1.3.0 ENVIRONMENTAL ~~ASSESSMENT~~ RESOURCE INVENTORY

(A) Pursuant to the City of Austin's Land Development Code (LDC), Section 25-8-121(A), and Title 30-5, ~~except to the extent that any of the following requirements are excluded by the Director as provided in Section 25-8-121 (D),~~ an ~~environmental assessment~~ Environmental Resource Inventory (ERI) report is required for all sites that are: ~~and COA Critical Environmental Feature Worksheet (hard copy and electronic format – cd, diskette, or other media) shall be submitted as detailed below to the director of Watershed Protection and Development Review for proposed development located:~~

~~(1)~~ over a karst aquifer;

~~(a) provide a Edwards Aquifer recharge zone map with site location, using the most current information~~

~~(b) provide site specific geological map showing bedrock units at a scale of 1"=400'~~

~~(2)~~ within ~~an area draining to~~ within a contributing zone of a karst aquifer; ~~or reservoir~~

~~(a) provide a contributing zone map to Edwards Aquifer recharge zone~~

~~(b) provide site specific geological map showing bedrock units at a scale of 1"=400'~~

~~(3)~~ in a water quality transition zone (WQTZ);

~~provide a site map or reference in the site plan application of all WQTZ boundaries (can combine with CWQZ, and floodplain map)~~

~~(4)~~ in a critical water quality zone (CWQZ);

~~provide a site map or reference in the site plan application of all CWQZ boundaries (can combine with WQTZ, and floodplain map)~~

~~(5)~~ in ~~a~~the 100 year floodplain; or

~~(a) provide a site map or reference in the site plan application packet of floodplains defined by FEMA (can combine with CWQZ, and WQTZ map)~~

~~(b) provide a site map of the COA floodplains in all water courses up to 64 acres of drainage (combined with FEMA floodplains)~~

~~(6)~~ on a tract that has slopes with a gradient of more than 15 percent. ~~provide a site map or reference in the site plan application all areas with over 15 percent slopes.~~

~~(7) An applicant requesting that information be excluded from an environmental assessment, as provided in Section 25-8-121 (D), shall provide the following information to the Director:~~

~~(a) documentation that the designated City geologist and wetland biologist have visited the site and concur with the applicant that the environmental assessment information is not necessary~~

~~(b) documentation that the site is not located over the Northern or Barton Springs Segments of the Edwards Aquifer~~

~~(c) documentation that no known environmental variance to Austin's Land Development Code, Section 25-8, will be required to accomplish the proposed development of the property.~~

ERI reports are valid for 7 years after their completion date. A standardized ERI report template is available from the Watershed Protection Department (WPD) or in ECM 1.3.1. Applicants requesting a waiver to exclude information required in the ERI report pursuant to LDC Section 25-8-121(D) or Title 30-5 shall complete an ERI Waiver Request Form and submit the form to the appropriate WPD reviewer prior to submittal of the development application. The ERI Waiver Request Form is available in ECM 1.3.2.

ECM 1.3.0(B) is deleted in its entirety and replaced

~~(B) An environmental assessment (EA) must:~~

~~(1) Identify critical environmental features (CEFs) and propose protective measures for the features. All CEFs must be shown on a site map with proposed setbacks, with site topography contour elevation interval of 2 feet, at a scale of no greater than 1"=200'. Photographs of identified features and site conditions are encouraged to assist in evaluation by City staff.~~

~~All CEF locations must be entered in the COA Critical Environmental Feature Worksheet supplied with application material. Locations must be accurate and presented as latitude and longitude coordinates (WGS 1984 datum).~~

~~EA sections identifying geological CEFs, i.e., CEFs listed in subsection (a)-(e) below, must be prepared by a Licensed Professional Geoscientist in the State of Texas if the site is located over the Edwards Aquifer Recharge Zone, as defined by the City of Austin.~~

~~Specific requirements for feature types are as follows:~~

~~(a) springs~~

~~1. are defined as points or zones of natural groundwater discharge in upland and/or riparian zones which produce measurable flow down gradient of the source, or a pool, or both, or (during drought conditions) an area characterized by the presence of a mesic plant community (refer to Facultative-wet or Obligate plant species as listed in the National List of Plant Species That Occur in Wetlands, South Plains, Region 6, U.S. Department of the Interior, Washington D.C.)~~

~~2. standard setback - 150' radius around spring CEF Buffer Zones: LDC, Section 25-8-281 C, 1a~~

~~3. administratively approved modified setback - same square footage as standard setback with 50' minimum below spring and square foot balance applied up gradient or area contributing to the spring~~

~~4. the Director may grant an administrative variance to further reduce setbacks for CEFs; however, the applicant for a variance must demonstrate that the proposed measures used in place of setbacks preserve all characteristics of the CEF. LDC, Section 25-8-281 (D)~~

~~(b) bluffs~~

~~1. are defined as an abrupt vertical change in topography of more than 40 feet with an average slope steeper than four feet of rise for one foot of horizontal travel (400 % or 76 degrees)~~

2. standard setback - 150' radius around the bluff CEF Buffer Zones: LDC Section 25-8-281, C1a

3. administratively approved modified setback - same square footage as standard setback with 50' minimum below bluff and square foot balance applied up gradient of bluff

4. the Director may grant an administrative variance to further reduce setbacks for CEFs; however, the applicant for a variance must demonstrate that the proposed measures used in place of setbacks preserve all characteristics of the CEF LDC 25-8-281 (D)

(c) canyon rimrocks

1. are defined as an abrupt vertical rock outcrop of more than 60% slope (31 degrees), greater than 4 feet vertically, and a horizontal extent equal or greater than 50'

2. standard setback - 150' radius around rimrock CEF Buffer Zones: LDC Section 25-8-281, C1a

3. administratively approved modified setback - same square footage as standard setback with 50' minimum below rimrock and square foot balance applied up gradient of rimrock.

4. the Director may grant an administrative variance to further reduce setbacks for CEFs; however, the applicant for a variance must demonstrate that the proposed measures used in place of setbacks preserve all characteristics of the CEF LDC 25-8-281 (D)

(d) caves

1. are defined as underground voids large enough for an adult to enter. Point Recharge Identification Criteria: Environmental Criteria Manual (ECM) Section 1.10.0 - 1.10.3, & 1.10.4, C1

2. significance is determined by following the evaluation protocol, ECM Section 1.10.4, A & B

3. standard setback - 150' to 300' radius around surveyed surface projection of the cave footprint. (LDC Section 25-8-281, and ECM Section 1.10.4, C, 3, and Figures 1-61, 1-62, 1-63 ECM Appendix V)

4. administratively approved modified setback - same square footage as the standard setback applied to the drainage area measured from the first break in slope at the cave entrance and/or surface projection of the cave footprint (LDC 25-8-281 (D;)ECM Section 1.10.4, C2)

5. the Director may grant an administrative variance to further reduce setbacks for CEFs; however, the applicant for a variance must

demonstrate that the proposed measures used in place of setbacks preserve all characteristics of the CEF- LDC 225-8-281 (D)

6. guidance for protection of caves in undesirable pre-existing conditions is provided in the ECM Section 10.10.4, C, 5

(e) sinkholes and recharge features

1. are defined as a circular or oblong depressions formed in soluble rock by the action of subterranean water which is a potential point of significant recharge (with or without a surface opening) Point Recharge Identification Criteria: ECM Section 1.10.0 - 1.10.3, & 1.10.4, C1

2. significance is determined by following the evaluation protocol, ECM Section 1.10.4, A & B

3. standard setback - 150' to 300' radius around surveyed around surface delineation of feature measured from the first break in slope (LDC Section 25-8-281, and ECM Section 1.10.4, C, 3, and Figure 1-61, 1-62, 1-63 ECM Appendix V)

4. administratively approved modified setback - same square footage as the standard setback applied over the drainage area to the sinkhole or fracture (LDC 25-8-281 (D); ECM Section 1.10.4, C, 2)

5. the Director may grant an administrative variance to further reduce setbacks for CEFs; however, the applicant for a variance must demonstrate that the proposed measures used in place of setbacks preserve all characteristics of the CEF LDC 25-8-281 (D)

6. guidance for protection of sinkholes in undesirable pre-existing conditions is provided in the ECM Section 10.10.4, C, 5

(f) wetlands (LDC, Section 25-8-282)

1. are defined as lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water. An area shall be classified as a wetland if it meets the Army Corps of Engineers three parameter technical criteria as outlined in the Corps of Engineers 1987 Wetlands Delineation Manual (Section D. Routine Determinations):

a. three parameters for wetland determination include prevalence hydrophytic vegetation, hydric soil formation, and presence of adequate hydrology

b. recommended routine method: wetland hydrology and hydric soils can be assumed if an area under examination is dominated (over 50% vegetative cover) by Facultative-wet and/or Obligate plant species as listed in the National List of Plant Species That Occur in Wetlands, South Plains, Region 6, U.S. Department of

the Interior, Washington D.C.; and an abrupt boundary is evident between Facultative-wet and/or Obligate plant communities and Upland plant communities

c. if the area is dominated by Facultative plant species, the hydric soil and hydrology parameters cannot be assumed; therefore, are also required for determination as a wetland the area is not a wetland if dominated by Upland plant species, soils that are not hydric, or hydrology that is not wetland

d. exceptions include permitted water quality wet ponds, roadside ditches, and ponds fed by wells or other artificial sources of hydrology

e. potential wetlands are mapped on the U.S. Department of Interior, Fish and Wildlife Department, National Wetland Inventory Quad Maps; however, these areas must meet the Army Corps 1987 Delineation Manual criteria before classified as CEFs reference:

(USFWS) US Fish and Wildlife Service. 1993. National Wetland Inventory Map. Austin Area Quads. U.S. Department of the Interior, Washington, D.C.

2. standard setback - 150' around the outside edge of the wetland area; appropriate for wetlands fed by sheet flow from all directions. LDC Section 25-8-281

3. administratively approved modified setback - same square footage as the standard setback applied to the natural drainage patterns above and below the wetland; appropriate for fringe wetlands along streams or ponds in-line with streams.

4. the Director may grant an administrative variance to further reduce setbacks for CEFs; however, the applicant for a variance must demonstrate that the proposed measures used in place of setbacks preserve all characteristics of the CEF LDC 25-8-281 (D)

5. wetland mitigation – minimum 1:1 replacement of same square footage as wetland CEF and standard 150' setback; appropriate for isolated wetlands whose source of hydrology will be compromised by the proposed development

Wetland replacements must be approved by the Director of Watershed Protection and Development Review. Replacements may include but are not limited to the following examples:

a. on-site constructed wet ponds (for direction see ECM, Section 1.6.6, Design Guidelines For Wet Ponds)

~~b. on-site detention ponds landscaped with a native wet prairie (for direction see COA Standard Specification Manual, Section 609S, Native Grassland Seeding and Planting For Erosion Control)~~

~~c. additional on-site buffers around existing water features or CEFs~~

~~d. on-site bio-filtration + infiltration enhancement of standard sedimentation/filtration water quality and/or detention ponds (consists of replacing most of sand bed or detention basin with wet prairie landscape over porous soil, over gravel infiltration substrate)~~

~~6. wetland restoration or enhancement for water quality controls; appropriate for existing ponds in-line with unclassified waterways or isolated ponds that can treat a development's storm water runoff (ECM, Section 1.6.6)~~

~~(2) Provide an environmental justification for spoil disposal locations or roadway alignments. The environmental assessment should identify inappropriate spoil disposal areas or roadway alignments, if present, to be considered during the Site Development phase or Construction Plan phase.~~

~~(a) spoil disposal sites (for guidance see LDC, Sections 25-8-323 and 25-8-343)~~

~~(b) roadway alignments are justified by selecting alternatives of least impact to environmental resources or sensitive areas including, trees (LDC, Sections 25-8-602 through 25-8-627), stream crossings (LDC, Section 25-8-262), and slopes (LDC, Sections 25-8-301 and 25-8-322)~~

~~(3) Propose methods to achieve overland flow and justify enclosed storm sewers (LDC, Section 25-8-185). The environmental assessment should identify existing significant drainage patterns that support natural character, if present, for use in the Site Development phase or Construction Plan phase. Buffers around unclassified drainages may be employed as grassy filter strips for water quality credit where sheet flow can be maintained from adjacent impervious cover (For water quality credits see ECM, Section 1.6.7 F)~~

(B) The guidance for completing the ERI form is as follows:

1. **Site/Project Name** – Provide the name of the site or project. If possible, provide the same name that will appear on the development application and the proposed plan set.

2. **County Appraisal District Property Identification Number** – Provide the County Appraisal District Property Identification Number for all tracts within the proposed development. Identification numbers are available at the county appraisal district's online property search tool.

3. **Address/Location** – Provide the street address of the proposed development. If no street address exists, then give the street block address; for example, 500 block of Barton Springs Road.

4. **Watershed** – Identify the watershed(s) present on site. A map of the City of Austin's watershed boundaries can be viewed online using the City of Austin's Development Web Map at:

   http://www.austintexas.gov/GIS/developmentwebmap/

   or downloaded at:

   ftp://ftp.ci.austin.tx.us/GIS-Data/Regional/coa_gis.html

5. **Aquifer Zones** –Indicate whether or not the site is within the Edwards Aquifer Recharge Zone; Edwards Aquifer Contributing Zone; Edwards Aquifer 1500 feet Verification Zone, and/or the Barton Springs Zone as defined by LDC 25-8-2 or Title 30. Maps of these regulated areas can be viewed online using the City of Austin's Development Web Map at:

   http://www.austintexas.gov/GIS/developmentwebmap/

   or downloaded at:

   ftp://ftp.ci.austin.tx.us/GIS-Data/Regional/coa_gis.html

   If the property is over the recharge zone, a Professional Geoscientist Licensed in the State of Texas as defined in ECM 1.12.3(A), must complete the Hydrogeologic report for the ERI and the karst surveys. The Professional Geoscientist shall seal and sign the ERI.

6. **Floodplain Modification** – If any floodplain modifications are proposed with this development project, check all conditions that apply. Pursuant to LDC 25-8-261 and 25-8-364, unless the proposed floodplain modification is necessary to protect public health and safety or necessary for development allowed in the Critical Water Quality Zone, a functional assessment is required. Guidance and forms for the Functional Assessment (FA) are located in ECM Appendix X. The completed FA shall be attached to the end of the ERI report.

7. **Proposed Utility Lines** – If a proposed project is within an urban or a suburban watershed and utilities lines are proposed to be located parallel to and within Critical Water Quality Zone, then riparian restoration is required by LDC 25-8-261(E) and a Functional Assessment must be completed and attached to the ERI. Guidance and forms for the functional assessment are available Appendix X.

8. **Critical Environmental Features** (CEFs) – Identify, describe and provide protective measures for all CEFs on site and within 150 feet of the site boundaries. Guidance for

protective measures is in ECM 1.10.0. If no CEFs are present, enter a zero in the space(s) provided. If CEF(s) are present on site or within 150 feet of site boundaries, include the Critical Environmental Feature Worksheet as an attachment to the ERI report. Provide color photographs and detailed description of each CEF(s). The CEF description should supplement information not included in the CEF worksheet such as, presence of wetland and/or spring-indicator plant species, direct or indirect indicators of recharge infiltration at point recharge features, etc. If the standard buffer is not proposed, provide rationale for the proposed alternative buffer.

Except for wetland CEFs, if the standard buffer is not provided and/or other variance from LDC 25-8-281 or Title 30-5-281 are proposed, then a written Administrative Variance Request for each CEF must be provided. Administrative Variance Request forms are available in ECM 1.3.3.

9. **Maps** – Provide four maps; a geologic map with two foot topographic contours, a historic aerial photo (greater than or equal to 15 years), a soils map, a CEF and well locations map on the most current (less than 5 years) aerial photo with two foot topographic contours. All maps must show a north arrow, a legend, map scale, the property boundaries and areas within 150 feet of the site. Geologic maps and digital data are available online from the Bureau of Economic Geology STATMAP GIS Database. Soils information and digital soil data files are available at the USDA NRCS web soil survey. Historic and current aerial photography with two-foot contour interval is available at the City of Austin links below.

   The CEF location map must show all CEFs and wells on site on current aerial photo. For all CEFs show the standard 150 foot buffer; with maximum of 300 foot buffer for point recharge features (see ECM 1.10.0 for buffer guidance). If an alternative buffer or wetland mitigation is proposed, show both the standard buffer and proposed alternative buffer/mitigation. Use shading and or hatching to differentiate between the two buffer areas.

   Additional maps may be required, if the following zones are present on site; Edwards Aquifer Recharge Zone, Edwards Aquifer Contributing Zone, 1500-foot Verification Zone, Water Quality Transition Zone, Critical Water Quality Zone, and City of Austin fully developed floodplain. Maps can show multiple zones provided they are legible. All information required for these maps can be viewed online using the City of Austin's Development Web Map at:

   http://www.austintexas.gov/GIS/developmentwebmap/

   or downloaded at:

   ftp://ftp.ci.austin.tx.us/GIS-Data/Regional/coa_gis.html

10. **Hydrogeologic Report** – Pursuant to LDC 25-8-122 and Title 30-5-122 an ERI must include a hydrogeologic report. The purpose of this component is to provide detailed information on the site geology, soils, and topography to offer insight on the occurrence of CEFs on the site.

Surface Soils- Provide a list of the surface soil units present on site. Include the soil series unit name and subgroup (taxonomic classification), the soil hydrologic group and soil thickness. All soils information is provided online by USDA NCRS County Soil Survey Maps. For example:

Houston Black, 2 to 8 percent (HoD2), Udic Pellusterts; Group D; 0 to 8.5-feet.

Soil series and their taxonomic classification (e.g. Mollisol-Udic Paleustalfs) aid with the identification potential CEF areas. The soils with an Aquic or an Udic moisture regime classification are saturated for all or most of time, and are likely to support wetland plant communities. The ability to transmit or impede water flow is characterized in the County Soil Survey for each soil series with a hydrologic group definition of A, B, C or D in the table of "Estimated Soil Properties Significant in Engineering." The hydrologic group and soil thickness are useful for identifying potential areas of high infiltration or very slow infiltration where point recharge features or wetlands may occur.

Provide a description of topography and drainages. The description of the topography facilitates the evaluation of steep slopes, where rimrocks may be present. If point recharge features are present on site, demonstrate that the proposed drainage patterns will protect the quality and quantity of surface water that is draining to a point recharge feature(s) (LDC-25-8-122(3).

Geology – List the group and formation of the surface geologic units. Provide the member names for rock unit over the Barton Springs Segment of the Edwards Aquifer. In all other areas, provide the member name if available or known. Geologic Maps are available from the Bureau of Economic Geology. A table with the common stratigraphic groups, formations and member names is provided below.

Group	Formation	Members
Quaternary Terrace and Alluvial Deposits		Recent Channel Deposit
		Colorado Lower Terrace
		Colorado High Terrace
Navarro Group	Kemp	
	Corsicana	
Taylor Group	Bergstrom	
	Pecan Gap	
	Sprinkle	
Austin Group	Austin Chalk	Mckown
		Pflugerville
		Pyroclastic and Igneous Intrusives
		Burditt Marl
		Dessau Chalk
		Jonah
		Vinson
		Atco
Eagle Ford Group	Eagle Ford Shale	South Bosque
		Bouldin Flags
		Cloice Shale
		Pepper Shale
Washita Group	Buda Limestone	
	Del Rio Clay	
	Georgetown Limestone	
Fredericksburg Group (Edwards Group)	Person	Marine
		Leached & Collapsed
		Regional Dense
	Kainer	Grainstone
		Kirschberg Evaporite
		Dolomitic
	Comanche Peak Formation- Only within the Northern Edwards	
	Walnut	Basal Nodular Mbr.
		Valley Key Marl
		Whitestone Lentile
		Cedar Park
		Bee Cave
		Bull Creek
Trinity Group	Upper Glen Rose	Member 5
		Member 4
		Member 3
		Member 2
		Member 1

Provide a brief description of the site geology, such as the location of rock outcrops, faults observed or mapped on site. Based on site observations, determine if the mapped geologic units are present on site. Describe any relationship between the location of

CEFs and the geologic units. Example: several lithologic contacts have a higher propensity for karst development and for the occurrence of contact springs and seeps'.

Wells – Provide the number of wells on or within 150-ft of the site. If no wells are present, enter "zero" in the space provided. Include all oil and water wells, recorded and unrecorded that are active, abandoned, capped, or monitoring. If the site has, or proposes to receive water or wastewater service from the City of Austin, all active water wells must be registered with the City of Austin's Water Utility (see Wastewater Utilities Report). All wells must comply with 16 TAC Chapter 76 and local groundwater district rules; if any. Both inactive and active wells should be reported the local groundwater district. Identify all off site wells by contacting neighboring land owners and research the Texas Water Development Board water well data online.

11. **Vegetation Report** - Pursuant to LDC 25-8-123 and Title 30-5-123, an ERI must include a vegetation report. The description of the plant communities shall include the description of protected riparian areas on site. Protected riparian areas have minimum canopy extent of ½ acre, voids in tree canopy comprise less than 30 percent of the total area, at least 50 percent of all trees have diameters of eight inches or greater measured at 4½feet above ground, and are dominant by a diversity of trees by presence of at least three riparian tree species. Riparian tree species are list in Appendix X and include such trees as post oak, blackjack oak, cedar elm, eastern red cedar, mesquite, pecan, American elm, hackberry, green ash, box elder, and other trees.

    List the dominant woodland, grassland/prairie/savanna, and hydrophytic plant species present on site. Provide both common and scientific names in tables. If a plant community is not present on site, check 'no' and enter n/a in the table.

12. **Wastewater Utilities Report** – Indicate the type of wastewater treatment proposed for the development by checking the appropriate box. Confirm that the site wastewater collection systems will be constructed to accordance all State, County and City standards [(LDC 25-8-361(D)].

    If applicable, attach the calculation for the sizing of the wastewater drainfield or wastewater irrigation area(s) or indicate appropriate site plan sheet with the calculations.

    Provide environmental justification for the location of wastewater lines within the CWQZ. Discuss alterative alignments or construction methods that were considered or will be used to reduce environmental impacts to CEFs, riparian area, and watercourses (see LDC 25-8-261 & 361 and follow guidelines in ECM 1.5).

    If over the Edwards Aquifer, describe the wastewater disposal systems proposed for the site, its treatment level and effects on receiving watercourses or the Edwards Aquifer.

13. **Provide signature and contact information** for person that certifies that, to best of their knowledge, the responses provided are accurate. If the site is over the Edwards recharge zone, the qualified Geologist [as defined in ECM 1.12.3(A)] must seal and sign the report.

    Attach additional information as required, including the Functional Assessment, additional maps, CEF photographs and descriptions, if required.

ECM 1.3.1 (Hydrogeologic Element) is deleted in its entirety, renamed and replaced

~~**1.3.1 Hydrogeologic Element. See LDC Section 25-8-122.**~~

~~(A) generally describe the topography, soils, and geology of the site~~

~~—~~

~~references may include USGS Topo 7.5' Quad Maps, USDA Soil Survey County Maps, Barton Springs/Edwards Aquifer Conservation District, 2003, 1:28,000 Geologic Map of the Barton Springs Segment of the Edwards Aquifer, and Bureau of Economic Geology Geologic Quad Maps~~

~~- references:~~

~~- Bureau of Economic Geology, University of Texas. 1992 Geologic Map of the Austin Area, Texas.~~

~~- Garner, L.E., and K.P. Young. 1976. Environmental Geology of the Austin Area: An Aid to Urban Planning. The University of Texas at Austin, Bureau of Economic Geology.~~

~~- Garner et al. 1976. Geologic Map of the Austin Area. Reprinted 1992. The University of Texas at Austin, Bureau of Economic Geology.~~

~~- Proctor et al. Revised 1981. Geologic Atlas of Texas, Austin Sheet, Francis Luther Whitney Memorial Edition, University of Texas Bureau of Economic Geology.~~

~~- (TECQ) Texas Commission on Environmental Quality. 2005. Edwards Aquifer Recharge Zone Boundary Maps. Chapter 213.~~

~~- http://www.tceq.lstate.tx.us/compliaance/field _ops/eapp/program.html.~~

~~- (TWDB) Texas Water Development Board, Water Well Drillers' Records, March 2005.~~

~~- USDA Soil Survey of Travis/Williamson/Hays County, Texas. Soil Conservation Service now~~

~~Natural Resource Conservation Service, Temple Texas.~~

~~- http://www.soildatamart.nrcs.usda.gov~~

~~(B) identify springs, bluffs, canyon rimrock, and point recharge features including caves, sinkholes, faults, solution cavities and enlarged fractures~~

~~- reference: ECM 1.3.0~~

~~- a karst survey over the Edwards Aquifer Recharge Zone should be provided, consisting of 50' transects in a grid pattern across the project site completed by a Texas Licensed Geoscientist in the discipline of geology with experience in Central Texas~~

~~(C) demonstrate that proposed drainage patterns will protect the quality and quantity of recharge at significant point recharge features (ECM Section 1.10.4, C, 3, and Figure 1-61, 1-62, 1-63 ECM Appendix V)~~

1.3.1 Environmental Resource Inventory (ERI) Report

Click HERE to access PDF download of Environmental Resource Inventory (ERI) Report

(Insert PDF File 1_3_1ERI_Form here)

ECM 1.3.2 (Vegetative Element) is deleted in its entirety, renamed and replaced

~~1.3.2 Vegetative Element. See LDC Section 25-8-123.~~

~~(A) Demonstrate that the proposed development preserves to the greatest extent practicable the significant trees and vegetation on the site (See LDC Sections 25-8-602, 603, 604, 605, 621, 622, 623, 624, 625, 626, and 627). Demonstrate that the proposed development provides maximum erosion control and overland flow benefits from the vegetation. The environmental assessment should identify areas of significant vegetation, if present, for use in the Site Development phase or Construction Plan phase.~~

~~(1) guidance reference: ECM, Section 3.5.1 to determine tree significance when comparing alternative development sites or alignments~~

~~(2) guidance reference: ECM, Section 3.5.2 relative to tree preservation design criteria~~

~~(3) guidance reference: ECM, Section 3.5.3 for methods to design around constraints and select design alternatives~~

~~(B) include one of the following (as required by LDC 25-8-123):~~

~~(1) a tree survey of all required trees~~

a. follow guidelines established in ECM, Sections 3.3.2, 3.3.3, and 3.3.4

b. for Park surveys follow guidelines established in ECM, Section 5.3.1

c. for Hill Country follow guidelines established in ECM, Section 3.3.4.

(2) on approval of the city arborist, stereo aerial photographs that are nine inches by nine inches in size, are at a scale of one inch to 400 feet or larger, and were photographed between the months of April and November (follow guidelines in ECM, Section 3.3.3, B, C, & D)

(C) for a commercial or multifamily site, include a vegetation survey that shows the approximate locations and types of all significant vegetation, as required by LDC 25-8-123

(3). A general description of the vegetation includes:

(1) vegetational area of Texas on site

recommended reference:
Gould, F.W., G.O. Hoffman, and C.A.

Rechenthin. 1960. Vegetational Areas of Texas.

College Station: Texas Agricultural Extension Service, Texas A&M University.

(2) dominant vegetational communities

recommended references:

Amos, B.B., and Gehlbach, F.R., 1988, Edwards Plateau Vegetation, Plant Ecological Studies in Central Texas.

Diamond, D.D., D.H. Riskind, and S.L. Orzell. 1987. A Framework for Plant Community Classification and Conservation in Texas. Texas J. Sci.39:203-221.

Frye, Roy G., Kirby L. Brown and Craig A McMahan, 1984, The Vegetation Types of Texas. Texas Parks and Wildlife, Austin, Texas.

Gould, F.W. 1975. Texas Plants – A Checklist and Ecological Summary. College Station: Texas A&M University.

McMahan, C.A., R.G. Frye, and K.L. Brown. 1984. The Vegetation Types of Texas, Including Cropland. Texas Parks and Wildlife Department. 40p.

Texas Parks and Wildlife. 1978. Natural Regions of Texas. Source: “Preserving Texas’ Natural Heritage,” LBJ School of Public Affairs Research Project.

(3) list taxonomic and common names of dominant trees, shrubs, vines, grasses, and forbs on the development tract

(4) important species and natural areas

~~a. identify priority and other significant woodlands and prairies as mapped on the City of Austin Biological Resource Sector Maps; contact Watershed Protection and Development Review Department, Environmental Resources Management Division for information~~

~~b. identify areas defined by ECM's Glossary as Protected Riparian Areas, "Floodplain Woodlands"~~
~~follow guidelines in ECM, Sections 1.7.7, 1.7.8, and 1.7.9 to recommend protection and restoration of floodplains when alterations are proposed~~

1.3.2 Environmental Resource Inventory (ERI) Waiver Request Form

Click HERE to access PDF download of Environmental Resource Inventory (ERI) Waiver
(Insert PDF File 1_3_2_ERI_Waiver here)

ECM 1.3.3 (Utilities Element) is deleted in its entirety, renamed and replaced

1.3.3 Utilities Element. See LDC 25-8-124.

~~(A) wastewater report must:~~

~~—~~

~~(1) provide environmental justification for a sewer line location in a critical water quality zone (see LDC 25-8-261 & 361 and follow guidelines in ECM, 1.7.7, A and B, 4)~~

~~a. present alternatives for tunneling, micro-boring, or optional alignments outside the critical water quality zone and compare environmental constraints for each alternative~~

~~b. for unavoidable construction in Parks, greenbelts, and creeks follow guidelines outlined in ECM, Section 5.4.8, 5.4.9, and 5.4.10~~

~~(2) verify environmental compliance for use of on-site wastewater disposal systems (LDC 25-8-361, D)~~

1.3.3 Administrative Variance Form for Variances from LDC 25-8 and Title 30

Click HERE to access PDF download of Administrative Variance from LDC 25-8 and Title 30
(Insert PDF File 1_3_3_Administrative_Variance here)

1.3.4.2 Design Criteria Clarifications for Site Plans of Industrial Development Projects not Enclosed Within a Building.

A. Calculations of Impervious Cover. Placement of gravel for driveways, haul roads, parking lots or storage yards will be considered impervious cover, per LDC 25-8-63 and ATCSR 30-5-63, and shall be included in the calculation of impervious cover for the purpose of determining water quality volume for water quality control structures. Calculations of impervious cover must comply with the definition of impervious cover in LDC 25-1-23 and 25-8 of the LDC and 30-5 of ATCSR and 1.2.3.1, 12.3.2, 1.8.0 and Appendix Q-2 of the ECM.

B. The Critical Water Quality Zone (CWQZ) is not to be disturbed. Establish the width of the CWQZ in accordance with 25-8 of the LDC and 30-5 of ATCSR.

C. The Water Quality Transition Zone (WQTZ) may be used for open-air industrial activities in accordance with all other City of Austin Land Development Code requirements for development in the WQTZ. Excavation and mining are defined as development (LDC 25-1-~~23~~21) but are not subject to impervious cover limitations for development within the WQTZ. Establish the width of the WQTZ in accordance with 25-8 of the LDC and 30-5 of the ATCSR.

D. Tree Protection. Describe tree protection measures or a replacement plan that is in compliance with LDC Chapter 25-8; if within the zoning jurisdiction of the City of Austin.

E. Riparian Corridor Preservation. Protection of riparian corridor areas should be emphasized, as described in ECM 1.7.0, Floodplain Modification Criteria.

F. Modifications to the 100-year floodplain must be in accordance with 25-8-364 of the LDC, 30-5-364 of the ATCSR, and Section 1.7.0 of the City of Austin Environmental Criteria Manual (ECM), Floodplain Modification Criteria, including preservation of protected riparian areas (as defined in ECM, Glossary).

G. Water quality controls are required for all development in the Barton Springs Zone (LDC 25-8-211). Excavation, mining, grading and dredging are defined as development (1.3.4.1 C.). Outside of the Barton Springs Zone ~~and urban watersheds~~, water quality controls are required ~~when impervious cover is greater than 20% of the net site area. In urban watersheds, water quality controls are required~~ if impervious cover is greater than ~~5,000~~ 8,000 square feet. Water quality controls must comply with the Chapter 25-8 of the LDC and 30-5 of the ATCSR; the ECM and the Drainage Criteria Manual (DCM). Alternative water quality controls~~, such as vegetative filter strips,~~ may be proposed for treatment.

H. Erosion and sedimentation controls are required for all graded or cleared areas that do not drain to an open resource extraction pit, a temporary sedimentation basin or to water quality

control structures. Erosion and sedimentation controls must comply with 25-8 of the LDC and 30-5 of the ATCSR and the ECM. Temporary sedimentation ponds may be required for excavation and grading activities in order to capture sediment and to prevent infiltration of sediment-laden stormwater. Either the permanent outlet structure or a temporary outlet must be constructed prior to development of any embankment or excavation that leads to ponding conditions. The outlet system must consist of a low-level outlet and an emergency overflow meeting the requirements of the Drainage Criteria Manual (Section 8.3) and/or the Environmental Criteria Manual (section 1.4~~.2.K~~), as required. The outlet system shall be protected from erosion and shall be maintained throughout the course of construction until final restoration is achieved.

I. Backfill material. Only uncontaminated earthen material or inert construction rubble, as defined and regulated by Texas Administrative Code (TAC) 335.507 as Class 3 industrial solid waste, that is suitable for structural fill may be used as backfill. Protruding metal must be removed from concrete or cement rubble. No garbage, asphalt or soils containing petroleum residues may be used. All backfill material must meet the criteria of inert and essentially insoluble. Chemical analyses by a certified laboratory may be required if the material has an odor, texture or appearance indicating that it is not inert and essentially insoluble. The operator will obtain a Backfill Load Certificate of all material placed as backfill from each vehicle driver. Backfill Load Certificates must be kept onsite and available for inspection by the City of Austin. Post a sign near the backfill area stating that only uncontaminated earthen material and inert construction rubble may be accepted.

J. The site plan must comply with all other applicable sections of the LDC or the ATCSR not otherwise specified in this criteria.

1.3.4.3 Pollutant Attenuation Plan Report.

Describe the phasing of site development or use, operations, water quality best management practices, and reclamation plans.

A. Submit the following in report format:

1. Engineering Report. Describe the industrial activities occurring outdoors. If operations are to be phased over several years, then describe the areas of the site and anticipated activities during each phase.

(A) Drainage and water quality control plan. Describe existing and proposed site and offsite drainage patterns and water quality Best Management Practices (BMPs). The drainage control plan shall describe stormwater controls over the course of site development and closure, particularly compliance with TPDES general permit discharge limits for the proposed industrial activity per SIC codes. Include all stormwater management practices such as dust suppression and vehicle washing or vehicle wash-out. A copy of the TPDES Stormwater Pollution Prevention Plan may be submitted in lieu of a description of the drainage control plan. Address operations related to potential stormwater pollutants, such as particle washing, dust control, batch plant operation or building operation. The plan must also address compliance with the following sections of the LDC (or ATCSR) : Chapter 6-5,Water Quality; Chapter 25-7 (30-4), Drainage; Chapter 25-8 (30-5), Environment, Article 6, Water Quality Controls; and Section 1.7.0, Floodplain Modification Criteria, of the Environmental Criteria Manual. Provide a topographic map depicting the drainage control plan that shows existing and proposed drainage patterns

onsite and to adjacent offsite properties, stormwater discharge points, water quality control structures, erosion and sedimentation controls. The scale of the map should not exceed 1 inch equals 400 feet. If the site is adjacent to the Colorado River, include all drainageways and all drainages located within 150 feet of a Critical Environmental Feature.

(B) Reclamation plan. Describe how the area used for outdoor industrial activities will be stabilized or restored upon termination of proposed industrial activities. Describe land restoration measures such as building demolition, excavation or fill to alter topography, revegetation and tree replacement. At a minimum; all unconsolidated material and/or unvegetated areas must be stabilized with vegetation or other soil stabilization controls in order to prevent erosion and runoff of sediment, per LDC 25-8-185 or ATCSR 30-5-185 and Section 1.4 of this manual. Additional specific criteria for reclamation plans for Resource Extraction of unconsolidated mineral products or natural resources are listed in 1.3.4.4.C and for Rock Quarry or Mining; in 1.3.4.5.D.

1) Revegetation. Describe revegetation plans for the site. The plan may include any or all of the following components, at the discretion of the applicant. The corresponding sections of the LDC or ECM are provided as a reference.

a) Topsoil. Establish topsoil from site stockpiles or per the criteria of COA Specification 609S.3 C, Native Grassland Seeding and Planting for Erosion Control, or propose a procedure to develop soil using site materials. Developed soil must be similar in pH, organic carbon content, aggregetation, cation exchange capacity, nutrients, and microbial community to native, undisturbed soils within the county.

b) Native Grasslands. Describe a seeding plan to establish native grasslands based on COA Specification 604S.6, Seeding for Erosion Control. An applicant may propose alternative grassland species from COA Specification 609S.

c) Woody vegetation. Follow guidelines in ~~1.5.0, Revegetation Criteria,~~ Section 1.4 of the ECM.

d) Tree Mitigation. If the site is located within the zoning jurisdiction of the City of Austin, then the plan should describe tree mitigation. Follow LDC requirements (25-8-604 B) for removal of all trees over 8 inches in diameter. Tree replacement from the uplands zone may be placed in the ~~WQTZ~~ CWQZ of the Colorado River in order to enhance stream bank integrity. Follow ECM Section 3.5.4, Mitigative Measures, for mitigation or replacement guidelines.

e) Riparian Corridor Protection. If the applicant proposes mitigation for the loss of riparian habitat, then 1.7.0 of the ECM should be used for guidance.

f) Agricultural vegetation. Describe proposed crops or rangeland vegetation to be used to maintain an agricultural exemption. If fertilizers, pesticides or herbicides are to be used to establish vegetation, then describe these cultivation methods and materials.

g) Irrigation. If an irrigation system will be used to establish vegetation, then describe it.

h) Vegetative coverage. Restoration shall be acceptable when the grass has grown at least 1½ inches high with 95% coverage, provided no bare spots larger than 16 square feet exist (Source: ECM, Appendix P-1).

(C) ~~[Reserved for future Erosion Hazard Zone Analysis.]~~ Development proposed within 100 feet of the centerline of a waterway with a drainage area of 64 acres or greater or located where significant erosion is present should perform an erosion hazard zone analysis in accordance with the Drainage Criteria Manual.

B. Submit the following exhibits with the Pollutant Attenuation Plan Report:

1. Site Plan. The site plan shall show location of operations (including areas of future phases), drainageways, topography at a maximum contour interval of 2 feet, Critical Environmental Features, CWQZ, WQTZ, 100-year floodplain, and water quality control system or structures or discharge points. If the site is located within the city limits of the City of Austin, then also show protected size trees. Scale shall be no greater than 1 inch equals 400 feet.

2. Aerial Photograph. Submit an aerial photograph or satellite image of the site that is not more than five years old and at a scale of no greater than 1 inch equals 400 feet.

3. Reclamation Plan. Show the location of components of the proposed reclamation plan such as protected riparian corridor areas, restoration of disturbed areas, areas of revegetation, and redevelopment areas. Scale shall be no greater than 1 inch equals 400 feet.

1.3.4.5 Rock Quarry or Mining Assessment.

Additional components of the Pollutant Attenuation Plan are required for the following Resource Extraction industries: on-site extraction of surface or sub-surface consolidated mineral products or natural resources. Submit the Rock Quarry or Mining Assessment as a separate section of the Pollutant Attenuation Plan. [Includes Quarries; Dimension Stone (SIC Code 1411)].

A. Design Criteria Clarifications for Rock Quarry or Mining Activity and Related Activities.

1. Tree Protection. If the site is located within the zoning jurisdiction of the City of Austin, then describe tree protection measures or a replacement plan that is in compliance with LDC Chapter 25-8.

2. Riparian Corridor Preservation. Protection of riparian corridor areas should be emphasized, as described in ECM 1.7.0, Floodplain Modification Criteria.

3. Temporary Stabilization Requirements. Any disturbed area that is observed to be the source of dust or sediment in runoff, including material stockpiles, shall be revegetated per COA Standard Specification 604S, Seeding for Erosion Control. The purpose of temporary stabilization is to prevent erosion or runoff of sediment-laden stormwater to natural water bodies.

4. Stormwater Control Requirements.

A) Permanent Best Management Practices (BMPs) for stormwater control and treatment are required and must be designed and constructed in accordance with the criteria of the City of Austin LDC, ECM and DCM. Water quality controls are required for all development in the Barton Springs Zone (LDC 25-8-~~481~~211). Excavation, mining, grading and dredging are defined as development (see 1.3.4.1 C.). Outside of the Barton Springs Zone~~ or urban watersheds~~, water quality controls are required~~ when impervious cover is greater than 20% of the net site area. In urban watersheds, water quality controls are required~~ if impervious cover is greater than ~~5,000~~ 8,000 square feet. Water quality controls must comply with the Chapter 25-8 of the LDC and 30-5 of the ATCSR; the ECM and the Drainage Criteria Manual (DCM). Alternative water quality controls~~, such as vegetative filter strips~~, may be proposed for treatment.

B) Temporary BMP structures are required adjacent to active excavation areas and materials handling areas if runoff is not discharged to a permanent BMP structure for quarries located in the Barton Springs Zone. This is based on the assumption that sediment generated during quarrying will infiltrate fractures, solution cavities and recharge features on the quarry floor and recharge to the Edwards Aquifer. Temporary BMPs must be designed and constructed to meet the criteria of the City of Austin LDC and ECM.

C) Sedimentation basins for the discharge of materials processing water must be sized to contain the maximum daily volume of discharged wash water plus the volume for the two-year storm event. Sedimentation basins must be designed and constructed in accordance with the criteria of the City of Austin LDC and ECM.

5. Quarry Pit Backfill Criteria.

A) Pit sideslopes within competent rock may be stabilized as a vertical face.

B) Backfill material. If the pit is to be backfilled, then only uncontaminated earthen material or quarried spoils material from the site may be used to backfill the quarry pit. All potential recharge features greater than one square foot or one foot diameter in area located on the quarry or mine floor must be sealed prior to the placement of backfill. All backfill material must meet the criteria of inert and essentially insoluble. Chemical analyses by a certified laboratory may be required if the material has an odor, texture or appearance indicating that it is not inert and essentially insoluble. The operator will obtain a Backfill Load Certificate of all material placed as backfill from each vehicle driver. Backfill Load Certificates must be kept onsite and available for inspection by the City of Austin. Post a sign near the backfill area stating that only uncontaminated earthen material may be accepted.

C) Fill material shall be compacted from the bottom of the excavation to within five (5) feet of final grade. The method of compaction must be specified in the plan.

D) In an open pit that is partially backfilled, the slope of the backfilled area must be restored to a final slope of 3-horizontal to 1-vertical unit ratio (3 H:1 V) or as a series of benches with maximum height of 4 feet in order to prevent erosion and to disperse runoff back to sheet flow. (LDC 25-8-185 or ATCSR 30-5-185).

E) The final grade of backfilled areas may not exceed the pre-existing natural grade of the site prior to the initiation of extraction operations unless a variance is obtained from ~~the Zoning and Platting~~ Land Use Commission.

B. Provide a Resource Extraction Plan that shows the location and depth of the proposed resource extraction in plan and profile view. Plan view must include 2-ft contour (or less) interval topography at a scale no greater than 1 inch equals 400 feet. Include a general description of material and depth to be extracted on a cross-section profile. Submit as a 24-inch by 36-inch document. Provide notes on resource operation stormwater controls, procedures for accepting fill material and reclamation methods.

C. Reclamation Plan for Recharge Enhancement. If the quarry is located within the Edwards Aquifer Recharge Zone or overlying the Edwards Group or the Georgetown Formation rock strata, then the owner may operate an open pit as an aquifer recharge enhancement project. Submit a plan that describes the location, construction, operation and management that maintains good surface water quality comparable to ground water concentrations of nutrients, total suspended solids, metals, organic compounds and ions in Barton Springs, as reported by the U.S.G.S. in the most recent Water Bulletin report. The recharge enhancement may be for a portion of the site or for the entire site. Recharge enhancement projects must be designed and built in accordance with any other applicable local, state or federal regulation.

D. Reclamation Plan for Rock Quarry or Mining. Portions of quarries or mines that will not be operated for recharge enhancement must submit a plan that describes the reclamation methods and materials for land re-use or re-development. This portion of the Pollutant Attenuation Plan describes how the site will be stabilized or restored following resource extraction. Describe phasing within the report and show on 24-inch by 36-inch sized sheet (s). Show the location of components of the proposed reclamation plan such as protected riparian corridor areas, restoration of disturbed areas, areas of revegetation, and redevelopment areas. Scale shall be no greater than 1 inch equals 400 feet.

1. Pit Reclamation/Closure. This section will describe closure methods for portions of the site where excavation has been completed or that have been inactive for more than two years.

A) Stabilization. Describe the measures that will be used; such as reseeding or placement of erosion blankets, temporary irrigation or other soil stabilization practices for spoils piles.

B) Backfill for pit closure. Describe materials and methods to be used for backfill per criteria in 1.3.4.5 A. 5. Partial pit backfill may be proposed.

C) Backfill as constructed wetland and migratory fowl habitat. Following the criteria of the U.S. Army Corps of Engineers Regulatory Guidance Letter No. 02-2, December 24, 2002, “Guidance on Compensatory Mitigation Projects for Aquatic Resource Impacts Under the Corps Regulatory Program Pursuant to Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act of 1899” and describe the restoration methods and materials. The site may not be within the Controlled Compatible Land Use Area of the Austin-Bergstrom International Airport, as defined in Chapter 25-13 of the LDC, Airport Hazard and Compatible Land Use Regulations.

2. Revegetation. Describe revegetation plans for the site per 1.3.4.3 A. 1. (B) 1) or per the U.S. Department of Agriculture, Natural Resources Conservation Service’s Conservation Practice Standard entitled “Land Reconstruction, Abandoned Mined Land” and referenced as Code 543.

1.3.4.7 Fiscal Security Required for Payment of Site Reclamation.

Fiscal security shall be posted for payment of site reclamation costs in the event that the owner or operator fails to do so, per ~~25-7-65~~ 25-8-186 of the LDC. Fiscal may be posted for separate portions of the site in order to allow partial release of the fiscal security. Fiscal security shall be posted in compliance with 25-1-112 of the LDC and 1.2.1.1 of the ECM. The amount posted shall be a minimum of $500 per acre for the entire site; or $500 per acre for the area within the limits of construction and $2 per square yard for the area to be revegetated on a permanent perimeter erosion and sedimentation control berm; or an alternate amount submitted by an engineer in accordance with 1.2.1.1 D of the ECM that is approved by the Director ~~of the Watershed Protection and Development Review Department~~.

1.10.0 ~~POINT RECHARGE~~ CRITICAL ENVIRONMENTAL FEATURE IDENTIFICATION AND PROTECTION ~~CRITERIA~~

1.10.1 Statement of Intent

~~These~~The intent of these guidelines ~~are intended~~ is to assist applicants in complying with the Land Development Code (LDC) Sections 25-8-121, 25-8-151, 25-8-281, 25-8-282, 30-5-151, 30-5-281 and 30-5-282 ~~and 25-8-151 of the LDC~~. The guidelines specify and outline ~~the general nature of information to be submitted by applicants and outline~~ the decision-making process for the identification, evaluation and determination ~~determining the extent~~ of protective buffers for critical environmental features (CEFs) for the Environmental Resource Inventory (ERI) Report ~~setbacks surrounding "Point Recharge Features" as defined in the Watershed Regulations~~.

1.10.2 Background

A. In adopting the Land Development Code, the Austin City Council found that:

1. Protection of critical environmental features such as caves, sinkholes, springs, canyon rimrocks and bluffs is necessary to protect water quality in those areas most susceptible to pollution;

2. Minimum standards should be adopted and applied as general principles for the conservation and development of land., ~~the purposes~~ The purpose of ~~which~~ the standards ~~are include~~:

(a) ~~•~~ To prevent loss of recharge to localized aquifers supplying local seeps and springs essential to the maintenance of the ecosystem and the ~~base flow~~ baseflow and water quality of many of Austin's creeks; and

(b) ~~•~~ To ~~prevent loss of recharge to~~ maintain or enhance the water quality of the Edwards Aquifer ~~and to protect~~ by protection the water ~~the~~ quality of surface water recharging the ~~recharge to the~~ Edwards Aquifer.

B. Thus, the underlying principles and objectives of the watershed regulations with respect to critical environmental features ~~and point recharge features~~ are the:

1. Protection of the natural character and function of ~~features~~ CEFs;

2. Protection of groundwater ~~ground water~~ quality and quantity through protecting and maintaining ~~quality of~~ recharge; and,

3. 6 ~~Protecting and maintaining the quantity of recharge.~~Protection of surface water quality and quantity through maintaining the quality and quantity of surface water runoff and overland flow.

ECM 1.10.3 (Special Submittal Requirements) is deleted in its entirety, renamed and replaced

~~1.10.3 Special Submittal Requirements~~

~~For all proposed developments located in watersheds designated as "water supply suburban" or "water supply rural," an environmental assessment is required (Section 25-8-121 of the Land Development Code). The hydrogeologic element of the environmental assessment shall contain, at a minimum, either the information listed in Section 1.10.3 A below, or the information listed in Section 1.10.3 B below.~~

~~A. Certification by a competent professional that there are no wells, sinkholes or other point recharge features on the site, or,~~

~~a report from a geologist providing evidence that the sinkhole, well or other feature does not contribute recharge.~~

~~B. A report by a geologist that includes the following information:~~

~~1. Project Description. Describe the location and type of development. The location of the site shall be indicated on a USGS 7.5 minute quadrangle map. In addition, a description of background information sources, surveys and additional data gathering techniques shall be provided.~~

~~2. Site Geology. Describe the surface geology of the site including its geologic formations, stratigraphy, and structure. A geologic map at a scale of one (1) inch = 200 feet or (one (1) inch = 400 feet if the development is greater than 640 acres) shall be provided. The geologic map is to indicate site geology and include the location of karst features, faults, fractures and the Edwards Aquifer recharge zone.~~

~~3. Critical Environmental Features. Describe and locate all critical environmental features on a map with a scale of one (1) inch = 200 feet (or one (1) inch = 400 feet if the development is greater than 640 acres). Delineate the critical water quality zone and water quality buffer zone on the same map.~~

~~4. Water Well Inventory. Locate any existing water wells on the site and in the immediate vicinity of the proposed development. Prepare a list of all pertinent information that can be obtained for the wells. Some information may be available from the Texas Water Commission; however, an on-site field investigation is required. Include all available hydrogeologic information, such as: water levels, drillers logs, pump test data, seismic surveys, etc. Well locations may be delineated on the geologic map.~~

~~5. Soils. Describe the type of soils and the depth to bedrock on the site. If land use plans include spray irrigation on the proposed development site, on-site surveys must be conducted. Otherwise, information from the Soil Conservation Service Soil Surveys may be used.~~

~~6. Lineament Survey. A lineament survey may be required if unlined detention or sedimentation/filtration ponds or recharge basins are proposed on-site. Lineaments shall be indicated on a map with a scale of one (1) inch = 200 feet.~~

1.10.3 Critical Environmental Feature Identification

The intent of the following section is to assist applicant in the identification of critical environmental features (CEFs) by providing general criteria and specific indicators for the field identification of CEFs not included in the general definition stated in LDC 25-8-1, 30-5-1 and ECM 1.10.3defined in LDC 25-8-1 and 30-5-1.

A. **Bluffs** are an abrupt vertical change in topography of more than 40 feet with an average slope steeper than four feet of rise for one foot of horizontal travel (400 % or 76 degrees). Bluffs are any steep slopes in soil, rock, or alluvial deposits that meet the dimensions and slope requirements stated above and are not manmade cuts such as roadside rock outcrops and active rock quarry walls. Generally, bluffs are associated with riparian areas.

B. **Canyon Rimrocks** are an abrupt vertical rock outcrop of more than 60% slope (31 degrees), greater than 4 feet vertically, and a horizontal extent equal or greater than 50 feet. All outcrops that meet the dimensions and slope requirements stated above are critical environmental features. Rock outcrop means naturally occurring aggregate of one or more minerals that are visible at the Earth's surface such as Quaternary-age alluvial deposits, basalt, limestone, shale, or claystone layers. Rock outcrop does not mean soil. Rimrocks are continues rock layers or beds that are traceable along the slope for 50 feet. A person measuring the length of canyon rimrock should not interpret any faulting and fracturing of the rock outcrop and/or mass wasting covering a portion of the outcrop is not a break in the overall length of the feature. Canyon rimrock do not include manmade cuts such as roadside rock outcrops and rock quarry walls. Generally, rimrocks are associated with riparian areas and tributary canyons.

C. **Point Recharge Features** consist of several types of natural openings and topographic depressions formed by the dissolution of limestone that lies over the Edwards Aquifer recharge zone and may transmit a significant amount of surface water into the subsurface. Point recharge feature means a cave, sinkhole, a fault, joint or other natural features.

    1. Caves are natural underground voids form by the dissolution of limestone and are large enough for a person to enter. Applicants must determine the subsurface extent of all caves identified on their property. If a cave map is not available, the applicant should then conservatively estimate the cave footprint to be within 300 feet of the cave's entrance or have the cave passage surveyed. Geologist may use at least two rock cores along with geophysical surveys methods to determine the cave's dimensions. Rock cores should be located with the intent to correlate anomalies and to verify the finding of the geophysical survey. The cores should extend least five feet beyond the depth of the geophysical surveys results.

2. Fractures also referred to as a parting or a joint; are a measureable, larger than hairline, separation in a rock. Only those fractures that are solution enlarged (or fissures) and show evidence of direct or indirect of potential infiltration are CEFs.

3. Faults are fractures along which there has been displacement of the rocks on one side of the fracture relative to the other side. Not all faults and fractures are CEFs. A CEF determination for all faults must demonstrate that there has been solution-enlargement of the fault, the solution-enlargement should extend into subsurface and show direct or indirect evidence of potential infiltration.

4. Joints are fractures (see fracture above).

5. Other natural features are all natural cavities formed by the dissolution of limestone that are too small for a person to enter or are smaller than 18 cubic feet that are not epikarst features or a clustering of epikarst features. Epikarst is the zone of weathering at the upper surface of a limestone that includes the solutionally modified (karren) bedrock surface and the overlying and include the regolith. Other natural recharge features include solution cavities and swallow holes or swallets. Swallet is used in a general sense to indicate the place where losing (or sinking) streams infiltrate into the subsurface. Swallets can vary in shape and size. The transportation and deposition of organic debris, soil, sediment, and gravel by the stream or creek during periods when it is flowing may obscure swallets. Stream gauging is the best method for detecting a swallet hole.

6. Sinkholes are topographic depressions formed by karst dissolution of limestone that have bowl volume of at least 18 cubic feet. Sinkhole formation implies that karst processes including collapse, soil sapping, and subsidence has caused the land surface to sink relative to the surrounding area. The amount of subsidence can be subtle, as little as 6-inches in cross-section; the subsidence may have a funnel-shaped pit, a vertical shaft, or a bowl shape. Exposed rock may be present at the perimeter of the sinkhole. Land clearing activities may have obscured many sinkholes by filling and covering them with soil fill material, trash, brush, and rock. To be defined as a CEF, a sinkhole must exhibit either direct and/or indirect evidence of potential infiltration. Sinkholes may also contain a cave.

Karst features that may not be CEFs include closed and karst depressions, karren, and epikarst features. They are immature karst features that are associated with surficial weathering of limestone or the weathered zone at the soil/bedrock interface... A brief description of these immature karst features is below:

1) Closed depressions that have a bowl volume of less than 18 cubic feet. These features should be hand-excavated to confirm that they do not have a karst origin or direct or indirect evidence of potential infiltration.

2) Karst depressions are closed depressions that have a bowl volume of less than 18 cubic feet. These features should be hand-excavated to confirm that they lack evidence of potential infiltration.

3) Karren is minor surficial dissolution or weathering of limestone. They are not CEFs but may be associated with CEFs.

4) Epikarst is the upper weathered rock zone where limestone dissolution occurs at the surface or beneath the soil. The extent of the dissolution will diminish with depth. They are not CEFs but may be associated with CEFs.

Over the Edwards Aquifer Recharge Zone, an engineer qualified to practice geology (ECM 1.12.2) and/or a geologist (ECM 1.12.2) familiar with local hydrogeological characteristics and ordinance objectives should determine the occurrence of karst features by completing a karst survey. The survey method should consist of walking transects 50 feet apart across the project site completed by a Texas Licensed Geoscientist in the discipline of geology with experience in Central Texas.

Direct evidence of recharge includes flow observations, decreased flow downgradient of a point recharge feature, the presence of flow indicators, brief duration of ponding, a positive infiltration or percolation test and the detection of air movement. The observation of surface flow infiltrating into the feature is direct evidence of rapid infiltration. For point recharge features located in drainages with flowing water, verifying infiltration is determined by a direct measurement of a decrease of surface flow downgradient of a point recharge feature. Indicators of potential infiltration include the presence of erosion and depositional patterns such as debris lines, high water markers, leaf litter lines, and drainage patterns. Flow indicators should be evaluated even if the recharge feature has an accumulation of soil, sticks, and leaves. A person may prefer to conduct an on-site infiltration or percolation test at a potential recharge feature to demonstrate the presence or absence of recharge. An infiltration result of greater than 1×10^{-6} cm/sec is a positive infiltration result. In addition, the brief duration of ponding water in a closed depression is an indicator of rapid infiltration. Short duration of ponding indicates that infiltration is likely related to a subsurface conduit that is partially plugged. Air movement into or out of a karst opening is an indication of significant interconnected subsurface conduits and passageways. Air movement may not always be noticeable, depending upon atmospheric conditions.

Indirect evidence of recharge includes the presence and characteristics of subsurface voids as determined by geotechnical or geophysical investigations or speleological surveys, the sapping of fines through epikarst, or an interpreted karst origin suggesting the capacity of rapid infiltration.

Potential karst features filled with rock, soil, trash, or leaves must be excavated, and their relative infiltration rate assessed. Recharge features may be partially plugged from the natural or anthropogenic deposition of sediment. Historically, recharge features may have been filled with trash or rocks or other fill, which may obscure a recharge feature. The probing and excavation through materials to expose the opening or underlying bedrock is preferred. Soil filling of a point recharge feature does not rule out potential infiltration. In some cases, heavy equipment may be needed to excavate and adequately assess the feature. This level of investigation requires written approval from TCEQ, if in their jurisdiction under the Edwards Aquifer Protection Program, and/or from the City of Austin Watershed Protection Department. Please refer to TCEQ's Instructions to Geologists (TNRCC -0585) for details. Notification for hand excavation is not required; however, protocol must follow U.S.Fish and Wildlife Services Requirements for Conducting Presence/Absence Surveys for Endangered Karst Invertebrates in Central Texas (September 8, 2011). Excavations should extend into the subsurface until bedrock or a karst conduit is encountered. The geologist must document the excavation

of all potential recharge features by taking photographs, descriptions and measurements before, during and after excavation of a feature and include this information in the ERI report.

D. Springs and Seeps are points or zones of natural groundwater discharge that produce measurable flow , or a pool of water, or maintain a hydrophytic plant community (refer to Facultative-wet or Obligate plant species as listed in the National List of Plant Species That Occur in Wetlands, South Plains, Region 6, U.S. Department of the Interior, Washington D.C.), or other physical indicators ; especially during drought conditions. Physical indicators of a spring or a seep include the existence of a pool of water, even if small, the presence of hydrophytic plants, the mineralization of calcium carbonate such as travertine and/or tufa, and/or the detection of a water temperature gradient in the creek or pool. Geologic indicators include lithologic contacts and structural features such as a fracture, a conduit, a fault zone, and a bedding plane.

1. Some common hydrophytic plants associated with springs and seeps may include:

Liverworts and mosses	*Marchantiohyta and Bryophyta*
Maidenhair fern	*Adiantum capillus-veneris*
Wood fern	*Thelypteris kunthii*
Wooly dicanthelium	*Dichanthelium scabriusculum*
Spicebush	*Lindera benzoin*
Muhly grass	*Muhlenbergia sp.*
Water-pimpernel	*Samolus valerandi* ssp *parviflorus*
Bushy bluestem	*Andropogon glomeratus*

2. Common lithologic contacts with springs and seeps in the Austin area are:
   - Quaternary Alluvial Deposit overlying Limestone or Claystone
   - Austin Chalk and Eagle Ford Shale Contact
   - Buda Limestone and Del Rio Clay Contact
   - Edwards Group and Comanche Peak Formation
   - Edwards Group and Walnut Formation
   - Walnut Formation and Glen Rose Formation
   - Dolomitic Member and Basal Nodular Contact within the Edwards Group
   - Cedar Park Member and Bee Cave Member within the Walnut Formation

D. **Wetlands** are transitional lands between terrestrial and aquatic systems where the water table is usually at or near the surface and may have shallow water present. An area shall be classified as a wetland if it meets the Army Corps of Engineers three parameter technical criteria as outlined in the Corps of Engineers 1987 Wetlands Delineation Manual (Section D. Routine Determinations):

The identification of wetlands should be completed by someone familiar with the Army Corps of Engineers three-parameter technical criteria as outlined in the Corps of Engineers 1987 Wetlands Delineation Manual (Section D. Routine Determinations). The three parameters for wetland determination include prevalence of hydrophytic vegetation, hydric soil formation, and the presence of adequate hydrology. The recommended routine method assumes adequate hydrology and hydric soils if if the

area under examination is dominated (over 50% vegetative cover) by Facultative-wet and/or Obligate plant species (as listed in the National List of Plant Species That Occur in Wetlands, South Plains, Region 6, U.S. Department of the Interior, Washington D.C.) and an abrupt boundary is evident between these Facultative-wet and/or Obligate plant community and the Upland plant communities. If the area is dominated by Facultative plant species, the hydric soil and hydrology parameters cannot be assumed and must be examined to determine if an area is a wetland. .

Permitted water quality wet ponds, roadside ditches, and ponds fed by wells or other artificial sources of hydrology are not considered wetlands.

Atypical situations are unauthorized activities such as the alteration or removal of wetland vegetation, placement of dredge or fill material over hydric soils, construction of levees, drainage systems, or dams that significantly alter the wetland hydrology are considered as atypical situations. Wetland areas under these circumstances should be delineated in accordance to Section F of the Corps of Engineers 1987 Wetlands Delineation Manual.

ECM 1.10.4 (Evaluate Karst Features for Evidence of Significant Recharge and Other Environmental Significance) is deleted in its entirety, renamed and replaced

1.10.4 Evaluate Karst Features for Evidence of Significant Recharge and Other Environmental Significance

~~Occurrence of karst features should be determined by a qualified engineer and/or geologist, familiar with local hydrogeological characteristics and ordinance objectives. This determination will generally be conducted as a part of the environmental assessment prepared under the requirements of Section 25-8-121 of the LDC and may be reviewed and verified by the Watershed Protection and Development Review Department. The following guidance is provided for evaluation of point recharge feature significance and protection.~~

~~A. Evaluate the Karst Feature for Evidence of Other Significance. Under Section 25-8-281 of the LDC, protection of environmental significance other than hydrogeological significance may be recommended by a person submitting an application or the Director of the Watershed Protection and Development Review Department. This would typically involve protection of rare species or ecosystems or other geological, ecological, archaeological or historical value. Application of this provision could include such protection measures as setbacks, conservation easements, restrictive covenants or special drainage or other site design recommendations.~~

~~Although "other significance" is not the direct concern of the ordinance, it will be most efficient and cost effective to determine if a feature may require such protection early in the process, since the protection of other significance may pre-empt or supersede any buffers required under other paragraphs of Section 25-8-281 of the LDC.~~

~~Are significant biological or archaeological resources associated with the karst features? For example, several species of rare cave fauna are known to exist in caves in the Austin area. Five~~

(5) of these species are currently proposed for federal listing as endangered species. If such significance exists, setbacks or design considerations may be recommended by the applicant or the Watershed Protection and Development Review Department.

For the determination of geological, biological, archaeological, historical or other significance of specific karst features, the Watershed Protection and Development Review Department will rely heavily on input from the Texas Cave Management Association and/or other scientists in appropriate disciplines.

B. Evaluate the Karst Feature for Evidence of Significant Recharge. Fundamentally, any karst feature with a well defined surface opening (such as a cave) which has a catchment area greater than 70,000 square feet (corresponding to a basin with a radius of approximately 150 feet or approximately 1.6 acres) is presumed to be a significant point recharge feature unless proven otherwise. Any sinkhole with such a catchment area (with or without a surface opening) is also presumed to be a significant point recharge feature or has the potential to become such a feature (e.g., through enlargement or disturbance during construction) unless proven otherwise.

In evaluating any feature and especially those of questionable significance, the following information should be considered:

1. Does the karst feature or cluster of contiguous features show evidence of openings to the subsurface, prominent fractures, areas of visibly high porosity or a closed depression with no surface outlet?

2. Does the feature show direct evidence of actual recharge through primary or secondary observations?

Direct evidence includes observations of surface or subsurface flow as indicated by erosion and sedimentation patterns or flow-loss studies. A person may prefer to conduct on-site tests of infiltration or percolation to demonstrate the presence or absence of recharge, however such tests should be conducted in a manner so as not to disturb or destroy other characteristics of the feature (e.g., cave formations, cave faunas). Indirect evidence of recharge includes the presence and characteristics of subsurface voids as determined by geotechnical or geophysical investigations or speleological surveys.

C. Determination of Required Setbacks.

1. General: Catchment Area, Subsurface Voids. The upslope limits of the catchment area of any given point recharge feature (wherein some geographic buffer zone is to be designated) extends to the highest topographic contour above the feature irrespective of the degree of slope. The catchment area for a cave or sinkhole frequently will include a well-defined bowl-shaped "immediate catchment area" which may be a few feet to many yards across which represents the local collapse zone over a subterranean cavity. The sharp slope break present at the perimeter of such a collapse zone shall 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.

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Knowledge of the full underground extent of any subsurface voids associated with a point recharge feature will aid in determining the appropriateness of buffer zones. The presence of extensive, shallow subsurface voids extending beyond the limits of standard buffer zones may suggest that alternative protection measures would be appropriate.

2. General: Drainage Patterns. Extending beyond the immediate catchment area, drainage towards a point recharge feature may come through a small or large well-defined drainageway or may proceed generally by overland flow on relatively flat slopes. These characteristics should be taken into consideration, as described below.

Point recharge features located in a waterway or floodway or having a defined swale leading to them have the potential for very significant amounts of recharge. Here, waterway refers to any defined swale or channel, not just the minor, intermediate and major waterways defined in Chapter 25-8 of the LDC. If the feature is afforded protection equivalent to the maximum setbacks provided for by the provisions of Section 25-8-281 due to its location in a Critical Water Quality Zone and/or a Water Quality Buffer Zone left undeveloped and undisturbed under the provisions of Sections 25-8-395, 25-8-425 or 25-8-455 of the LDC, then the evaluation may be considered complete.

3. Standard Requirements. Section 25-8-281 of the LDC defines the standard, lower and upper limits of required buffer zones, based on the limit of the full catchment area (see Figure 1-61 in Appendix V of this manual for examples). In some cases where several point recharge features occur in close proximity (i.e., two (2) or more features within a 1.6 acre area) setback provisions may be applied collectively or setbacks may overlap, provided that the minimum standard setback for each feature is retained.

4. Proposals for Smaller Buffers. Section 25-8-281 of the LDC allows for the demonstration that a buffer smaller than the catchment area sufficiently protects the critical environmental feature. This demonstration should be based on a combination of compatibility of adjacent (proposed) land uses, local topographic characteristics and the vegetative development in the buffer area (see Figures 1-61 and 1-62 in Appendix V of this manual). For purposes of water quality protection, smaller buffers may be considered under the following criteria:

• Compatible Land Uses - The decision on allowing narrower buffer zones under Section 25-8-281 of the LDC should be based primarily on compatibility of adjacent land use types and treatment and not on structural solutions to water quality protection (see note, below). A presumption against smaller buffers can be assumed where,

- The upslope area beyond the standard buffer has an impervious cover greater than 40 percent; or

- The upslope area drains off of roadways, parking lots, commercial, office or retail land uses or residential lots of SF-4 or greater densities; or

- Hazardous materials regulated by the City of Austin's Hazardous Materials Storage and Registration Ordinance or applicable state or federal statutes are stored or used; or

- The upslope area above the feature drains an area, which is managed or landscaped in a way (e.g., with herbicides or pesticides) which presents a reasonable doubt that water quality can be protected.

• Topographic and Other Site Characteristics - Where compatible land uses are proposed next to a feature, the following site characteristics should be considered:

- Where the topographic slope from the edge of the feature to the outer edge of the required buffer is greater than two (2) percent (two (2) feet rise over each 100 feet) and/or when a defined swale, channel, creek or waterway drains towards the feature, no reduction of the setback will be allowed on the upslope side. In either case, flow velocities towards the point recharge feature will be substantial (especially during the few large storm events providing the majority of annual recharge).

- Where the slopes above a feature are less than two (2) and there is no defined drainageway leading towards the feature and the buffer area is well-vegetated with at least 75 percent cover of native grasses, forbs, shrubs and trees, then the following may be considered:

- Where the full catchment area of a feature extends beyond 300 feet upslope and where slopes above the feature are between one (1) and two (2) percent, the buffer may be reduced to a minimum of 150 feet.

- Where the full catchment area extends up to 300 feet and slopes above the feature are between one (1) and two (2) percent, the buffer may be reduced to a minimum of 100 feet on the upslope side.

- Where the full catchment area extends up to 300 feet and slopes above the feature are one (1) percent or less, the buffer may be reduced to the minimum of 50 feet from the upslope edge of the feature.

- Where a point recharge feature occurs in a drainageway and the drainageway continues downslope from the feature, the buffer width may coincide with the limit of the immediate catchment area on the downslope side of the feature, subject to the standard minimum 50 foot buffer.

Note: The diversion of drainage out of or away from the catchment area of a point recharge feature will not constitute evidence of the protection of water quality and will not be considered, alone, a legitimate basis for lessening buffer zones. The provisions of Section 25-8-151 of the LDC (Innovative Management Practices -- see Section 1.10.6 below) provide an alternative pathway towards protection of point recharge features. It should be anticipated, however, that plans relying on Section 25-8-151 of the LDC will be reviewed under the highest standards of environmental reliability and engineering performance.

5. Undesirable Pre-existing Conditions. Where actions prior to the effective date of the Comprehensive Watersheds Ordinance (May 18, 1986) resulted in incompatible land use within the drainage catchment of a point recharge feature, or degraded runoff has been diverted to the feature by previous actions, mitigative action should be taken in conjunction with any proposal which is subject to these criteria.

In such situations, the following solutions should be sought as part of any new development proposal, in the following order of preference:

- Re-establish required buffers in accordance with these criteria;
- Employ innovative management practices to improve the quality of runoff entering the recharge feature; and lastly
- Divert degraded runoff from the point recharge feature.

D. Treatment of Karst Features Which Lack Evidence of Significant Recharge. A person must demonstrate how these features will be considered during design and construction, to negate

~~the possibility that through grading or other land disturbance, they will become pathways for the infiltration of contaminated runoff. Restrictions on excavation and site grading activities which could expose subsurface voids or otherwise create additional avenues of recharge within the construction area may be required. Such measures as plugging of sinkholes may be appropriate in certain cases. Nothing in the ordinance prevents the voluntary protection of small karst features.~~

~~E. Newly Discovered or Identified Features. If, after development has begun, a karst feature becomes a point recharge feature (e.g., by excavation of a previously undetected large underground void), a person must report the occurrence in writing to the Watershed Protection and Development Review Department. The report shall contain an evaluation of the significance of the point recharge feature and a plan to mitigate any negative impacts, if necessary.~~

1.10.4 Determining Size of Critical Environmental Feature Protective Buffers

The establishment of CEF protective buffers is required by Code and as part of the Environmental Resource Inventory (ERI) report. The standard buffer distance for all CEFs is 150 feet with 300 feet maximum for point recharge features. Buffers are also three-dimensional, extending across the land as well as above and below the land surface. The intent of this section is to explain the reasons for buffering CEFs and to provide guidance for determining CEF buffers.

The Watershed Protection Department may administratively reduce the standard buffer or approve wetland mitigation. Wetland mitigation occurs at least at a 1:1 ratio for wetland CEFs and their associated 150 feet buffer. In general, the standard CEF buffers are not administratively reduced below 50 feet for point recharge features and springs. The director may grant a variance to the standard buffers described in Subsection (B) only after determining that the development proposed with the variance meets the objective of the requirement for which the variance is requested. In regards to critical environmental features, the minimum standard for the conservation of and the development around a CEF is:

1. For a property within the Barton Springs Zone, the granting of the variance will result in water quality that is at least equal to the water quality achievable without the variance.

2. All characteristics of the CEF will be preserved and additional protective measures are provided to maintain or enhance the feature. The CEF existing characteristics include the surrounding vegetation, ecological habitat, natural hydrology, and the water quality and quantity benefits associated to the feature.

3. The variance, if granted, must be a minimum departure from the Code. In regards to CEF buffers, minimum departure means by providing the maximum buffer distance feasible. Feasibility is not based on marketing or economic considerations or unique conditions derived because of the method by which a person voluntarily subdivides or develops land, except as provided under the "Hardship Provisions" of Section 25-8-25 of the LDC.

If the Watershed Protection Department denies an applicant’s request for a buffer reduction per LDC 25-8-42, then the applicant may request a Land Use Commission variance in accordance with LDC 25-8-41.

A. **Bluffs & Canyon Rimrocks** - Construction of impervious cover and land use activities in the upslope area adjacent to canyon rimrocks and bluffs often results in an increase in the velocity and the frequency of surface water runoff flowing over canyon rimrocks and bluffs. The resulting erosion associated with the increased runoff causes sediment-laden runoff to enter down-gradient watercourses and causes slope instability, particularly in those rimrocks and bluffs with underlying clay soils or shales. The entrained sediment in runoff water often has water quality contaminants attached that can accumulate in the watercourses downstream.

   If a steep rock outcrop area meets the requirements for a bluff or canyon rimrock as stated in ECM 1.10.3(A), then the standard buffer required is 150 feet. An applicant may request and reduce this buffer distance to less than 150 feet if:

   1. The upgraded slopes do not exceed 15% and the average slope does not exceed 10%.

   2. There is no evidence of erosion and/or preferential flow paths within 50-ft of the crest of the bluff or canyon rimrock.

   3. The rimrock is stable and there is no evidence of instability such as rock mass- wasting of the slope or undercutting.

   Recommended protective measures for granting a reduction of the buffer for a rimrock or bluff CEF include:

   1. Provide or enhance up-gradient vegetation within 50 feet of rimrock to at least 95% vegetative cover, with unvegetated areas not exceeding 10 square feet,

   2. Provide structural controls to spread the water over the land up-gradient of the rimrock to achieve sheet flow through the buffer area.

   3. Provide additional CEF buffer area equal to or greater than the standard buffer area along the drainage on site.

B. **Point recharge features** are conduits for karst aquifer recharge. Epikarst features are not CEFs, however they provide the subsurface drainage network of fractures, conduits, and voids that store and transport water to the recharge feature. Knowledge of the full underground extent of any subsurface voids associated with a point recharge feature and its associated catchment area will aid in determining the appropriate buffer size.

   Construction around point recharge features can alter surface, epikarst and subsurface drainage patterns or sever karst conduits that may carry water to the aquifer or nearby springs and seeps and wetlands. The increase in impervious cover and land use activities within the catchment area for a point recharge feature can diminish the water quality of water infiltrating into an aquifer by increasing contaminant load. The establishment of a protective buffer is a standard approach to reduce the effects of urbanization on surface and subsurface water inflows into the aquifer. The purpose of the buffer is to protect water quality and quantity through the protection of the native vegetation; the surface, subsurface and epikarst drainage patterns; and to maintain compatible land-use activities up-gradient and overlying the point recharge feature.

1. **Standard Buffers** – The standard buffer for point recharge features is dependent on the surface and subsurface characteristics of the feature and surrounding land use and conditions. The buffer should extend to protect the surface drainage area to the feature and the subsurface extent of caves. In some cases where several point recharge features occur in close proximity (i.e., two (2) or more features within a 1.6-acre area or 150 feet), buffer provisions may be applied collectively or buffers may overlap, provided that the minimum standard buffer for each feature is retained. Buffers are also three-dimensional, extending across the land as well as above and below the land surface.

    a. **Surface expression and drainage –** The standard buffer shall be 150 feet measured from the edge of the immediate catchment area of the point recharge feature. If the catchment area of the recharge feature extends beyond 150 feet, the buffer zone may extend up-gradient to a maximum 300 feet measured from the edge of the immediate catchment area of the karst feature.

    b. **Subsurface (cave footprint) –** The standard buffer also shall extend 150 feet, as measured from the surface projection of the cave footprint. For a mapped cave, if the accessible footprint extends less than 100 feet from the cave opening, no additional buffer is required. For caves of an unknown extent and configuration, the assumed extent of the cave is 300 feet in all directions and the required buffer will be 300 feet measured from the edge of the immediate catchment area of the cave.

2. **Administratively Approved Modified Buffers -** An administratively reduced buffer for point recharge features may not be granted to less than 50 feet.

    a. **Surface expression and drainage –** If the topographic break or catchment area draining to a point recharge feature is less than 150 feet from the immediate catchment area, the buffer may be reduced to coincide with the topographic break but not to less than 50 feet. If the catchment area of the recharge feature extends beyond 150 feet but is less than 300 feet, the buffer zone may be reduced to coincide with the topographic break as measured from the edge of the immediate catchment area of the karst feature.

    Reductions in the standard buffer should not occur if any of the following are present within the catchment area or standard setback area:

    1) Where epikarst bedrock is exposed at surface.

    2) Where direct evidence of potential infiltration is present (See ECM 1.10.3.C).

    3) A fracture zone is present within 150-ft.

    4) A fault is present within 150 feet of the recharge feature.

    5) A cave footprint is within 50 feet of the surface.

    6) There are springs and/or seeps CEFs within 500 feet of the recharge feature.

7) The vegetation cover within the catchment area is less than 95% and bare soil areas larger than 10 feet by 10 feet are present.

8) The upslope area beyond the standard buffer has an impervious cover greater than 40 percent; or

9) The upslope area drains off of roadways, parking lots, commercial, office or retail land uses or residential lots of SF-4 or greater densities; or

10) Hazardous materials regulated by the City of Austin's Hazardous Materials Storage and Registration Ordinance or applicable state or federal statutes are or will be stored or used adjacent to the catchment area; or

11) The upslope area above the feature drains an area that is managed or landscaped in a way (e.g., with herbicides or pesticides) which presents a reasonable doubt that water quality can be protected.

b. **Subsurface (cave footprint) –** The cave footprint must be protected by at least a 50 foot buffer. Since factors potentially impacting water quality and quantity in caves are less understood and more complex than for surface features, reductions in the standard buffer around a cave footprint will be determined on a case-by-case basis. Factors for consideration include:

1) Depth of the cave from the surface.

2) Extent of the cave.

3) Development of the cave along structural features such as faults and fractures.

4) Epikarst bedrock is exposed at the surface over or adjacent to the cave foot print.

5) A fracture zone is present within 150-ft of the cave foot print.

6) A fault is present within 150 feet of the cave foot print.

7) A cave footprint is within 50 feet of the surface.

8) There are springs and/or seeps CEFs within 500 feet of the cave.

9) The vegetation cover within catchment area is less than 95% and bare soil areas larger than 10 feet by 10 feet are present.

10) The upslope area beyond the standard buffer has an impervious cover greater than 40 percent; or

11) The upslope area drains off of roadways, parking lots, commercial, office or retail land uses or residential lots of SF-4 or greater densities; or

12) Hazardous materials regulated by the City of Austin's Hazardous Materials Storage and Registration Ordinance or applicable state or

federal statutes are or will be stored or used adjacent to the catchment area; or

13) The upslope area above the feature drains an area that is managed or landscaped in a way (e.g., with herbicides or pesticides) which presents a reasonable doubt that water quality can be protected.

Nothing prevents the voluntary protection of small karst features, which lack evidence of significant recharge. A person should consider in their project design how to negate the possibility of these features becoming pathways for the infiltration of contaminated runoff during and after construction. Restrictions on excavation and grading activities, which could expose subsurface voids or otherwise create additional avenues of recharge within the construction area, may be required.

Note: The diversion of drainage out of or away from the catchment area of a point recharge feature will not constitute evidence of the protection of water quality and will not be considered, alone, a legitimate basis for reducing buffer zones. The provisions of Section 25-8-151 of the LDC (Innovative Management Practices -- see Section 1.10.6 below) provide an alternative pathway towards protection of point recharge features. It should be anticipated, however, that plans relying on Section 25-8-151 of the LDC would be reviewed under the highest standards of environmental reliability and engineering performance.

Undesirable Pre-existing Conditions – In such situations in which actions prior to the effective date of the Comprehensive Watershed Ordinance (May 18, 1986) resulted in incompatible land use within the drainage catchment of a point recharge feature, or in degraded runoff being diverted to the feature, mitigation actions should be taken in conjunction with any proposal and are subject to these criteria. The following solutions should be sought as part of any new development proposal, in the following order of preference:

- Re-establish required buffers in accordance with these criteria
- Employ innovative management practices to improve the quality of runoff entering the recharge feature; and lastly
- Divert untreated runoff from the point recharge feature.

Newly Discovered or Identified Features. If, after development has begun, a karst feature becomes a point recharge feature (e.g., by excavation of a previously undetected large underground void), a person must report the occurrence in writing to the Watershed Protection Department (LDC 25-8-281 (**D)**). The report shall contain an evaluation of the significance of the point recharge feature and a plan to mitigate any negative impacts, if necessary. (see ECM: Void and Water Flow Mitigation 1.12.0)

C. Springs and seeps - The protection of springs and seeps helps to maintain baseflow of Austin Area creeks. Baseflow is essential for maintaining water levels in local reservoirs. Springs or seeps that are located up-gradient of the recharge zone maintain water

quantity in local aquifers. Spring/seep buffers protect the spring orifice or zone of seeps from disturbance and help preserve their groundwater flow paths.

The reduction of the standard buffer for springs/seeps is rare. Often the standard buffer is not adequate for protecting the ground water flow paths to springs/seeps from surrounding trenching and construction activities which can alter the groundwater flow paths to them. Spring and seeps buffers are only reduced if there is preexisting development within the setback area. In the case for buffer reductions, the greatest maximum setback distance should be provided, so that is it a minimum departure from the 150 feet required. Buffer for springs and seeps can only be administratively reduced to 50 feet on case-by-case basis and only if the applicant provides justification that the flow quantity and quality shall be preserved. A site-specific investigation of the hydrogeologic conditions associated with the spring or seep is required. Recommended protective measures for granting, on a case-by-case basis, a reduction of the buffer for a spring and seeps CEF included both:

1. Provide additional CEF buffer equal to or greater than the standard buffer area along the drainage on site.

2. Prohibit subsurface activities within 150 feet of spring or seep.

Applicants must demonstrate that proposed measures preserve all characteristics of the spring or seep, per LDC 25-8-42 (D)(3). Applicants requesting a spring or seep buffer to be reduced to less than 50-ft, must seek a Land Use Commission variance in accordance with LDC 25-8-41.

D. **Wetlands** – The protection of wetlands and the ecosystem services they provide is critical to maintaining and restoring the chemical, physical and biological integrity of surface water resources. Among these ecosystem services, wetlands can reduce the impacts from storm runoff, retain pollutants, reduce sediment, support instream baseflow, replenish groundwater, sequester carbon and provide critical resources for wildlife.

1. Standard Setback – The standard setback for a wetland CEF is a 150-foot CEF buffer around the outside edge of the wetland area. The protection of the Standard Setback may be appropriate to maintain the source water which supports saturation, or to maintain the surrounding physical or biological characteristics which support the wetland. The Standard Setback should be applied and preserved for wetlands that are fed by sheet flow from multiple directions, wetlands with pronounced diversity and vigor, or wetlands located in ecologically significant or sensitive areas.

2. Administratively approved modified setback – The standard setback may be modified so that the same square footage as the standard setback is applied to the natural drainage patterns above and below the wetland, or to adjacent surface water resources that would not otherwise be protected. The minimum setback average width should not be less than 50ft from centerline. An administratively approved modified setback may be applied based on the source of water supporting the

wetland, the biological characteristics of the wetland and the physical characteristics of the area around the wetland.

3. Mitigation – The Wetland CEF, the standard buffer, and/or administratively approved modified setback can be reduced on a case-by-case basis if 1:1 mitigation in the form of in-kind and on-site wetland enhancement or replacement is provided. Enhancements and replacements may include, but are not limited to, the following examples:

   a. on-site constructed wet ponds (for guidance see ECM, Section 1.6.6, Design Guidelines For Wet Ponds)

   b. on-site detention ponds landscaped with a native wet prairie (for guidance see COA Standard Specification Manual, Section 609S, Native Grassland Seeding and Planting For Erosion Control)

   c. additional on-site buffers around existing water features or CEFs

   d. on-site bio-filtration and infiltration enhancement of standard sedimentation/filtration water quality and/or detention ponds

   e. wetland restoration or enhancement for water quality controls; appropriate for existing ponds in-line with unclassified waterways or isolated ponds that can treat a development's storm water runoff (ECM, Section 1.6.6)

The Director of Watershed Protection Department may grant an administrative variance to further reduce setbacks for CEFs. The applicant for a variance must demonstrate that the proposed measures used in place of setbacks preserve all characteristics of the CEF.

ECM 1.10.5 (Protection of Point Recharge Features and Maintenance of Buffers) is deleted in its entirety, renamed and replaced with former ECM 1.14

~~1.10.5 Protection of Point Recharge Features and Maintenance of Buffers~~

~~A. Maintain Buffers Around Recharge Features in a Natural State. It is required 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 and are specified in Section 25-8-281 of the LDC. Additionally, recharge basins approved under Section 25-8-213 of the LDC may be constructed within buffer zones. The allowance of "yards" within a buffer zone should not be taken to imply that regular landscaping is appropriate for buffers. The "natural state" of a buffer will typically be a combination of dense native grasses and forbs in a mosaic of shrubs and trees.~~

~~B. Protect Point Recharge Features from Developed and Developing Areas. Point recharge features should be protected from areas of construction and development activity and from developed land uses to prevent recharge of pollutants. Based on adjacent land uses and site characteristics, such measures as detention, sedimentation/ filtration structures, drainage by-pass channels, berms, special erosion controls or other measures may be required (Section 25-8-281 of the LDC) to prevent contaminants from entering the aquifer.~~

~~Runoff protection measures for point recharge features, whether temporary or permanent, should be installed according to applicable city standards, including the erosion and sedimentation control criteria found in Section 1.4.0 of this manual. Such features as temporary and permanent erosion control measures should be placed at the perimeter of and not within, buffer zones. Boughs of brush for standard brush berms should not be gathered from within buffer areas.~~

~~C. Evaluate for Recharge Enhancement. If it is determined that post-development runoff will be of sufficient quality, measures such as recharge enhancement structures might be considered on a case-by-case basis. These may be especially appropriate if maintenance of recharge quantity is questionable due to unavoidable impacts of the proposed development. Rigorous demonstration of the capability, reliability and maintenance of proposed recharge enhancement systems will be required.~~

1.~~1~~410.~~0~~5 Critical Environmental Feature Buffer Maintenance and Inspection

1.~~1~~410.~~1~~5.1 Statement of Intent

The City of Austin has determined that Critical Environmental Feature buffers require ongoing maintenance to preserve their water quality function. This section describes the requirements for maintaining and inspecting buffers that are established by Sections 25-8-281 and 25-8-282 of the Land Development Code. Periodic inspections are necessary in order to verify that the vegetation, other natural characteristics, and protective infrastructure remain intact within the buffer area.

Additional guidelines for establishing the buffer and protection of point recharge features are in Section 1.10.4 (*Determining Size of Critical Environmental Feature Protective Buffers*), of the Environmental Criteria Manual.

This section applies to all Critical Environmental Feature buffers, as defined below.

1.~~1~~410.5.2 Requirements

(A) Definitions

(1) CATCHMENT AREA. The land area that drains to a point recharge feature. The upslope limits extend to the highest topographic contour above and around the feature, irrespective of the degree of slope. A sharp slope break present at the perimeter of a well-defined, bowl-shaped depression is the rim of the sinkhole and is within the catchment area.

(2) CRITICAL ENVIRONMENTAL FEATURE BUFFER. A land area established to protect or mitigate for the impacts to a Critical Environmental Feature (CEF). The natural vegetative cover must be retained to the maximum extent practicable. Construction disturbance must preserve all characteristics of the CEF and is limited to low-impact, minor modifications such as trails and protective structures.

(3) DRAINAGE WAY. The land surface that conveys surface flow to a larger body of water. This includes any channel that concentrates stormwater runoff.

(4) NATIVE VEGETATION. A native, or indigenous, species of Central Texas known to this region to exist as a result of only natural processes, with no human intervention. Once established, native species do not require irrigation, fertilization, or other chemical support when located in appropriate habitat. Native species of trees, shrubs, grasses, and wildflowers are listed in the Native Plant database of the Lady Bird Johnson Wildflower Center website.

(5) NUISANCE VEGETATION. Vegetation that is of an invasive or detrimental nature and may be harmful to the functioning or water quality protection of a Critical Environmental Feature. This may include terrestrial or aquatic plants such as kudzu (*Pueraria lobata*), Bermuda grass (*Cynodon dactylon*), elephant ear (*Colocasia*), arundo cane (*Arundo donax*), hydrilla (*Hydrilla verticillata*), and greenbriar (*Smilax bona-nox L.*). Refer to the City of Austin Invasive Species Management Plan for additional plant species.

(6) NON-MECHANIZED EQUIPMENT. Equipment that is operated by hand and may include the use of hand-held motorized tools, such as chain saws.

(B) The protection of a Critical Environmental Feature buffer may require perimeter controls such as a perimeter fence, physical barrier, other structures, and signage. Fencing must meet the specifications of the City of Austin Standard Specifications Manual or a standard approved by the Watershed Protection Department. If a fence is constructed, then at least one access gate with a lockable latch must be installed. Fencing is recommended for the following conditions:

(1) The buffer is located adjacent to industrial, commercial, multi-family, or single-family residences.

(2) The buffer contains the catchment area of a cave or sinkhole.

(3) The buffer area contains an ecological community that is sensitive to disturbances that may impact water quality or alter the natural characteristics of the Critical Environmental Feature.

(4) The buffer area contains steep slopes and is located outside of a Critical Water Quality Zone.

(5) The buffer area is potentially hazardous or dangerous to individuals.

(6) The buffer area contains State or Federally protected species.

(C) Cave gates may be required. The materials and construction method must be approved by the Watershed Protection Department.

(D) Other proposed structures, such as diversion berms or recharge enhancement structures, within the buffer must retain the functionality and integrity of the Critical Environmental Feature. Generally diversion berms would only be allowed inside a buffer to direct clean or treated runoff toward recharge features. Otherwise, diversion berms outside the buffer would direct untreated

runoff away from a recharge features. The materials and construction method must be approved by the Watershed Protection Department.

(E) Native vegetation within the buffer must be maintained such that it provides water quality benefits such as filtering sediment, allowing infiltration, promoting sheetflow of stormwater runoff, and preventing erosion. This maintenance does not include the requirement to provide supplemental irrigation for upland vegetation. Removal is to be conducted with non-mechanized equipment and without the use of herbicides. Removal of nuisance vegetation including seedling ash junipers may be conducted with prior approval and documentation from the Watershed Protection Department.

(F) Inspection of a Critical Environmental Feature buffer should occur at least every 6 months. The vegetation within the buffer area and associated infrastructure (fences, gates, berms, signs, trails, etc.) should be inspected. Additional conditions, such as red-imported fire ant activity, should be noted within cave buffers. Inspection records must be retained for three years by the land management entity for the City of Austin review.

(G) The owner must maintain the area within the buffer in a natural, vegetated state and preserve the natural characteristics of the Critical Environmental Feature. Maintenance activities shall utilize non-mechanized equipment. Mowing of ground cover is specifically not allowed. The following activities must be conducted:

(1) Trash must be removed from the buffer area on an as needed basis.

(2) Herbicide and pesticide use is prohibited within Critical Environmental Feature buffers on sites that are subject to the Save Our Springs Ordinance, per ECM 1.6.9.2 D.

(3) Upland vegetation must be replaced under the following conditions:

(a) A contiguous area greater than 10% total area of the buffer has dead, native vegetation. The type of vegetation may be an area of dead forbs and grasses or shrubs or trees. If Austin Water Utility has implemented Stage 2 or greater water restrictions, then revegetation may be postponed until watering is allowed twice per week.

(b) The area must be stabilized immediately if bare soil greater than 10 square feet in area results from vegetation death. Stabilization shall comply with other applicable sections of the Environmental Criteria Manual.

(4) Wetland vegetation located outside of a drainage way must be replaced under the following conditions:

(a) A contiguous area greater than 10% total area of the buffer consists of dead obligate, wetland vegetation; or

(b) Wetland vegetation was removed for infrastructure repair. Re-establish the hydrophytic wetland plant community per original, approved site or construction plans or as approved by the Watershed Protection Department.

(5) Routine preventive maintenance for gates, fences and trails should occur at least annually. If infrastructure damage exists, then repair must occur within two (2) months.

(6) Any observed condition that represents an immediate threat to water quality or public health must be remedied as soon as possible.

(H) Additional maintenance activities may be required. These activities may include:

(1) Trail surfaces that have eroded should be repaired within two (2) months.

(2) Missing or damaged signs should be replaced within six (6) months.

(3) Recharge enhancement structures should be maintained per the design recommendations. This may require clearing debris and sediment on a periodic basis.

(I) Any other conditions required by a legal document, such as a restrictive covenant or conservation easement, shall be followed.

(J) Failure to maintain a Critical Environmental Feature buffer that results in water quality degradation is considered to be a violation of City Code Chapter 6-5 (*Water Quality*). Penalties may be imposed.

A new Subsection (D) is added to ECM 1.10.6 (Guidelines for Review of Innovative Management Practices Proposing Transfer of Recharge Sites) as follows:

1.10.6 Guidelines for Review of Innovative Management Practices Proposing Transfer of Recharge Sites

D. Restoration of Karst Features

An applicant may voluntarily restore a karst feature to it's original, natural state; as reasonably possible. Restoration may include removing dumped trash, rock rubble, organic debris, or filled or washed in soil and restoring native vegetation according to Item No. 609S of the City of Austin Standard Specifications Manual. For safety reasons, opening a karst feature may necessitate installation of a cave gate to restrict public access to the feature. Restoration efforts should result in improving the quantity and quality of recharge water. The directing of treated or untreated stormwater to a recharge feature may require a Class V injection well permit from the Texas Commission on Environmental Quality.

Requests to restore karst features will be reviewed by the director of the Watershed Protection Department on a case-by-case basis.

ECM 1.10.7 (Evaluation Flow Chart for Karst and Point Recharge Features) is repealed.

~~**1.10.7 Evaluation Flow Chart for Karst and Point Recharge Features**~~

~~The flow chart presented in Figure 1-63 in Appendix V of this manual is a schematic guide to the evaluation of point recharge features under the Comprehensive Watershed Ordinance and these guidelines. The decision points in the flow chart are numbered for reference the relevant sections or paragraphs in these documents.~~

1.12.1 Description

This section describes criteria for notification requirements and guidance for furnishing and installing mitigation measures for voids and water flow features discovered in bedrock during excavation activities. This section has been developed to provide guidance for response to Section 25-8-281(D) of the Land Development Code and Note 8 of Appendix P-1 of the Environmental Criteria Manual that says:

"All work must stop if a void in the rock substrate is discovered which is; one square foot in total area; blows air from within the substrate and/or consistently receives water during any rain event; or potentially transmits groundwater. At this time it is the responsibility of the Project Manager to immediately contact a City of Austin Environmental Inspector for further investigation."

Construction activities within 50 feet of the void must stop. Construction may only proceed after mitigation measures are reviewed and approved by the Watershed Protection Department, per LDC 25-8-281(D)(3).

This section provides mitigation alternatives for use in addressing anomalous features or discrete discharge points that are observed upon initial excavation (e.g., trench) or that are discovered when trench backfill material is removed. The purpose of the mitigation is to preserve voids and water flow features while maintaining utility integrity and preventing pollution.

This section does not apply to excavations occurring below the water table or in unconsolidated earth material. Those occurrences must be addressed on a case by case basis.

City of Austin Standard Specification Item No. 658S and Standard Details 658S-1 through 658S-7 are referenced within this document and are to be used in conjunction with this section of the Environmental Criteria Manual. Standard Specification Item No. 658S provides instructions for reporting, materials use and implementation. Standard Details 658S-1 through S-7 are to be used for site plan correction submittals.

ECM 1.12.2 (Materials to be Used for Mitigation) becomes ECM 1.12.4, and a new Subsection 1.12.2 (Definitions Applicable to Void Mitigation) is added as follows:

1.12.2~~4~~ Materials to be Used for Mitigation

A. 3 x 5 hard rock: Rocks shall be sound with a minimum of 3 inches (75 mm) in smallest dimension and 5 inches (125 mm) in largest dimension. Use only open-graded rock of the size indicated on Details, with fines removed.
B. Controlled Low Strength Material (CLSM): Shall meet the requirements for CLSM as specified in City of Austin Standard Specification Item No. 402S.
C. Filter Fabric: Shall meet the requirements for filter fabric as specified in City of Austin Standard Specification Item No. 620S.
D. Low Slump Concrete: Shall meet the requirements for Class I, Curb & Gutter, Hand-vibrated Concrete (3500 psi) as specified in City of Austin Standard Specification Item No. 403S.7, Table 5. 2500 psi concrete mixtures allowed or required by the Texas Commission on Environmental

Quality (TCEQ) that meets Class D, Table 5 of the City of Austin Standard Specification Item No. 403S.7 may be accepted as an alternate on a case-by-case basis.
E. Polypropylene Bags filled with pea gravel. Pea gravel shall meet requirements of City of Austin Standard Specification Item No. ~~specification~~ 510.2 (5).
F. Gravel Backfill: Gravel backfill shall meet requirements of City of Austin Standard Specification Item No. 510.2 (2) (a) for pipe bedding stone.
G. Permanent Turf Reinforcement Mat (PTRM): Non-degradable turf reinforcement mat shall meet the specification requirements of the U.S. Department of Transportation, Federal Highway Administration (FHWA) FP-03, Section 713.18. The mat shall be made of nylon or other inert plastic and not be coated with chemical, substance or film. Maximum mesh opening shall be no greater than 2.5 mm (0.1 inch).

1.12.2 Definitions Applicable to Void Mitigation

A. Cave footprint. The surface projection of the outer edge of the subsurface passages of a cave.

B. Contractor. A qualified person that supervises site construction activity and subcontractors.

C. Edwards Aquifer Recharge Zone. All land area over the Edwards Aquifer that recharges the aquifer, as determined by the surface exposure of the Edwards Group and Georgetown Formation (as defined in LDC 25-8-2 (D)(3) and LDC 25-8-2 (D)(5)).

D. Geologist. A geoscientist licensed under the Geology discipline by the Texas Board of Professional Geoscientists (Texas Administrative Code, Title 22, Part 39, Chapter 850.10 (18)) and who has been trained to identify and describe the geological origin of voids in karst terrain. A Professional Engineer with geological experience in karst terrain who qualifies to practice geoscience per the Texas Board of Professional Geoscientists rules (Texas Administrative Code, Title 22, Part 39, Chapter 851), may serve as the Geologist.

E. Geologist representative. A qualified person who has been trained to identify and describe the geological origin of voids in karst terrain geology and works under the direct supervision of a Geologist.

F. Void Mitigation Area. A land area established for water quality and/or structural integrity protection of a subsurface cave or solution conduit of karst-origin that is discovered during construction

ECM 1.12.3 (Procedures for Investigating Voids and Water Flow Features) becomes ECM 1.12.5 and is amended, and a new Subsection 1.12.3 (Note Required) is added as follows:

1.12.3~~5~~ Procedures for Investigating Voids and Water Flow Features

A. The Owner or designated Representative shall provide the services of a Geologist ~~geoscientist licensed under the Geology discipline by the Texas Board of Professional Geoscientists (Title 22, Part 39, Chapter 850.1) (Geologist),~~ and/or a ~~qualified person (~~Geologist

representative~~) who has been trained to identify and describe the geological origin of voids in karst terrain geology and works under the direct supervision of a Geologist. A Professional Engineer with geological experience in karst terrain who qualifies to practice geoscience per the Texas Board of Professional Geoscientists rules (Title 22, part 39, Chapters 850 and 851), may serve as the Geologist~~.

B. ~~The owner shall designate a~~A Geologist or Geologist representative ~~to~~ shall observe trench walls greater than 5 feet (1.5 meters) deep of projects located within the Edwards Aquifer Recharge Zone (as defined by the City of Austin), accessible tunnel shafts, wet wells or tunnel excavations or within 500 feet (152.5 meters) of a cave, sinkhole, spring or seep identified during the permit review. Inspections must occur at least once daily during excavation operations and prior to backfilling the trench. The Contractor shall be responsible for providing 24-hour prior notice of excavation activity to the designated Geologist or Geologist representative. The Contractor shall be responsible for ensuring that the Geologist or Geologist representative has observed the vertical face of all excavation activities (including pre-trenching operations) prior to any initial temporary back fill operations and following backfill removal for bedding, final back fill, pipe or manhole installation. In trenches less than 5 feet (1.5 meters) deep, the ~~The~~ Contractor shall request inspection by the Geologist of any void that is greater than 1 square foot (0.3 meters) in total area; blows air from within the substrate; ~~and/or~~ consistently receives water during any rain event; or potentially transmits groundwater ~~even in trenches less than 5 feet (1.5 meters) deep~~. The Geologist or Geologist representative will submit a record of the daily inspections on a weekly basis to the geologists in the Environmental Resources Management division, Watershed Protection ~~and Development~~ Review Department. The record shall include the Geologist Void Description and Documentation Log Sheet for each void or water flow feature encountered. If no voids or water flow features are observed, then the record shall consist of a description of the trenches inspected and the statement that no voids or water flow features were encountered.

C. If a void greater than 1 square foot (0.3 meters) in total area is intercept, then the ~~The~~ Contractor must stop all excavation or trenching activities within ~~25~~ 50 feet (~~7.62~~ 15.24meters) of the outer edge of the void's interior extent.

D. Each underground void or water flow feature occurrence shall be mitigated in accordance with the following procedures and methods:

1. The Geologist or Geologist representative will observe the trench wall for any voids larger than 1 cubic foot (0.023 cubic meters) or water flow feature. The Geologist or the Owner will call the City of Austin Environmental Inspector, the City of Austin geologist, the Construction Inspector or Site/Subdivision Inspector, as necessary, for additional observation of the anomaly. For General Permit projects, the General Permit office shall be notified. For City of Austin-constructed projects, the location of the anomaly shall be recorded in the Construction Inspector's daily progress report. The owner must also notify the Texas Commission on Environmental Quality (TCEQ) for projects located within the jurisdictional boundaries of the Edwards Aquifer Recharge Zone, as defined in Chapter 213 of Title 30 of the Texas Administrative Code.

2. Initial observation of a void or water flow feature will be made from the top of the trench. The role of the Contractor is to provide an Excavation Safety System Plan (City of Austin Standard ~~Technical~~ Specification Item No. 509S) and to install all necessary safety equipment to allow direct observation of the anomaly. The Geologist or Geologist representative shall report the location (station), size, and depth of the anomaly encountered as observed. If flowing water is encountered, the Geologist or Geologist representative shall inspect the area of flow

and document the discharge. Observations are to be recorded on the Geologist Void Description and Documentation Log Sheet (provided in Attachment A).

3. If pre-trenching operations are conducted, the Geologist or Geologist representative shall note observations and the survey station location of the anomaly prior to temporary backfill operations. In certain cases, the Geologist or Geologist representative may determine that the void requires protection prior to backfill operations. Such protection would be required to prevent the interim backfill from entering the void and may consist of providing plywood planking or other barricade to block the backfill. Water flow features may require temporary mitigation measures as well. The Geologist representative or Geologist shall establish what measures to take, if any.

4. If groundwater is encountered in an area where CLSM bedding is not already specified for the section of pipe, it is anticipated that CLSM bedding will be required. If groundwater is encountered, but is at a rate of one gallon per minute or less, and the flowing water is encountered in an area where CLSM bedding is already specified for the section of pipe, no additional mitigation for the flowing water is anticipated. However, void mitigation measures may still be necessary. If the discharge rate is higher than one gallon per minute, additional water flow measures may be directed by the Owner's Representative.

5. If the void is located at the bottom of the trench, temporary void protection per Class I, Standard Detail 658S-1, shall be provided at all times that trench excavation is halted and until Owner's geological and biological inspections have occurred and the Contractor has been given instructions on how to proceed.

6. A second trench ~~void or water flow feature~~ inspection may be ~~required following final excavation operations~~ when backfill is removed if clay-filled or fragile features are present. The purpose is to re-inspect voids or features that may have enlarged since the initial trenching inspection. The role of the Contractor is to stabilize the trench to allow for observation of the anomaly from within the trench and to provide an Excavation Safety System Plan (City of Austin Standard ~~Technical~~ Specification Item No. 509S). The Contractor shall be required to install all necessary safety equipment to allow direct observation of the void or water flow feature. The role of the Contractor is to assist in the investigation by providing access to the anomaly (e.g., ladders, harness and rigging, scaffolding, etc.) and confined space safety equipment. The role of the Contractor is to install all necessary shoring and trench protection. The role of the Contractor's designated safety supervisor is to ensure that all OSHA requirements are met during anomaly observation. The role of the Contractor is to not place pipe, pipe bedding, or backfill within ~~25~~ 50 feet (~~7.62~~ 15.24 meters) of the anomaly prior to final inspection by the Geologist or Geologist representative.

7. The Geologist or Geologist representative shall observe, investigate and document the anomaly. Documentation will include the Geologist Void Description and Documentation Log Sheet (Attachment A), photos and/or sketches of the encountered void and/or water flow feature.

8. The Geologist and Owner's Representative shall confer regarding the anomaly and establish the void and/or water flow mitigation measure to be installed. The Engineer or designated representative shall verify the proposed mitigation methods and modify design drawings or site plans as necessary to direct the Contractor how to implement the void and/or water flow mitigation measures.

9. Voids that are less than 18 cubic feet in volume, are dry, have no airflow and are located at least 1 foot above the top of a utility pipe do not require a City of Austin site plan correction prior to mitigation. Mitigation measures may be installed after the City of Austin geologist concurs with the owner's Geologist's description and the Engineer's proposed mitigation. The mitigation must be documented in a site plan correction prior to completion of the project. TCEQ approval requirements must still be followed, if the site is located within the TCEQ-defined Edwards Aquifer Recharge Zone.

~~9~~10. Voids greater than 18 cubic feet (0.504 cubic meters) require a site plan correction submittal and approval by the City of Austin. The Engineer or designated representative will submit a site plan correction to the City of Austin for all ~~anomalies~~ voids encountered that require mitigation measures~~; except for voids that are less than 18 cubic feet (.504 cubic meters), are dry, have no airflow and are located above the top of a utility pipe~~. The site plan correction will show the surveyed location of the anomaly (ies) and shall reference mitigation measures from this section. The corresponding Standard Detail (s) from the 658S series shall be included in the correction. The Contractor may not proceed with construction of the mitigation measures or excavate or place pipe or pipe bedding or backfill within ~~25~~ 50 feet (~~7.62~~ 15.24 meters) of the anomaly (ies) until a site plan correction is approved.

~~10. Mitigation of voids that are less than 18 cubic feet (.504 cubic meters), are dry, have no airflow and are located above the top of a utility pipe may proceed following a site meeting of the Engineer, the Geologist, the City of Austin Environmental Inspector, a City of Austin geologist and concurrence of a mitigation method. The Environmental Inspector will issue a punch list that will require a site plan correction approval prior to issuing a Certificate of Occupancy on any private project or prior to a final walk-through on a subdivision project and prior to the issuance of the engineer's concurrence letter. For City of Austin General Permits office projects, a member of that office must be present at the site meeting and agree with the proposed mitigation method.~~

11. The role of the Contractor is to construct the void and/or water flow mitigation measure in accordance with the approved site plan correction. The Contractor shall notify the Watershed Protection Department geologist 48 hours in advance of mitigation installation.

12. Upon completion of a void and/or water flow mitigation measure installation, a Geologist or ~~designated~~ Geologist representative shall inspect the work before the Contractor resumes construction activities within ~~25~~ 50 feet (~~7.62~~15.24 meters) of the anomaly. The owner's Geologist must observe and photograph the phases of the installation of the mitigation measures and submit an electronic report to the Watershed Protection Department within one week.

1.12.3 Note Required

A. A note indicating that the Void and Water Flow Mitigation Rule applies to a site that is located within the Edwards Aquifer Recharge Zone must be added to subdivision or site plan applications. The requirements are as follows:

1. Preliminary Plans, Plats and Subdivision Applications. This note shall be added to the general notes section: "This site is subject to the City of Austin's Void and Water Flow Mitigation Rule."

2. Site plans, construction plans, all other applicable plans of excavation or trenching activity. This note shall be added to the cover sheet: "This project is subject to the Void and Water Flow Mitigation Rule (COA ECM 1.12.0 and COA Item No. 658S of the SSM) provision that all trenching greater than 5 feet deep must be inspected by a geologist (Texas P.G.) or a geologist's representative."

3. If a cave, sinkhole, spring or seep (as defined in ECM 1.10.0) is located within 500 feet of proposed trenching activities and is located outside of the Edwards Aquifer Recharge Zone, then the note will be added at the request of the Watershed Protection Department reviewer.

ECM 1.12.4 (Selection of Appropriate Void or Water Flow Mitigation Measures) is moved to ECM 1.12.6, and amended as follows:

1.12.46 Selection of Appropriate Void or Water Flow Mitigation Measures

A. GENERAL

1. The Engineer will establish the appropriate permanent void and water flow mitigation measures. Void and/or water flow mitigation measures shall be installed as herein depicted and specified for most anomalies encountered. If the Geologist or Geologist representative observes unusually large voids or unforeseen circumstances, other measures may be prescribed by the Engineer or designated representative.

2. Definitions of void types.

a. Size:

1. Grade 1: An opening in rock measuring more than 1 cubic foot (.028 cubic meters) (e.g., 1 foot by 1 foot by 1 foot), but less than 18 cubic feet (.504 cubic meters) (e.g., 2 feet by 3 feet by 3 feet).

2. Grade 2: An opening in rock measuring 18 cubic feet or more (.504 cubic meters) but less than 160 cubic feet (4.48 cubic meters) (e.g., 4 feet by 4 feet by 10 feet or 2 feet by 2 feet by 20 feet).

3. Grade 3: An opening in rock measuring 160 cubic feet or more (4.48 cubic meters). A specifically designed mitigation measure will typically be required for this size void. A licensed geotechnical or structural engineer must provide a cave-roof stability analysis that demonstrates that the proposed mitigation measures will minimize the risk of infrastructure or cave collapse.

b. Water Flow

1. Type A: Dry.

2. Type B: Water Flow less than one gallon per minute or evidence of previous water flow.

3. Type C: Water Flow of one gallon per minute or greater that is from a discrete discharge point or horizon in bedrock. (Water flow from unconsolidated material requires additional geotechnical evaluation beyond the scope of this specification.).

c. Biological Characteristics

1. Level 1: No evidence of biological organisms (i.e., no millipedes, spiders, salamanders, etc.) or potential habitat (organic matter, plant roots, webs, etc.). Refer to the protocol in United States Fish and Wildlife Service, Section 10(a)(1)(A) Scientific Permit Requirements for Conducting Presence/Absence Surveys for Endangered Karst Invertebrates in Central Texas (Revised September 8, 2011).

2. Level 2: Evidence of biological organisms (i.e., millipedes, spiders, salamanders, etc.) or potential habitat (organic matter, plant roots, webs, etc.). Refer to the protocol in United States Fish and Wildlife Service, Section 10(a)(1)(A) Scientific Permit Requirements for Conducting Presence/Absence Surveys for Endangered Karst Invertebrates in Central Texas (Revised September 8, 2011).

B. MITIGATION MEASURES BASED ON TYPE OF VOID

1. Class I are temporary protection measures (as indicated in Standard Detail 658S-1). They shall be required for Grade 1 and Grade 2 voids located at the bottom of the trench during times that construction operations are halted. Voids occurring in the trench wall ~~may~~ shall be protected with a temporary covering, if deemed necessary by the Engineer or designated representative. ~~Voids occurring in the trench wall may be protected with a temporary plywood covering, if deemed necessary by the Engineer or designated representative.~~ Additional

protective measures for Grade 3 voids shall be provided at the direction of the Engineer and/or the City of Austin.

2. Class II are permanent void mitigation measures (as indicated in Standard Detail 658S-2) and shall be required for Grade 1 and Grade 2 voids located at the bottom of a trench.

3. Class III are permanent void mitigation measures (as indicated in Standard Detail 658S-3) and shall be required for Grade 1, Type A and Grade 2, Type A voids located along the sides of a trench.

4. Class IV are permanent void mitigation measures (as indicated in Standard Detail 658S-4) RESERVED FOR FUTURE RULE REVISION.

5. Class V are permanent void mitigation measures (as indicated in Standard Detail 658S-5) and shall be required for Grade 1, Type B/C and Grade 2, Type B/C voids intercepted on both sides of a trench that convey flowing water and are located along the sides of a trench above the pipe bedding material zone.

6. Modified Class V are permanent void mitigation measures (as indicated in Standard Detail 658S-6) and shall be required for Grade 1, Type B/C and Grade 2, Type B/C voids intercepted on one side of a trench that may convey flowing water and are located above the pipe bedding material zone.

7. Specific permanent void mitigation measures for Grade 3 voids are designed by the engineer. A geotechnical or structural engineer must provide a cave stability analysis that demonstrates that the proposed mitigation measures will minimize the risk of infrastructure or cave collapse. The analysis should use a beam analysis theory model and site-specific rock strength data. A geotechnical investigation or geophysical survey may be needed to determine the extent, configuration and depth of the cave. Geotechnical borings should be of sufficient depth to intercept potential lower levels of a cave. Attachment B describes the requirements of the cave stability analysis.

8. Establishing a void mitigation area for a Grade 3 void may be used as a permanent mitigation measure. The void mitigation area must include the cave footprint and extend 50 feet radially from the edge of the cave footprint. The owner must fence the void mitigation area perimeter in order to prevent unauthorized activities that threaten recharge water quality.

Reference Table for Void Mitigation Measures

Mitigation Measure Class	Grade	Void location	Water Flow Type	Mitigation Measures	Standard Detail
Temporary					
I	1 or 2	floor or wall	A, B, or C	cover	658S-1
	3	floor or wall	A, B, or C	cover per Engineer or City of Austin requirements	658S-1 and/or additional measures
Permanent					
II	1 or 2	floor	A, B, or C	stabilize and seal void, encase and support pipe	658S-2
III	1* or 2	wall	A	stabilize and seal void, encase and support pipe	658S-3

IV	1 or 2	flow feature within the horizon of the pipe bedding material	B or C	RESERVED FOR FUTURE RULE REVISION	RESERVED FOR FUTURE 658S-4
V	1 or 2	wall above the horizon of the pipe bedding material and flow feature occurs on both trench walls	B or C	isolate and convey flow across the trench, encase and support pipe	658S-5
Modified V	1 or 2	wall above the horizon of the pipe bedding material and flow feature occurs on one trench wall	B or C	stabilize void and convey flow across the trench, encase and support pipe	658S-6
Modified Concrete Retard	1, 2 or 3	groundwater flow within trench	B or C	prevent longitudinal flow along pipe	658S-7
Engineer designed	3	floor or wall	A, B, or C	preserve feature characteristics, seal feature, encase and/or support infrastructure	Specifications and details to be provided by the engineer

* This mitigation requires review and informal approval of City of Austin and Engineer prior to installation. Installation may occur prior to submittal and approval of a site plan correction.

Void Classification

Size Grade	**Volume (cubic ft)**	**Water Flow Type**	**Flow rate (gallons per minute)**
1	< 18	**A**	Dry
2	> 18 and <= 160	**B**	< 1
3	> 160	**C**	>1

C. VOID AND WATER FLOW MITIGATION MEASURES

1. Class I temporary void mitigation measures, as indicated in Standard Detail 658S-1, generally consist of:

a. Void at bottom of trench or along sidewall of trench: Temporary protection of the void by covering the void opening with filter fabric with minimum of 3 foot (915 mm) distance from edge of void to edge of filter fabric. Install prior to covering trench or temporary backfilling operations.

b. Cover the void opening with plywood planking with a minimum of 1 foot (305 mm) distance from edge of the void to the edge of the planking. Planking is to be placed to prevent backfill from entering void. Place a rock (minimum weight of 5 pounds (2.3. kg)) or concrete block over planking.

c. Additional protective measures may be required, as determined by the City of Austin. Measures may include erosion and sedimentation controls adjacent to or within the trench or excavation, barriers to preserve moisture conditions within the void or structural support for stability.

2. Class II permanent void mitigation measures, as indicated in Standard Detail 658S-2, generally consist of:

a. Permanent protection of the void by hand packing with 3 to 5-inch (75 to 125 mm) rock to provide stable bearing support and covering the rock at the opening with filter fabric. Low slump concrete (Class I, 3500 psi) will be placed to cover opening area and to seal void at the limits of excavation. Concrete shall be a minimum of 18-inches (457 mm) thick within the void opening and shall extend a minimum of 6 inches (152 mm) beyond the edge of the void. Void openings that are less than 30 inches deep shall be sealed entirely with concrete. Place a form to ensure proper placement of low slump concrete-seal over the void opening. After the void is covered, the controlled low-strength bedding and backfill material may be placed. The controlled low-strength fill material shall extend a minimum of 5 feet (1.5 meters) beyond the edge of all voids in all directions.

b. For Grade 2 voids, additional measures may be specified by the engineer (e.g., increase thickness of concrete and placement of rebar reinforcement in the concrete, placement of a steel plate over void opening, etc.).

3. Class III void mitigation measures, as indicated in Standard Detail 658S-3, generally consist of:

a. Permanent protection of the void by hand packing large areas with pea gravel-filled polypropylene bags to provide stable bearing support to protect void from infiltration of backfill material. If void is greater than 100 cubic feet (2.8 cubic meters) or is within a rock strata that is structurally unstable, then 3 to 5-inch (75 to 125 mm) rock may be utilized behind the gravel-filled polypropylene bags to prevent ground collapse. A connector pipe may be required to maintain air or water flow within a void bisected by the trench. After the void is filled, place low slump concrete (Class I, 3500 psi) to seal the void opening. If needed, place a form to ensure a minimum thickness of 18 inches (457 mm) into the void.

b. Secondary containment of wastewater and stormsewer lines by installation of carrier pipe or low slump concrete (Class I, 3500 psi) or by CLSM encasement is required. If CLSM encasement is proposed, then the engineer must submit pipe deflection and wall crushing calculations. Encasement by low slump concrete (Class I, 3500 psi) or by CLSM shall be a minimum of 6 inches (152 mm) thickness on all sides of the pipe and shall extend a minimum of 5 feet (1.5 m) beyond the edge of any voids. Design of carrier pipe must be reviewed by the City of Austin for all City of Austin wastewater and stormsewer lines prior to submittal of the site plan correction. Stabilizing collars and other supports, as needed or required, must be provided. The engineer must modify Standard Detail 658S-3 or provide a specific detail showing proposed carrier pipe installation and void mitigation.

4. Class IV void mitigation measures, as indicated in Standard Detail 658S-4, are RESERVED FOR FUTURE RULE REVISION.

5. Class V void mitigation measures, as indicated in Standard Detail 658S-5, generally consist of:

a. Placement of CLSM bedding material along the length of pipe as determined by the Engineer.

b. Placement of gravel backfill material wrapped in PTRM. Limits of gravel backfill material placement shall extend one foot (.305 meters) beyond limits of void in all directions. PTRM shall be placed along areas between the gravel material and trench walls/earth backfill and shall overlap at top.

c. A minimum of 3 feet (.915 meters) of CLSM backfill shall be placed along the length of pipe on either side of the gravel backfill material and shall extend a minimum of 1 foot (.305 meters) above the gravel backfill material. Use forms to control the placement of CLSM material.

6. For Type B and C voids or zones intercepted on one side of a trench; it is anticipated that mitigation measures will consist either of utilizing controlled low strength material (CLSM) for bedding of the pipe and/or backfill of manholes within the area of water flow, or the use of modified concrete retards. The modified Class V permanent void mitigation measures, as indicated in Standard Detail 658S-6, or the Modified Concrete Retard, as shown in Standard Detail 658S-7, shall be followed.

7. Modified Concrete Retards, per Standard Detail 658S-7, or manholes backfilled with CLSM should be placed when water discharge occurs along a rock horizon for a distance of 5 feet (1.5 meters) or more.

8. For Grade 3 voids, the Engineer's ~~will design~~ specific void mitigation measures will be installed by the Contractor.

D. REPORTING

1. The Geologist or Geologist's Representative shall provide written documentation to the Owner's Representative describing the void and water flow mitigation measures taken on the Project. This information must be submitted to the City of Austin Watershed Protection and Development Review Department with the site plan correction. The report shall include, at a minimum, the following information:

a. Location (line stationing, distance from permanent structure, depth in trench from adjacent surface grade, geologic strata, etc.).

b. Physical dimensions of a void and/or description of water flow recorded on the Geologist Void Description and Documentation Log Sheet (provided as Attachment A) and the TCEQ's Edwards Aquifer Protection Program Solution Cavity Forms for plan, profile and cross-section views. Obtain the most recent version of the Solution Cavity Forms from form TCEQ-0585 "Instructions to Geologists" from the TCEQ Edwards Aquifer Protection Program website.

c. Photographs, field notes, maps, sketches, and measurements.

d. The type of void and status of mitigation action taken. A copy of the plan sheet shall be included that shows the location of the void and details of mitigation measures. The Engineer shall affix their stamp to any report(s) and to the site plan correction submitted to the City of Austin.

e. The Geologist shall affix their stamp to any report (s) submitted to the City of Austin.

A new Subsection, ECM 1.12.7 (Penalties) is added:

1.12.7 Penalties

A. Failure to comply with this rule is considered a violation of LDC 25-8-281(D), Critical Environmental Features. Penalties may be imposed.

ECM 1.12 Attachment A (Geologist Void Description and Documentation Log Sheet) is repealed in its entirety and replaced

~~ATTACHMENT A.~~

~~Geologist Void Description and Documentation Log Sheet and TCEQ Edwards Aquifer Protection Program (EAPP) Solution Cavity Forms (Use the most recent version of the EAPP forms available. Download Form TCEQ-0585 "Instructions to Geologists" from the TCEQ Edwards Aquifer Protection Program website.)~~

~~GEOLOGIST VOID DESCRIPTION AND DOCUMENTATION LOG SHEET~~

~~Name:_____ Project Name:_____~~

~~Date:_____ Time:_____ COA Site Plan No.:_____~~

~~Construction Supervisor's Name: _____Phone Number~~

~~Project Engineer: _____~~

~~How was void intercepted? (trenching, excavating, etc.)~~

~~Depth of void from ground surface:~~

~~Location of void, as distance measured from two closest surveyed stations:~~

~~GPS Coordinates of void:~~

~~(report as UTM State Plane Coordinate system, NAD 83 or state reference system for a handheld GPS unit)~~

~~Size of void: width length height~~

~~Depth extending into rock~~

~~Shape of void: circular Keyhole irregular, curved shape~~

~~vertical fracture fracture trend: (azimuthal degrees)~~

~~horizontal fracture~~

~~Characteristics: water flowing out? Rate or volume? air flow out?~~

~~Cave formations inside? Type:~~

~~Cave stream or pool visible?~~

~~Type of soil on floor of void: dark brown brown~~

~~Red clay light brown sand or gravel~~

~~Organic material present? (leaves, plant roots)~~

~~Fracture trend: (azimuthal degrees)~~

~~Void origin? Phreatic Vadose Collapse Fracture~~

~~Distance to closest CEF (cave, sinkhole, spring, fault):~~

~~Is the void potentially a flow path for water?~~

~~Type of void: Type A (1 cubic ft to 18 cubic feet and no hydrologic or biologic activity)~~

~~Type B (greater than 18 cubic feet and smaller than 160 cubic feet with no hydrologic or biologic activity)~~

~~Type C (greater than 18 cubic feet and smaller than 160 cubic feet with hydrologic or biologic activity)~~

~~Type D (larger than 160 cubic feet with hydrologic or biologic activity)~~

~~Life signs present? (scat, webs, animals, tracks, skeletal remains)~~

~~Distance to closest CEF (cave, sinkhole, fault, spring):~~

~~If life signs are present, conduct a biological survey for karst invertebrates and describe results here.~~

~~Suggestion for mitigation method: I _____ II _____ III _____ IV _____ (To be designed by a licensed engineer)~~

ATTACHMENT A. Geologist Void Description and Documentation Log Sheet

Geologist Void Description and Documentation Log Sheet and TCEQ Edwards Aquifer Protection Program (EAPP) Solution Cavity Forms (Use the most recent version of the EAPP forms available. Download Form TCEQ-0585 "Instructions to Geologists" from the TCEQ Edwards Aquifer Protection Program website.)

GEOLOGIST VOID DESCRIPTION AND DOCUMENTATION LOG SHEET

City of Austin Site Plan No.: _____ Project Name: _____

TCEQ EAPP ID No: _____ Feature ID: _____

Inspection Date: _____ Time: _____

Latitude: _____ OR Easting: _____

Longitude: _____ Northing: _____

Datum: _____ Datum: _____

Coordinate System & Units: _____ Coordinate System & Units: _____

Trench Station ID: _____ Depth Below Surface: _____

Intercepted By: Backhoe Trencher Dozer Drill Other _____

Shape (Circle One): Spherical Keyhole Dome Irregular Other _____

Vertical Fracture Trend _____ Horizontal Fracture _____

Size: _____ft Length _____ft Width _____ft Height _____ft^3 Volume

Extends into Rock: _____ft

Water Flow (Y/N): ☐ Rate: _____ Note: _____

Air Flow (Y/N): ☐ Rate: _____ Note: _____

Pooled Water or stream(Y/N): ☐ Volume: _____ Note: _____

Organic Matter (Y/N): ☐ Note: _____

Speleothems (Y/N): ☐ Note: _____

Signs of Troglobitic Life (Y/N): ☐ Note: _____

Soil piping (Y/N): ☐ Note: _____(movement of unconsolidated materials and requiring further evaluation)

Origin (Circle One): Phreatic Vadose Collapse Fracture

Soil Fill: Dark Brown (Circle One): Brown Red Clay Light Brown Sand/Gravel Munsell Soil Color:

R161-14.25

Closest CEF or Recharge Feature:_____ Type:_____ Distance:_____

Size Category:
- Grade 1 ☐ ($1\ ft^3 < V < 18\ ft^3$)
- Grade 2 ☐ ($18\ ft^3 \leq V < 160\ ft^3$)
- Grade 3 ☐ ($\geq 160\ ft^3$)

Water Flow Category:
- Type A ☐ (Dry)
- Type B ☐ (<1 gpm or evidence of previous flow)
- Type C ☐ (≥ 1 gpm from discrete discharge point or bedrock horizon)

Biological Category:
- Level 1 ☐ (No evidence of macrofauna)
- Level 2 ☐ (Evidence of macrofauna)

Suggested Mitigation:
- Class I ☐ (**Temporary** measure only; Grade 1 and 2 voids)
- Class II ☐ (Grade 1 and 2 voids; floor of trench)
- Class III ☐ (Grade 1/Type A and Grade 2/Type A voids on trench sidewalls)
- Class V ☐ (Grade 1 or Grade 2 with water flow features/voids on sidewalls above bedding)
- Custom ☐ (Site Specific Measure)

Geologist/Inspector: _____ Phone No.: _____

Construction Supervisor: _____ Phone No.: _____

Project Engineer: _____ Phone No.: _____

COA Void Description Log Sheet 04-2014

ADDITIONAL NOTES AND SKETCHES

Insert grid and/or lines

END

A new ECM 1.12 Attachment B (Cave Stability Analysis) is added as follows:

ATTACHMENT B. Cave Stability Analysis.

General

1) Major voids should be structurally analyzed. A major void is defined as one that has a minor span of more than 10 feet or one that will be compromised by excavation, trenching, or any project activity.
2) An individual detail should be prepared for each major void to clearly explain the strategy specific to that void.
3) The mitigation repair must follow the standard environmental details of City of Austin Standard Details 658S- 1 through 658S-7, wherever possible.
4) Representation of the full extent of the known void on a plan view of the project allowing for review of the void with respect to all project elements such as utilities, structure foundations, and roadways.
5) Staff from the affected City of Austin departments (Watershed Protection Department, Austin Water Utility, Public Works Department or others) will review the proposed mitigation repair for environmental, utility, groundwater flow, and structural aspects.
6) Extracted corings and test holes through the void area must be deep enough to show that there are no secondary or underlying voids that may be subject to collapse or damage by the construction of the project or routine use over the life of the facility. Minimum suggested additional depth is 10 feet but a greater depth may be necessary at certain sites.
7) Visual observation of the cave is required to record any environmentally sensitive characteristics, to document evidence of cave roof collapse from construction operations, and to note discontinuous features that may affect the overall stability of the void.

8) If direct observation of the cave cannot occur due to safety reasons, then indirect measurement methods and observations must be utilized. The analysis should be adjusted to provide a greater safety factor to account for conditions that are not detected via indirect measurements and observations.

9) The Engineer(s) must affix their seal to reports, details and site plan correction sheets that are submitted to the City of Austin.

Environmental

1) Document the presence of water flow features such as cave drips, cave pools, cave streams, cave formations and solution-enlarged fissures or conduits that allow transmittal of water beyond the accessible portion of the cave. Pools, streams or formations may or may not be active at the time of inspection. These are indicators of recharge potential and are to be preserved.

2) Submit a map of the cave footprint that shows all recharge features, springs and voids within a 150-foot radius of the cave footprint. Also show all existing and proposed utilities and infrastructure within a 150-foot radius.

3) For City of Austin Capital Improvement Projects (CIPs) or projects constructed by the City of Austin on behalf of another agency, follow the permitting requirements of the Balcones Canyonlands Conservation Plan Infrastructure program. Contact the Austin Water Utility, Wildlands Conservation Division for guidance and procedures.

Structural Requirements

1) Testing and reporting on the competency of the rock in terms of strength, rock quality designation (RQD), characterization of the formation, and possibly other soundness parameters such as compressive and tensile strengths and cohesion to estimate shear capacity of the rock is required.

2) Structural analysis of the strength of the compromised void that will remain after all cuts, utility trenches, and excavations are completed with appropriate safety factors.

3) Accurately modeling the structural conditions found in natural voids can be difficult. The thinly bedded nature of some sedimentary rock and slip planes, fissures, and fracturing of that rock often preclude the use of some models such as Voussoir arches. Therefore, a relatively straight forward beam analysis with some degree of fixed end conditions is often the most appropriate approach to determine the capacity of a cave roof in limestone formations. The shape of the cave, such as highly sloped walls, would affect the critical beam length to be analyzed in that case. Pressure arch models and other theories may be appropriate, but must be very carefully considered before use. Recommendation of the final analysis methodology remains with the design engineer. Provide justification for the methodology used, cite the reference document for the methodology, and include all assumptions in the report. The methodology must be approved by the City of Austin in order to approve the void mitigation submittal. The AASHTO LRFD load

and resistance factors and load combinations from the current version of the Bridge Design Specifications should be used for voids under roadways.

4) Factor of safety is the allowable strength of the native limestone rock compared to the calculated forces under service load conditions. Due to the relatively large uncertainty in dealing with natural materials, large factors of safety on the order of 4.0 are necessary and preferably much greater factors are desirable.
5) There must be a clear, positive load path in normal concrete or another approved structural material from floor to ceiling to support roof of void shown on shown on details and included on the plans.
6) A normal strength concrete is required for structural “wall” elements; however, any approved flowable fill is adequate where a large expanse of a void is being completely filled in.
7) There must be full, positive retention of all unbound materials such as gravel, pea gravel, loose rock, bagged materials, or any other fill materials. For example, formed concrete walls from floor to ceiling would be required to retain a floor to ceiling gravel fill.

END

PART 4. The Environmental Criteria Manual Section 1.14 (*Critical Environmental Feature Buffer Maintenance and Inspection)* is moved into ECM Subsection 1.10.5 (*Critical Environmental Feature Buffer Maintenance and Inspection*).

1.~~14~~10.~~05~~5 Critical Environmental Feature Buffer Maintenance and Inspection

1.10.5.1 Statement of Intent

The City of Austin has determined that Critical Environmental Feature buffers require ongoing maintenance to preserve their water quality function. This section describes the requirements for maintaining and inspecting buffers that are established by Sections 25-8-281 and 25-8-282 of the Land Development Code. Periodic inspections are necessary in order to verify that the vegetation, other natural characteristics, and protective infrastructure remain intact within the buffer area.

Additional guidelines for establishing the buffer and protection of point recharge features are in Section 1.10.4 (*Determining Size of Critical Environmental Feature Protective Buffers*), of the Environmental Criteria Manual.

This section applies to all Critical Environmental Feature buffers, as defined below.

1.10.5.2 Requirements

(A) Definitions

(1) CATCHMENT AREA. The land area that drains to a point recharge feature. The upslope limits extend to the highest topographic contour above and around the feature, irrespective of the degree of slope. A sharp slope break present at the perimeter of a well-defined, bowl-shaped depression is the rim of the sinkhole and is within the catchment area.

(2) CRITICAL ENVIRONMENTAL FEATURE BUFFER. A land area established to protect or mitigate for the impacts to a Critical Environmental Feature (CEF). The natural vegetative cover must be retained to the maximum extent practicable. Construction disturbance must preserve all characteristics of the CEF and is limited to low-impact, minor modifications such as trails and protective structures.

(3) DRAINAGE WAY. The land surface that conveys surface flow to a larger body of water. This includes any channel that concentrates stormwater runoff.

(4) NATIVE VEGETATION. A native, or indigenous, species of Central Texas known to this region to exist as a result of only natural processes, with no human intervention. Once established, native species do not require irrigation, fertilization, or other chemical support when located in appropriate habitat. Native species of trees, shrubs, grasses, and wildflowers are listed in the Native Plant database of the Lady Bird Johnson Wildflower Center website.

(5) NUISANCE VEGETATION. Vegetation that is of an invasive or detrimental nature and may be harmful to the functioning or water quality protection of a Critical Environmental Feature. This may include terrestrial or aquatic plants such as kudzu (*Pueraria lobata*), Bermuda grass (*Cynodon dactylon*), elephant ear (*Colocasia*), arundo cane (*Arundo donax*), hydrilla (*Hydrilla verticillata*), and greenbriar (*Smilax bona-nox L*.). Refer to the City of Austin Invasive Species Management Plan for additional plant species.

(6) NON-MECHANIZED EQUIPMENT. Equipment that is operated by hand and may include the use of hand-held motorized tools, such as chain saws.

(B) The protection of a Critical Environmental Feature buffer may require perimeter controls such as a perimeter fence, physical barrier, other structures, and signage. Fencing must meet the specifications of the City of Austin Standard Specifications Manual or a standard approved by the Watershed Protection Department. If a fence is constructed, then at least one access gate with a lockable latch must be installed. Fencing is recommended for the following conditions:

(1) The buffer is located adjacent to industrial, commercial, multi-family, or single-family residences.

(2) The buffer contains the catchment area of a cave or sinkhole.

(3) The buffer area contains an ecological community that is sensitive to disturbances that may impact water quality or alter the natural characteristics of the Critical Environmental Feature.

(4) The buffer area contains steep slopes and is located outside of a Critical Water Quality Zone.

(5) The buffer area is potentially hazardous or dangerous to individuals.

(6) The buffer area contains State or Federally protected species.

(C) Cave gates may be required. The materials and construction method must be approved by the Watershed Protection Department.

(D) Other proposed structures, such as diversion berms or recharge enhancement structures, within the buffer must retain the functionality and integrity of the Critical Environmental Feature. Generally diversion berms would only be allowed inside a buffer to direct clean or treated runoff toward recharge features. Otherwise, diversion berms outside the buffer would direct untreated runoff away from a recharge features. The materials and construction method must be approved by the Watershed Protection Department.

(E) Native vegetation within the buffer must be maintained such that it provides water quality benefits such as filtering sediment, allowing infiltration, promoting sheetflow of stormwater runoff, and preventing erosion. This maintenance does not include the requirement to provide supplemental irrigation for upland vegetation. Removal is to be conducted with non-mechanized equipment and without the use of herbicides. Removal of nuisance vegetation including seedling ash junipers may be conducted with prior approval and documentation from the Watershed Protection Department.

(F) Inspection of a Critical Environmental Feature buffer should occur at least every 6 months. The vegetation within the buffer area and associated infrastructure (fences, gates, berms, signs, trails, etc.) should be inspected. Additional conditions, such as red-imported fire ant activity, should be noted within cave buffers. Inspection records must be retained for three years by the land management entity for the City of Austin review.

(G) The owner must maintain the area within the buffer in a natural, vegetated state and preserve the natural characteristics of the Critical Environmental Feature. Maintenance activities shall utilize non-mechanized equipment. Mowing of ground cover is specifically not allowed. The following activities must be conducted:

(1) Trash must be removed from the buffer area on an as needed basis.

(2) Herbicide and pesticide use is prohibited within Critical Environmental Feature buffers on sites that are subject to the Save Our Springs Ordinance, per ECM 1.6.9.2 D.

(3) Upland vegetation must be replaced under the following conditions:

(a) A contiguous area greater than 10% total area of the buffer has dead, native vegetation. The type of vegetation may be an area of dead forbs and grasses or shrubs or trees. If Austin Water Utility has implemented Stage 2 or greater water restrictions, then revegetation may be postponed until watering is allowed twice per week.

(b) The area must be stabilized immediately if bare soil greater than 10 square feet in area results from vegetation death. Stabilization shall comply with other applicable sections of the Environmental Criteria Manual.

(4) Wetland vegetation located outside of a drainage way must be replaced under the following conditions:

(a) A contiguous area greater than 10% total area of the buffer consists of dead obligate, wetland vegetation; or

(b) Wetland vegetation was removed for infrastructure repair. Re-establish the hydrophytic wetland plant community per original, approved site or construction plans or as approved by the Watershed Protection Department.

(5) Routine preventive maintenance for gates, fences and trails should occur at least annually. If infrastructure damage exists, then repair must occur within two (2) months.

(6) Any observed condition that represents an immediate threat to water quality or public health must be remedied as soon as possible.

(H) Additional maintenance activities may be required. These activities may include:

(1) Trail surfaces that have eroded should be repaired within two (2) months.

(2) Missing or damaged signs should be replaced within six (6) months.

(3) Recharge enhancement structures should be maintained per the design recommendations. This may require clearing debris and sediment on a periodic basis.

(I) Any other conditions required by a legal document, such as a restrictive covenant or conservation easement, shall be followed.

(J) Failure to maintain a Critical Environmental Feature buffer that results in water quality degradation is considered to be a violation of City Code Chapter 6-5 (*Water Quality*). Penalties may be imposed.