat degradation may justify less public access for a particular tract.

Effective management strategies can be any combination of, but are not limited to: fencing; signage; seasonally-restricted access; selected access to non-habitat areas of a tract only; careful trail and amenities location, design and relocation; ranger patrols and enforcement; or prohibited access to selected sensitive areas of a tract. Preserve managers are encouraged to consider creative plans that could increase public education and recreational opportunities while ensuring the welfare of the target species of concern.

Access to specific sites during specific seasons will be regulated to conserve target species and their associated communities. Creation of new roadways, trails, and cleared right-of-ways that open the canopies of woodland and shrubland communities, create additional impervious cover, or facilitate public use of preserve interiors or high quality sites occupied by target species should be discouraged. Access routes for preserve operation and maintenance can be rerouted if in an approved land management plan.

3.10.1 Basic Preserve Access Control

Provisions for adequate fencing and signage on all preserve components shall be undertaken by BCCP land managers. As preserve lands are acquired, upgrading of fencing along perimeter boundaries should be undertaken as soon as practical to achieve human access control. Interior fencing, if appropriate, should be established as a lower priority. Posting of signs should also be undertaken as soon as practical to identify the land as a preserve component or to prevent unauthorized use. These signs should be placed along perimeter fences, gates and other access points, and long trails and roads.

3.10.2 Individual or Independent Group Use

It is necessary to avoid, detect, and reduce the types of localized detrimental impacts associated with human activity on the preserves. The following types of outdoor activities may be allowed if they do not conflict with conservation of target species as described in the individual preserve land management plans.

3.10.3 Walking/Jogging/Hiking

Unsupervised group access should not be allowed within 100 meters of occupied songbird habitat during the breeding/nesting season, unless such access can be documented to show no apparent degradation to the welfare of the species of concern. Relatively extensive trail networks along existing right-of-ways may have to be maintained and monitored if this activity is approved. Creation of new trails will be addressed in preserve land management plans and should leave woodland canopies intact. In golden-cheeked warbler habitat, new trails should not fragment woodland interiors or allow human use intensity that threatens this species.

3.10.4 Fishing

Fishing may be allowed where there is existing access to lake frontage that is not inhabited by target species. If allowed, fishing locations will be designated and fishing will not be allowed outside designated areas. Fishing in environmentally-sensitive springs and deeper spring runs, especially where rare salamander species are present, will

be prohibited. Construction of new roads, access points and other support facilities for fishing must be approved in the preserve land management plans. Stocking of native or exotic species is prohibited unless specified in an approved land management plan.

3.10.5 Swimming/Boating/Rafting/Tubing

Designated water access areas may be available at selected locations, based on approved land management plans. Bank access restrictions may be necessary to protect adjacent target species habitats.

3.10.6 Bicycling

This activity is prohibited, except for selected sites designated as experimental sites, with appropriate monitoring for effects on the preserve and enforcement of all applicable rules. As part of an approved plan, creation of new trails should leave woodland canopies intact. In golden-cheeked warbler habitat, trails cannot fragment woodland interiors or allow human use intensity that threatens this species. Any new bicycle trails should be designed to minimize erosion, and existing approved trails exhibiting significant erosion should be closed and repaired. Any existing trails not approved by the Coordinating Committee Secretary will be closed.

3.10.7 Horseback Riding

This activity is prohibited, except for selected sites designated as experimental sites, with appropriate monitoring for effects on the preserve and enforcement of all applicable rules. Stables and similar facilities for the long-term (overnight or longer) maintenance of groups of horses shall not be constructed within any part of the preserve system. Contracts with private and commercial facilities on adjacent lands may be negotiated for use of tracts during the non-nesting and breeding season, provided that mitigation, clean up, and cowbird trapping are implemented. However, horses may be used for appropriate preserve O&M activities.

3.10.8 Off-Road Vehicle (ORV) Riding

This is prohibited as a recreational activity because it is not compatible with preserve management objectives and goals. Furthermore, appropriate barriers and enforcement penalties should be established to minimize trespass into preserve properties and subsequent damage by ORV users. However, these vehicles may be used for appropriate preserve O&M activities.

3.10.9 Picnicking

This activity will require provision of trash receptacles and restroom facilities at staging areas located near the periphery of tracts. If preserve managers wish to allow this activity, preserve land management plans will designate picnic sites that can be easily maintained, to avoid creating focal centers for cowbird feeding activity.

3.10.10 Camping

This activity is allowed only in designated areas and if related to O&M or guided educational activities. When allowed, camping should be restricted to minimum-impact camping. Preserve managers will designate suitable camping areas, and these minimum-impact camping areas should be rotated frequently to enable each site to recover from past use. Only closed-burning fires (such as camp stoves) will be allowed.

3.10.11 Nature Viewing

Some examples of permitted nature viewing opportunities are designated viewing areas with blinds, trails with descriptive trail brochures, or guided tours. Educational tours should be encouraged but procedures for review of tour group activities will be established in land management plans, as discussed below. Attempts to artificially improve wildlife viewing by maintenance of supplemental feeding areas are prohibited.

3.10.12 Spelunking

All access to caves must be restricted to permits issued by the appropriate land management agency, based on an appropriate program in the land management plan for the preservation of the cave ecosystem.

3.10.13 Rock Climbing

Rock climbing and related activities are prohibited, except for selected sites designated as experimental sites, with appropriate monitoring for effects on the preserve and enforcement of all applicable rules.

3.11 Non-Commercial Group Use

Non-commercial groups are nonprofit organizations, schools, and educational groups that request visitation to any tract for educational purposes or research. This use should be encouraged as long as it is monitored for possible habitat degradation and adverse impacts. These groups will be issued permits by the appropriate land management agency. The permit process should include user guidelines that protect target species and their respective habitats.

3.12 Educational Uses

Educational use is defined as those activities whose primary intent is to present or interpret information about the ecology of the preserve sites or the target species. Daytime field trips by school groups are typical of this public-use category.

3.13 Research Uses

Research use activities include those activities that will gather and interpret site-specific data in a way that improves understanding of the ecology of preserve species, plant communities, and aquatic and subterranean environments. Such activities will be coordinated through the appropriate preserve land manager.

3.14 Commercial Use

3.14.1 Guided Tours

Commercial tour groups are allowed to schedule tours of preserve sites, subject to the provision that such groups abide by prevailing visitation guidelines for that tract. The preserve land manager remains responsible for appropriate land management, including public access, regardless of whether operations, including private group tours, are accomplished by the land manager or through contractual arrangement. Contractual arrangements for guided tours will be non-exclusive with regard to public access.

3.14.2 Film-Making

Film production projects may be allowed subject to approval by the preserve manager and the Coordinating Committee Secretary. The film production process must not negatively impact the preserve environment.

4.0 PROBLEM ANIMAL CONTROL

Certain animals have been identified as potential direct threats to target species, particularly cowbirds, fire ants, and predators. Typical animal control efforts on preserve tracts will likely involve some combinations of the following approaches: public education; manipulation of problem species habitat; selective relocation of individual problem animals; selective destruction of individual problem animals; and destruction of problem animals on a population level. Control efforts should use methods that emphasize maximum selectivity and effectiveness at minimum cost. Destruction of problem animals will be done in a humane manner.

4.1 Deer

White-tailed deer and other browsers can cause serious problems with over-browsing vegetation and need to be controlled. Such methods have been discussed previously in the guidelines found under the section entitled, "Management of Browsing Pressure."

4.2 Cowbirds

Cowbirds, an open-field bird species, are well known for parasitism of songbird nests. It is suggested that management approaches to reduce cowbird populations include the following elements: restoration of native ground cover and dense woodlands for those areas previously disturbed; removal of any supplemental bird feeding stations; elimination of wildlife food plots; and minimization of livestock stables and holding pens. Although these approaches have been associated with reduced cowbird abundance, it may still be necessary to remove individual cowbird eggs from parasitized songbird nests.

Intensive cowbird trapping programs on an interim or permanent basis may be necessary at selected sites. Preserve managers may use trapping, singularly or in conjunction with other habitat manipulation strategies. Trapping should be designed to maximize the effect of cowbird control and minimize capture and loss of non-target species.

4.3 Predators

Bird nest predators may be controlled selectively. Some problem animals that predate songbird eggs and young are domestic and feral cats, raccoons, possums, snakes, jays, and skunks. Managers of preserves adjacent to residential areas should consider a live-trapping program to reduce the number of domestic and feral cats that may hunt songbirds on preserves.

4.3 Fire Ants

Fire ants may be controlled with an integrated Pest Management (IPM) program using approved chemicals and bait formulations. Fire ant control should be designed to minimize impact on native ants and other flora and fauna. Chemical control of exotic fire ant colonies may be necessary to avoid infestation of caves.

5.0 MANAGEMENT OF SPRINGS AND ASSOCIATED WATERCOURSES

Flowing springs and spring runs downstream of spring discharges will be protected from destructive human impacts. This could include such suggested methods as informative markers, and/or fencing, in the case of damaged sites or sites occupied by species of concern. For remote springs, this objective may be achieved simply by designing preserve access points to keep such sensitive sites relatively inaccessible to human visitation.

The introduction of non-native fauna into spring runs is prohibited. Where necessary, spring runs may be fenced to exclude livestock from damaging stream banks and wetland vegetation.

Preserve managers should be aware that both water quality and spring discharge quantity are important to the viability of spring ecosystems. Monitoring should be conducted to design and evaluate management plans that prevent degradation of local groundwater resources or loss of aquatic habitats within preserves. This activity will be done subject to the availability of adequate funding.

6.0 MONITORING AND RESEARCH FOR ENDANGERED SPECIES VIABILITY

Long-term monitoring for endangered species viability will be the responsibility of every managing partner. In order to complete the required 30,428 acre preserve and karst acquisition in a timely fashion, it will be necessary for the Permit holders to direct BCCP

fund resources initially towards purchase of the remaining acres needed. As the preserve system grows, additional funds will be needed for ongoing operation and maintenance of the preserves. While the importance of monitoring and research is evident, it is likely to remain a secondary priority for funding by the Permit holders.

Baseline monitoring studies for biological data will be gathered in each preserve tract in accordance with the Land Management Guidelines and the approved land management plans. Subsequent monitoring as identified in the respective land management plan will be implemented to determine the status of each listed endangered species. These activities will be initiated as soon as possible, contingent upon available funding.

The Coordinating Committee may elect to work with managing partners on the establishment of a joint monitoring effort to be prorated on the basis of the number of acres that each managing partner holds.

6.1 Bird Species

Baseline monitoring studies should concentrate on determining basic population levels on preserve lands, key population parameters, and other ecological parameters that may affect the target species. Demonstration or research projects could be undertaken to determine the effects of different management techniques or specific human impacts on songbird productivity and/or habitat use.

6.2 Cave Invertebrates

Baseline monitoring studies should concentrate on basic inventory and distribution assessments for listed and rare karst invertebrates. Considerable information is needed on cave microclimates and related factors important to invertebrate populations. The effects of different management techniques on subterranean environments and on target karst populations may require complex experimental research designs.

6.3 Spring Systems

Springs and spring runs should be monitored for water quality and seasonal discharge, as well as for populations of aquatic target species. Effects of development within watershed recharge areas might also be considered as research topics for key springs on preserve lands.

6.4 Plants

Baseline monitoring studies should concentrate on plant distribution and abundance patterns within preserves, factors important to plant species survival, and the effects of different management techniques on those factors and on individual populations. Monitoring of browsing population levels as they relate to levels of hardwood regeneration, especially in golden-checked warbler and black-capped vireo habitat, should be an initial emphasis. Non-native and/or ornamental plant species that invade preserves should be removed where practicable to facilitate recovery of native species.

6.5 Community-Based Approaches

Monitoring of natural communities within the preserve system should be done at varying scales of detail. For example, randomly distributed field plots, aerial photographs, and satellite imagery all may be appropriate techniques to assess ecological features. Monitoring of the natural communities will help to determine ecosystem-wide factors affecting the success of the preserve system. Population dynamics for hill-country woodland plants are not well known and will need to be studied in order to predict future woodland and forest distribution and composition.

6.6 Species-Specific Management Strategies

6.6.1 Management of Songbirds

Basic concerns of songbird management include: nest parasitism and predation; vegetation dynamics; habitat fragmentation and edge effects; and conflicts between black-capped vireo and golden-checked warbler habitat requisites and management for the two species when in close proximity.

Nest parasitism by cowbirds and browsing pressure should be controlled using a unified approach. In general, fragmentation of woodlands will decrease habitat quality for target nesting songbirds by increasing exposure of their nests to predation and parasitism. This appears to be true along even narrow trails and small, clear-cut openings within wooded environments. Consequently, vireo and warbler habitat ideally should be managed as large blocks with no interior artificial clearings or cleared right-of-ways. Where existing permanent easements, roads, and trails are already established, site-specific maintenance and monitoring activities should be used.

When the habitats (or potential habitats) of the two key endangered songbirds occupy the same general area, conflicts may arise over which environmental variables to emphasize

in preserve land management strategies. Ultimately, resolution of this technical dilemma may require consultation with USFWS staff, species experts, practicing land managers, and designated species recover teams. General site characteristics, current vegetation cover type, land use history, terms and conditions of the application section 10(a) permit, and the location of individual tracts within the preserve system should be considered when determining management practices at any given location.

Black-Capped Vireo Management: Public access into the vireo habitat during the breeding/nesting season should be strictly regulated. For the purposes of public access, that period is defined as from March 1 to September 1.

Use of prescribed fires and other types of permissible vegetation management techniques used to create or restore vireo habitat must be conducted outside of the breeding season. Selected vireo management sites need to be identified and then manipulated using previously described vegetation control techniques designed to create favorable vireo habitat. Vireo population goals for a given area and associated numbers of managed vireo habitat areas should be established using current technical knowledge.

Golden-Cheeked Warbler Management: Public access into warbler habitat during the breeding/nesting season should be strictly regulated. For the purposes of public access, that period is defined as from March 1 to September 1. To minimize impact from humans, preserve managers may rotate public access among various units of habitat, close trails and roads that enter occupied habitat, or allow only supervised access to trails that provide viewing of target species from the periphery of occupied habitat.

Disturbed woodland interior openings and other areas clear of a mature tree cover should be considered for habitat restoration activities. Overall emphasis for warbler habitat should be placed on native hardwood regeneration. This will likely require direct plantings of native hardwood species in combination with exclusion of browsing animals. In addition, localized thinning of young junipers may be required to reduce competition with hardwoods.

6.6.2 Cave Invertebrates

Public access to caves and larger karst openings should be strictly regulated using a permit system obtained from the appropriate preserve land manager. Fire ant control should be implemented where cave infestations occur that can threaten sensitive cave invertebrates. The surface drainage and sub-surface environment must be maintained in a natural condition with minimal ground and vegetation disturbances.

6.6.3 Plant Species

Preserve sites with observed stands of target plant species should be protected from human disturbance, browsing, and soil erosion, using fencing and other appropriate measures. Preserve land managers may choose to develop plots using rare plant species grown through seed recovery from external populations threatened by destruction, or from other internal or external sources.