AN ORDINANCE AMENDING THE 2012 DRAINAGE MANUAL FOR THE CITY OF ROGERS, ARKANSAS; PROVIDING FOR THE EMERGENCY CLAUSE AND FOR OTHER PURPOSES.

WHEREAS, on December 11, 2012, the Rogers City Council passed Ordinance No. 12-127, adopting the 2012 Drainage Manual for the City of Rogers; and

WHEREAS, the Northwest Arkansas Regional Planning Commission commissioned a study of the Cave Springs Recharge Area; and

WHEREAS, the Northwest Arkansas Regional Planning Commission and the US Fish & Wildlife Service recommends inclusion of Chapter 10: Cave Springs Direct Recharge Area Water Quality Protection Requirements, to the 2012 Drainage Manual for the City of Rogers, Arkansas, to help protect the endangered species in the area; and

WHEREAS, development can still continue with the adoption of the best management practices;

BE IT ORDAINED BY THE CITY COUNCIL OF THE CITY OF ROGERS, ARKANSAS:

Section 1: That the 2012 Drainage Manual for the City of Rogers, Arkansas, is hereby amended to add Chapter 10 which shall read as shown in the attached Exhibit "A" (attached hereto and incorporated by reference as if set out word for word herein).

Section 2: That the need to amend the 2012 Drainage Manual for the City of Rogers, Arkansas, is urgent, therefore, an emergency is declared to exist and this ordinance shall become effective on its date of passage and publication.

Section 3: **Severability Provision-** In the event that any section, paragraph, subdivision, clause, phrase, or other provision or portion of this Ordinance shall be adjudged invalid or unconstitutional, the same shall not affect the validity of this Ordinance as a whole, or any part or provision, other than the part so decided to be invalid or unconstitutional, and the remaining provisions of this Ordinance shall be construed as if such invalid, unenforceable or unconstitutional provision or provisions had never been contained herein.

Section 4: **Repeal of Conflicting Ordinances and Resolutions-** All ordinances, resolutions or orders of the City Council, or parts of ordinances, resolutions or orders of the City Council in conflict herewith are hereby repealed to the extent of such conflict.

PASSED this 28th day of July, 2015.

APPROVED:

C. GREG HINES, Mayor

Attest:

PEGGY DAVID, City Clerk

CITY OF ROGERS SEAL CITY CLERK

Requested by: Lance Jobe
Prepared by: Chris Griffin, Senior Staff Attorney

EXHIBIT "A"

CHAPTER 10. CAVE SPRINGS DIRECT RECHARGE AREA WATER QUALITY PROTECTION REQUIREMENTS

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CHAPTER 10. CAVE SPRINGS DIRECT RECHARGE AREA WATER QUALITY PROTECTION REQUIREMENTS

1.0 INTRODUCTION

Cave Springs Cave is located in the northwest Arkansas community of Cave Springs, near the intersection of Arkansas Highways 264 and 112 in southern Benton County. Cave Springs Cave provides habitat for the largest known population of Ozark Cavefish (*Amblyopsis rosae*), a federally listed threatened species. In addition to providing habitat for federally protected species, water quality in the cave is an indicator of regional water quality in the shallow aquifer. In 2014, The Nature Conservancy and Ozark Underground Laboratory (OUL) performed an extensive literature review of cave hydrology, biology and water quality[1]. Based on this study, primary water quality goals for the Cave Springs Recharge Area are to limit discharges of oxygen-depleting contaminants, turbidity/fine sediments, nutrients, and metals to the groundwater system through the use of best management practices (BMPs).

The purpose of this chapter is to provide criteria and guidance for BMPs to protect the unique karst resources of the Cave Springs Recharge Area while allowing for future growth and development. The Cave Springs Recharge Area encompasses lands that are included in the municipalities of Cave Springs, Rogers, Lowell, and Springdale and has a total recharge area of 12,515 acres (19.5 square miles). Exhibit 10-1 shows the Cave Springs Recharge Area, which is comprised of two major areas:

The Direct Recharge Area includes 5,702 acres (8.9 square miles) and provides most of the recharge water for the Cave Springs cave system. This is an area where soils allow for relatively rapid recharge, and there is a direct hydrologic connection between infiltrating runoff and the karst system. The northeastern boundary of the Direct Recharge Area lies roughly parallel to, and west of, Interstate 49 (I-49).

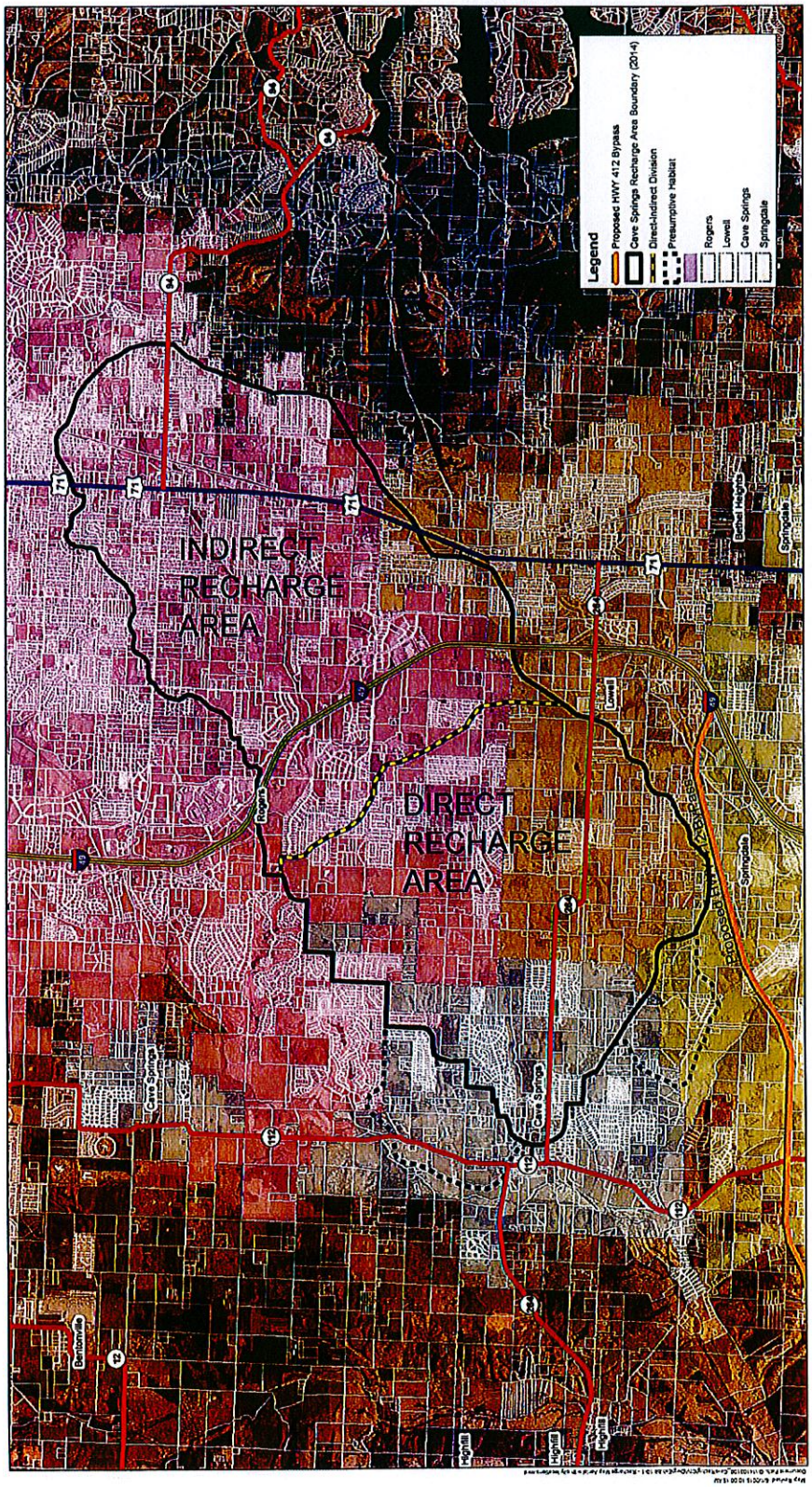
The Indirect Recharge Area encompasses 6,813 acres (10.6 square miles) and lies to the northeast of the Direct Recharge Area. Groundwater tracing has shown that very little of the water from losing streams in this area reaches the Cave Springs cave system. However, the dye tracing indicates that there is some groundwater movement from the Indirect Recharge Area into the Direct Recharge Area and ultimately to Cave Springs cave. I-49 lies entirely within the Indirect Recharge Area.

Exhibit 10-2 shows losing stream segments, soils mapping, major roads and other features within the Recharge Area. Based on analysis of groundwater elevations and tracing data, a "trough" in the groundwater potentiometric surface is located from Cave Springs to the east. This trough is located

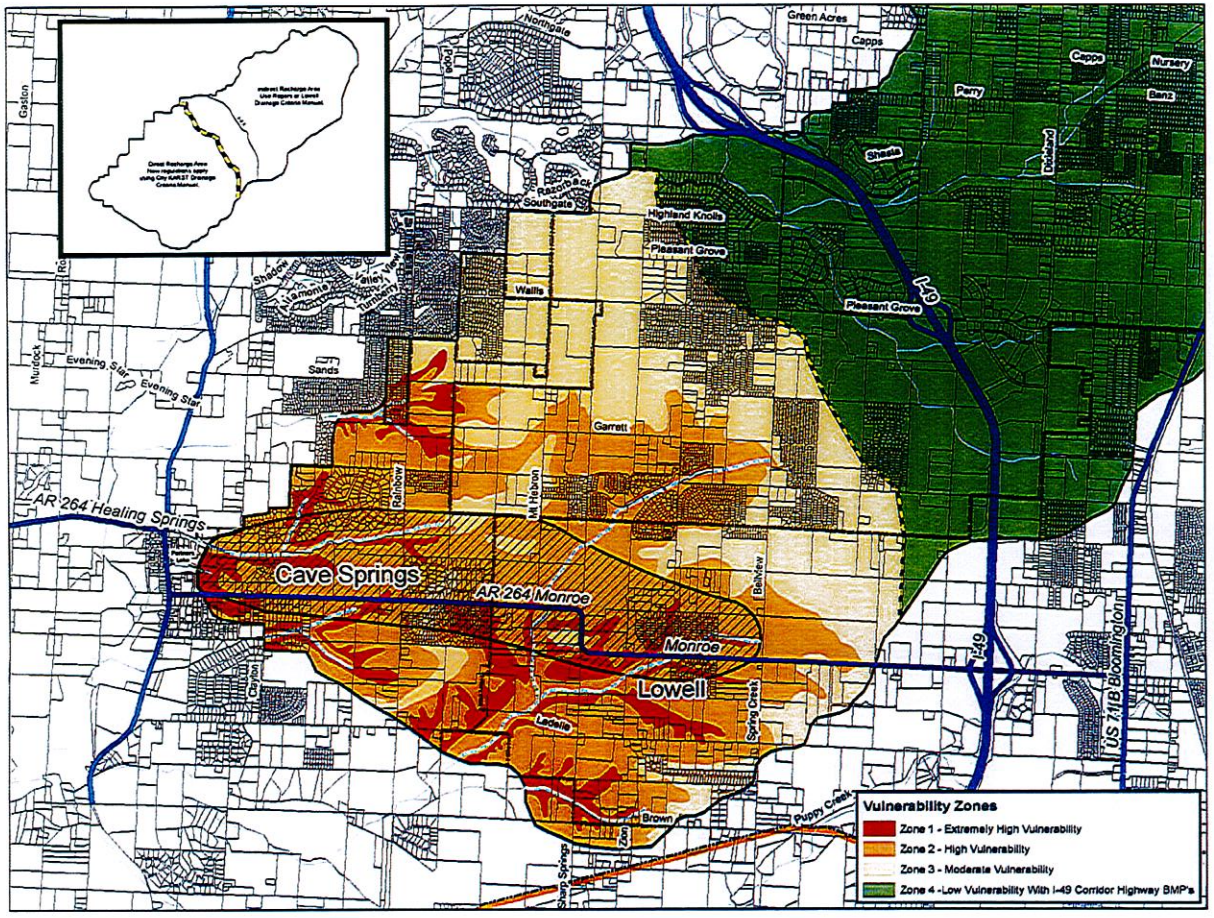
[1] OUL & Nature Conservancy 2014. *Summary of Existing Knowledge about Hydrogeology, Cave Biology, and Cave Conservation Methods Applicable to Cave Springs Cave, Benton County, Arkansas.*

roughly parallel to Highway 264 and is shown on Exhibit 10-2. This groundwater trough represents a preferential pathway whereby contaminants can enter the Cave Springs groundwater system. Mapping of the Direct and Indirect Recharge Areas is based on previous studies dating back to the 1970's and hydrogeologic studies in 2014 presented in the *Groundwater Tracing and Recharge Area Delineation Summary Report* (OUL 2015).

This chapter has been developed to provide criteria and guidance for compliance with the *Cave Springs Area Karst Resource Conservation Regulations* (*CSK Regulations*). This is not a stand-alone chapter and must be used in conjunction with Chapters 1 – 9 of the *Drainage Criteria Manual.* Chapter 9 - *Water Quality* provides criteria for many BMPs including swales, buffers, ponds, etc. that can be used to comply with the *CSK Regulations* with modifications and enhancements as noted in this chapter.



Cave Springs Area Karst Resource Conservation Study
Rogers, Lowell, Cave Springs, Springdale
Direct & Indirect Recharge Area Location
Exhibit "10-1"



Cave Springs
Direct Recharge Area
Vulnerability
Zone Map
Exhibit "10-2"

2.0 SCOPE AND APPLICABILITY

The *CSK Regulations* and the criteria and guidance in this chapter were developed through a stakeholder process involving representatives from the Cities of Cave Springs, Rogers, Lowell, and Springdale; the United States Fish and Wildlife Service (USFWS); The Nature Conservancy; Northwest Arkansas Regional Planning Commission (NWARPC); the Arkansas State Highway and Transportation Department (AHTD); University of Arkansas; landowners; representatives from the construction and development industry; and others. This chapter and the *CSK Regulations* apply to the Direct Recharge Area. For the Indirect Recharge Area, the criteria in Chapter 9 – *Water Quality* apply. AHTD has already developed plans for BMPs for the I-49 corridor that will be protective of the water quality of the karst system, and this area is not addressed in this chapter.

The *CSK Regulations* and criteria in this chapter are in addition to other water quality regulations in local codes and ordinances related to stormwater, wastewater, underground storage, etc. The applicant must also comply with Arkansas Department of Environmental Quality (ADEQ) permitting requirements and Northwest Arkansas Municipal Separate Storm Sewer System (MS4) requirements, as applicable. Federal regulations including Section 404 and Section 401 may apply on some sites, as well as Federal Emergency Management Agency (FEMA) and local floodplain regulations. To the extent that there are conflicting requirements between various regulations, the more restrictive/protective shall apply. **These requirements do not apply to existing development or development projects that have submitted preliminary plats for governmental regulatory review, prior to the effective date of the *CSK Regulations* as described in Section 3.1.3.**

2.1 Objectives

Primary objectives of the *CSK Regulations* and this chapter include:

1. Provide additional protection for the Cave Springs Recharge Area through the use of stream buffers, runoff reduction practices, filtration, source controls, construction practices and control measures, wastewater policies and practices, requirements for buried facilities that are potential contaminant sources, and spill prevention and control practices to protect the quality of water entering the groundwater system.

2. Reduce the rate at which surface water is entering the shallow groundwater system that sustains the cavefish through disconnection of impervious area, detention and filtration.

3. Provide a reasonable and practical framework for water quality protection that recognizes risk and vulnerabilities and how site-specific circumstances and mitigating factors including stormwater control measures/BMPs must be taken into account, building upon the technical foundation and recommendations made by OUL and The Nature Conservancy.

4. Develop practical criteria and methods to enhance treatment of detained runoff in the Direct Recharge Area that will allow for development of the area in a responsible manner that protects water quality through implementation of BMPs.

2.2 Geographic Extent & Characteristics of Recharge Area

Exhibit 10-2 of the *CSK Regulations* illustrates the geographic extent of the Direct Recharge Area. Municipal boundaries of the Cities of Cave Springs, Rogers, Lowell, and Springdale are shown on Exhibit 10-1. In addition, Exhibit 10-2 illustrates the following key features of the Recharge Area:

- Losing Streams –These reaches were identified through hydrogeologic analysis and tracer studies by OUL (OUL 2015). Note that not all reaches of streams are identified as losing streams – upper reaches of some streams further east and north of Cave Springs are not identified as losing reaches.

- Cave Springs Groundwater Trough – The trough extends east from Cave Springs and is an area of rapid groundwater recharge and generally poor to fair soil treatment capability. The trough encompasses an area of approximately 1.8 square miles and is an area of heightened vulnerability for the karst system.

- Soil Treatment Capability – These ratings are based on soil gradation and infiltration characteristics. In general, soils with more rapid infiltration have lower treatment capability and higher potential for direct recharge to the karst system. Soils are classified as follows:

    - Good Treatment Capability Soils - The major soil series in this group are Captina and Peridge. Captina and Peridge Series soils are in this group because they have a high percent of material that will pass through a Number 4 sieve (particle size less than 4.76 millimeters). These are loamy materials, excluding gravels and coarse materials that provide less filtration, and provide good natural cleansing. When constructing stormwater detention basins the upper horizons of these soils can be stockpiled and amended to create a media filtration layer to blanket the bottom of detention ponds to enhance contaminant removal.

    - Fair Treatment Capability Soils - Major soil series that are in this group are the Nixa and Tonti soil series. Nixa soils are in this group because they have a relatively low percentage of material that will pass through a Number 4 sieve and because they have a fragipan typically located 17 to 30 inches below the surface. If undisturbed, soils above the fragipan become saturated during wet-weather conditions and appreciable lateral flow often occurs along preferential flow routes toward discrete recharge zones where the fragipan is breached or where other soil series lacking a fragipan exist. If the fragipan is

breached in constructing stormwater detention ponds the low percentage of material that will pass through a Number 4 sieve and the moderate permeability of the soils above and below the fragipan provide ineffective natural cleansing for passing waters. Tonti Series soils are in this group because they have more fine textured material in their upper horizons than the Poor Treatment Capability Soils. However, below a depth of about a foot and a half the Tonti Series soils have characteristics similar to Poor Treatment Capability Soils.

- Poor Treatment Capability Soils - The major soil series in this group is the Noark soil series. These soils are classified as poor for treatment capability because they have high percolation rates and a relatively low percentage of material that will pass through a Number 4 sieve. The texture is too coarse to provide much of the natural cleansing present in soils.

- I-49 Corridor – The I-49 corridor lies in the southwestern portion of the Indirect Recharge Area. AHTD and the USFWS have developed a plan for BMPs along this corridor that includes lined ponds and other practices. Because BMPs have already been developed for this area, this area is not addressed in the chapter.

Implementation of BMPs in accordance with the *Drainage Criteria Manual* is required throughout the Direct and Indirect Recharge Area. *Conservation Regulations* and criteria in this chapter, which provide for buffers and enhanced treatment methods, are required only in the Direct Recharge Area.

3.0 WATER QUALITY PROTECTION ZONES

A tiered, or zoned, approach has been developed for the Cave Springs Recharge Area using risk-based vulnerability factors. Four risk-based zones are defined based on vulnerability criteria that include the following:

- Location in Direct or Indirect Recharge Area.
- Nature of existing and proposed land use.
- Ability of soils overlying high-permeability and karst layers to treat stormwater.
- Proximity to losing streams and other areas with soils that rapidly recharge the karst system.
- Potentiometric head map including Cave Springs Groundwater Trough. This is an area with high recharge potential to the groundwater system.

Requirements for site characterization, buffers, and best management practices (BMPs) vary by zones.

3.1 Applicability

3.1.1 EFFECTIVE DATE

The CSK Regulations shall apply only to development activities that occur in the Cave Springs Direct Recharge Area after Council Approval.

3.1.2 APPLICABILITY

The CSK Regulations shall apply to the following development activities:

- Any development, including but not limited to residential, commercial, industrial, construction of public infrastructure, or other grading activity, that exceeds one acre in disturbance or is part of a larger common development [any project that requires a permit for stormwater discharge from the Arkansas Department of Environmental Quality];
- New or expanded industrial use, gas stations, laundromats, commercial development, mining, or hazardous material storage regardless of the size of the disturbance; and,
- Subdivisions of tracts of land which create three or more lots or which subdivide tracts of land greater than one acre.

3.1.3 EXEMPTIONS

The following development activities shall be exempt from the application of the CSK Regulations:

- Pending applications that have received preliminary plat approval prior to the effective date of the CSK Regulations, provided that such applications shall not be exempt if the final plat is denied or if the preliminary plat approval expires.
- Development of single-family detached home on a residential lot, which was subdivided and developed with public infrastructure prior to the effective date of the CSK Regulations.
- Residential or commercial development on a lot which existed prior to the effective date of the CSK Regulations, which does not cause the disturbance of 1 acre or more and is not part of a larger common development.

3.1.4 MORE RESTRICTIVE REGULATION APPLIES

In the interpretation and application of these CSK Regulations the provisions herein shall be held to be minimum requirements for the promotion of the public health, safety and welfare. Whenever the requirements of these CSK Regulations are more or less restrictive than the requirement of any other lawfully adopted rules, regulations or ordinances, including any applicable state or federal regulations, the more restrictive regulation or the regulation imposing the higher standards shall govern.

Zones are depicted on mapping shown on Exhibit 10-2. If site-specific conditions indicate that topography, soils, geology or other factors should result in an alternate zone classification, it will be the responsibility of the applicant to technically evaluate and provide supporting information to justify a variance for their project area. Such justification would need to be provided by an Arkansas-registered Professional Engineer and/or an Arkansas-registered Professional Geologist experienced in karst hydrology in a format described in City Ordinance No.

3.2 Risk-based Water Quality Protection Zones

Exhibit 10-2 of the *CSK Regulations* provides mapping of risk-based water quality protection zones for the Cave Springs Recharge Area. Zones are color-coded by the zone designations 1-4:

Zone 1 (Extremely High Vulnerability) represents the highest risk to the water quality and hydrology of the groundwater system. These are lands where the hydrobiological setting and existing and/or foreseeable land uses pose extremely high risks of groundwater impacts that could potentially adversely affect Ozark Cavefish and the associated biological community. Zone 1 includes areas that are mapped for:

- Poor soil treatment capability - highly permeable or karst soils at shallow depths that directly and rapidly recharge the groundwater system.
- Proximity to losing stream corridors and other sensitive features - areas within a zone of high vulnerability from losing streams (measured from center of stream), or other known direct/high-permeability recharge areas included in Zone 1.
- Areas within the Cave Springs Groundwater Trough are included in Zone 1.

Zone 2 (High Vulnerability) is an area that has a high risk to water quality of the groundwater system. These are lands where the hydrobiological setting and existing and/or foreseeable land uses pose high risks of groundwater impacts with potential to adversely affect Ozark Cavefish and the associated biological community. This area has some overlying soils that can provide filtration of stormwater; however, excavations for development projects, including utilities, building foundations, detention and water quality ponds have the potential to penetrate to highly permeable or karst layers.

Zone 3 (Moderate Vulnerability) is an area with moderate risk to the groundwater system water quality based on native soils that have good potential for filtration, greater thickness of overlying soil layers, and greater distance from sensitive features. These are lands where the hydrobiological setting and existing and/or foreseeable land uses pose moderate risks of groundwater impacts likely to adversely affect the Ozark Cavefish and the associated biological community. Within the Direct Recharge Area these are typically upland areas underlain by soils capable of removing many contaminants. They are remote from sinkholes or losing streams and are areas where land use does not include localized groundwater contamination hazards, such as suburban development utilizing on-site disposal of sewage or concentrated or confined animal operations (including poultry).

Zone 4 (Low Vulnerability, Indirect Recharge Area) is an area of relatively low risk to the groundwater system. These are areas that contribute relatively minor amounts of water to the groundwater system recharging Cave Springs cave and are unlikely to have significant deleterious impacts on water quality and cave fauna. Chapter 9 of the Drainage Criteria Manual is applicable to Zone 4. The I-49 corridor is a part of Zone 4. The existence of I-49 poses greater groundwater quality vulnerability than the Indirect Recharge Area lands located further to the east. Because AHTD and USFWS have developed approved plans for BMPs for the corridor, the area is included in Zone 4.

4.0 DISTURBANCE PERMIT REQUIREMENTS

A Disturbance Permit Application, Report, and permit are required for all development projects in the Direct Recharge Area (Zones 1, 2, and 3) under the *Cave Springs Area Karst Resource Conservation Regulations*. Disturbance Permits are not required in the Indirect Recharge Area (Zone 4); however, MS4 and State of Arkansas requirements apply in these areas.

The Disturbance Permit Application and Report should provide the following information at a minimum:

1. Description of proposed development project including land use, proximity to sensitive features, potential contaminant sources (both surface and subsurface) associated with development (construction and post-construction), proposed plan to disconnect impervious surfaces (as recommended by *Drainage Criteria Manual*, etc.).

2. Mapping should identify karst areas, stream buffers, floodplains, and other vulnerable areas. Filtration practices shall be implemented in conjunction with conventional BMPs to provide a high level of treatment for runoff discharging to these sensitive areas.

3. Preliminary grading and drainage plans should be provided.

4. Preliminary wastewater plans should be provided.

5. Identification of other sensitive features and risk factors including steep slopes (greater than15%); erosive soils; areas with poor vegetative cover and areas of existing erosion; floodplains; unstable stream reaches; storage areas for hazardous materials, fertilizers, pesticides, etc.; wetlands and waterbodies; sanitary wastewater collection/storage/treatment/pumping facilities; and other potential subsurface sources.

6. Delineation of inner and outer buffers in accordance with buffer widths described by zone herein. In general, each zone will have a restrictive inner buffer where development activities will be strictly limited and an outer buffer that is determined based on site-specific characteristics. The outer buffer may be reduced in some circumstances based upon the use of BMPs that replace functions of the buffer. In these cases, encroachments into the outer buffer may be allowed as long as there are BMPs that would offset or mitigate impacts.

7. Identification of BMPs for stormwater (construction and post-construction), wastewater, industrial source controls, and runoff management practices. In cases where encroachments into the outer buffer are proposed, the applicant shall provide documentation of mitigating factors for buffer width reductions using the *Cave Springs Outer Buffer Width Adjustment Worksheet* (provided in this chapter).

8. Documentation of funding mechanism for maintenance of buffer areas and BMPs and Maintenance Plan describing the nature, frequency and entity responsible for maintenance activities.

An Arkansas-registered Professional Engineer must prepare the Disturbance Permit Application and Report, and the final version of the report and supporting drawings must be signed and stamped by an Arkansas-registered Professional Engineer.

5.0 BUFFER REQUIREMENTS

Maintaining adequate distance between sources of potential contaminants and receiving waters/recharge areas is a fundamental and effective BMP for managing stormwater runoff and minimizing adverse water quality effects. Buffers are used as components of water quality protection strategies in many other karst and non-karst areas in the U.S. and are an important part of the strategy for the Cave Springs Direct Recharge Area. All buffer widths referenced in this chapter and the *CSK Regulations* are measured from the stream centerline or center of sensitive feature/area. For stream buffers, the buffer width is on both sides of the stream centerline (for example, a 100-foot buffer would actually have a total width of 200 feet, 100 feet on each side of the stream centerline). For "point" features, the buffer width is the radius projected from the center of the feature. Buffer requirements apply only to Zones 1, 2, and 3.

The *Cave Springs Outer Buffer Width Adjustment Worksheet* provides buffer widths and adjustment factors. The inner buffer width is fixed, but the outer buffer width can be reduced based on site-specific factors and BMPs. The worksheet form and an example are provided below.

5.1 Inner Restrictive Buffers

Inner restrictive buffers are generally "no development" zones. Planning for development should seek to preserve these areas and minimize impacts from utilities, roads and other features that must cross or encroach on the buffer area. Inner buffer widths vary by zone from 100 feet in the Extremely High Vulnerability zone to 50 feet in the High Vulnerability zone to 25 feet in the Moderate Vulnerability zone.

Allowable uses/activities within **inner** buffers include:

- Utility crossings – Buffer areas should not be viewed as preferred utility corridors but, if necessary, can be used for a development. In some cases utility crossings with enhanced BMPs may be required. When a crossing or encroachment cannot be avoided, it is allowable subject to the *Drainage Criteria Manual* erosion and sediment control requirements and additional BMPs listed herein. An approved Disturbance Permit from the City of Rogers is required prior to construction activities.

- Open space – Open space or park uses with heavy concentrations of animals (dog parks, horse paths, etc.) are not allowed in the inner buffer, but many other open space uses are compatible.
- Trails, biking/hiking paths – Pedestrian paths also provide benefit of maintenance access along stream corridors.
- Herbicide use in native landscaped areas should be as limited as possible within the buffer zone to small spot treatments. No utility corridor spraying is allowed. Herbicides must not be used when there is ponded or flowing water on the surface, all labeled instructions must be followed.
- Road and bridge crossings constructed in accordance with applicable water quality regulations – the number of crossings should be minimized to the extent practical through land planning.
- Wetland mitigation and stream stabilization/restoration projects.
- Projects to enhance or restore functions of the buffer or stream. Buffer restoration is one of the factors that can be used to reduce the width of the outer buffer.
- Stormwater BMPs that cannot feasibly be located in the outer buffer or that must be located in the inner buffer to achieve desired functions.
- Maintenance activities associated with these allowable uses.

Prohibited and restricted use/activities within **inner** buffers include:

- Grading, stripping, or other soil-disturbing practices should be minimized to the extent practical.
- Filling or dumping.
- Draining the buffer area by ditching, underdrains, or other systems.
- Use, storage, or application of pesticides, herbicides, fertilizers, or hazardous/toxic materials.
- Fueling facilities and bulk storage of fuel or petroleum products above or below ground.
- Storage or operation of motorized vehicles other than for maintenance or emergency use.
- Structures or impervious surfaces, with the case-by-case exception of paved trails (preferred for maintenance) and associated facilities such as picnic tables/sitting areas.
- Land application of biosolids.

- Other activities or land uses that are determined by the City to pose an unacceptable risk to water quality of the receiving waters and cave system.

5.2 Outer Variable-width Buffer

The outer variable-width buffer (outer buffer) is in addition to the inner buffer. The outer buffer can be reduced, as described below, to a minimum width for each zone. Inner and/or outer buffers are not required for Zone 4. The outer buffer, with a maximum width of 300 feet in Zone 1 (inclusive of restrictive inner buffer), is intended to encompass sensitive site features including high-permeability recharge areas, karst features, losing streams, and areas that have high potential to contribute to contaminant loading. Areas within the outer buffer that pose high risks to water quality including erodible soils, areas of erosion/poor vegetative cover, steep slopes, existing areas of hazardous material, or waste storage shall be mapped. To the extent that these or other known risk factors to water quality exist outside of the outer buffer on a site, these areas must be mapped by the applicant as a part of the Disturbance Permit Application, and BMPs must be provided to mitigate potential water quality impacts.

Allowable activities and land uses in the outer buffer are the same as those allowed in the inner buffer and also include BMPs associated with a project that provide similar functions to the buffer or enhance functions of the buffer. Additional land uses, including those that consist of mostly pervious areas, can be incorporated within the buffer, depending on site-specific conditions, BMPs, and other factors that justify reductions in the maximum extent of the outer buffer, as determined by an Arkansas-registered Professional Engineer.

The width of the outer buffer may be reduced depending on site-specific conditions, BMPs, and other factors including the following:

- Soil treatment capability
- Land use characteristics
- Losing stream corridors
- Average ground slope
- Buffer zone filtration characteristics
- Stormwater detention and stormwater treatment practices
- Wastewater disposal quantities and quality
- Proximity to Cave Springs Groundwater Trough

BMPs that are designed that provide similar functions to the buffer upon which they encroach in terms of water quality may be used to justify reductions in the outer buffer width. Site-specific conditions, which justify a variance, may be used to support a reduction in the outer buffer width. Restoration activities within degraded buffers to improve function are encouraged and can be used to reduce the overall outer buffer width while stabilizing degraded areas adjacent to streams.

Cave Springs Outer Buffer Width Adjustment Worksheet

Note: Buffers apply to losing stream and other sensitive features that directly recharge the Cave Springs aquifer. Most losing streams are included in Zone 1; however, there may be losing stream segments and other sensitive features in Zones 2 and 3. Determination of reductions to outer buffer zone should be based on the section(s) of land that are directly affected by the considered reduction(s), rather than applied to the entire area of development. One or more of the reduction considerations can be applied to different areas of the development. Each side of the channel should be considered separately.

Buffer Condition	Zone 1 – Extremely High Vulnerability	Zone 2 – High Vulnerability	Zone 3 – Moderate Vulnerability
Maximum outer buffer width both sides of centerline of channel (feet)	300	200	100
Minimum inner buffer width both sides of centerline of channel (feet)	100	50	50
Eligible outer buffer width adjustment both sides of centerline of channel (feet)	200	150	50
Describe the portion and side of channel being considered (banks identified left to right looking downstream)	Ex. Clear Creek, Right Bank Buffer, 2000 feet through Green Acres Development (see attached map).		

Adjustment Factors	Buffer Adjustment (feet)	*Place "X" if applicable*	Buffer Adjustment (feet)	*Place "X" if applicable*	Buffer Adjustment (feet)	*Place "X" if applicable*
1 – Land Use						
1a – Parks and open space	-50		-40		-30	
1b – Large lot residential (>0.5 acre) or low-density (<2 units/acre)	-25		-20		-15	
1c – Residential high-density (>2 units/acre)	0		0		0	
1d – Office land use	0		0		0	
1e – Commercial land use	Not allowed per zoning without variance process		Not allowed per zoning without variance process		0	
1f – Industrial land use					0	
1g – Agricultural land use	0		0		0	
Total Land Use Width Adjustment (feet)	Sum of X's =		Sum of X's =		Sum of X's =	
2 – Average Ground Slope within 50 feet of edge of inner buffer (choose one)						
2a – 0-3% toward waterway	-10		-10		-10	
2b –Greater than 3% toward waterway	0		0		0	
Total Ground Slope Width Adjustment (feet)	Sum of X's =		Sum of X's =		Sum of X's =	
3 – Outer Buffer Zone Vegetation Characteristics within 50 ft of inner buffer (choose one)						
3a –Good dense, healthy vegetative cover (>80%)	-25		-20		-15	
3b – Existing fair cover (30-70%) to be restored to good (>80%)	-35		-30		-20	
3c –Existing poor cover (<30%) to be restored to good (>80%)	-50		-40		-30	
Total Filtration Characteristics Width Adjustment (feet)	Sum of X's =		Sum of X's =		Sum of X's =	
4 – Implementing Best Management practices (BMPs)						
4a – No below-surface disturbance within inner buffer	-20		-15		-10	
4b – No direct overland or piped discharge to inner buffer or losing stream	-25		-20		-15	
4c - Minimize directly connected impervious surfaces	-20	X	-15		-10	
4d – Stormwater pond designed in accordance with Karst Provisions of City Drainage Manual with additional media filtration layer	-100		-75		-50	
4e-- Other stormwater quality BMPs from City Drainage Manual that provide the WQCV and media filtration of runoff (raingardens, media filters, and similar)	-100		-75		-50	
Total Best Management Practices Adjustment (feet)	Sum of X's =		Sum of X's =		Sum of X's =	
5 – Wastewater Disposal Quantities & Quality						
5a – City Gravity Sewer System	0		-25		-25	
5b – Pumped Effluent Sewer System	0		0		-25	
5c- Septic Tank & Leaching Fields	Not allowed without variance process		Not allowed without variance process		Not allowed without variance process	
5d--Utility trenches constructed with cutoffs in trench to minimize preferential flow through trench bedding	-25	X	-20		-15	
Total Wastewater Disposal Width Adjustment (feet)	Sum of X's =		Sum of X's =		Sum of X's =	
TOTALS						
Outer Buffer Adjustment Total (feet) - Total of adjustments for items with "X" =						
Eligible Outer Buffer Width Adjustment from Centerline of Channel	200		150		50	
Adjusted Outer Buffer 200 feet - Total of Adjustments, Minimum of zero (0) =						
Total Buffer Width required From Centerline of Channel after adjustments) (feet) Inner Buffer + Adjusted Outer Buffer =						

EXAMPLE **Cave Springs Outer Buffer Width Adjustment Worksheet** *EXAMPLE*

Note: Buffers apply to losing stream and other sensitive features that directly recharge the Cave Springs aquifer. Most losing streams are included in Zone 1; however, there may be losing stream segments and other sensitive features in Zones 2 and 3. Determination of reductions to outer buffer zone should be based on the section(s) of land that are directly affected by the considered reduction(s), rather than applied to the entire area of development. One or more of the reduction considerations can be applied to different areas of the development. Each side of the channel should be considered separately.

Buffer Condition	Zone 1 – Extremely High Vulnerability	Zone 2 – High Vulnerability	Zone 3 – Moderate Vulnerability
Maximum outer buffer width both sides of centerline of channel (feet)	300	200	100
Minimum inner buffer width both sides of centerline of channel (feet)	100	50	50
Eligible outer buffer width adjustment both sides of centerline of channel (feet)	200	150	50
Describe the portion and side of channel being considered (banks identified left to right looking downstream)	Ex. Clear Creek, Right Bank Buffer, 2000 feet through Green Acres Development (see attached map).		

Adjustment Factors	Buffer Adjustment (feet)	*Place "X" if applicable*	Buffer Adjustment (feet)	*Place "X" if applicable*	Buffer Adjustment (feet)	*Place "X" if applicable*
1 – Land Use						
1a – Parks and open space	-50		-40		-30	
1b – Large lot residential (>0.5 acre) or low-density (<2 units/acre)	-25	X	-20		-15	
1c – Residential high-density (>2 units/acre)	0		0		0	X
1d – Office land use	0		0	X	0	
1e – Commercial land use	Not allowed per zoning without variance process		Not allowed per zoning without variance process		0	
1f – Industrial land use					0	
1g – Agricultural land use	0		0		0	
Total Land Use Width Adjustment (feet)	Sum of X's =	-25	Sum of X's =	0	Sum of X's =	0
2 – Average Ground Slope within 50 feet of edge of inner buffer (choose one)						
2a – 0-3% toward waterway	-10		-10		-10	X
2b –Greater than 3% toward waterway	0	X	0	X	0	
Total Ground Slope Width Adjustment (feet)	Sum of X's =	0	Sum of X's =	0	Sum of X's =	-10
3 – Outer Buffer Zone Vegetation Characteristics within 50 ft of inner buffer (choose one)						
3a –Good dense, healthy vegetative cover (>80%)	-25		-20	X	-15	X
3b – Existing fair cover (30-70%) to be restored to good (>80%)	-35		-30		-20	
3c –Existing poor cover (<30%) to be restored to good (>80%)	-50		-40		-30	
Total Filtration Characteristics Width Adjustment (feet)	Sum of X's =	0	Sum of X's =	-20	Sum of X's =	-15
4 – Implementing Best Management practices (BMPs)						
4a – No below-surface disturbance within inner buffer	-20		-15		-10	
4b – No direct overland or piped discharge to inner buffer or losing stream	-25		-20		-15	
4c - Minimize directly connected impervious surfaces	-20	X	-15	X	-10	X
4d – Stormwater pond designed in accordance with Karst Provisions of City Drainage Manual with additional media filtration layer	-100	X	-75	X	-50	
4e – Other stormwater quality BMPs from City Drainage Manual that provide the WQCV and media filtration of runoff (raingardens, media filters, and similar)	-100		-75		-50	
Total Best Management Practices Adjustment (feet)	Sum of X's =	-120	Sum of X's =	-90	Sum of X's =	-10
5 – Wastewater Disposal Quantities & Quality						
5a – City Gravity Sewer System	0	X	-25	X	-25	
5b – Pumped Effluent Sewer System	0		0		-25	X
5c– Septic Tank & Leaching Fields	Not allowed without variance process		Not allowed without variance process		Not allowed without variance process	
5d–Utility trenches constructed with cutoffs in trench to minimize preferential flow through trench bedding	-25	X	-20		-15	
Total Wastewater Disposal Width Adjustment (feet)	Sum of X's =	-25	Sum of X's =	-25	Sum of X's =	-25
TOTALS						
Outer Buffer Adjustment Total (feet) - Total of adjustments for items with "X" =	-170		-135		-60	
Eligible Outer Buffer Width Adjustment from Centerline of Channel	200		150		50	
Adjusted Outer Buffer 200 feet - Total of Adjustments, Minimum of zero (0) =	30		15		0	
Total Buffer Width required From Centerline of Channel after adjustments) (feet) Inner Buffer + Adjusted Outer Buffer =	**130**		**65**		**50**	

5.3 Buffer Area Maintenance

Inner buffers are to be maintained in a "natural" condition that promotes dense and diverse vegetation. Periodic maintenance may involve removing fallen trees, repairing areas of erosion, weed control and vegetation management. A "manicured" turf appearance is generally undesirable in the inner buffer and landscaping and maintenance practices such as less frequent mowing can help to discourage foot traffic and other urban/suburban activities in this area.

The outer buffer may be used for a broader set of activities than the inner buffer, and maintenance should be performed to keep a dense vegetated cover. Typical activities include mowing, weed control, clearing of debris/fallen trees, spot revegetation, and aeration.

Inner and outer buffer areas should be maintained in accordance with *BMP SC-10 Vegetative Buffers* in Chapter 9. Given the extent of buffers used in the Direct Recharge Area it will generally only be necessary to perform sediment removal in portions of buffers adjacent to disturbed and/or developed areas. Areas should be revegetated to match adjacent buffer areas following sediment removal.

6.0 STORMWATER BMP REQUIREMENTS

BMPs are required in all zones for protection of water quality during both construction and post-construction phases of development and for above ground and below ground potential contaminant sources. This section describes BMP requirements by zone for stormwater (construction and post-construction), wastewater, and others including construction dewatering and industrial discharges.

6.1 Non-Structural BMPs

Non-structural source control BMPs are required in all zones and are important for keeping sources of pollution from getting into the karst system. Education on source control BMPs is key to ensuring that BMPs are implemented and that the public is aware of the water quality concerns with practices such as petroleum and chemical storage, etc. Preservation of buffers is one of the most effective non-structural BMPs and is a major component of the water quality protection strategy for the Cave Springs Recharge Area. Chapters 8 and 9 of the *Drainage Criteria Manual* provide guidance on many non-structural practices that are applicable to the Direct Recharge Area. The following lists additional requirements related to selected practices:

1. BMP CM-1 Construction Sequencing and Phasing – The Disturbance Permit Application and Report should describe how disturbances within buffer areas are minimized or avoided. Disturbances in buffer areas should be promptly revegetated and mulched to provide cover. Phasing is limited to 20 acres of disturbance in Zone 1 and 40 acres of disturbance in Zone 2.

2. BMP CM-2 Hazardous Waste Management and Chemical Storage – All requirements of CM-2 apply both to construction and post-construction activities involving hazardous wastes and chemical storage. In addition, storage of hazardous materials and chemicals that are potential contaminants is not allowed within the inner or outer buffer areas. These requirements apply to construction activities as well as the long-term use of the site.

3. BMP CM-3 Solid Waste Management – Solid and liquid wastes should not be stored within buffer areas and areas/containers for liquid waste disposal should be watertight and covered. For commercial, industrial and office sites, waste storage areas and other activities that generate waste should be located on a portion of the site outside of the buffer area.

4. BMP CM-4 Concrete Washouts – Concrete washouts are not allowed in buffer areas. Concrete washouts should be avoided in Zone 1 to the extent practical, and those installed in Zones 1 and 2 should be lined with a 30-mil plastic liner. A 10-mil liner may be used in Zone 3.

5. BMP CM-5 Construction Staging and Access – Construction staging is not allowed in buffer areas and access to buffer areas where work is occurring should occur at limited, controlled access points. Vehicle maintenance and fueling must occur outside of buffer areas.

In general, land uses requiring Spill Prevention, Containment, and Control (SPCC) Plans (SPCC Regulations in Title 40 Code of Federal Regulation Part 112) for bulk storage of fuel or other sites for storage of waste (junkyards, landfills, transfer stations, etc.) are not allowed in the Direct Recharge Area. To the extent that a project is proposed requiring creation or modification of a SPCC Plan within the Recharge Area, the City will review the SPCC Plan and may add requirements as appropriate for protection of the karst groundwater system.

6.2 Construction BMPs

Construction BMPs in Chapter 8 of the *Drainage Criteria Manual* apply throughout the Cave Springs Recharge Area. In the Direct Recharge Area, special care should be taken with construction BMPs because of the adverse affects of sediment and turbidity in discharges to karst areas. The BMPs identified in *Section 4.1 Working in or Crossing a Waterway* should be followed for any construction activities within the inner buffer, including work on utilities, roads and bridges.

The following requirements apply in addition to the criteria in Chapter 8:

1. Disturbances in inner and outer buffer areas should be minimized to the extent practical.

2. Topsoil and soil that is rated as having "good" treatment capability must be segregated and stockpiled for use in revegetation and/or as a primary component of the filtration media mix for enhanced treatment in detention facilities.

3. Redundant perimeter controls are required between areas of disturbance and designated undisturbed buffer areas (double row of silt fence, double row of wattle, berm and wattles, etc.) in Zones 1 and 2.

4. Construction should be phased to limit the maximum area of disturbance at a given time to 20 acres in Zone 1 and 40 acres in Zone 2.

5. If a karst feature (spring, sinkhole or other direct recharge feature associated with karst hydrology) is encountered during construction, construction in the vicinity should be halted and the area protected with redundant perimeter controls. An Arkansas-registered Professional Geologist or Engineer should evaluate to recommend design modifications to limit impacts and direct recharge of runoff.

6. Construction dewatering discharges must receive treatment prior to discharge to buffer areas. Treatment methods including filter bags, sedimentation basins and/or sheet flow/infiltration are required upgradient of buffer areas. Criteria in Chapter 8 *BMP CM6 Construction Dewatering Discharges* apply.

6.3 Structural BMPs (post-construction)

The minimum requirements applicable to all zones are those in Chapter 9 of the *Drainage Criteria Manual.* These BMPs include runoff reduction measures, providing the water quality capture volume (WQCV), implementing source controls, and stabilizing drainageways. Additional requirements apply in Zones 1, 2, and 3.

6.3.1 Disconnected Impervious Area

Disconnection of impervious area is an important BMP for reducing the volume of runoff that must be treated. Methods of disconnecting impervious areas include direction of downspouts from roofs to pervious areas, use of swales and vegetated buffer strips, cross grading to drain driveways to pervious areas and others. Level spreaders, described in *BMP EC-13* in Chapter 8 are effective BMPs for diffusing runoff as shallow flow to a vegetated buffer area. Given the extent of buffers that are required in the Direct Recharge Area, level spreaders can provide many benefits to the buffer areas compared to discharges from concentrated outfalls.

For residential development in Zones 1, 2 and 3, final plats and covenants shall require disconnection of at least 50% of the **on-lot** impervious area (roofs, hardscaping, driveways, etc.) associated with a development. In Zone 3, office, commercial and industrial sites must provide disconnection of at least 25% of impervious surfaces on the lot. Plans for impervious area disconnection must be included as a part of the Disturbance Permit Application and Report.

6.3.2 Ponds, Constructed Wetlands and Filters

BMPs including extended wet detention, constructed wetland basins, bioretention and sand filters provide a high degree of treatment by virtue of multiple unit processes including sedimentation, filtration, adsorption/absorption, and/or biological processes. These BMPs are acceptable for use in Zones 1, 2, and 3 following the criteria in Chapter 9. Wet ponds or wetlands should be designed to prevent or minimize seepage and maintain a permanent pool. In some cases this may require lining of the pond/wetland.

While the BMPs noted above are acceptable for use in the Direct Recharge Area and are capable of achieving desired results using the criteria in Chapter 9, it is far more common for development in the area to use extended dry detention ponds and combine water quality treatment and flood storage in a facility with a multi-stage storage/outlet design. Extended dry detention basins provide treatment primarily via sedimentation and can be effective BMPs. However, in areas with high permeability soils or when excavated through the fragipan, these ponds can actually serve as direct recharge areas when head builds up in the pond during runoff events.

When extended dry detention facilities are used as BMPs in the Direct Recharge Area (Zones 1, 2 and 3), additional filtration of runoff is required. The Captina and Peridge Series soils in the area have good treatment capability because they contain enough fine material that they allow runoff to percolate at a moderate rate, typically in the range of 0.8 to 1.2 inches per hour. To provide additional filtration, a "filter media" layer must be installed beneath extended dry detention ponds in Zones 1, 2 and 3.

6.3.3 Filter Media

Captina and/or Peridge soils scraped from the upper soil horizon during construction and stockpiled are appropriate soils as the base of the filter media. These are silt loam soils that are moderately well drained and have low runoff potential. They are desirable for treatment because of the moderate rate of percolation/infiltration. Given the fact that the media will be placed in the bottoms of extended dry detention ponds and will have a much higher hydraulic loading rate in that setting, native soil that will be used as filter media should be amended with additional sand to achieve the following composition:

- Clay 15%
- Sand 65%
- Silt 20%.

The intent of this media composition is to provide infiltration at a rate ranging from 0.8 to 1.5 inches per hour while water is stored in the pond and draining out through the outlet structure. The initial rate is intended to be in the higher end of the range, with decay over time due to accumulation of fine sediments in the filter layer to the point where it must be maintained to restore infiltration. A long-term infiltration rate through the media of approximately 1 inch per hour is desirable.

Native soil that will be used for filter media must be tested to determine composition and amended to achieve the required composition. Samples of native soil that will be used as filtration media should be tested for potential to leach nutrients and metals so that they do not inadvertently become a contaminant source. Provide a copy of this analysis to the city by a geotechnical firm.

It is critical that the native soils are homogenously mixed with the additional sand and the contractor should collect a minimum of one quality control sample per 10,000 ft^2 of pond bottom to confirm that the desired mixture has been achieved. A geotechnical company shall test and provide results to the city. Some tolerances are allowable; however, the percentage of sand should be at least 60%, and the clay content should be no more than 20%.

The use of filter media in the bottoms of extended dry detention ponds in Northwest Arkansas is a new practice, and criteria for filter media may be refined based on testing, field observations, and/or feedback from engineers, developers and regulators. The recommended percentages are based on review of nationwide literature on biofiltration media composition, compatibility with native soils in the area, and a desire to balance the need for treatment with the desire to drain runoff from ponds following events.

6.3.4 Filter Layer for Extended Dry Detention

A layer consisting of 18-inches of the filtration media described above should be installed beneath the top stage floor, low flow channel and micro-pool as shown in Exhibits 10-3 and 10-4, EDB Filtration Media and Low Flow Channel Details. The filtration media is not intended to be the primary outlet for the extended dry detention pond, instead, it is meant to provide a high level of treatment via filtration for water that infiltrates through the pond bottom while the pond is filling and draining. The pond area should be over-excavated by 18-inches and well-mixed filter media placed in the pond bottom. Filter media should not be compacted to more than 80% standard proctor. Sod is placed on top of the filter media for the top stage floor, and the trickle channel is also constructed above the filter media layer. The filter layer should be installed as one of the final steps in the construction sequence, once disturbed areas of the site have been stabilized and the forebay and pond outlet structure have been completed.

6.3.5 Filter Layer Maintenance

The forebay of an extended dry detention basin, if specified by design engineer, can play a critical role in maintaining the ability of the filter media to infiltrate water by removing coarse sediments that would otherwise deposit on the pond bottom. Even with this pretreatment, periodic maintenance will be required to maintain infiltration capacity. Routine maintenance should include:

- Mowing and weed control (collect and dispose of clippings).
- Replacement/repair of sod.

- Sediment removal – This is most typically required after large events. If there are visible sediment deposits on the top stage floor, low flow channel or micro-pool they should be removed.

- Aeration – Annual aeration of the top stage floor may be required to maintain infiltration capacity through the sod layer and upper media horizon.

- Because the top stage floor and low flow channel are designed to drain out through the outlet structure in 48 hours, standing water beyond that duration may be an indication that the water quality orifice plate is obstructed.

Maintenance criteria for extended dry detention basins in Chapter 9 also apply.

6.4 Retention/Containment Standards for Highway Runoff

Future state and/or federal highway projects within the Cave Springs Direct Recharge Area must provide BMP treatment systems comparable to or exceeding the system that has been approved for the I-49 corridor. These systems may include lined ponds, filtration practices and other BMPs.

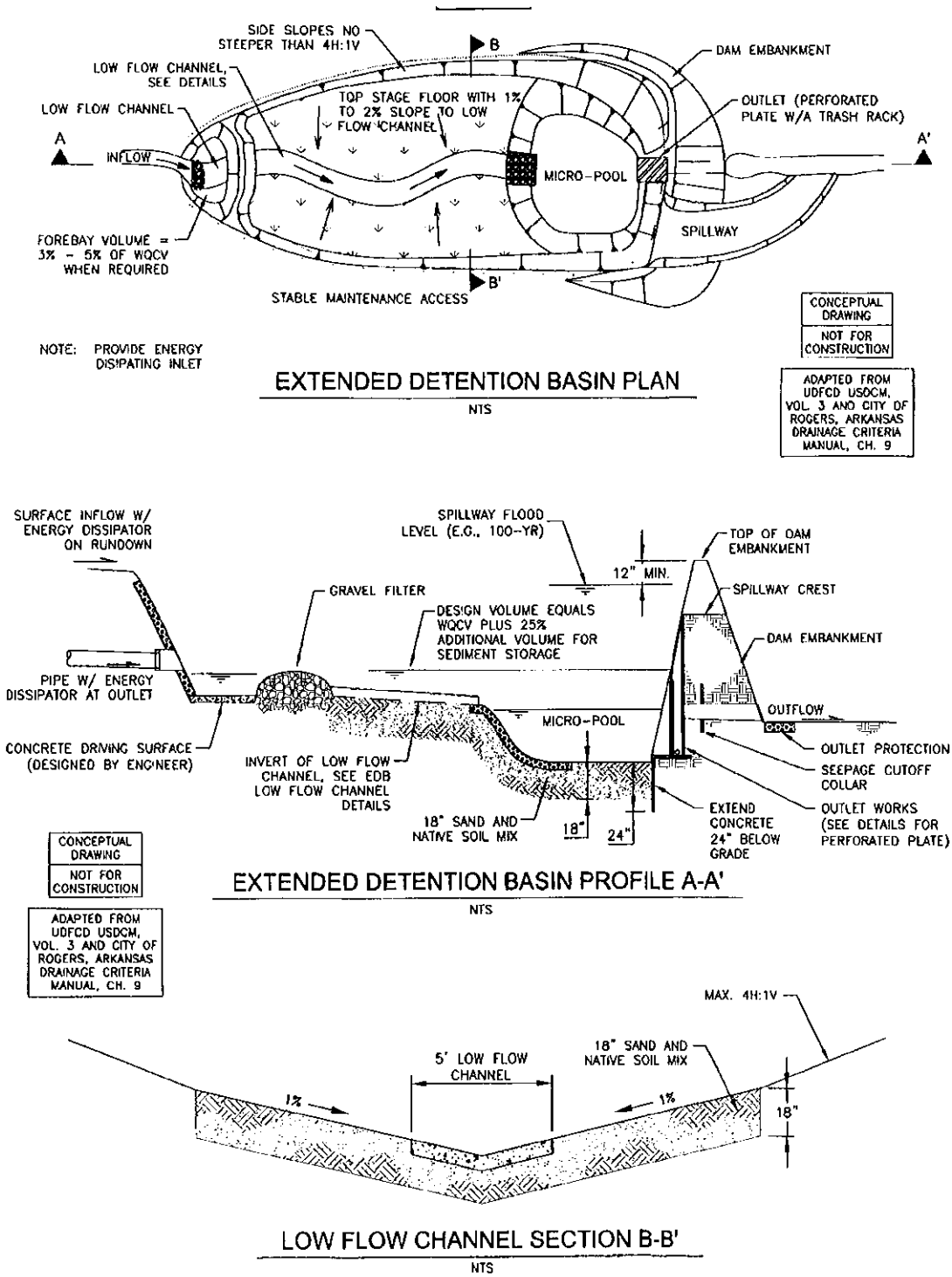
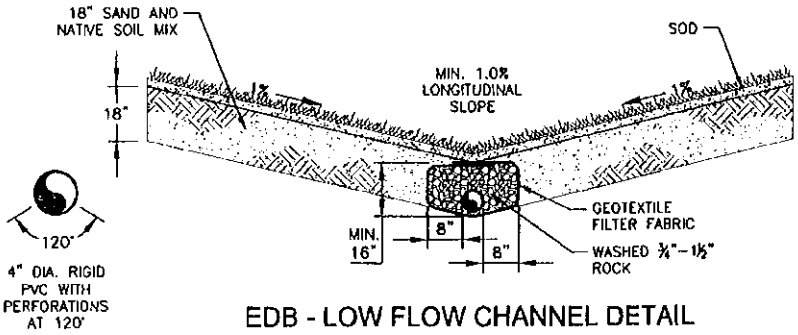
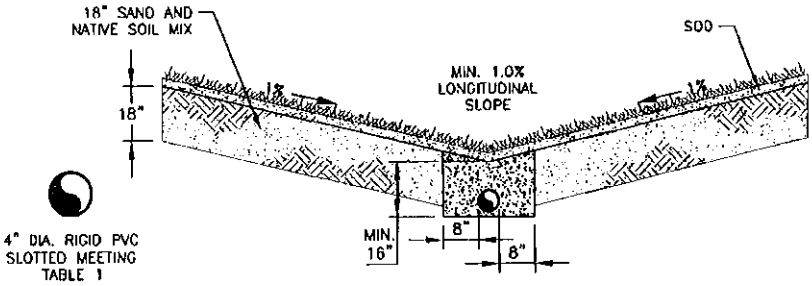


Exhibit 10-3. Extended Dry Detention Basin Filter Media Detail



EDB - LOW FLOW CHANNEL DETAIL
OPTION 2 - VEGETATED SWALE WITH
PERFORATED UNDERDRAIN PIPE

NTS



EDB - LOW FLOW CHANNEL DETAIL
OPTION 3 - VEGETATED SWALE WITH
SLOTTED UNDERDRAIN PIPE

NTS

Exhibit 10-4. Low Flow Channel Filter Media Details

7.0 WASTEWATER BMP REQUIREMENTS

7.1 Pressure and Gravity Sewer Lines

The need for a gravity sewer collection system is paramount in the City of Cave Springs especially, but also in the City of Lowell as it relates to vulnerability of the Direct Recharge Area groundwater quality. Based on data from the Northwest Arkansas Conservation Authority (NACA) studies and rough sewer interceptor plans, preliminary cost to bring a 24" interceptor from NACA to the Osage Creek crossing of Highway 264 just west of Cave Springs involves 25,800 linear feet at $350+ per linear foot or $9,000,000±. Several million dollars more will be required to tie in existing subdivisions currently using pumped effluent systems. STEPP systems should be avoided. Meanwhile, recommended policy for sewer service in new subdivisions will be to require gravity sewer systems to each lot with a "drainage basin" type lift station installed to collect sewage that when gravity sewer is available would provide one point for connection to said new gravity sewer.

With exception of service lines, all public and privately maintained pressure and gravity sewer lines located within 300 feet of a losing stream, anywhere in Zone 1 or the Cave Springs Groundwater Trough, must meet all criteria and design standards of the Cities of Rogers or Springdale (which are based on the Ten State Standards) and Cave Springs pumped effluent systems until a gravity sewer system is available. As shown in Exhibit 10-5, these sewer lines must be constructed using geomembranes installed in the bottom of the sewer trench under the pipe bedding up the sides of the trench to 12" above the top of the pipe. Trench dams shall be installed at 400'+/- intervals and at mainline branches. These trench dams shall extend 6" into undisturbed soil on the bottom and sides of the trench and must extend to within 12" of finished grade. Trench dams may be composed of bentonite clay, flowable concrete fill, manufactured anti-seep collars, or other widely accepted materials and methods of practice.

An 8" PVC monitoring well shall be installed on the upstream side of each trench dam from the surface down to the sewer pipe flow line designed to intercept any flow along or immediately beneath the sewer pipe. Each monitoring well shall be sampled annually for dye that will be introduced into the upstream sewer main to check for sewer leakage. As an alternative to dye tracing, the utility owner may implement a monitoring program to test annual samples for the presence of wastewater by commonly accepted laboratory practice or implement an annual inspection program capable of detecting defects and exfiltration points in sewer mains.

All pressure and gravity sewers in Zones 1, 2, 3 & 4 must meet all criteria and design standards of Rogers or Springdale Water Utilities.

7.2 Sewage Lift Stations

All wastewater lift stations shall be equipped with two or more pumps such that the wastewater lift station is capable of pumping the total rated capacity with one pump out of service.

A control system with remote transmission of data or equivalent shall be implemented at wastewater lift stations. Graphical display screens shall show, and the control system shall be capable of transmitting, the instantaneous station discharge, wet well water level, pump run times, pump starts, pump status (such as running, off, or alarm conditions), power status, and standby generator status. Wastewater lift station alarm systems shall transmit and identify alarm conditions to a municipal facility that is staffed 24 hours a day. If such a facility is not available, the alarm shall be transmitted to municipal offices during normal working hours and to the home of the responsible person(s) in charge of the lift station during off-duty hours. The control system and communication method shall be coordinated with the local municipal agency for integration with their SCADA system and operational procedures.

Fuel or gas standby generators with appropriate fuel storage containers, or an approved alternative secondary power supply, shall be provided as a backup power source for wastewater lift stations. In the event of a power failure, the redundant power system shall automatically operate the wastewater lift station, shall have sufficient capacity to start up and maintain the total rated running capacity of the station. A portable pump connection to the force main with rapid connection capabilities and appropriate valving shall be provided outside the dry well and wet well, similar to Exhibit 10-6.

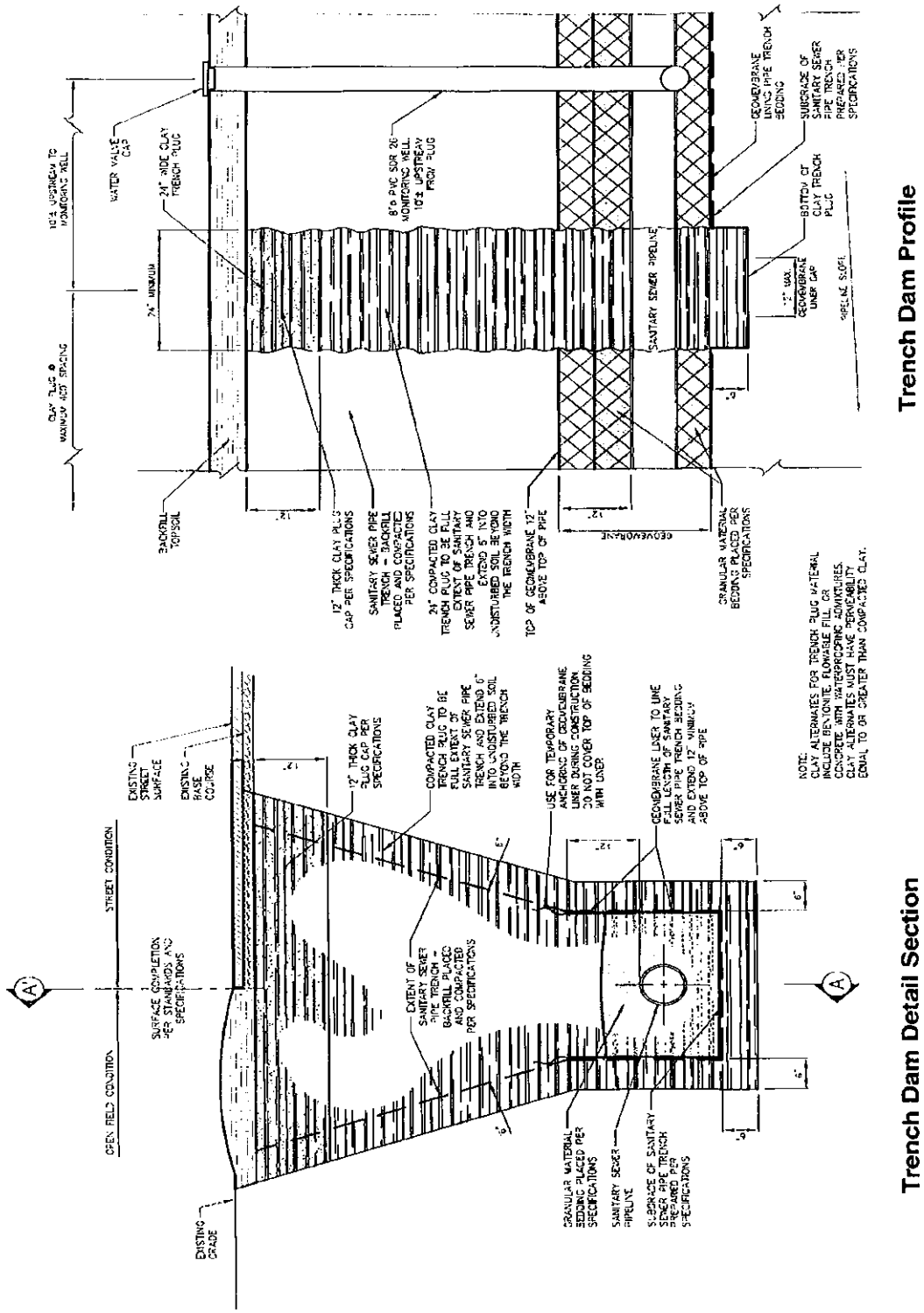
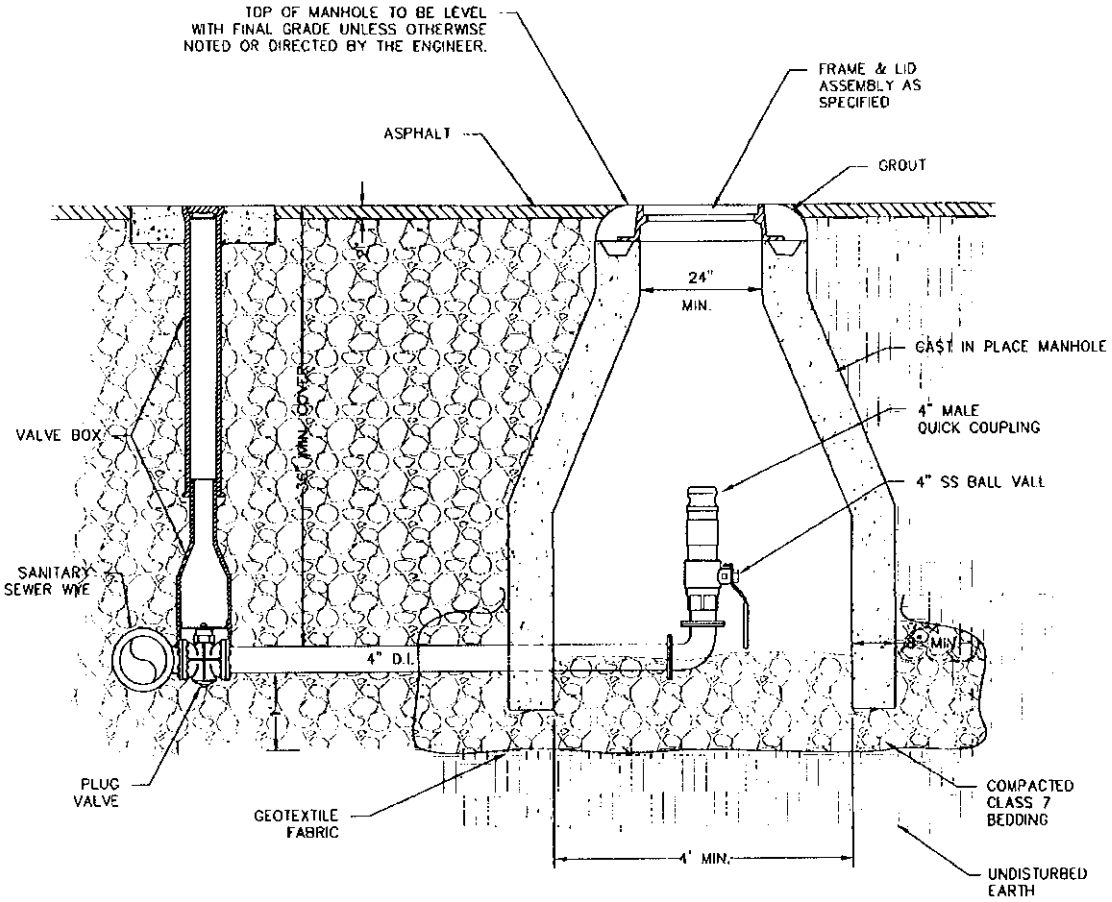


Exhibit 10-5. Trench Dam for Sanitary Sewer Pipeline Trench



NOTE: SEE PUMP STATION PLAN FOR LOCATION AND CONFIGURATION OF ASSEMBLY.

BYPASS MANHOLE & QUICK CONNECTION

N.T.S.

Exhibit 10-6. Bypass Manhole and Quick Connect Detail

8.0 BMPS FOR INDUSTRIAL DISCHARGES & OTHER CONTAMINANT SOURCES

8.1 Industrial & Commercial Contaminant Sources

Industrial and commercial land uses are not allowable in Zones 1 or 2 of the Direct Recharge Area per zoning without a variance, and discharges requiring permitting under ADEQ industrial stormwater and/or wastewater discharge permits are prohibited in these zones. Under special circumstances, these types of land uses may be allowed when there is not a feasible location outside of Zone 1 or Zone 2; however, this would require a special Disturbance Permit review process to identify BMPs that would adequately protect water quality given the nature of the discharge and the proximity to direct recharge areas. In cases where a variance is allowed the applicant must demonstrate that, with BMPs, the proposed land use will pose no higher risk to water quality than permitted land uses.

For commercial and industrial land uses or other land uses requiring a permit from ADEQ and/or a federal agency in Zone 3, the requirements of Chapter 9 and this chapter apply. Any potential stormwater, wastewater, SPCC or other plans and associated permits must be submitted as a part of the Disturbance Permit Application.

8.2 Bulk Storage of Fuel and Hazardous Materials

Bulk storage of fuel and other hazardous materials is discouraged in the Direct Recharge Area because of the threat that spill and leaks pose to groundwater quality. Bulk storage of fuel and similar substances must comply with SPCC regulations and hazardous materials and waste must be managed in accordance with the Resource Conservation and Recovery Act (RCRA).

The following additional restrictions apply:

1. Underground storage tanks are prohibited in Zones 1 and 2.

2. Aboveground storage of bulk fuel or other hazardous materials is also prohibited in Zones 1 and 2.

3. Underground storage tanks are allowed in Zone 3; however, any such underground storage tanks must have secondary containment.

4. Aboveground storage of bulk fuel or other hazardous material is allowed in Zone 3 with appropriate secondary containment, spill prevention, control and countermeasure BMPs and appropriate federal, state and local regulations.