ARR040000 Recertification Notice of Intent for Regulated Small Municipal Separate Storm Sewer Systems (MS4s) General Permit

version 1.17

(Submission #: HQ2-YX2A-TDAE0, version 1)

Details

AFIN	88-00838
Submission ID	HQ2-YX2A-TDAE0
Submission Reason	Renewal

Form Input

Permit Information

Recertification Instruction

Please review all fields carefully for typos or inaccurate information. If the information in the corresponding field is incorrect, please update the corresponding field with the correct information by typing over the existing information.

If the Permittee (Legal Name) changes, you will need to also submit a permit transfer form.

The update SWMP must be submitted in accordance with the permit.

Permittee (Legal Name)

The permittee means any person (an individual, association, partnership, corporation, municipality, state, or federal agency) who has the primary management and ultimate decision-making responsibility over the operation of a facility or activity.

Permit No.
ARR040011

AFIN
88-00838

Permittee (Legal Name)
City of Fort Smith

Site Contact Person

Contact Person Information

First Name	Last Name
Stan	*Snodgrass*

Title
Director of Engineering

Phone Type	Number	Extension
Business	479-784-2247	

Email
snodgrass@fortsmithar.gov

Urbanized/Core Areas
Fort Smith

Receiving Stream
Massard Creek, Little Massard Creek, Spivey Creek, Sunnymede Creek, No Name Creek, Oak Park Tributary, May Branch, Mill Creek, Little Vache Grasse Creek, Poteau River

Is this MS4 identified on the list of the EPA approved Total Maximum Daily Loads (TMDL)?
The Poteau River has an EPA approved TMDL, however, since the WLA is zero the city does not perform monitoring.

From our database, the Responsible Official are listed in the following

Responsible Official First Name
Carl E.

Responsible Official Last Name
Geffken

Responsible Official Title
City Admin

Did the Responsible Official Change?
No

Please provide the Responsible Official Email Address
cgeffken@fortsmithar.gov

From our database, the Cognizant Official are listed in the following

Cognizant Official First Name
Stan

Cognizant Official Last Name
Snodgrass

Cognizant Official Title
Engineer

Did the Cognizant Official Change?
No

Please provide the Cognizant Official Email Address
snodgrass@fortsmithar.gov

Mailing Address

P.O. Box 1908

Fort Smith, AR 72902

Is the invoice address the same as the mailing address?
Yes

Attach Updated SWMP and Updated Storm Sewer System Map

COFS Storm Sewer Map June 2024.pdf - 06/05/2024 10:40 AM
City of Fort Smith SWMP.pdf - 06/05/2024 01:03 PM
Comment
No major changes to SWMP; the previous BMP 6.3 is now combined with BMP 3.4.

BURNS McDONNELL

CITY OF FORT SMITH

STORMWATER MANAGEMENT PROGRAM

ARR040011
PROJECT NO. 169312

JUNE 2024

CONTENTS

List of Abbreviations

Abbreviation	Term/Phrase/Name
ADEQ	Arkansas Division of Environmental Quality
BMP	Best Management Practice
CFR	Code of Federal Regulations
EPA	Environmental Protection Agency
MCM	Minimum Control Measure
MS4	Municipal Separate Storm Sewer System
NOI	Notice of Intent
NPDES	National Pollutant Discharge Elimination System
PSA	Public Service Announcement
SIC	Standard Industrial Classification
SWMP	Stormwater Management Program
TMDL	Total Maximum Daily Load
TSS	Total Suspended Solids
WLA	Waste Load Allocation

Certification

City of Fort Smith
Stormwater Management Program

Certification

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

I certify that I have read and will comply with all the requirements of the Regulated Small Municipal Separate Storm Sewer Systems (MS4's) General Permit ARR040000.

Name _____

Date: _____

Introduction

The Stormwater Management Program (SWMP) has been developed for the City of Fort Smith (City) in accordance with the Arkansas Department of Energy & Environment, Division of Environmental Quality (ADEQ) state permit Municipal Separate Storm Sewer System (MS4) General Permit (ARR040000). The permit authorizes stormwater discharges from regulated small MS4s located within the State of Arkansas. The City currently serves a population of 89,142 (2020) within city limits. The primary purpose of the SWMP is to improve and preserve the quality of water in the receiving streams by reducing the discharge of pollutants within the City's MS4.

Regulatory Background

ADEQ issued a new state general permit on August 1, 2019, dictating the City's responsibilities to protect water quality, reduce the discharge of pollutants to the maximum extent practicable, and to satisfy the appropriate water quality requirements of the Arkansas Clean Water Act. As part of these responsibilities, the City was required to submit an updated SWMP. The SWMP contains Best Management Practices (BMPs) and measurable goals to track progress and performance of meeting the permit requirements to the maximum extent practicable.

EPA has delegated authority to issue MS4 stormwater discharge permits in the State of Arkansas. Arkansas Department of Environmental Quality (ADEQ) has the regulatory authority and is responsible for issuing permits for regulating stormwater discharges from small MS4s to surface waters in the state. The City will strive to meet the state permit requirement with each reissuance by complying with new or revised standards as soon as practicable. Effective August 1, 2024, ADEQ issued their renewed general permit for small or phase II MS4s.

Minimum Control Measures and Best Management Practices

Each Minimum Control Measure (MCM) outlines a series of BMPs the City will implement with the intended purpose of reducing stormwater pollution. Each BMP includes a description of the practice, as well as measurable goals to identify progress towards achieving the purpose of the BMP. All measurable goals include a description of the actions the City is taking or plans to take to implement the goal, and how the effectiveness of the goal is measured or progress towards achievement of the goal is tracked. Measurable goals that do not show desirable metrics will be re-evaluated and/or replaced during the next update to the SWMP.

At the end of each BMP section is a table that includes an overview of all BMPs, measurable goals, and implementation schedule for ease of access. This table is intended to be a living log to document the measures the City is taking each year to meet the obligations of the permit.

A Table of Organization is included as Appendix A to identify the City's primary point of contact (by title) and key contacts implementing BMPs across the organization. Appendix B attached to the SWMP provides an organizational chart to demonstrate key department representatives and the MCM(s) each department participates in.

Receiving Waterbodies/Impaired Waterbodies and Total Maximum Daily Load (TMDL) Requirements

The waterbodies receiving stormwater directly from the MS4 include Massard Creek, Little Massard Creek, Spivey Creek, Sunnymede Creek, No Name Creek, Oak Park Tributary, May Branch, Mill Creek, Little Vache Grasse Creek, and Poteau River. These waterbodies flow to and ultimately discharge to the Arkansas River.

The City has evaluated its receiving waters and the 2020 Impaired Waterbodies 303(d) list to determine whether the permitted discharges flow to any impaired waterbodies. The Poteau River (AR_11110105_001) is listed on the 303(d) list as not supporting its designated uses for aquatic life. It is listed as both a Category 4a waterbody with an approved TMDL for Turbidity, and as a Category 5 waterbody with an impairment for Dissolved Oxygen, for which an approved TMDL has not been implemented.

According to the 2005 “TMDL For Turbidity for the Poteau River Near Fort Smith, AR” document, “the wasteload allocation (WLA) for point source contributions were set to zero because no point source discharges were identified within the study area. Future growth (i.e. new permits) would not be restricted by this turbidity TMDL.” Based on discussions with ADEQ, no waterbody monitoring is required at this time since the City is not considered a source of the pollutants of concern (turbidity, dissolved oxygen).

The City maintains compliance with the TMDL since no WLA has been assigned and proposes no sampling or analysis of the MS4 discharge under an established program. Similarly, no monitoring is required for the dissolved oxygen impairment. Although the sources for both impairments are unknown, the City has implemented BMPs to decrease loadings of organic materials and chemicals.

MCM 1: Public Education and Outreach on Stormwater Impacts

Performance Standards

The stormwater public education and outreach program shall include:

1) more than one (1) mechanism;

2) at least five (5) different stormwater themes or messages over the permit term. At a minimum, at least one (1) theme or message shall be targeted to the land development community. For non-traditional MS4s, the land development community refers to landscaping and construction contractors working within its boundaries; and

3) The stormwater public education and outreach program shall reach at least fifty (50) percent of the population over the permit term.

Decision Process

The City has implemented a public education program to distribute educational materials to the community and has conducted outreach activities about the impacts of stormwater discharges on waterbodies.

The City plans to inform individuals and households about the steps they can take to reduce stormwater pollution through print media, social media, and television advertisements. The target audiences selected for the education program are those that are likely to have significant impacts on stormwater. The selected audiences include residential, commercial, industrial, and land development communities. The City's public education program will target pollutant source topics including soil erosion from construction activities, fertilizers, herbicides/insecticides, household hazardous chemicals, hazardous chemicals used in commercial and industrial processes, automotive fluids, restaurant/grocery wastes, and litter/cigarette butts. The City's outreach strategy includes printed brochures, newspaper ads or postings, and social media to reach the target audience. It is expected that 50% of the target audience will be reached by the end of the permit term.

The Engineering Department is responsible for the overall management and implementation of the stormwater management program. Other departments responsible for implementing certain BMPs will be outlined in that specific BMP. The success of the public education and outreach on stormwater impacts program will be evaluated based on the number of successfully completed measurable goals each reporting year, as outlined in the annual report.

BMP 1.1: Publish Stormwater Related Articles and Information for the Residential, Commercial, Industrial, and Land Development Communities on Social Media

MEASURABLE GOAL 1.1.1: Stormwater information and/or articles will continue to be posted at least 12 times annually on the City of Fort Smith social media pages.

Posting stormwater related information and articles to a social networking site allows the City to reach a large number of the population in an economic way. The educational information addresses pollutants from lawns and gardens, vehicles, runoff, and provides information on illicit discharges and pollutant reductions. The stormwater pollution hotline will be included in all posts to ensure the public is aware about where to report stormwater pollution instances. The Engineering Department is responsible for developing the posts and the Communications Department will maintain the social media pages. The measurable goal for this BMP should be a minimum of 12 posts annually. This number allows for one post approximately every month, which is achievable for the City and doesn't overwhelm the audience. Facebook posts are simultaneously posted across the City's other social media including Instagram and X, formerly known as Twitter. This goal shall measure success of reaching the targeted audiences through the number of visits to the City's Facebook, Instagram, and X pages as documented in the annual report.

BMP 1.2: Post Stormwater Related Information and Contacts on the City's Website

Measurable Goal 1.2.2: Stormwater information on the website will be reviewed twice per year and updated as necessary.

The City will continue to post stormwater information available on the website for the general public. The City will maintain contact information for the Engineering Department, the phone number for the Stormwater Pollution Hotline, and the City's Storm Drainage Standards. Under the renewed permit, the City will also make a digital copy of this Stormwater Management Program (SWMP) and annual reports available on the webpage.

The measurable goal for this BMP should be reviewing information on the website a minimum of twice per year and making updates if necessary. If no changes were necessary, the City will document that no changes were needed.

This goal shall measure success by measuring the number of visitors twice per year with a webpage counter as documented in the annual report.

The Engineering Department is responsible for ensuring that information on the website is up to date. Information is posted on the Engineering Department's website at https://www.fortsmithar.gov/government/departments/engineering.

BMP 1.3: Broadcast Stormwater Related Public Service Announcement on City's Public Access Television Channel

MEASURABLE GOAL 1.3.3: Air Public Service Announcements (PSAs) on the local television channel at least twice annually.

Public Service Announcements are an economical way of reaching a large audience on the City's public access channel. Citizens who tune into the public access channel to find out local information and up-to-date events and activities.

It is attainable for the City to air a minimum of two PSAs on an annual basis. This allows for plenty of time for development and scheduling of PSAs on the City's public access channel. Each broadcast will be aired on the TV channel for a 15 day timeframe.

The Engineering Department is responsible for developing the PSAs and providing them to the City Clerk's office who will broadcast them on the City's public access channel. The number of PSAs broadcast per year will be documented in the annual report.

BMP 1.4: Distribute Stormwater Related Brochures to the Land Development Community

MEASURABLE GOAL 1.4.4: Distribute brochures focused on soil erosion and construction site erosion control to all members of the land development community who are issued Fill & Grading Permits or Building Permits for New Construction.

Stormwater runoff from construction sites not only carries sediment but it can also carry pesticides, cleaning solvents, concrete wash, asphalt, fuel, and motor oil.

The Engineering Department is responsible for updating and distributing the brochure to all Fill and Grading Permit applicants. The Building Safety Division is responsible for distributing the brochure to all applicants under the Building Permits for New Construction.

Table 1: BMPs for Public Education, Outreach, and Involvement

BMP	Description	Measurable Goal	Frequency of Action	Responsible Person(s)
1.1	Educational Content on social media Pages	Post 12 times and record number of views per post after one week.	12 times annually	Engineering Department & Communications Department
1.2	Stormwater Content on City of Fort Smith Website	Review webpage and update as necessary. Track visitors to the webpage.	Twice per year	Engineering Department
1.3	Broadcast stormwater PSA on City TV Channel	Air stormwater public service announcement.	Twice per year	Engineering Department & City Clerk's Office
1.4	Distribute stormwater brochures to members of the land development	Complete review of brochure and update if needed.	Annually	Engineering Department

	community who are issued Fill & Grading Permits or Building Permits for New Construction	Record number of brochures distributed.	Annually	Engineering Department & Building Safety Division

MCM 2: Public Involvement and Participation

Performance Standards

The stormwater public involvement/participation program shall include at least five (5) public involvement activities over the permit term.

Decision Process

The City has implemented a public involvement and participation program to distribute educational materials to the community and has conducted outreach activities about the impacts of stormwater discharges on waterbodies. The City will host a public review and comment period to accept considerations from the public about the NOI and SWMP, as described in BMP 2.1. The City will involve the public in the development and implementation of this program during the public review period outlined in BMP 2.1 and by hosting public outreach activities for hands-on experience.

The target audiences for the public involvement program include:

a. Single & Multi-Family Residences
b. Commercial Businesses
c. Industrial Businesses
d. Land Development Community
e. Civic Clubs/Organizations
f. Student Clubs/Organizations
g. Religious Organizations

The Engineering Department is responsible for the overall management and implementation of the stormwater management program. Other departments responsible for implementing certain BMPs will be outlined in that specific BMP. The success of the public education and outreach on stormwater impacts program will be evaluated based on the number of successfully completed measurable goals each reporting year, as outlined in the annual report.

BMP 2.1: The City Will Host a Public Review and Comment Period for the NOI and SWMP

MEASURABLE GOAL 2.1.1: Before the NOI and SWMP are approved by ADEQ, the City will hold a 30-day public review period to receive comments and input from the public. Review and consider public comment suggestions into SWMP.

The City will provide public notice for a minimum 30-day review period for public input in the development of the draft NOI and SWMP. In order to give the public opportunity to provide input in the development of the NOI and SWMP, the City will hold a review period beginning on date in order to receive questions and comments from the public. This review period will be advertised in the River Valley Democrat Gazette and on the City website. The proposed SWMP

will be available on the City's website and a hard copy available for review in the Engineering Department office. The Engineering Department is responsible for implementing this BMP. The City will provide public notice for a minimum 2-week (14 day) review period for review of the draft SWMP using the City's News webpage. The City will solicit public comments and feedback for the draft SWMP using the City's Contact Us webpage. Public comments received will be reviewed and considered to determine whether proposed changes will be implemented into the SWMP. This goal shall measure success of reaching the targeted audiences through number visits to the webpage and number of comments received, as documented in the annual report.

BMP 2.2: Utilize Alternative Sentencing Personnel to Clean Curbs, Gutters, and Pick up Trash Accumulated Along City Streets

MEASURABLE GOAL 2.2.1: Alternative sentencing personnel will meet on a monthly basis under the renewed permit and the City will record the number of days spent picking up litter or cleaning out ditches.

Alternative sentencing personnel, also known as the "A" Team, have been utilized for minor maintenance work on the City's stormwater drainage system since the City's first MS4 permit. Using the "A" Team for such work allows those involved to perform their public service, and it provides them with first-hand knowledge of the pollutants in our waterways and the efforts necessary to remove them.

Maintenance activities performed by the "A" Team include clearing litter from city right-of-ways, cleaning city drainage easements, checking and clearing obstructions from drainage inlets and easements, cleaning dirt and grass from curbs and gutters, cleaning concrete swales, and cleaning leaves from roadside ditches. The "A" team will continue to meet once a month under the renewed permit. Additionally, the City will record the number of days spent picking up litter or cleaning out ditches in the annual report. The Street Operations Department is responsible for overseeing the activities of the "A" Team.

BMP 2.3: New Storm Sewer Manhole Covers Will Be Marked with the Warning "Storm Sewer- No Dumping- Drains to River"

MEASURABLE GOAL 2.3.1: Marking new manholes will continue under the renewed permit.

The City has required that all new manhole covers located in City right-of-way, on both municipal projects and private developments be marked with the following warning "Storm Sewer- No Dumping- Drains to River". The Land Development Community are primarily used to install the new covers. Placing covers on new manholes educates both the general public and personnel installing the covers on the environmental consequences of illegal dumping in storm drains. Installing these manhole covers allows the Land Development Community to have an active role in preventing stormwater pollution within the community. Placement of the marked

manhole covers on all new construction will continue under the new permit. The Engineering Department is responsible for ensuring that all new storm sewer manholes have marked covers.

BMP 2.4: Existing Storm Sewer Manholes Will Be Marked with the Warning "Storm Sewer- No Dumping- Drains to River"

MEASURABLE GOAL 2.4.1: Storm Sewer Decals shall be placed on at least 20 manholes per year by citizen volunteers and/or members of the City's "A" Team.

The City began a storm drain marker program where members of the public place decals with the warning "Storm Sewer- No Dumping- Drains to River" on existing manholes throughout the City's jurisdiction. Citizens involved with this work include both volunteers from the general public and members of the City's "A" Team. Placing these decals on existing manholes educates the public on the environmental consequences of illegal dumping in storm drains. It also allows citizens to become involved in preventing stormwater pollution within the community. In order to prevent the program from becoming overly burdensome to those involved, it was decided that the minimum marking requirement should be no more than 20 manholes per year. The program for the marking of existing manholes will continue under the new permit. The Engineering Department is responsible for administering the manhole marking program.

BMP 2.5: Operate a Community Hotline for Reporting Stormwater Pollution and Complaints

MEASURABLE GOAL 2.5.1: Operate stormwater Pollution hotline and track the number of complaints received. The City will also record the measures which the hotline is advertised within the reporting year.

The stormwater pollution hotline supplements the City's efforts to stop illicit discharges and determine where stormwater problems currently exist. Advertising the hotline also further facilitates public involvement in the Stormwater Management Plan. The stormwater pollution hotline number is 479-784-2225, also the Engineering Department's phone number. The Engineering Department is responsible for maintaining and advertising to the public.

BMP 2.6: Maintain a Volunteer Adopt-A-Spot or Adopt-A-Street Program

MEASURABLE GOAL 2.6.1: Continue to operate a volunteer Adopt-A-Spot or Adopt-A-Street program and record the number of volunteer groups which participate.

The Adopt-A-Spot and Adopt-A-Street programs create a unique partnership between the City and its business community, civic organizations, and residents. The programs allow groups or individuals to become directly responsible for the litter abatement, the appearance, and the upkeep of public rights-of-way, parking lots, parks, planters, and green areas. To show its appreciation, the City recognizes each of these civic contributions by installing a special "Adopt-A-Spot" sign to commemorate the participating organization. Both the Adopt-A-Spot and Adopt-

A-Street programs were fully implemented and operational prior to the original MS4 permit. The Street Operations Department is responsible for maintaining the list of the Adopt-A-Spot and Adopt-A-Street groups. The Street Operations Department is responsible for installing the roadway signs.

BMP 2.7: Host a City-Wide Cleanup Event

MEASURABLE GOAL 2.7.1: Host a city-wide cleanup event twice per year and record the number of items collected in tons.

The City hosts a city-wide cleanup event twice per year, during the months of April and October (spring and fall). Four pickup locations are spread throughout the City Ward where manned trash dumpsters will be available for residents to dispose of household trash, furniture, refrigerators, stoves, washers/dryers, freezers, and microwaves. With each event, the number of materials collected is recorded, serving as a tangible measure of progress towards a cleaner, healthier city. The event is in partnership with Keep America Beautiful and Keep Arkansas Beautiful campaigns to promote citizen responsibility among residents to prevent litter and promote recycling. The Solid Waste Services Department is responsible for hosting the event twice per year. The success of this BMP will be evaluated based on the number of successfully completed events each reporting year and the tonnage of materials collected in both spring and fall events, as outlined in the annual report.

Table 2: BMPs for Public Involvement and Participation

BMP	Description	Measurable Goal	Frequency of Action	Responsible Person(s)
2.1	Host a public review and comment period for NOI and SWMP.	The City will host a 30-day public review period and consider suggestions into SWMP.	May 2024	Engineering Department
2.2	Utilize alternative sentencing personnel to clean curbs and gutters	Alternative sentencing personnel will meet on a monthly basis and the City will record the number of days worked.	Monthly	Street Operations Department
2.3	New storm sewer manhole covers will be marked with the warning: “Storm Sewer-No Dumping-Drains to River.”	Marking new manholes will continue under the renewed permit	Twice per year	Engineering Department
2.4	Existing storm sewer manholes will be marked with the warning: “No Dumping- Drains to River.”	Storm Sewer Decals shall be placed on at least 20 manholes per year	Annually	Engineering Department
2.5	Operate a community hotline for stormwater pollution.	Operate hotline and track number of complaints received	Annually	Engineering Department

2.6	Maintain a Volunteer Adopt-A-Spot or Adopt-A-Street Program	Continue to operate volunteer program and record number of volunteer groups.	Annually	Street Operations Department
2.7	City-wide cleanup event	Host a citywide cleanup event and record the tonnage of materials collected	Twice per year	Solid Waste Services Department

MCM 3: Illicit Discharge Detection and Elimination

Performance Standards

The stormwater illicit discharge detection and elimination program shall include:

1) Dry-weather screening of all stormwater outfalls located in the MS4's coverage area at the time of this permit coverage over the permit term. Only those outfalls draining undeveloped watersheds do not need to be screened for illicit discharges; and

2) The storm sewer system map shall be updated annually as needed for changes occurring in the MS4's coverage area boundaries at the time of permit coverage.

Decision Process

The City has developed, implemented, and enforces an Illicit Discharge Detection and Elimination program. Illicit discharges include discharges to the MS4 which are not entirely composed of stormwater, with an exception for allowable non-stormwater discharges pursuant to another NPDES permit. This may include things such as discharges from emergency firefighting activities.

The City previously developed a complete storm sewer system map which will be updated periodically to include newly identified outfall locations, as described in BMP 3.1. The storm sewer system map includes outfalls, surface waters receiving those discharges, catch basins, pipes, ditches, and public and private stormwater facilities. The City has effectively enforced an ordinance to prohibit illicit discharges into the MS4, as described in BMP 3.2. The ordinance was chosen as the most effective way for the City to enforce illicit discharges by implementing procedures and actions. The City continues to educate public employees, businesses, and the general public about illicit discharges and improper disposals of waste. This plan works in conjunction with MCM 2: Public Education and Outreach and MCM 6: Pollution Prevention/Good Housekeeping for Municipal Operations to reach a wide audience.

The Engineering Department is responsible for the overall management and implementation of the stormwater management program. Other departments responsible for implementing certain BMPs will be outlined in that specific BMP. The success of the public education and outreach on stormwater impacts program will be evaluated based on the number of successfully completed measurable goals each reporting year, as outlined in the annual report.

BMP 3.1: Update and Maintain Storm Sewer System Map

MEASURABLE GOAL 3.1.1: The storm sewer map will be reviewed at least once per year and updated if necessary to include all newly constructed public and private storm sewers and drainage ditches.

The storm sewer map aids the City in targeting outfalls with dry weather flows and other suspicious discharges for more in-depth inspection. It also aids in coordinating management activities to remove illicit connections and track storm drain system maintenance. In 2004, the

City began working with a local high school EAST (Environmental and Spatial Technology) lab to develop a map of the storm sewer system. However, this arrangement did not work well due to student time constraints, and City staff took over the storm sewer mapping. In 2005, City staff completed the first phase of the mapping process which included locating all of the Cit's storm sewer and drainage ditch outfalls. Outfalls were located with aerial maps and by physical inspection. The initial work was used to begin outfall inspections on the storm sewer system in the fall of 2005.

In 2009, City staff began compiling information from various sources into one map of the entire storm sewer system. The records included subdivision plans, record drawings for Capital Improvements Projects, City sewer atlases, and aerial photography. Mapping of the storm sewer system was complete by the spring of 2011.

The Engineering Department is responsible for maintaining and updating the storm sewer system map. The City has been updating the map since 2011 and will continue to update it once annually under the renewed permit.

BMP 3.2: Mechanism to Prohibit, Eliminate, and Enforce Illicit Discharges into the City's Storm Sewer System

MEASURABLE GOAL 3.2.1: Enforcement of the ordinance will continue under the renewed permit.

An ordinance that prohibits illicit discharges to the storm sewer system within the City became effective in 1997. Specifically, the regulations are found in Section 25-183(a) and (b) and in Section 25-186 (a) of the municipal code. Under the renewed permit, the City will continue to ensure that these regulations are being implemented using appropriate enforcement measures. The enforcement measures and penalties are outlined in Section 1-9 and 25-192 of the municipal code.

A copy of Sections 1-9, 25-183 (a) and (b), 25-186 (a), and 25-192 have been included in Appendix C for reference. Both the Engineering Department and the Utility Department are responsible for ensuring the ordinance is enforced and illicit discharges are abated.

BMP 3.3: Mechanism to Prohibit, Eliminate, and Enforce Illegal Dumping into the City's Storm Sewer System

MEASURABLE GOAL 3.3.1: Enforcement of the ordinance will continue under the renewed permit.

Illegal dumping degrades surface water quality, gives off offensive odors, and presents direct health hazards from vectors among many other things. Ordinances have been developed addressing these issues. Chapters 16 and 25 of the municipal code prohibit illegal dumping. These ordinances are enforced by the City's Neighborhood Services Division. The success of this goal is measured through implementation of the ordinance. The City will continue to enforce these ordinances prohibiting illegal dumping under the new permit.

BMP 3.4: Dry Weather Inspection of Storm Sewer System

MEASURABLE GOAL 3.4.1: Perform a dry weather survey of 20% of the storm drain system outfalls per year to identify non-stormwater flows. Areas found to have suspicious discharges will be inspected further to detect connections to the wastewater system and identify areas where wastewater might be leaking into adjacent storm drainpipes.

Targeted inspection of areas where high nutrient levels, suds and oily discharges, or dry weather flows are found allows the City to effectively and efficiently identify locations where illicit connections to the storm drain system exist. Outfalls with suspicious discharges will be further tested in the field by single parameter analysis with ammonia as the indicator chemical. The city will prioritize areas where dry weather discharges are observed. Once a suspicious discharge has been identified, two different methodologies will be employed to trace the source of the possible illicit discharge- storm drain network investigation and on-site investigations.

Field crews from the Street Operations Department and Engineering Department will strategically inspect manholes within the storm sewer system to measure physical indicators or perform single parameter analysis (ammonia) to isolate discharges to a specific segment of the network. Field crews shall inspect the manholes and the storm sewer system by one of the following three options:

- Field crews can work progressively up the trunk from the outfall and test manholes along the day (Small diameter outfalls, <36”; simple drainage network).
- Field crews can split the trunk into equal segments and test manholes at strategic junctions on the storm sewer system (Large diameter outfall, >36”; complex drainage, logistical or traffic issues)
- Field crews can work progressively down from the upper parts of the storm sewer network toward the problem outfall (Very large drainage area, >one square mile)

Once field crews have identified the pipe segment, on-site investigations will be used to find the specific discharge or improper connection. The three basic approaches that will be utilized for on-site investigations are dye, video, and smoke testing.

To eliminate the source, the following questions must be answered by City staff about each individual illicit discharge to determine how to proceed:

- Who is responsible?
- What methods will be used to fix the problem?
- How long will it take?
- How will removal be confirmed?

Illicit discharges will generally originate from one of the following sources:

- An internal plumbing connection

- A service lateral cross-connection
- An infrastructure failure within the sanitary sewer
- An indirect or transitory discharge resulting from leaks, spills, or overflows

The financial responsibility for removal of the source will typically fall on property owners, the City, or some combination of the two.

Dry weather inspections of the storm drain system will continue under the new permit. Initial inspections will be the responsibility of the Street Operations Department. Follow-up inspections on outfalls or segments found to have suspicious discharges will be the responsibility of the Engineering Department. The illicit discharge detection and elimination program will be evaluated at least once annually to assess if the goals of the program are being achieved. City staff will continue to schedule all patching, resurfacing, and crack sealing operations only during dry weather under the new permit. Both the Engineering and Street Operations Departments are responsible for roadway maintenance and resurfacing.

This goal shall measure progress through number of outfalls inspected with dry-weather flow identified and water quality samples collected each year, and number of outfalls re-inspected from illicit discharges that were detected in the previous year.

BMP 3.5: Develop Written Procedures for Responding to Complaints

MEASURABLE GOAL 3.5.1: Develop procedures for responding to complaints within the new permit term.

To enhance stormwater management and address community concerns, the City will develop a comprehensive written procedure for responding to complaints about stormwater issues. The City currently responds to citizen complaints within a timely manner and completes inspection reports to document the process. Developing written procedures will clearly outline the steps for responding to complaints regarding stormwater runoff, pollution, or other related issues. The Engineering Department is responsible for developing written procedures.

Table 3: BMPs for Illicit Discharge Detection and Elimination

BMP	Description	Measurable Goal	Frequency of Action	Responsible Person(s)
3.1	Update and maintain storm sewer map	Complete review of storm sewer map and make updates if necessary	Annually	Engineering Department
3.2	Prohibit illicit discharges by ordinance	Enforce ordinance	Annually	Engineering Department, Utility Department
3.3	Prohibit illegal dumping by ordinance	Enforce ordinance	Annually	Neighborhood Services Division

3.4	Dry weather inspection of storm sewer system	Perform dry weather screening to 20% of stormwater outfalls and record number screened	Annually	Engineering Department, Street Operations Department
3.5	Develop written procedures for responding to complaints	Develop procedure	By 2028	Engineering Department

MCM 4: Construction Site Stormwater Runoff Control

Performance Standards

The construction site stormwater control program shall include pre-construction site plan reviews (reviews of construction site Stormwater Pollution Prevention Plans) of 100 percent of projects from construction activities that result in a land disturbance of greater than or equal to one (≥1) acre. These applicable sites shall be inspected at least on a monthly basis to ensure compliance.

Decision Process

The City has implemented a construction site stormwater control program to control stormwater runoff from construction sites within city limits to prevent erosion and sediment from contributing to receiving waterbodies, including turbidity. The City will continue to require erosion and sediment controls at construction sites by the Fill and Grading Ordinance, and enforcement measures following inspections, as described in BMP 4.1.Construction sites within jurisdiction of the City are required to implement erosion control measures and control waste at construction sites, as described in BMP 4.3.The City conducts a pre-construction site plan review for all sites disturbing one or more acres for potential water quality impacts.

The city considers input from various stakeholders, including construction operators, developers, and the local community to ensure the program meets the needs of citizens. Complaints or notifications from the public are received directly to the Engineering Department via the Stormwater Pollution Hotline. In addition to MCM 2: Public Education Outreach and Involvement. Any outstanding violations are discussed with the responsible party and enforcement actions may be pursued. The BMPs and measurable goals listed below allow the City to reduce pollutants from construction sites in a cost-efficient way by utilizing existing staff.

BMP 4.1: Require Erosion and Sediment Controls at Construction Sites by Ordinance

MEASURABLE GOAL 4.1.1: Continue the enforcement of the ordinance.

In March of 2006, the City adopted a Fill and Grading Ordinance that requires fill and grading activities disturbing one or more acres to be permitted by the City. In 2011, parts of the ordinance were updated to reflect revised inspection procedures and ADEQ permit requirements.

According to this ordinance, construction site operators are required to implement appropriate erosion and sediment control BMP's. Natural vegetation must be retained wherever practicable in order to minimize the potential for soil loss. Erosion control devices must be in place prior to the start of grading. Soil stabilization shall be complete within two weeks of clearing or inactivity in construction. If seeding or another vegetative erosion control method is used, the vegetation shall become established within three weeks, or the City may require that the site be reseeded and/or mulched to stabilize the site. The entire disturbed area must be stabilized by seeding and

mulching when site grading is complete. The City may require seeding and mulching on any part of the site that will remain inactive for longer than two weeks or when an erosion problem is identified.

If a wet watercourse will be crossed regularly during construction a temporary stream crossing will be required. The watercourse channel must be stabilized after any in-channel work. Stabilization adequate to prevent erosion shall be located at the outlets of all pipes and paved channels.

A temporary access road is required at all sites. Other measures may be required by the City to ensure that sediment is not washed into the storm drains and construction vehicles do not track sediment onto public streets.

Structural controls must be installed and maintained to reduce sediment from stormwater runoff. They must be installed after the clearing necessary for the installation of the controls, but before the clearing for the remaining portions of the site. Techniques that divert upland runoff past disturbed slopes shall also be employed.

Dust abatement measures must be provided as often as necessary to prevent the operations from producing dust in amounts damaging to property, cultivated vegetation, domestic animals, or causing a nuisance to persons living or occupying buildings in the vicinity of the work area.

Clearing and grading of natural resources, such as wetlands, shall not be permitted, except when in compliance with the ordinance and with applicable state and federal laws. Clearing, except that necessary to establish sediment control devices, shall not begin until all sediment control measures have been installed.

Measures must be installed that will prevent the discharge of solid materials, including building materials, to waters of the State. The measures utilized must ensure and demonstrate compliance with State and City waste disposal as well as temporary and permanent sanitary sewer or septic system regulations. If concrete washout will occur on site, measures must be provided to prevent the discharge of concrete washout waters to waters of the State. Measures must also be provided to prevent discharges from fuel storage areas, hazardous waste storage, and truck wash areas to waters of the State.

Permitting under the City's Fill and Grading Ordinance requires submittal of a permit application, an erosion and sediment control plan (stormwater pollution prevention plan), and a grading plan (site plan with erosion controls) for review and approval. The erosion and sediment control plan and the grading plan must meet the requirements of the latest version of the ADEQ NPDES General Stormwater Permit for Construction Activities. Sites disturbing less than an acre are not required to obtain a permit, however, all sites regardless of size must meet the minimum erosion control requirements outlined in the ordinance or be subject to enforcement actions.

An initial permit is valid for only six months. All permits are subject to review and re-approval and all re-approvals are subject to any reasonable additional requirements as may be deemed necessary by the City Engineer. At any time the City Administrator or his/her designated agents become aware of a potential violation of the requirements, a notice to that affect is issued to the person(s) engaged in the activity. The notice specifies the alleged violation and requires the

person(s) engaged in the activity to provide engineering documentation certifying the reasonableness of their actions with reference to the permit requirements. In absence of submitted documentation or after review of same, the City may proceed with enforcement. In the event that any person(s) fails to meet the minimum standards of this ordinance, the City may suspend the activities through a stop-work order or may revoke the permit. Any person(s) judicially determined to be in violation of the ordinance shall be deemed guilty of a misdemeanor and shall be subject to the penalties set forth in section 1-9 of the municipal code. In addition, the Board of Directors may, in lieu of or in addition to those penalties previously mentioned, cause to be initiated an action in the Circuit Court for the Fort Smith District of Sebastian County, Arkansas, for the purpose of restraining or abating any violation of the ordinance.

The City will continue to enforce the Fill & Grading Ordinance under the renewed permit. The Engineering Department is responsible for enforcing the Fill and Grading Ordinance, except on Utility Department projects. The Utility Department is responsible for ensuring that their projects comply with the City's Fill and Grading Ordinance. A copy of the Fill & Grading Ordinance is included in Appendix D.

BMP 4.2: Require All Construction Activities Disturbing Greater Than One Acre be Covered Under ADEQ Stormwater Construction General Permit

MEASURABLE GOAL 4.2.1: The City will continue to require the following to be submitted prior to approval of a Fill and Grading Permit: (a.) a copy of the NOI for coverage under ADEQ's Stormwater Construction General Permit for all construction projects disturbing five or more acres; (b.) for site disturbing one or more acres, but less than five acres, a copy of the Automatic Coverage Construction Site Notice for coverage under ADEQ's Stormwater General Permit.

Construction sites can be a significant source of sediment for City storm drains. To prevent sediment from entering storm drains it is important to plan for erosion and sediment control practices and procedures in advance of starting construction. Requiring developers to submit a copy of an NOI or Automatic Coverage Construction Site Notice has provided some additional assurance that careful preliminary planning for erosion and sediment control has been accomplished.

Submittal of the NOI or Automatic Coverage Construction Site Notice will continue as a requirement of the Fill and Grading Ordinance under the renewed permit. Except for Utility Department projects, the Engineering Department is responsible for ensuring that copies of the proper notices have been submitted. The Utility Department is responsible for maintaining records of notices on Utility Department projects.

BMP 4.3: Review all Pre-construction Site Plans That Will Disturb One or More Acres for Potential Water Quality Impacts

MEASURABLE GOAL 4.3.1: Continue procedure for reviewing site plans for all development projects exceeding 1 acre.

No entity shall conduct any grading that would alter an area one acre or more in size or would occur over or within 15 feet of an existing utility line, without first obtaining a Fill & Grading Permit from the City. Each application for a permit must include a grading plan (site plan with erosion controls) and an erosion and sediment control plan (stormwater pollution prevention plan). No permit is required for the following activities:

- Excavations below finished grade- including basements, footings, swimming pools, hot tubs, septic systems, retaining walls, and like structures authorized by a valid building permit;
- Cemetery graves;
- Refuse disposal- if controlled by other federal, state, or local regulations;
- Construction of one single-family or duplex residence;
- Building additions- less than 2,000 square feet authorized by a valid building permit;
- Emergency work or repairs immediately necessary to protect life, property or natural resources;
- Nursery and agricultural operations.

Public and private utility organizations may obtain a one-time approval for all routine underground electric, water, sewer, natural gas, telephone, or cable facilities. The approval will include a utility organization and its contractors, agents, or assigns and will be permanent in nature as long as the original approval procedures are followed.

Applications submitted to the Building Department for a Site Development Permit shall be reviewed by the Engineering Department to determine their conformance with the provisions of the Fill & Grading Ordinance. Grading plans shall be evaluated for conformance with minimum erosion control requirements. Within seven working days after receiving a properly completed application, the City shall, in writing:

- Approve the permit application; or
- Approve the permit application subject to such reasonable conditions as may be necessary to secure substantially the objectives of the ordinance; or
- Disapprove the permit application, informing the applicant of the reason(s) therefore, and of the procedure for submitting a revised application and/or submission.

The requirements of the ordinance may be varied by the Engineering Department upon written application by the person engaged in the grading. Variances may be granted upon determination that the literal application of the provisions of the ordinance would result in an unreasonable hardship. The denial of a variance is subject to review by the City Administrator. The review by the City Administrator shall be conducted on the written record and the applicant

shall have the right to submit written support materials. The decision of the City Administrator shall constitute the final administrative action of the City.

The Engineering Department is responsible for reviewing site plans for potential water quality impacts. This goal shall measure success through the number of Erosion and Sediment Control Permit(s) issued each year as documented in the annual report.

BMP 4.4: Address All Construction Stormwater Complaints That Fall Within the Jurisdiction of the City's Fill and Grading Ordinance. In the Event That a Substantiated Complaint Cannot be Addressed by the Fill and Grading Ordinance, the City will Forward that Complaint to ADEQ

MEASURABLE GOAL 4.4.1: The City will continue to address all construction storm water complaints that fall within the jurisdiction of the City's Fill and Grading Ordinance under the new permit. Any substantiated complaint that cannot be addressed by the Fill and Grading Ordinance will be forwarded to ADEQ.

Under the new permit, the City will continue to address all construction stormwater complaints that fall within the jurisdiction of the City's Fill and Grading Ordinance. In the unlikely event that a substantiated complaint arises that cannot be dealt with by the Fill and Grading Ordinance, City Staff will forward that complaint to ADEQ.

In order to gain public input about possible violations, the City will coordinate this effort with the public education program through BMP 4.6. The Engineering Department is responsible for responding to construction stormwater complaints.

BMP 4.5: Publicize the Stormwater Pollution Hotline on the City's Public Access TV or Social Media

MEASURABLE GOAL 4.5.1: Publicize the stormwater pollution hotline at least once per year, either through a public service announcement on the City's public access TV channel or in a post on the City of Fort Smith social media pages.

City staff can't be on every construction site every day, therefore, staff will also have to rely on citizen input and complaints to determine problem areas. In order to achieve this, the City will coordinate the construction site stormwater control program with the public education program. This will be accomplished by publicizing the stormwater pollution hotline and its purpose, either through PSA's on the City's public access television channel or through social media posts. The Engineering Department will be responsible for developing PSA's and social media posts. The City Clerk's office will be responsible for airing any PSA's on the City's public access channel.

BMP 4.6: Construction Sites Disturbing One or More Acres Shall be Inspected Monthly

MEASURABLE GOAL 4.6.1: continue monthly inspections of construction sites.

Under the new permit, monthly inspections of construction sites disturbing one or more acres shall continue. Engineering Department staff shall make the inspections and shall either approve that portion of the work completed or shall notify the property owner wherein the work fails to comply with the approved stormwater pollution prevention plan. During construction, the property owner shall keep approved plans for grading, stripping, excavating, and filling work on site. In order to obtain inspections, the property owner shall notify the Engineering Department at least two working days before the start of construction. At least one inspection per month will be conducted until the project is completed. The property owner shall notify the Engineering Department at least two working days before final stabilization occurs.

The property owner is also required to make regular inspections of all control measures in accordance with the inspection schedule outlined on the approved stormwater pollution prevention plan. The purpose of such inspections will be to determine the overall effectiveness of the control plan, and the need for additional control measures. All inspections must be documented in written form. Engineering Department staff are also authorized to enter the property as deemed necessary to make regular inspections to ensure the validity of the reports filed by the property owner.

All sites disturbing one or more acres will be inspected monthly, therefore, no prioritization will be required. If deficiencies are found during the inspection, property owners will be given three days to correct the deficiencies. If the deficiencies are not corrected within three days, a stop-work order will be issued, and their Fill and Grading Permit may be revoked. If deficiencies continue, or if a property owner refuses to comply, the case may be turned over to the prosecuting attorney's office.

Table 4: BMPs for Construction Site Stormwater Runoff Control

BMP	Description	Measurable Goal	Frequency of Action	Responsible Person(s)
4.1	Require erosion and sediment controls at construction sites by ordinance	Enforce ordinance and record the number of inspections and warnings or penalties issued	Once per year	Engineering Department, Utility Department
4.2	Require all construction activities disturbing at least one acre obtain coverage under ADEQ Stormwater Construction General Permit	Continue requirement	Once per year	Engineering Department, Utility Department
4.3	Review site plans for developments that disturb one or more acres to evaluate potential water quality impacts	Review site plans and record the number of plans reviewed	Once per year	Engineering Department
4.4	The City will address all construction stormwater complaints	Continue requirement	Once per year	Engineering Department
4.5	Publicize the stormwater pollution hotline on the City's TV channel or social media	Publicize hotline	Once per year	Engineering Department, City Clerk's Office

BMP	Description	Measurable Goal	Frequency of Action	Responsible Person(s)
4.6	Conduct monthly inspection of construction sites disturbing one or more acres	Conduct monthly inspections and record the number of sites inspected annually	Once per year	Engineering Department

MCM 5: Post-Construction Stormwater Management in New Development and Redevelopment Areas

Performance Standards

The post-construction SWMP shall include pre-construction site plan review (for compliance with local requirements for post-construction management of stormwater) of 100 percent of projects from construction activities that result in a land disturbance of greater than or equal to one (≥1) acre to ensure that required controls are designed per requirements. These applicable sites shall be inspected to ensure that controls are installed per requirements. The program shall also ensure that long-term O&M plans are developed, and agreements are in place for all applicable sites.

Decision Process

The City has developed, implemented, and enforces a program to address stormwater runoff in new development and redevelopment projects that disturb at least one acre or greater to ensure required controls are consistent with design requirements. A variety of BMPs have been implemented to prevent and minimize water quality impacts from construction sites into receiving waterbodies.

If hydrologic and hydraulic studies reveal that the post-development runoff for a proposed development or redevelopment project one acre or more in size will exceed the pre-development runoff, and the existing drainage system is not adequate to carry the post-development runoff, then the proposed development or redevelopment project is not permitted unless one or more of the following mitigation measures are used: onsite detention, off site or regional detention, or improvements to the existing drainage system.

Development and redevelopment projects one or more acres in size (or less than an acre if part of a larger common plan of development) that will increase the impervious area onsite, are not permitted without employing BMPs to address the water quality of the surface waters being discharged from the site. All BMP's or systems of BMPs utilized to address water quality are required to capture and treat the Water Quality Volume (WQv).

Areas where the land use or activities on site generate highly contaminated runoff with concentrations of pollutants more than those typically found in stormwater are known as Stormwater Hot Spots. When developing or redeveloping a hot spot site, a greater level of stormwater treatment is needed to prevent pollutant wash off after construction. This typically involves preparing and implementing a SWPPP that involves a series of operational practices at the site that reduces the generation of pollutants by preventing contact with rainfall. For the purposes of the City's Drainage Standards, Stormwater Hot Spots are classified as industrial facilities that:

- Have Standard Industrial Classification (SIC) codes listed in "40 CFR 122.26(b)(14) Subpart (i)- (xi)"

- And are required to submit applications for a stormwater permit to ADEQ.

The post-construction SWMP has been tailored to the City of Fort Smith by allowing the use of various detention practices to maintain pre-development runoff conditions and allowing the use of both acceptable and sub-standard BMP's to minimize water quality impacts. Allowable publicly owned detention practices include stormwater ponds and wetlands. Other detention methods such as infiltration trenches, infiltration basins, etc., may be used with proper documentation for privately owned detention, however, the practice will be discouraged. Acceptable BMPs for water quality are those that are designed to capture and treat the WQv with a goal of at least 80% removal of total suspended solids (TSS) from post-construction discharges. BMP's that meet this requirement can be divided into the following five basic groups:

- Stormwater Ponds
- Wetlands
- Infiltration Systems
- Filtering Systems
- Open Channel Systems

Sub-standard BMPs are those which do not qualify as "stand alone" practices for full WQv treatment. By themselves, these BMPs are unable to remove 80% TSS from post-construction discharges. However, sub-standard BMP's can be used appropriately for pretreatment, or in combination with other BMPs as part of an overall "treatment train," or may be applied in redevelopment situations on a case-by-case basis where other practices are not feasible.

The SWMP includes non-structural BMPs in the form of Stormwater Credits. The purpose of the stormwater credit system is to provide incentives to developers, engineers, and builders to implement better site design and locate new development in a manner that causes less impact to aquatic resources. By taking advantage of the credit system, developers and builders can reduce stormwater quality requirements. The credit system directly translates into cost savings to the developer by reducing the water quality volume that has to be captured and treated.

Structural BMPs in the City of Fort Smith post-construction SWMP include both acceptable and sub-standard BMP's. Acceptable BMP's can be divided into five basic groups. The basic groups and individual BMPs are listed below:

Group 1: Stormwater Ponds

- Micro pool Extended Detention Pond
- Wet Pond
- Wet Extended Detention Pond
- Multiple Pond System
- "Pocket" Pond

Group 2: Wetlands

- Shallow Wetland

- ED Shallow Wetland
- Pond/Wetland System
- "Pocket" Wetland

Group 3: Infiltration Systems

- Infiltration Trench
- Infiltration Basin

Group 4: Filtering Systems

- Surface Sand Filter
- Underground Sand Filter
- Perimeter Sand Filter
- Organic Filter
- Bioretention

Group 5: Open Channel Systems

- Dry Swale
- Wet Swale
- Grass Channels

Sub-standard BMPs include, but are not limited to, the following practices:

- Dry Extended Detention Ponds
- Catch Basin Inserts
- Water Quality Inlets and Oil/Grit Separators
- Hydro-Dynamic Structures
- Filter Strips
- Deep Sump Catch Basins
- Drywells
- On-Line Storage in the Storm Drain Network

BMP 5.1: Review Site Plans for Compliance with the Post-Construction Stormwater Management Requirements

MEASURABLE GOAL 5.1.1: All development and redevelopment projects disturbing one or more acres shall be reviewed for compliance with the post-construction stormwater management requirements contained in the City's Storm Drainage Standards. The City will record the number of plans reviewed annually.

In October of 2011, the City Board of Directors passed an ordinance adopting new Storm Drainage Standards that address post-construction stormwater management in development and redevelopment projects disturbing one or more acres. The post- construction stormwater

requirements are found in Chapter 5 of the City's Storm Drainage Standards. Chapter 5 has been included in Appendix E for further reference.

In order to comply with the City's MS4 Permit, all pre-construction site plans for sites disturbing one or more acres are being reviewed for compliance with the new Standards. The Engineering Department is responsible for reviewing site plans for conformance to these requirements. Progress towards the success of this goal shall be measured by the amount of site plans reviewed annually.

BMP 5.2: Inspect Post-Construction Stormwater BMPs for Correct Installation

MEASURABLE GOAL 5.2.1: All post-construction stormwater BMP's for sites disturbing one or more acres, or less than one acre if part of a larger common plan of development, shall be inspected to ensure they were constructed in accordance with the approved plans.

All post-construction stormwater BMPs for sites disturbing one or more acres will be inspected to ensure they are installed correctly and constructed in accordance with the approved plans. The Engineering Department is responsible for performing this inspection and recording the number of site inspections annually.

BMP 5.3: Require Long-Term Operational and Maintenance (O&M) Plans for Privately Maintained Post-Construction Stormwater BMPs

MEASURABLE GOAL 5.3.1 A legally binding and enforceable maintenance agreement shall be executed for all privately owned post-construction stormwater BMP's. The maintenance agreement shall be required as part of plan approval or the permitting process.

When BMP ownership is vested in the City of Fort Smith, long-term operation and maintenance shall be the responsibility of the City. However, when ownership is not vested in the City, the long-term operation and maintenance responsibility is vested with a responsible party by means of a legally binding and enforceable maintenance agreement that is executed as a condition of plan approval or the permitting process. The Engineering Department is responsible for ensuring that long-term maintenance agreements for privately owned BMP's have been signed and recording the number of plans developed on an annual basis.

Table 5: BMPs for Post-Construction Stormwater Management New Development and Redevelopment

BMP	Description	Measurable Goal	Frequency of Action	Responsible Person(s)
5.1	Review site plans for compliance with post-construction stormwater management requirements	Review site plans and record the number reviewed	Once per year	Engineering Department

5.2	Conduct post-construction stormwater BMP inspections	Inspect BMPs and record the number of sites inspected	Once per year	Engineering Department
5.3	Require long-term O&M plans for privately maintained post-construction stormwater BMPs	Record number of sites requiring long-term O&M plans and the number of plans developed	Once per year	Engineering Department

MCM 6: Pollution Prevention/Good Housekeeping for Municipal Operations

Performance Standards

The pollution prevention/good housekeeping program shall include, at a minimum, an annual employee training component for all eligible employees. An eligible employee is a new or veteran employee whose day-to-day work activities have the potential to impact stormwater quality. MS4s shall evaluate all current municipal owned facilities to ensure that industrial general stormwater permit coverage (ARR000000), if needed, is obtained. This evaluation shall be included in the first annual report. For all municipal facilities not requiring industrial stormwater permit coverage, the inspections must be performed at least annually for municipal facilities performing maintenance activities on mechanical equipment, facilities with fueling stations, facilities involved in waste storage, transfer or recycling, facilities with material stockpiles, and facilities storing fertilizers or pesticides. The O&M program shall include appropriate procedures, controls, maintenance schedules and recordkeeping to address Part III.2.F.c.(3) of this permit.

Decision Process

The City has implemented a pollution prevention/good housekeeping program for municipal operations to reduce pollutant runoff from municipal operations and educate city employees on preventing and reducing stormwater pollution from municipal activities. Educational materials available from EPA, ADEQ, and the City are distributed to employees during bi-annual training events to address maintenance activities, schedules, and long-term inspection procedures. The City of Fort Smith owns several facilities that discharge to the MS4 and are subject to ADEQ's Industrial Stormwater General Permit or an individual NPDES permit for discharges of stormwater associated with industrial activity. These facilities, and the applicable ADEQ permit numbers, are listed below:

- North "P" Street Wastewater Treatment Plant (AR0033278, ARR000830)
- Massard Wastewater Treatment Plant (Permit No. ARR000449)
- Fort Smith Transit Maintenance Facility (ARR000589)
- Fort Smith Landfill (Permit No. ARG160017, ARR00l 116)
- Sanitation Department Maintenance Facilities (Located at Fort Smith Landfill, also covered under Permit No. ARG 160017, ARR00l 116)
- Fort Smith Regional Airport (Permit No. ARR00B844)
- Port of Fort Smith (Leased by Five Rivers Distribution, ARR00B771)

For facilities not requiring industrial stormwater coverage, the City of Fort Smith requires annual inspections if they perform maintenance activities on mechanical equipment, have fueling

stations, are involved in waste storage, transfer, or recycling, have material stockpiles, and/or store fertilizers or pesticides. Currently, there are only two municipally owned facilities meeting these requirements. SWPPP's have been developed for both. The facilities are listed below:

- Street Operations Department/Utility Department Yard and Maintenance Facility
- Parks & Recreation Department Maintenance Facility

BMP 6.1: Inspection and Sweeping of Streets

MEASURABLE GOAL 6.1.1: Streets with curbs and gutters will continue to be swept an average of 6 times annually under the new permit and the tonnage of materials collected and disposed of will be recorded.

This BMP was part of the previous MS4 permit. Pollutants, such as sediment, debris, trash, road salt, and trace metals, can be reduced by street sweeping. Street sweeping can also control dust, improve the aesthetics of roadways, and decrease the accumulation of pollutants in catch basins.

The measurable goal for this BMP has been updated to clarify that only streets with curb and gutter are swept. Streets without curbs and gutter are not swept because the brushes pull dirt and debris from the side of the street and can actually increase the amount of pollutants on the roadway. The City maintains approximately 300 miles of streets with curb and gutter. The City will continue to sweep these streets at least 6 times annually under the new permit. The Street Operations Department is responsible for overseeing the City's street sweeping program.

BMP 6.2: Perform Preventative Maintenance on Storm Sewer System

MEASURABLE GOAL 6.2.1: Drain crews shall continue to perform at least 80 hours per month preventative maintenance on the City storm sewer system under the new permit. A summary of activities performed, and number of hours worked per month will be recorded.

Preventive maintenance is used to monitor systems constructed to control storm water. These systems should be inspected to uncover cracks, leaks, and other conditions that could cause failures of storm water mitigation structures and equipment, which, in tum, could result in discharges of pollutants to surface waters either by direct overland flow or through storm drainage systems. A preventive maintenance program can prevent failures through adjustment, repair, or replacement of structures before a major failure occurs. City crews currently perform maintenance on the municipal storm sewer system. While some of this work is complaint driven and occurs during heavy rainfall events, most of the maintenance is conducted during dry weather and can be classified as preventative. City crews shall continue performing at least 80 hours of preventative maintenance per month under the new permit. The Street Operations Department is responsible for maintenance of the storm drain system.

BMP 6.3: Distribute Training Materials on Stormwater Protection to City Employees

MEASURABLE GOAL 6.3.1: Training materials will continue to be distributed semi-annually to all eligible employees. The City will record the number of employees trained per year.

Pollutants generated by municipal operations accumulate on ground surfaces where they are transported by runoff to receiving waters. Educating municipal employees through a training program about the impacts of their work on storm water quality can help prevent pollution from municipal operations. As part of this program, employee training materials will be distributed that have been developed by the City, ADEQ, and EPA. The subject matter of the materials shall be related to reducing or eliminating the discharge of pollutants from streets, municipal parking lots, maintenance and storage yards, waste transfer stations, fertilizers, pesticides, new construction and land disturbances, fleet or maintenance shops with outdoor storage areas, and salt/sand storage locations. Employees shall also receive training on illegal dumping and recognizing and reporting illicit discharges.

The City will continue to distribute training materials semi-annually to all eligible employees under the new permit. The Engineering Department is responsible for producing the employee training materials and distributing them to the departments. The individual departments are responsible for disseminating the information to their employees.

BMP 6.4: Designate Vehicle Washing and Maintenance Areas for City Fleet

MEASURABLE GOAL 6.4.1: Designated vehicle washing, and maintenance areas will continue to be used under the new permit.

Used automobile fluids are toxic, even in small quantities, because of metal contaminants and organic petroleum- based constituents. They must be properly managed to prevent land, air, and water pollution. Designating washing and maintenance areas for city vehicles allows for the proper containment of spills and leaks associated with those activities. The City has designated vehicle washing and maintenance areas for the City fleet since the first year of the original MS4 permit (2004). The City will continue to maintain these areas under the new permit. The Street Operations, Parks and Recreation, Sanitation, Transit, and Utility Departments each have designated vehicle maintenance and/or washing areas. Each city department is responsible for the activities at their own facilities.

BMP 6.5: Deicing Salts and Salt/Sand Stockpiled Shall Be Stored Outside of the 100-Year Floodplain in Containment Areas That Prevent Discharge to the MS4

MEASURABLE GOAL 6.5.1: The City shall continue to store deicing salts and salt/sand stockpiles outside of the floodplain and in containment areas that prevent discharge to the MS4.

The storage of deicing materials can lead to water quality problems for surrounding areas. Covering salt storage piles reduces salt loss from stormwater runoff and potential contamination to streams, rivers, and other water bodies. Salt storage piles should also be located outside the 100-year floodplain for further protection against surface water pollution. The City stores its deicing salts in an enclosed shelter, located outside of the 100-year floodplain, and will continue to do so under the new permit.

The City also has a pre-mixed salt and sand stockpile that is kept ready for use during the winter months. This stockpile is stored in a covered containment area.

The City will continue to store the mixed salt and sand stockpile in this covered containment area and record the amount in tons of mixed salt and sand used to treat roads. The Street Operations Department is responsible for storing and maintaining the City's deicing salts and pre-mixed salt and sand stockpile.

BMP 6.6: Trash, Debris, and Other Solid Wastes Removed from Storm Sewers Shall Be Disposed of at Sanitary Landfill

MEASURABLE GOAL 6.6.1: The City shall continue to dispose of all trash, debris, and other solid wastes removed from the storm sewers at the sanitary landfill.

Storm sewer systems need to be cleaned regularly. Routine cleaning reduces the number of pollutants, trash, and debris in both the storm sewer system and the receiving waters. Clogged inlets can cause storm sewers to overflow, leading to increased erosion. Cleaning increases dissolved oxygen, reduces bacteria levels, and supports in-stream habitat. When clogged inlets are encountered, the debris causing the blockage many times will have to be removed by hand. This debris must then be disposed of in a proper manner. The City will continue to dispose of all trash, debris, and other solid wastes removed from the storm sewer system at the sanitary landfill under the permit. The Street Operations Department is responsible for cleaning out the storm drainage system and disposing of the materials removed. The success of this BMP is measured by the amount of waste properly disposed in tons in the annual report.

BMP 6.7: New Flood Management Projects Shall Be Assessed for Impacts on Water Quality

MEASURABLE GOAL 6.7.1: The City will continue to assess new flood management projects for water quality impacts and document the new or existing flood management projects assessed per year.

Procedures are currently in place within the Engineering Department for the review of flood management projects. Typically, a consulting engineer will be selected to design the project. Then a scope of services will be agreed upon, an engineering services fee will be negotiated and approved, and an engineering services contract will be executed. Depending upon the complexity of the project, design will proceed in either two or three phases: preliminary and final design; or conceptual, preliminary, and final design. Submittals are required for each design phase. The Engineering Department is responsible for reviewing the submittals for conformance to City design standards, City specifications, and appropriate engineering practice. The success

of this BMP will be documented through the number of new or existing flood management projects assessed per year.

Table 6: BMPs for Pollution Prevention/Good Housekeeping for Municipal Operations

BMP	Description	Measurable Goal	Frequency of Action	Responsible Person(s)
6.1	Inspection and sweeping of streets	Continue street sweeping and record the tonnage of material collected and properly disposed	Once per year	Street Operations Department
6.2	Perform preventative maintenance on storm sewer system	Drain crews shall perform 80 hours of maintenance per month	Once per month	Street Operations Department
6.3	Employee training memos	Distribute training materials and record number of employees trained	Once per year	Engineering Department
6.4	Designate vehicle washing and maintenance areas for city fleet	Continue activity	Once per year	Street Operations, Parks and Recreation, Sanitation, Transit, and Utility Departments
6.5	Store deicing salts and sand/salt outside of the 100-year floodplain	Continue deicing operations and record the amount of mixed salt/sand used in tons	Once per year	Street Operations Department
6.6	Trash, debris, and other solid wastes removed from storm sewers shall be disposed of at sanitary landfill	Document the amount of waste properly disposed of in tons	Once per year	Street Operations Department
6.7	New flood management practices shall be assessed for impacts on water quality	Document the new or existing projects assessed	Once per year	Engineering Department

APPENDIX A – TABLE OF ORGANIZATION

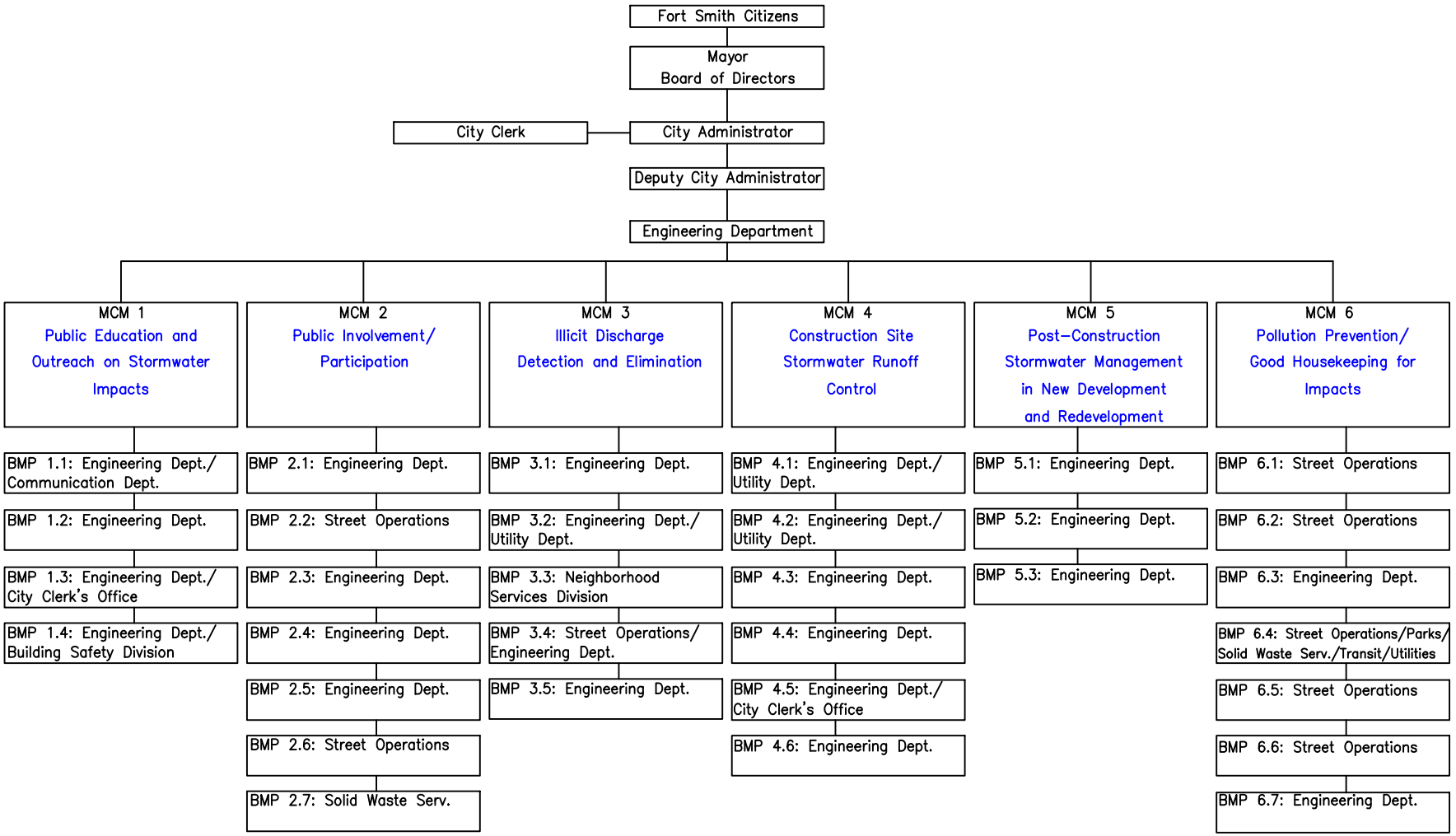


EXHIBIT "A"
2024 SWMP
TABLE OF ORGANIZATION

The City of Fort Smith ARKANSAS

DATE:	May 2024
SCALE:	
PROJ. TITLE:	MP4 PERMIT
ENGINEER:	
CADD:	
SHEET	1

06/04/24-13:43
Exhibit A-Table of Organization-2024.dwg
G:\ADEQ\2024 Report\

APPENDIX B – CONTACT LIST

EXHIBIT "B"
CONTACT LIST

Department	Contact	Position/Title	Phone
Building Safety Division	Jimmie Deer	Director	(479) 784-2235
City Clerk's Office	Amber Jones	Production Assistant	(479) 784-2205
City Administrator	Carl Geffken	City Administrator	(479) 784-2201
Communications Department	Josh Buchfink	Communications Manager	(479) 784-2224
Engineering Department	Stan Snodgrass	Director*	(479) 784-2247
Neighborhood Services Division	Jimmie Deer	Director	(479) 784-2235
Street Operations Department	Matt Meeker	Director	(479) 784-2363
Utility Department	Lance McAvoy	Director	(479) 494-3908
Parks and Recreation Department	Sara Duester	Director	(479) 784-1009
Solid Waste Services Department	Nicole Riley	Director	(479) 784-2461
Fort Smith Transit	Ken Savage	Director	(479) 784-2320

Notes:
* Primary point of contact.

APPENDIX C – ORDINANCES FOR ILLICIT DISCHARGES

Sec. 25-183. Use of public sewers required.

(a)

It shall be unlawful for any person to place, deposit, or permit to be deposited in any unsanitary manner upon public or private property within the city, or in any area under the jurisdiction of the city, any human or animal excrement, garbage, or other objectionable wastes.

(b)

It shall be unlawful to discharge any sewage or other polluted waters to any natural outlet within the city, or in any area under the jurisdiction of the city, except where suitable treatment has been provided in accordance with a valid, current national pollutant discharge elimination system permit covering such discharges. The control authority may immediately discontinue water service to the user or owner of any property where an unlawful discharge exists until such discharge of any sewage or polluted waters is properly eliminated.

Sec. 25-186. Use of public sewers.

(a)

No user shall introduce or cause to be introduced into the POTW any pollutant or wastewater which causes pass-through or interference. These general prohibitions apply to all users of the POTW whether or not they are subject to categorical pretreatment standards or any other National, State, or local pretreatment standards or requirements. No person shall discharge or cause to be discharged any stormwater, surface water, ground water, roof runoff, subsurface drainage, non-contact cooling water or unpolluted industrial process waters into any sanitary sewer but such waters shall be discharged into such sewers as are specifically designated as storm sewer or into a natural outlet. The discharge into any storm sewer or into natural outlet of any waters, which may have a deleterious effect upon the receiving stream, is prohibited.

Sec. 25-192. Penalties.

(a)

Any person determined to be guilty of a violation of any provision of section 25-183 or section 25-190 of this division shall be deemed guilty of a misdemeanor and shall be subject to the penalties and fines set forth in section 1-8 of this Code.

(b)

Any person found in violation of any of the provisions of this division, except section 25-190, shall be served by the control authority with written notice stating the nature of the violation, describing the penalty applicable to the violation and providing a reasonable time limit for the satisfactory correction thereof. The offender shall, within the period of time stated in such notice, permanently cease all violations. The user may deliver to the control authority, within five (5) days of receipt of such notice, a written request for a hearing before the control authority at which hearing the user shall be given an opportunity to show cause why the notice should be rescinded or modified. Any notice issued pursuant to this subsection may provide one (1) or more of the following penalties:

(1)

An administrative penalty of not more than one thousand dollars ($1,000.00) for each violation of the division, and each day of a continuing violation may be deemed a separate violation; and,

(2)

A compliance directive with time schedule mandating procedures which would bring the user into compliance with this division within the designated time schedule, which compliance directive with schedule shall be expressly stated to be subject to enforcement by withdrawal of the user's discharge permit or termination of POTW service upon noncompliance with the compliance directive with schedule; and,

(3)

A withdrawal of the user's discharge permit and termination of POTW service to the user.

The control authority shall be guided by the city pretreatment program enforcement management plan, which was adopted by the control authority on the effective date of this division, and confirmed hereby, in (1) the initial issuance of penalties set forth in notices issued pursuant to this subsection and (2) in the administrative adjustment or amendment to any such penalty as a result of a hearing requested by the User pursuant to the provisions of this subsection. No action to withdraw a user permit shall be final until the control authority has given notice of and conducted the show cause hearing provided for in the enforcement management plan.

(c)

Any person violating the provisions of this division shall become liable to the city for any expense, loss or damage occasioned the city by reason of such violation.

(d)

In enforcement of the penalty of withdrawing a user's discharge permit or terminating POTW service to a user, the control authority may discontinue water service to the user.

(e)

The city shall have the authority, after notice to the discharger, to immediately and effectively halt or prevent any discharge of pollutants to the sanitary sewer system which reasonably appears to present an imminent danger to the health or welfare of persons, or which threatens to interfere with the operation of the city's treatment facilities.

(f)

The listing of penalties in this section shall not preclude other appropriate judicial remedies available with reference to any violation of this division. In particular, the control authority may petition any court of pertinent jurisdiction to grant injunctive or other legal or equitable relief by reason of a violation. No judicial action against an industrial user to collect a civil penalty for violation of pretreatment standards or requirements shall be commenced without a majority vote of the board of directors.

Sec. 1-9. Penalty for violations.

(a)

In this section "violation of this Code" means:

(1)

Doing an act that is prohibited or made or declared unlawful, an offense or a misdemeanor by ordinance or by rule or regulation authorized by ordinance.

(2)

Failure to perform an act that is required to be performed by ordinance or by rule or regulation authorized by ordinance.

(3)

Failure to perform an act if the failure is declared a misdemeanor or an offense or unlawful by ordinance or by rule or regulation authorized by ordinance.

(b)

In this section "violation of this Code" does not include the failure of a city officer or city employee to perform an official duty unless it is provided that failure to perform the duty is to be punished as provided in this section.

(c)

Except as otherwise provided, a person convicted of a violation of this Code shall be punished by a fine not exceeding five hundred dollars ($500.00), or double such sum for each repetition thereof. If the violation is, in its nature, continuous in respect to time, the penalty for allowing the continuance thereof is a fine not to exceed two hundred fifty dollars ($250.00) for each day that the same is unlawfully continued.

(d)

If a violation of this Code is also a misdemeanor under state law, the penalty for the violation shall be as prescribed by state law for the state offense.

(e)

The imposition of a penalty does not prevent revocation or suspension of a license, permit or franchise.

(f)

Violations of this Code that are continuous with respect to time are a public nuisance and may be abated by injunctive or other equitable relief. The imposition of a "penalty" however does not prevent the simultaneous granting of equitable relief in appropriate cases.

APPENDIX D – FILL AND GRADING ORDINANCE

Sec. 11-81. Intent; introduction; purpose.

It is the intent of the city to safeguard the health, welfare and safety of the citizens of the city by implementing standards and procedures for the physical alteration of land. The provisions of this article are supplemental to and are not intended to supersede any federal or state regulations.

The purpose of the regulations contained in this article are to control grading, filling, and cutting (or similar activities) which alone or in combination may cause landslides, flooding, degradation of water quality, erosion, sedimentation and potential damage to utility lines. This article is also intended to protect the existing scenic character and quality of the city and its neighborhoods.

(Ord. No. 27-06, § 1, 3-21-06)

Sec. 11-82. Definitions.

ADEQ. The Arkansas Department of Environmental Quality.

Clearing. Any activity that removes the vegetative surface.

Cut. See excavation.

Erosion control. Any measure that prevents erosion.

Erosion and sediment control plan. A set of plans indicating the specific measures and sequencing to be used to control sediment and erosion on a development site during and after construction.

Excavation. The mechanical removal of earth material from water or land.

Fill. The deposit of earth material placed by artificial means.

Grade. The percentage of rise or fall per one hundred (100) feet.

Grading. Any stripping, cutting, filling or stockpiling of earth or land.

Grading permit. A permit issued by the city for the construction or alteration of ground improvements and structures for the control of erosion, runoff and grading.

Grading plan. A plan indicating the specific measures and phasing to be used to grade a development site during construction.

NPDES. National Pollutant Discharge Elimination System.

Phasing. Clearing a parcel of land in distinct phases, with the stabilization of each phase completed before the clearing of the next.

Sediment control. Measures that prevent eroded sediment from leaving the site.

Site. A parcel or lot of land or contiguous combination thereof, where grading is performed or permitted.

Stabilization. The use of practices that prevent exposed soil from eroding.

Utility line. Any public or franchised utility line, including water, sewer, gas, telephone, electric, fiber optic, cable TV or storm water.

Watercourse. Any body of water, including, but not limited to lakes, ponds, rivers, streams, and bodies of water delineated by the city.

Waterway. A channel that directs surface runoff to a watercourse or to the stormwater system.

(Ord. No. 27-06, § 1, 3-21-06; Ord. No. 54-11, § 1, 7-5-11)

Sec. 11-83. General requirements.

(a)

Protection. Persons engaged in grading shall not unreasonably damage public or private properties by such grading.

(b)

Site conditions. Grading shall conform insofar as practicable to the natural contours of the land, natural drainage ways, and other existing site conditions.

(c)

Adjacent properties. All grading shall be performed and maintained so that adjacent properties are not unreasonably burdened with surface waters as a result of such grading. Grading shall not unreasonably impede water runoff from higher properties nor unreasonably channel water onto lower properties.

(d)

Restoration. Land shall be revegetated and restored as close as practicable to its original condition following grading.

(e)

Underground utilities. Grading permit requirements shall also include identified easements for underground utilities and underground utilities identified by Arkansas One Call System prior to any grading. (Arkansas One Call System shall be contacted prior to any filling or excavating.)

(f)

Enforcement of general requirements. The general requirements of this section are applicable to all grading whether or not a permit is required by this article. At any time the city administrator, or his/her designated agents, become aware of a potential violation of these general requirements, a notice to that effect shall be issued to the persons engaged in the grading. The notice shall specify the alleged violation and shall require the persons engaged in the grading to provide engineering documentation certifying the reasonableness of the grading with reference to the general requirements of this section. In the absence of submitted documentation or after review of same, the city may proceed with enforcement pursuant to subsection 11-90(f) of this article. Additionally, a stop work order may be issued pursuant to subsection 11-90(e).

(g)

Other requirements. Other reasonable measures may be required if deemed necessary by the city engineer including but not limited to fencing.

(Ord. No. 27-06, § 1, 3-21-06; Ord. No. 54-11, § 2, 7-5-11)

Sec. 11-84. Grading permits required/exceptions.

(a)

Minimum standards. Although not subject to the permit requirements of this article, all grading on areas less than one (1) acre in size are required to meet the minimum standards set forth in sections 11-83 and 11-85, and subsections 11-86(c), (e), (f), (g) and (h) of this article, and shall be subject to the enforcement procedures of subsection 11-83(f) and subsections 11-90(e) and (f).

(b)

Grading permit required. No person shall conduct any grading that would alter an area one (1) acre or more in size, or which would occur over or within fifteen (15) feet of an existing utility line, without first obtaining a grading permit from the city.

(1)

Each application for a grading permit shall bear the name and address of the owner and/or developer of the site, and the name and contact information of the applicant's authorized representative.

(2)

Each application for a grading permit shall include a grading plan and an erosion and sediment control plan.

(c)

Exceptions. No permit shall be required for the following activities:

(1)

Excavations below finished grade, including basements, footings, swimming pools, hot tubs, septic systems, retaining walls, and like structures authorized by a valid building permit.

(2)

Cemetery graves.

(3)

Refuse disposal, if controlled by other federal, state, or local regulations.

(4)

Construction of one (1) single-family or duplex residence.

(5)

Building additions less than two thousand (2,000) square feet authorized by a valid building permit.

(6)

Emergency work or repairs immediately necessary to protect life, property or natural resources.

(7)

Nursery and agricultural operations.

(8)

City, Sebastian County, State of Arkansas, or federal construction projects.

(d)

One time approvals.

(1)

Utilities. Public and private utility organizations may obtain a one-time approval for all routine underground electric, water, sewer, natural gas, telephone, or cable facilities. The approval will include a utility organization and its contractors, agents, or assigns and will be permanent in nature as long as the original approval procedures are followed.

(Ord. No. 27-06, § 1, 3-21-06; Ord. No. 54-11, §§ 3, 4, 7-5-11)

Sec. 11-85. Minimum erosion control measures.

(a)

Structural controls.

(1)

Structural controls shall be installed and maintained to reduce sediment from stormwater runoff. Structural controls shall include, but not be limited to, silt fences, earthen dikes, drainage swales, check dams, subsurface drains, pipe slope drains, storm drain inlet protection, rock outlet protection, sediment

traps, reinforced soil retaining systems, gabions, and temporary or permanent sediment basins.

(2)

Structural controls must be installed after the clearing necessary for the installation of the controls, but before the clearing for the remaining portions of the site.

(3)

Techniques that divert upland runoff past disturbed slopes shall be employed.

(b)

Stabilization.

(1)

Soil stabilization shall be completed within two (2) weeks of clearing or inactivity in construction. Stabilization methods such as mulching, temporary seeding, permanent seeding, geotextiles, sod stabilization, vegetative buffer strips, protection of trees, and preservation of natural vegetation shall be used. The potential for soil loss shall be minimized by retaining natural vegetation wherever practicable. If seeding or other vegetative erosion control method is used, the vegetation shall become established within three (3) weeks of application or the city may require that the site be reseeded and/or mulched to stabilize the site.

(2)

Material deposits must be graded at two-week, minimum, intervals.

(3)

The entire disturbed area must be stabilized when site grading is complete. The city may require stabilization of any part of the site that will remain inactive for longer than two (2) weeks or when an erosion problem is identified.

(c)

Waterway and watercourse protection requirements.

(1)

A temporary stream crossing will be required if a wet watercourse will be crossed regularly during construction.

(2)

The watercourse channel must be stabilized after any in-channel work.

(3)

Stabilization adequate to prevent erosion shall be located at the outlets of all pipes and paved channels.

(d)

Construction site access requirements. A temporary access road shall be provided at all sites. Other measures may be required by the city to ensure that sediment is not washed into storm drains and construction vehicles do not track sediment onto public streets.

(e)

Dust abatement. Dust abatement measures shall be provided as often as necessary to prevent the operations from producing dust in amounts damaging to property, cultivated vegetation, domestic animals, or causing a nuisance to persons living or occupying buildings in the vicinity of the work area.

(f)

Other controls.

(1)

Measures shall be utilized to prevent the discharge of solid materials, including building materials, to waters of the state. Measures shall ensure and demonstrate compliance with state and city waste disposal, temporary and permanent sanitary sewer or septic system regulations.

(2)

If concrete washout will occur on-site, measures shall be provided which prevent the discharge of concrete washout waters to waters of the state.

(3)

Measures shall be provided to prevent discharges from fuel storage areas, hazardous waste storage and truck wash areas to waters of the state.

(Ord. No. 27-06, § 1, 3-21-06; Ord. No. 54-11, § 5, 7-5-11)

Sec. 11-86. Land alteration requirements.

(a)

Grading plan evaluation. Grading plans shall be evaluated by the city engineer for conformance with minimal erosion control requirements. The plans must identify any current regulatory floodplain and/or floodway impacted by the grading; a floodplain development permit shall also be submitted, if required.

(b)

Requirements varied. The requirements of this article may be varied by the city engineer upon written application by the person engaged in grading. Variances may be granted upon determination that the literal application of the provisions of this article would result in an unreasonable hardship. The denial of a variance is subject to review by the city administrator. The review by the city administrator shall by conducted on the written record and the applicant shall have the right to submit written support materials. The decision by the city administrator shall constitute the final administrative action of the city.

(c)

Clearing and grading. Clearing and grading of natural resources, such as wetlands, shall not be permitted, except when in compliance with this article and with applicable state and federal laws. Clearing, except that necessary to establish sediment control devices, shall not begin until all sediment control measures have been installed.

(d)

Phasing. Phasing shall be required on all sites disturbing greater than thirty (30) acres, unless a phasing plan is submitted to and approved by the city engineer.

(e)

Site drainage. Site shall be graded to provide the following drainage requirements:

(1)

The site must drain away from all buildings and toward the city's street or drainage way.

(2)

The site shall be graded to provide a minimum of six (6) inches of fall in ten (10) feet away from building foundations.

(3)

Grading of the fill material to create positive drainage is required. Standing water is prohibited.

(4)

Drainage shall be directed away from adjacent lots to the maximum extent possible.

(f)

Cut or fill slopes. Cut or fill slopes shall have a finish grade no steeper than fifty (50) percent (two (2) feet horizontal to one (1) foot vertical).

(g)

Maximum vertical cut or fill height. Cuts/fills shall be limited to ten (10) feet in vertical height unless approved the city engineer.

(h)

Fill material. All imported fill shall be free of materials greater than twelve (12) inches in diameter and any detrimental organic material or refuse debris unless approved by the city engineer. Acceptable fill material includes the following:

(1)

Rocks, concrete, brick and asphalt less than twelve (12) inches in diameter.

(2)

Sand.

(3)

Gravel.

(4)

Aggregates.

(5)

Clay/shale.

(6)

Soil.

(Ord. No. 27-06, § 1, 3-21-06)

Sec. 11-87. Grading plan specifications.

The applicant shall prepare and submit a grading plan that shall include:

Site plan. Site plan shall be at a scale no smaller than one (1) inch equals one hundred (100) feet; showing property lines, vicinity map, name and address of the owner, developer and adjacent property owners. The following items shall be shown on the site plan:

(1)

Existing grades. Existing grades and spot elevations.

(2)

Identify land to be disturbed. Land areas to be disturbed, including total acreage.

(3)

Cuts and fills. All cuts and fills, including height and slope.

(4)

Streets and rights-of-way. Location and names of all existing, or platted, streets or rights-of-way within or adjacent to tract; and location of all utilities and easements within or adjacent to the property.

(5)

Lot/building, etc. identification. The proposed location of lots, buildings, streets, parking lots, parks, playgrounds or greenspaces. Any existing or proposed buildings within one hundred (100) feet of the site.

(6)

Streets and drainage ways. Profiles and cross sections for proposed streets and drainage ways.

(7)

Surface water. Provisions for collecting and discharging surface water.

(8)

Underground utilities. Profiles and cross sections of streets, drainage systems, and underground utilities, if they are necessary to clarify the grading plan in terms of potential erosion or runoff, or if the grading on the site has

the potential of disturbing the utility line. Proposed grading plans that pose a risk to existing utility lines due to removal of cover or the placement of excessive loads or result in an undue burden to future maintenance activities will not be approved. Under such conditions applicant may include with the site plan a proposal for relocating any affected utility line. If the relocation is approved by the affected utility company, the applicant shall be responsible for all costs associated with the relocation.

(9)

Erosion/sediment measures. Erosion and sediment measures, including structural and vegetative measures.

(10)

Time schedules. A time schedule indicating the anticipated starting and completion dates of the development sequence and time of grading of each area prior to stabilization measures.

(11)

Temporary access road. Location of temporary access road.

(12)

Concrete washout. Location of areas used for concrete washout.

In addition, the site plan shall meet the requirements for a site map as established by the latest version of the ADEQ NPDES general stormwater permit for construction activities.

(Ord. No. 27-06, § 1, 3-21-06; Ord. No. 54-11, § 6, 7-5-11)

Sec. 11-88. Erosion and sediment control plan.

The applicant shall prepare and submit an erosion and sediment control plan that shall include:

(1)

Sequence of clearing and grading anticipated for construction of the development site. Sequencing shall include the anticipated dates for the start of construction, installation of temporary erosion and sediment control measures, and establishment of permanent vegetation.

(2)

Erosion and sediment control measures necessary to meet the objectives of this article that will remain installed and functioning throughout all phases of construction and after completion of development of the site until soil stabilization with permanent vegetation.

(3)

Proposed seeding mixtures, types of sod, method of seedbed preparation, expected seeding dates, kind and quantity of mulching for both temporary erosion control and permanent vegetative stabilization.

(4)

Provisions for maintenance of control facilities until the site soils are stabilized with permanent vegetation.

(5)

Submission of a copy of notice of intent or automatic coverage posting as required by ADEQ.

(6)

A description of post-construction stormwater management measures that will be installed during the construction process to control pollutants in stormwater discharges that will occur after construction operations have been completed. Post-construction stormwater management measures shall comply with the requirements of the City of Fort Smith Drainage Standards.

In addition, the erosion and sediment control plan shall meet the requirements for a stormwater pollution prevention plan as established by the latest version of the ADEQ NPDES general stormwater permit for construction activities.

(Ord. No. 27-06, § 1, 3-21-06; Ord. No. 54-11, § 7, 7-5-11)

Sec. 11-89. Review and approval.

Applications submitted to the building department for a site development permit shall be reviewed to determine their conformance with the provisions of this article. Within seven (7) working days after receiving an properly completed application, the city shall, in writing:

(1)

Approve the permit application; or

(2)

Approve the permit application subject to such reasonable conditions as may be necessary to secure substantially the objectives of this article; or

(3)

Disapprove the permit application, informing the applicant of the reason(s) therefor, and of the procedure for submitting a revised application and/or submission.

(Ord. No. 27-06, § 1, 3-21-06)

Sec. 11-90. Fees and enforcement.

(a)

Requirements. Each application for a grading permit shall include a grading plan and an erosion and sediment control plan.

(b)

Review fee. There shall be a one hundred dollar ($100.00) fee assessed and collected prior to review of any grading plan and erosion and sediment control plan.

(c)

Time Limit. An initial grading permit shall be valid for a maximum of six (6) months. All grading permits shall be subject to review and re-approval and all re-approvals shall be subject to any reasonable additional requirements as may be deemed necessary by the city engineer. If a grading permit is re-approved with no major revisions, an additional review fee will not be required.

(d)

Inspection.

(1)

The city engineer or his/her designated agent shall make inspections as hereinafter required and shall either approve that portion of the work completed or shall notify the permittee wherein the work fails to comply with the approved stormwater pollution prevention plan. Approved plans for grading, stripping, excavating, and filling work shall be maintained at the site during the progress of the work. In order to obtain inspections, the permittee shall notify the city engineer or his/her designated agent at least two (2) working days before the start of construction. At least one (1) inspection per month will be conducted until the project is completed. The permittee shall notify the city engineer or his/her designated agent at least two (2) working days before final stabilization occurs.

(2)

The permittee or his/her agent shall make regular inspections of all control measures in accordance with the inspection schedule outlined on the approved stormwater pollution prevention plan(s). The purpose of such inspections will be to determine the overall effectiveness of the control plan, and the need for additional control measures. All inspections shall be documented in written form.

(3)

The city engineer or his/her designated agent shall enter the property of the applicant as deemed necessary by the city engineer or his/her designated agent to make regular inspections to ensure the validity of the reports filed under Section (2) above.

(e)

Stop-work order; revocation of permit. In the event that any person conducting grading in the city limits fails to meet the minimum grading standards of this article, or fails to comply with any other applicable ordinance of the city, the city may suspend the grading operation or revoke the grading permit.

(f)

Violation and penalties.

(1)

Any person judicially determined to be in violation of the provisions of this article shall be deemed guilty of a misdemeanor and shall be subject to the penalties set forth in section 1-9 of the City of Fort Smith Municipal Code of Ordinances.

(2)

In addition, the board of directors may, in lieu of or in addition to penalties provided in this section, cause to be initiated an action in the circuit court for the Fort Smith District of Sebastian County, Arkansas, for the purpose of restraining or abating any violation of this article.

(Ord. No. 27-06, § 1, 3-21-06; Ord. No. 54-11, § 8, 7-5-11)

APPENDIX E – CHAPTER 5, STORM DRAIN STANDARDS

CHAPTER 5 – POST CONSTRUCTION STORMWATER MANAGEMENT

5.1 GENERAL

Land development projects and associated increases in impervious cover alter the hydrologic response of local watersheds and increase storm water runoff rates and volumes, flooding, stream channel erosion, and sediment transport and deposition; This storm water runoff contributes to increased quantities of water-borne pollutants, and; Storm water runoff, soil erosion, and nonpoint source pollution can be controlled and minimized through the regulation of storm water runoff from development sites. For these reasons, the Arkansas Department of Environmental Quality (ADEQ), under regulations administered by the United States Environmental Protection Agency (EPA) requires the City of Fort Smith to meet certain requirements as established in the National Pollutant Discharge Elimination System (NPDES), Phase II, for Small Municipal Separate Storm Sewer Systems (MS4's).

5.1.1 *Detention Required*

If hydrologic and hydraulic studies reveal that the post-development runoff for a proposed development or redevelopment project one acre or more in size will exceed the pre-development runoff, and the existing drainage system is not adequate to carry the post-development runoff, then the proposed development or redevelopment project shall not be permitted unless one or more of the following mitigation measures are used: onsite detention, offsite or regional detention, or improvements to the existing drainage system.

All detention facilities shall be designed to limit the peak storm water discharge rate of the 10-, 25-, 50-, and 100-year storm frequencies after development to pre-development flow rates.

5.1.1.1 Acceptable Detention Practices

Only stormwater ponds and wetlands shall be allowed for publicly owned detention, i.e. within residential subdivisions and developments (see Section 5.9). Other methods of detention such as infiltration trenches, infiltration basin, etc., will not be allowed for publicly owned detention and are discouraged for privately owned detention. If other methods are proposed, proper documentation of soil data, percolation, geological features, etc., will be needed for review and consideration.

5.1.1.2 Parking Lot Detention

Privately owned detention is permitted in parking lots to maximum depths of 6 inches. In no case shall the maximum limits of ponding be designed closer than 10 feet from a structure unless waterproofing of the structure and pedestrian accessibility are properly documented and approved. The minimum freeboard and the maximum ponding elevation to the lowest sill or floor elevation shall be 2 feet.

5.1.2 *Stormwater Treatment Required*

Development and redevelopment projects one or more acres in size (or less than an acre if part of a larger common plan of development), that will increase the impervious area onsite, shall not be permitted without employing Stormwater Treatment Practices (STP's) to address the water quality of the surface waters being discharged from the site. All STP's or systems of STP's utilized to address water quality shall be required to capture and treat the Water Quality Volume (WQ_v). The WQ_v shall be equal to:

$$WQ_v = (P_1)(R_v)(A)/12 \quad (5.1)$$

Where:
WQ_v = Water Quality Volume (acre-ft)
P_1 = The First One Inch (1.0") of Direct Runoff
R_v = Runoff Coefficient
A = Site Area (acres)

$$R_v = 0.05+0.009I \quad (5.2)$$

Where:
I = Site Impervious Cover (%)

The WQ_v shall be based on the impervious cover of the proposed site. Offsite existing impervious areas may be excluded from the calculation of the water quality volume requirements.

5.1.2.1 Acceptable Stormwater Treatment Practices (STPs)

All acceptable STP's shall be designed to capture and treat the WQ_v with a goal of at least 80% removal of total suspended solids (TSS) from post-construction discharges (See Table 5.2 for Pollutant Removal Percentages). STP's that meet these requirements can be divided into five basic groups – Stormwater Ponds, Wetlands, Infiltration Systems, Filtering Systems, and Open Channel Systems. When properly designed, the following STP's shall be considered sufficient to meet the requirements above:

Group 1: Stormwater Ponds

Stormwater ponds are practices that have a combination of a permanent pool, extended detention or shallow marsh equivalent to the entire WQ_v. Design variants include:

- Micropool Extended Detention Pond
- Wet Pond
- Wet Extended Detention Pond
- Multiple Pond System
- "Pocket" Pond

Group 2: Wetlands

Stormwater wetlands are practices that create shallow marsh areas to treat urban stormwater and often incorporate small permanent pools and/or extended detention storage to achieve the full WQ_v. Design variants include:

- Shallow Wetland
- ED Shallow Wetland
- Pond/Wetland System
- "Pocket" Wetland

Group 3: Infiltration Systems

Stormwater infiltration practices capture and temporarily store the WQ_v before allowing it to infiltrate into the soil. Design variants include:

- Infiltration Trench
- Infiltration Basin

Group 4: Filtering Systems

Stormwater filtering system capture and temporarily store the WQ_v and pass it through a filter bed of sand, organic matter, soil or other media. Filtered runoff may be collected and returned to the conveyance system, or allowed to partially exfiltrate into the soil. Design variants include:

- Surface Sand Filter
- Underground Sand Filter
- Perimeter Sand Filter
- Organic Filter
- Bioretention

Group 5: Open Channel Systems

Open channel systems are vegetated open channels that are explicitly designed to capture and treat the full WQ_v within dry or wet cells formed by checkdams or other means. Design variants include:

- Dry Swale
- Wet Swale
- Grass Channels

5.1.2.2 Sub-Standard Storm Water Treatment Practices

Many current and future stormwater management structures may not meet the performance criteria specified in Section 5.1.2.1 above to qualify to be used as "stand-alone" practices for full

WQ_v treatment. Reasons for this include poor longevity, poor performance, inability to decrease TSS by 80%, or inadequate testing. Some of these practices include:

- Dry Extended Detention Ponds
- Catch Basin Inserts
- Water Quality Inlets and Oil/Grit Separators
- Hydro-Dynamic Structures
- Filter Strips
- Deep Sump Catch Basins
- Dry Wells
- On-Line Storage in the Storm Drain Network

In some cases, these practices are appropriately used for pretreatment, as part of an overall STP system, or may be applied in redevelopment situations on a case-by-case basis where other practices are not feasible. New structural BMP designs are continually being developed, including many proprietary designs. All current and future structural practice design variants should fit in one of the five STP groups referenced above if the intent is to use them independently to treat the full WQ_v. Current or new STP design variants cannot be accepted for inclusion on the list until independent pollutant removal performance and monitoring data determine that they can meet the 80% TSS removal target and that the new STPs conform with local and/or State criteria for treatment, maintenance, and environmental impact.

5.1.2.3 Stormwater Hot Spots

Stormwater hot spots are areas where land use or activities generate highly contaminated runoff, with concentrations of pollutants in excess of those typically found in stormwater. A greater level of stormwater treatment is needed at hot spot sites to prevent pollutant washoff after construction. This typically involves preparing and implementing a ***stormwater pollution prevention plan*** (SWPPP) that involves a series of operational practices at the site that reduces the generation of pollutants by preventing contact with rainfall.

For the purposes of this document, stormwater hot spots shall be classified as industrial facilities that:

- have Standard Industrial Classification (SIC) codes listed in "40 CFR 122.26(b)(14) Subpart (i) – (xi)"
- and, are required to submit applications for a storm water permit to the Arkansas Department of Environmental Quality (ADEQ).

A copy of "40 CFR 122.26(b)(14) Subpart (i) – (xi)" can be found in Appendix 5A.

5.1.3 *Variances*

Criteria for differential runoff and detention guidelines are set out in the following in an attempt to decrease the possible effects of development on downstream properties due to increased runoff and pollutants. Variances to the requirements in this chapter may be granted by the Engineering Department if it is determined that detention would be ineffective to prevent flooding or would aggravate the flooding conditions. Variances to the detention requirements do not relieve the developer/owner of any water quality requirements. However, reductions in the required WQ_v are possible with the use of storm water credits (See Section 5.9).

5.1.4 *Verification of Adequacy*

Projects shall provide documented verification of adequacy according to the scope and complexity of design. Documentation must have original signature and be certified as-built by the same Arkansas Registered Professional Engineer, if feasible.

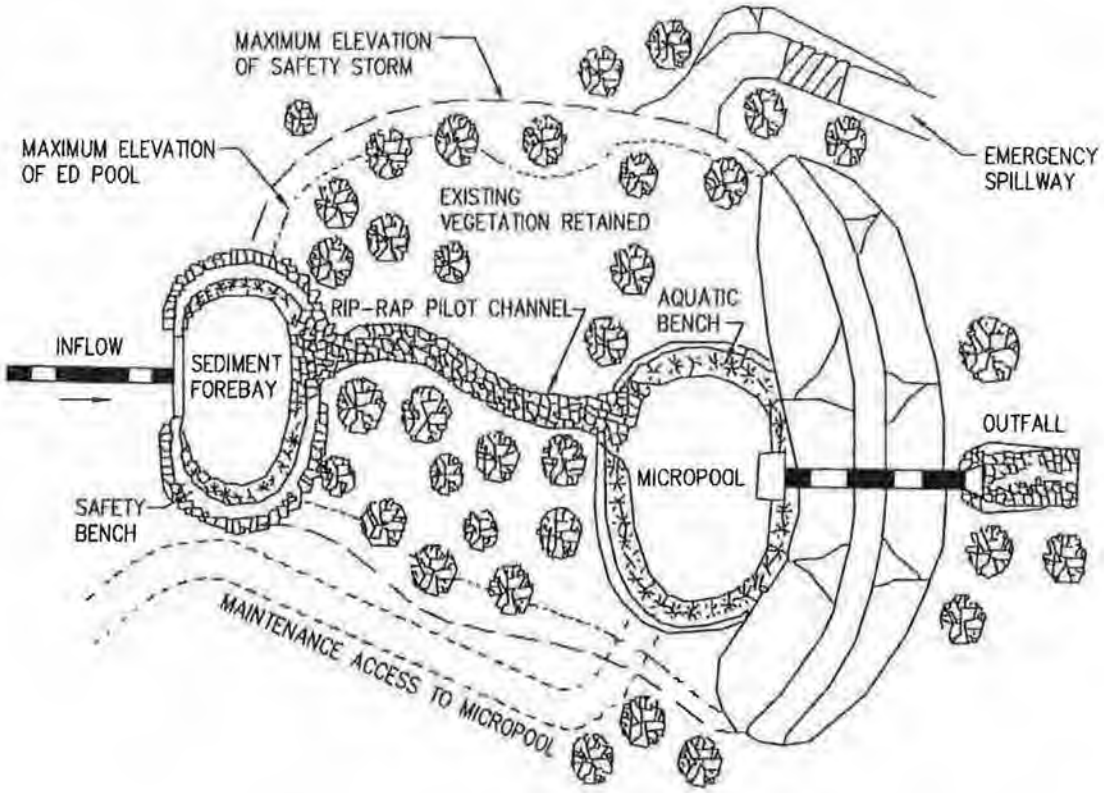
5.2 DESIGN CRITERIA – STORMWATER PONDS

Stormwater ponds are practices that have a combination of a permanent pool, extended detention or shallow marsh equivalent to the entire WQ_v. Design variants include:

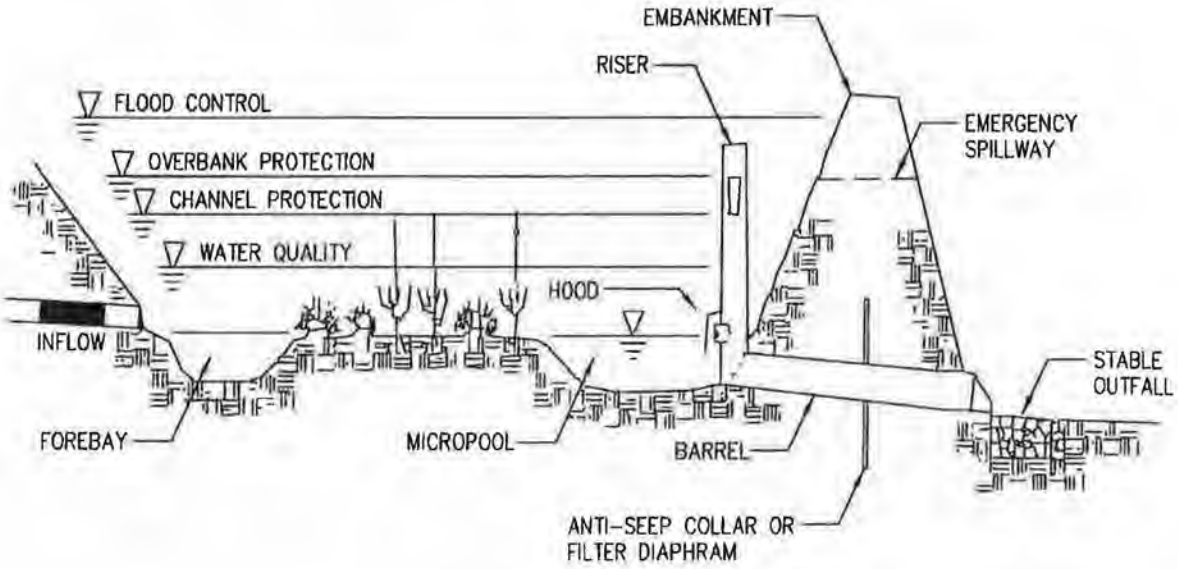
- Micropool Extended Detention Pond (Figure 5-1)
- Wet Pond (Figure 5-2)
- Wet Extended Detention Pond (Figure 5-3)
- Multiple Pond System (Figure 5-4)
- "Pocket" Pond (Figure 5-5)

The term "pocket" refers to a pond or wetland that has such a small contributing drainage area that little or no baseflow is available to sustain water elevations during dry weather. Instead, water elevations are heavily influenced and, in some cases, maintained by a locally high water table.

Stormwater ponds may be used in residential, private, commercial, and industrial subdivisions and developments to meet the detention and WQ_v requirements.

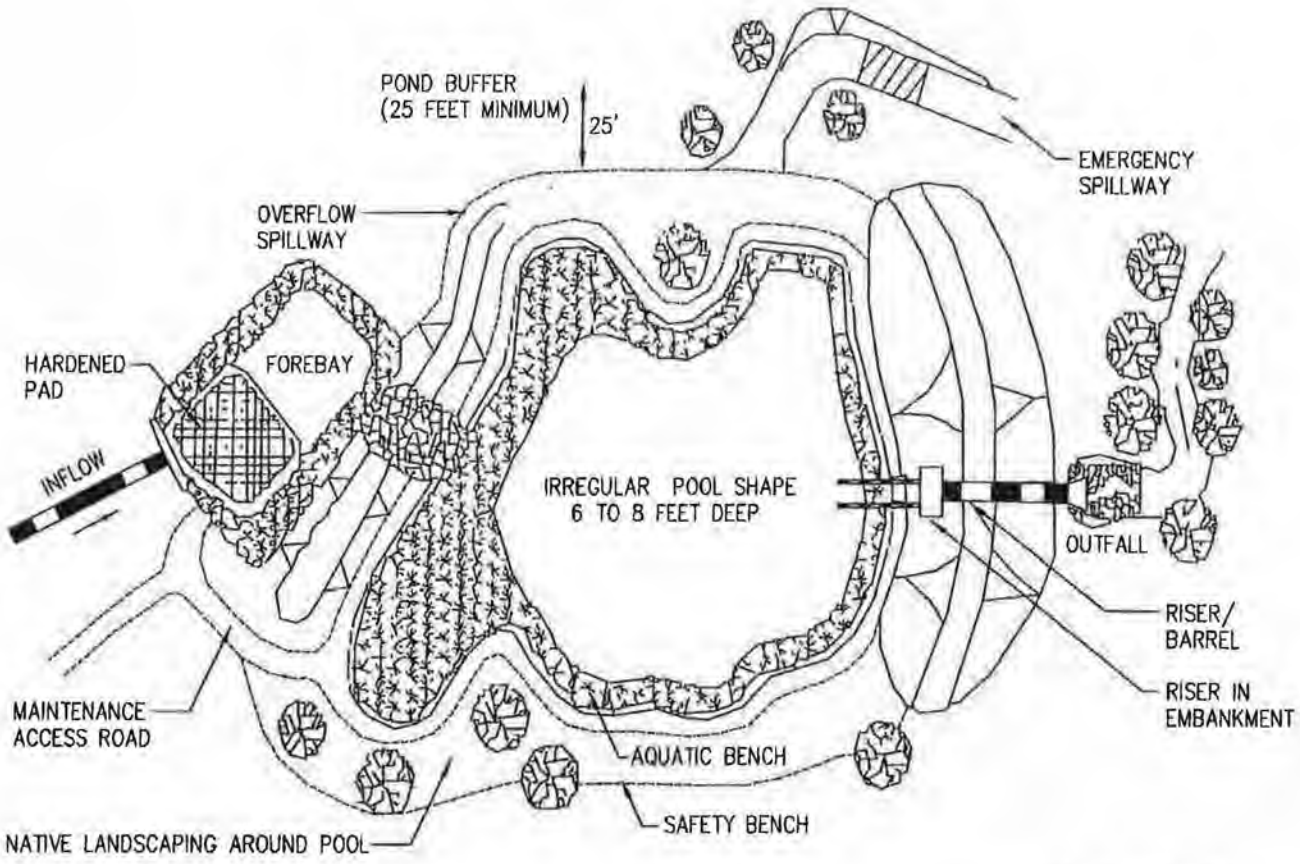


PLAN VIEW



PROFILE

FIGURE 5-1. Micropool Extended Detention Pond



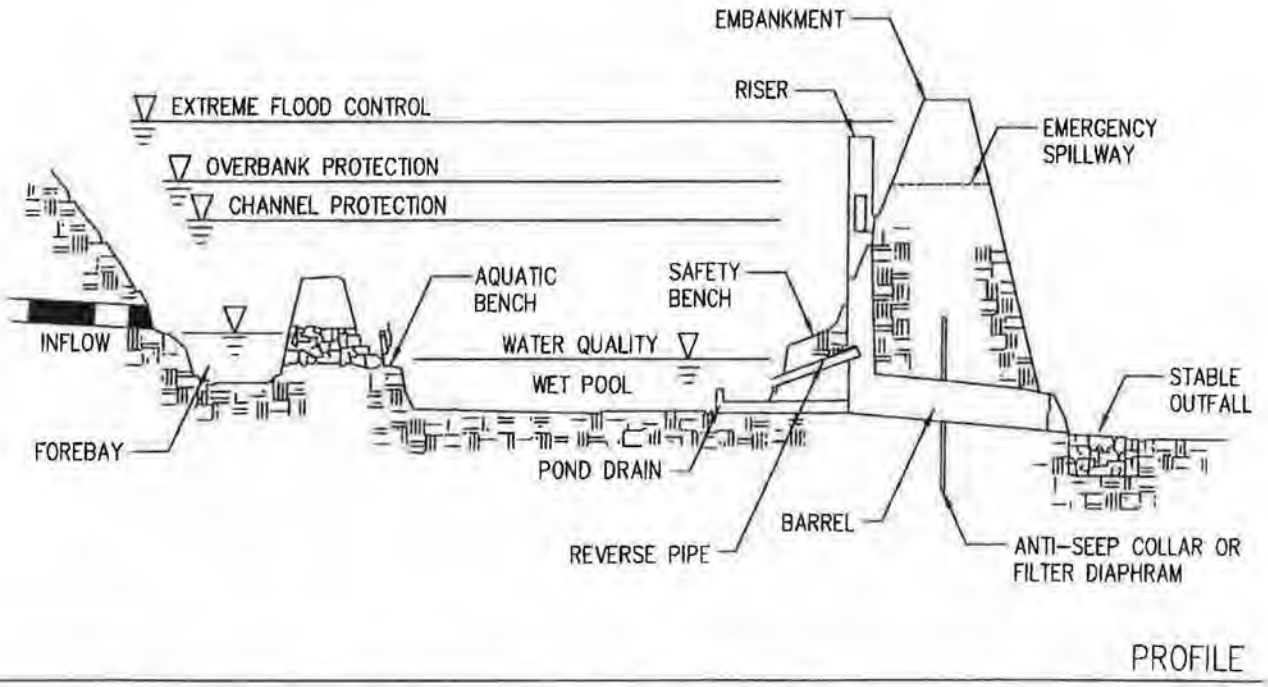
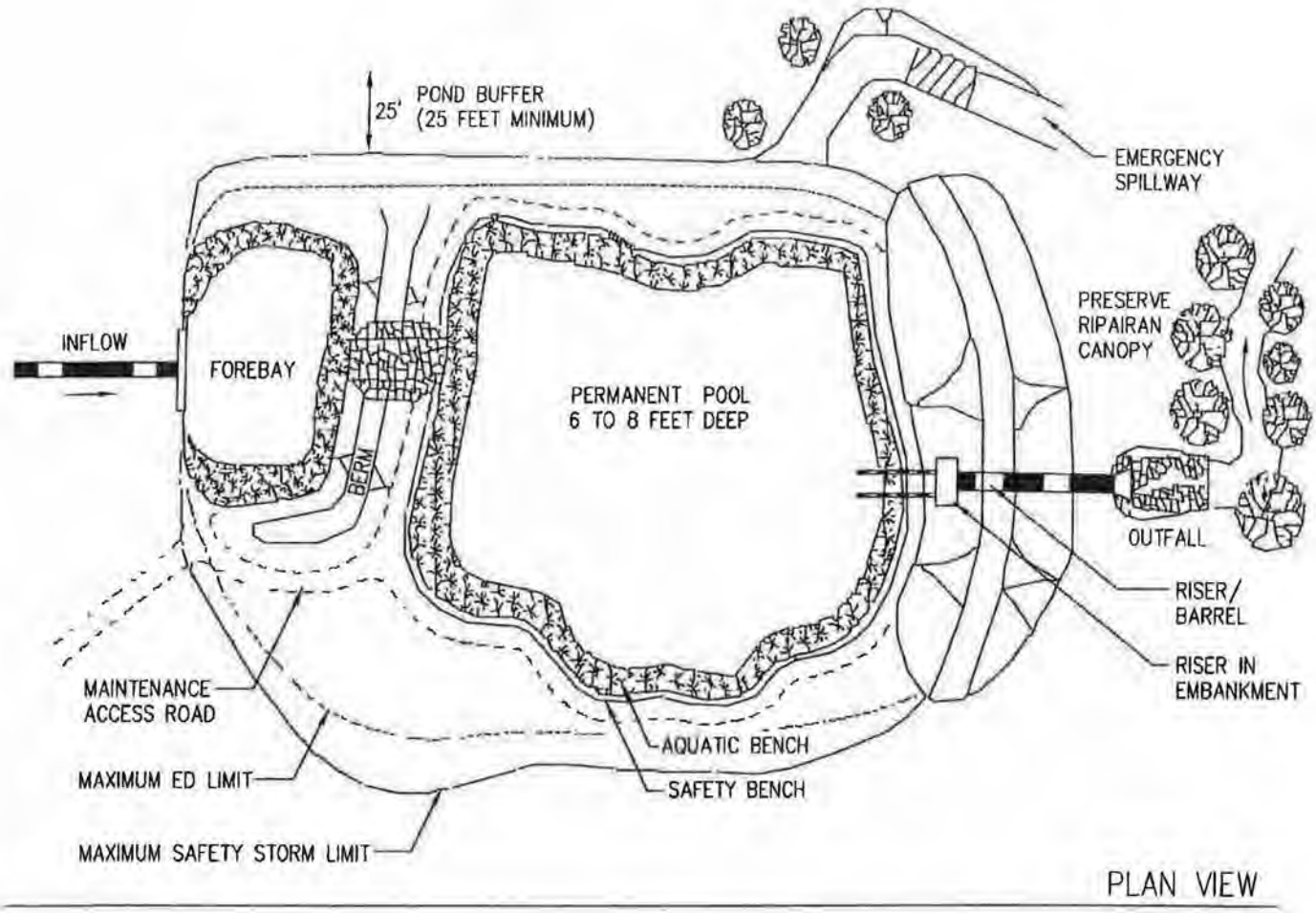


FIGURE 5-1. Micropool Extended Detention Pond



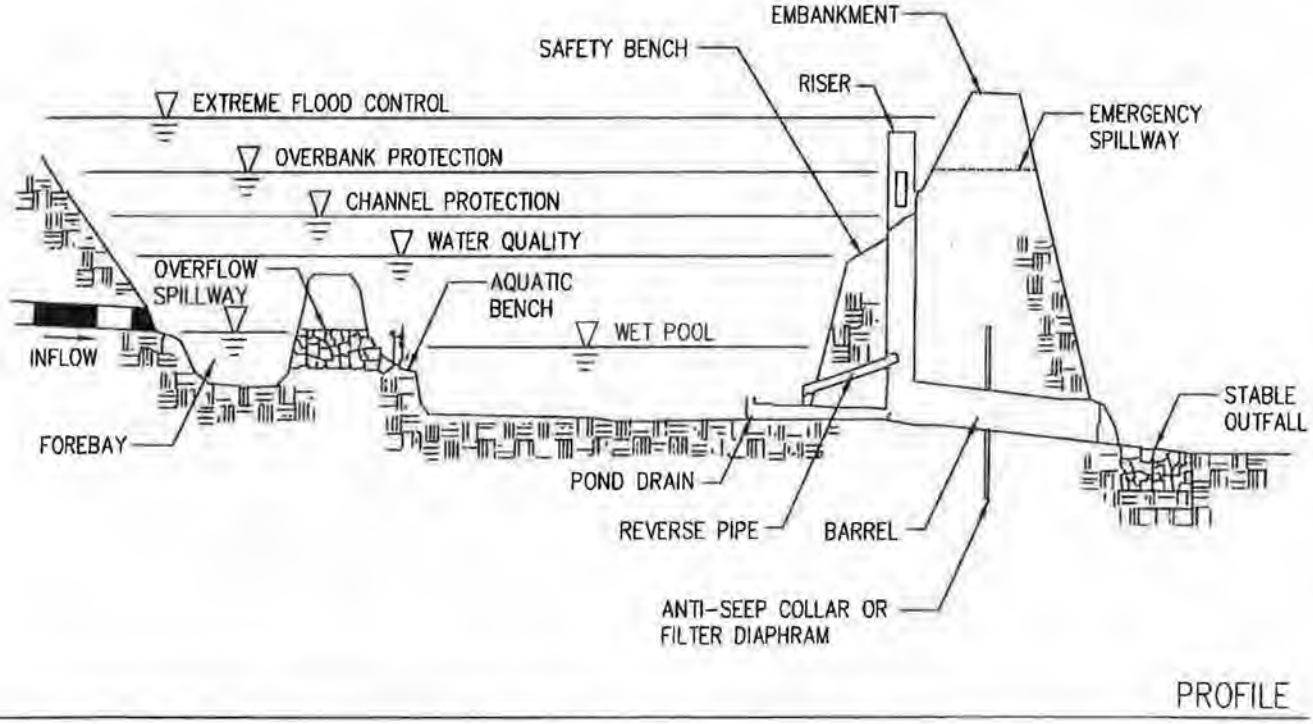
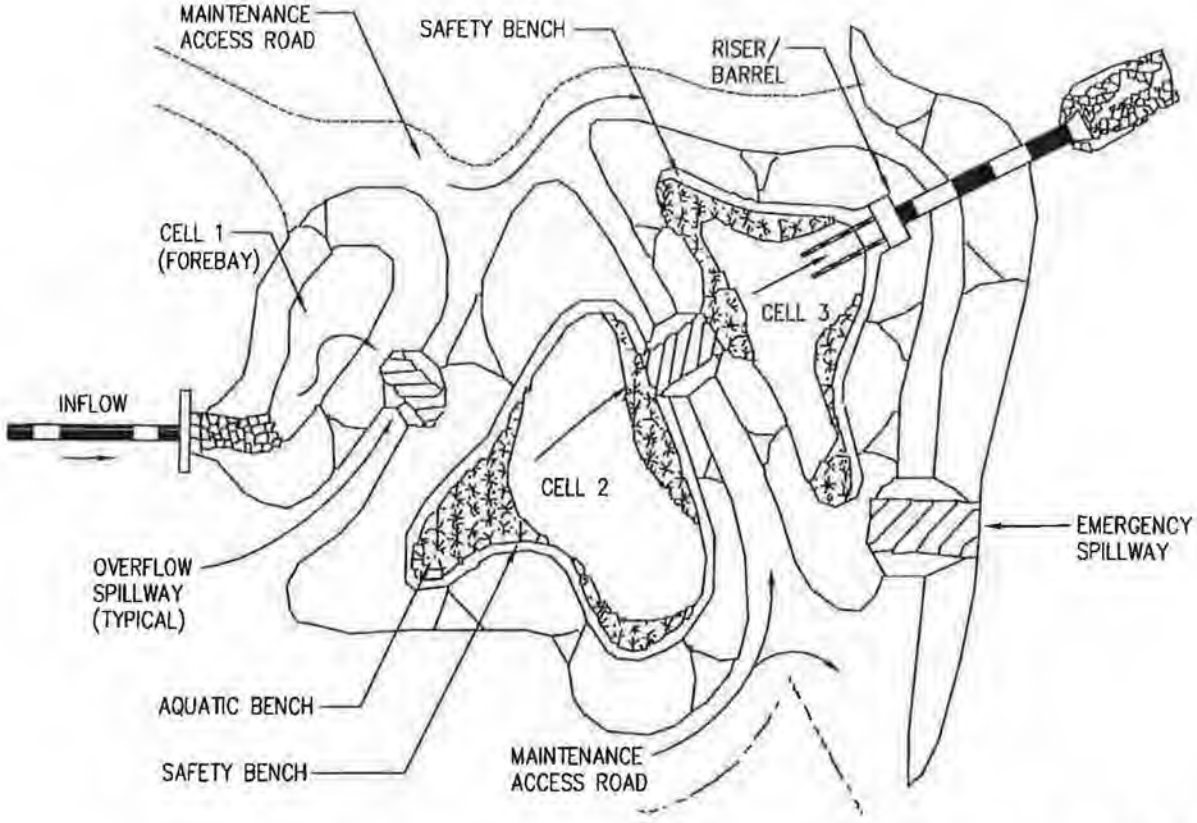


FIGURE 5-3. Wet Extended Detention Pond



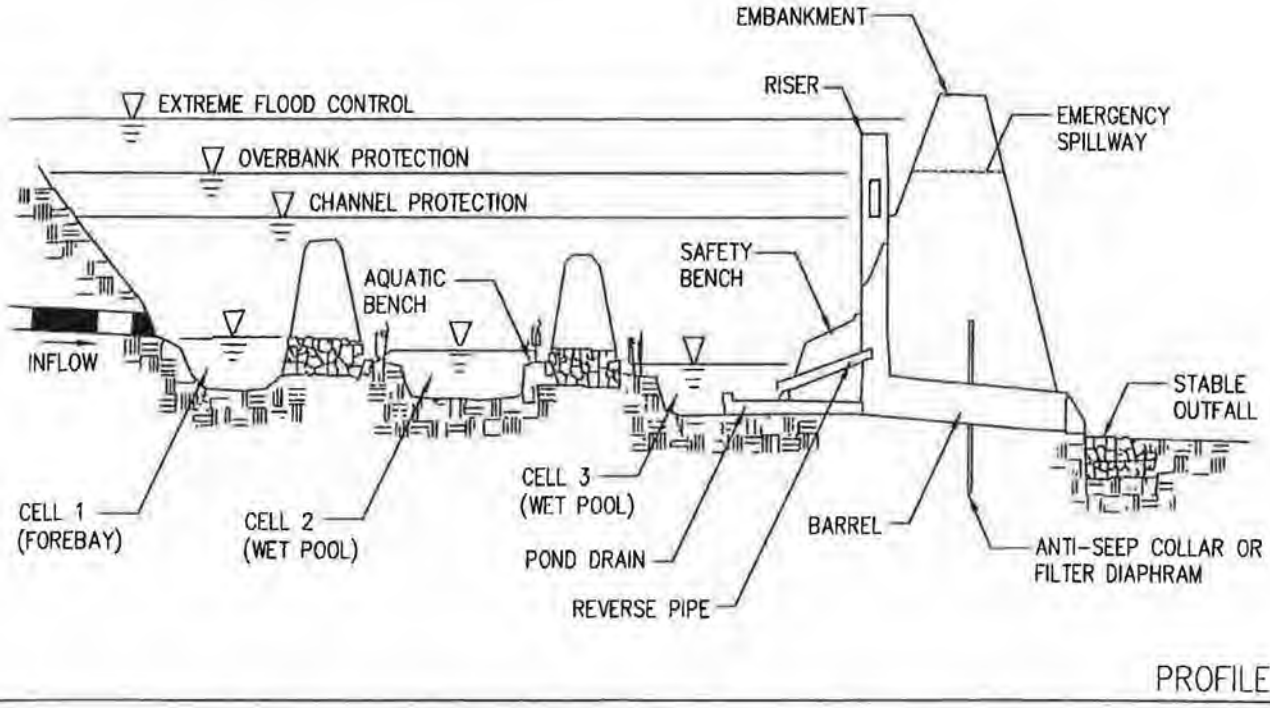
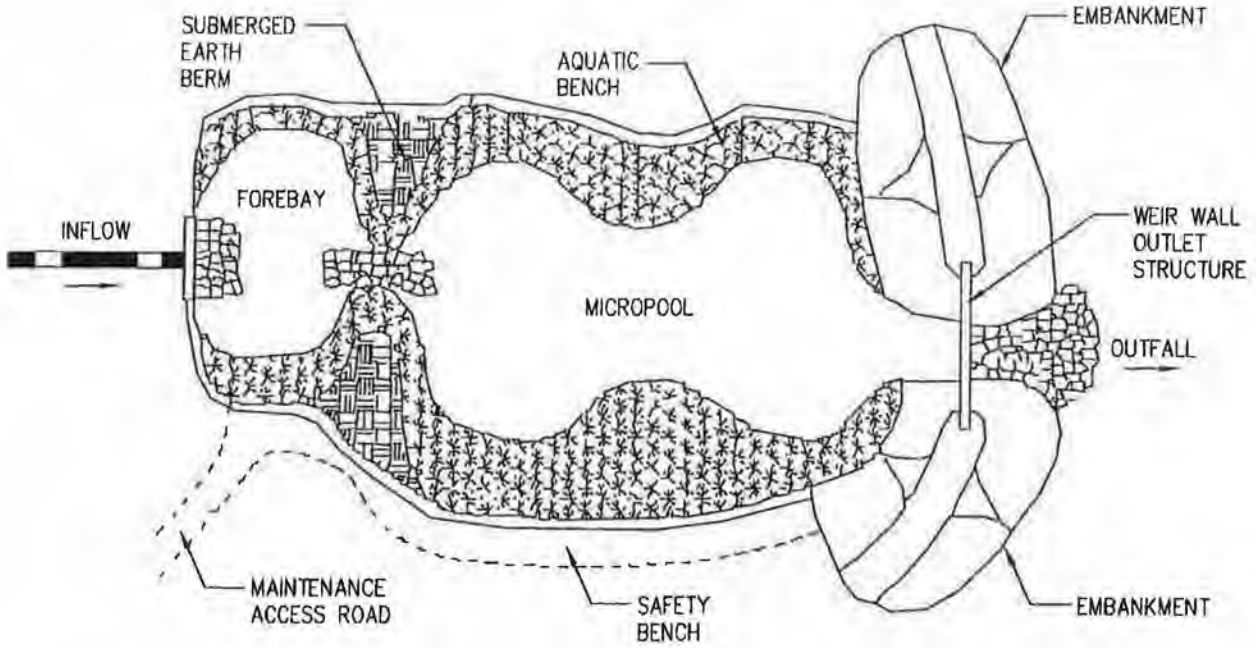
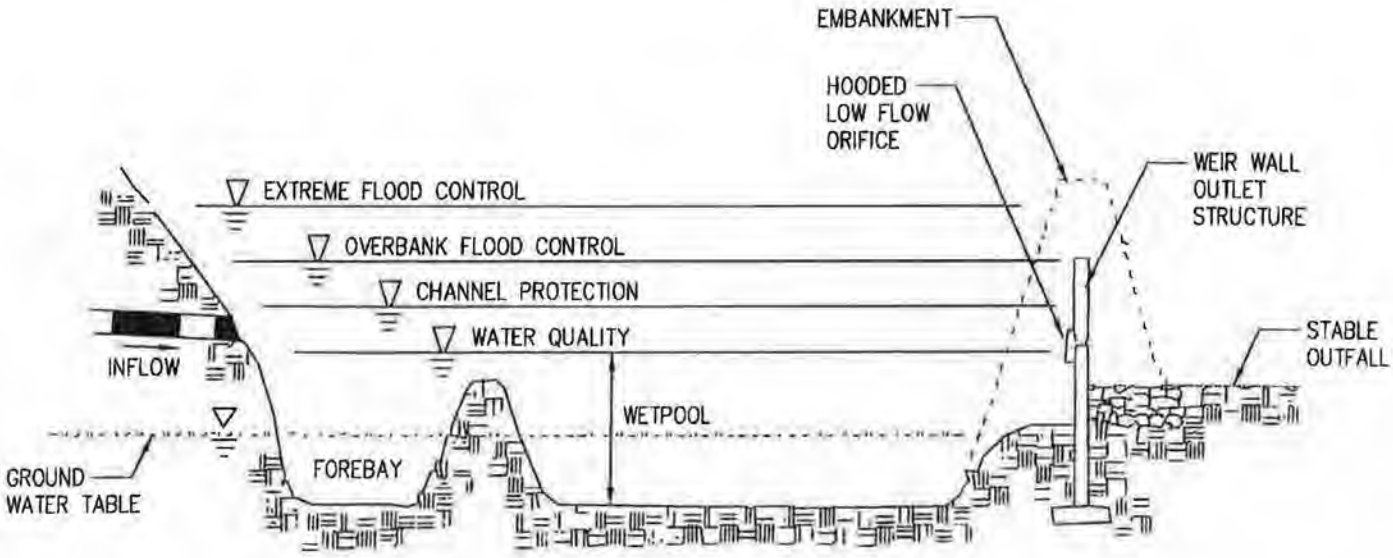


FIGURE 5–4. Multiple Pond System



PLAN VIEW



PROFILE

FIGURE 5-5. Pocket Pond

Dry extended detention ponds that have no permanent pool are not considered an acceptable "stand-alone" option for meeting WQ_v. However, with the approval of the Engineering Department, they may be used in conjunction with other STP's to meet the WQ_v requirement. They may also be used to meet the detention requirement.

5.2.1 *Feasibility Criteria*

When used to meet water quality requirements, a minimum contributing drainage area of ten acres or more is preferred for stormwater ponds, unless groundwater can be confirmed as the primary water source (i.e., pocket ponds).

Stormwater ponds shall not be located within jurisdictional waters, including wetlands.

Stormwater ponds shall be located within the parcel limits of the project under consideration, except as specified below. No stormwater ponds will be permitted within public road rights-of-way. Location of stormwater ponds immediately upstream or downstream of the project will be considered by special request if proper documentation is submitted with reference to practicality, feasibility, and proof of ownership or right-of-way use of the area proposed.

In no case shall the limits of maximum ponding for a stormwater pond be closer than 25 feet horizontally from any structure.

5.2.1.1 Safe Dam Act

National responsibility for the promotion and coordination of dam safety lies with FEMA. State responsibility for administration of the provisions of the Federal Dam Safety Act is given by Title 15, Chapter 22 of the Arkansas State Code. Rules and regulations relating to applicable dams are promulgated by the Arkansas Soil and Water Conservation Commission (ASWCC).

All dams within the state of Arkansas, except those that meet certain exemptions, must have a construction and operation permit from ASWCC. Under the ASWCC criteria, a dam is exempt from the regulations if it is less than 25 ft in height or has a normal storage volume less than 50 ac•ft. The ASWCC also allows an exemption if the crest height of the dam is below the ordinary high water mark of the stream at that location. However, smaller dams may also be required to meet the dam safety regulations as well. If persons downstream feel that their life or their property is endangered by a dam, they can petition the ASWCC for the dam safety regulations to be enforced *(2)*. Consult Reference *(2)* for more information on dam safety regulations, design criteria, and hazard classifications. Any questions regarding permits, exemptions, design criteria, or compliance with dam safety regulations should be directed to the ASWCC.

Dams which are greater than 10 feet in height but do not fall into State or Federal requirement categories shall be designed in accordance with the latest edition of the SCS Technical Release No. 60, "Earth Dams and Reservoirs," as Class "C" structures *(1), (8)*.

An analysis shall be furnished of any soil proposed for use in earthen dam construction. Borings of the foundation for an earthen dam may be requested by the Engineering Department. Earthen dam structures, of any height, shall be designed by a Professional Engineer registered to practice in the state of Arkansas.

5.2.1.2 Freeboard Criteria

All stormwater ponds shall have a minimum freeboard of one foot.

5.2.1.3 Minimum Geometric Criteria

The minimum length to width ratio for stormwater ponds is 1.5:1 (i.e., length relative to width). Long flow paths and irregular shapes are recommended.

5.2.1.4 Pond Benches

The perimeter of all deep pool areas (four feet or greater in depth) shall be surrounded by two benches:

- A safety bench that extends 15 feet outward from the normal water edge to the toe of the pond side slope. The maximum slope of the safety bench shall be 6%.
- An aquatic bench that extends up to 15 feet inward from the normal shoreline and has a maximum depth of eighteen inches below the normal pool water surface elevation.

5.2.1.5 Safety Features

Side slopes to the pond shall not exceed 3:1 (h:v), and shall terminate on a safety bench. Both the safety bench and the aquatic bench may be landscaped to prevent access to the pool. The bench requirement may be waived if slopes are 4:1 or flatter.

The principal spillway opening shall not permit access by small children, and endwalls above pipe outfalls greater than 24 inches in diameter shall be fenced to prevent a hazard.

5.2.2 *Detention Criteria*

When used to meet detention requirements, stormwater ponds shall be designed to limit the peak storm water discharge rate of the 10-, 25-, 50-, and 100-year storm frequencies after development to pre-development flow rates.

5.2.2.1 Volume of Detention

Volumes of detention shall be evaluated according to the following methods:

- Volumes of stormwater ponds with total drainage areas of 20 acres or less may be evaluated by the "Modified Rational Hydrograph Method."

- For basins with total drainage areas larger than 20 acres, the Owner's Engineer shall submit the proposed method of evaluation for the sizing of the stormwater pond to the Engineering Department. The method will be evaluated for professional acceptance, applicability, and reliability by the Engineering Department. No detailed review for projects larger than 20 acres will be rendered before the method of evaluation of the detention/retention basin is approved.

- The computed hydraulic detention volume shall be increased by 25 percent as a factor of safety and to provide for sediment storage. The Engineering Department may reduce this requirement depending on the development characteristics and stream stability of upstream tributary areas.

5.2.2.2 Routing Method

The hydrograph routing method used shall be the Modified Puls Method.

5.2.2.3 Stormwater Pond Design Procedure (Modified Rational Method)

1. Compute pre-development and post-development site characteristics:
   - Drainage Area
   - Composite Runoff Coefficient
   - Time of Concentration
2. Determine rainfall intensity for pre-development conditions (10- through 100-year storm).
3. Compute pre-development peak runoff rates using Rational Formula. These flow rates will be the maximum allowable release rates from the detention basin.
4. Determine inflow hydrograph using Modified Rational Method (see example problem and Figure 5-6 in section 5.2.2.4).
5. Find estimated detention volume using Modified Rational Method
6. Size Stormwater Pond based on estimated required volume. Develop stage-storage curve for the detention basin.
7. Size release structure based on allowable release flow. Develop stage-discharge curve for the release structure.

8. Route the inflow hydrographs (developed using the Modified Rational Method for the 10- through 100-year storms) through the stormwater pond using Modified Puls Method.

9. Check routed hydrographs to ensure flows do not exceed pre-development peaks. Adjust stormwater pond and release structure if necessary.

5.2.2.4 Example Problem – Modified Rational Method

The following example problem describes the general procedure to complete a design of a stormwater pond using the Modified Rational Method. The values and information provided in this example do not represent actual data for the City of Fort Smith but are only provided to illustrate the procedure.

Given: A 10-acre site currently agricultural use is to be developed for townhouses. The entire area is the drainage area of the proposed stormwater pond.

Determine: Maximum release rate and required detention storage.

Solution:

Step 1: Determine 100-year peak runoff rate prior to site development. This is the maximum release rate from site after development.

NOTE: Where a stormwater pond is being designed to provide detention for both its drainage area and a bypass area, the maximum release rate is equal to the peak runoff rate prior to site development for the total of the areas minus the peak runoff rate after development for the bypass area. This rate for the bypass area will vary with the duration being considered.

Present Conditions $Q = CiA$ (See Section 2.4.1) (5.9)

$C = 0.30$
$T_c = 20$ minutes
$i_{100} = 7.0$ in./hr
$Q_{100} = 0.30(7.0)(10) = 21.0$ cfs (Maximum Release Rate)

Step 2: Determine inflow hydrograph for storms of various durations in order to determine maximum volume required with release rate determined in Step 1.

NOTE: Incrementally increase durations by 10 minutes to determine maximum required volume. The duration with a peak inflow less than the maximum release rate or where required storage is less than storage for the prior duration is the last increment.

Future Conditions (Townhouses)

$C = 0.80$
$T_c = 15$ minutes
$i_{100} = 7.7$ in./hr
$Q_{100} = 0.80(7.7)(10) = 61.6$ cfs

Check various duration storms.

20 min	$i = 7.0$	$Q_{in} = 0.80\ (7.0)\ (10) = 56.0$ cfs
30 min	$i = 5.8$	$Q_{in} = 0.80\ (5.8)\ (10) = 46.4$ cfs
40 min	$i = 5.0$	$Q_{in} = 0.80\ (5.0)\ (10) = 40.0$ cfs
50 min	$i = 4.4$	$Q_{in} = 0.80\ (4.4)\ (10) = 35.2$ cfs
60 min	$i = 4.0$	$Q_{in} = 0.80\ (4.0)\ (10) = 32.0$ cfs
70 min	$i = 3.7$	$Q_{in} = 0.80\ (3.7)\ (10) = 29.6$ cfs
80 min	$i = 3.4$	$Q_{in} = 0.80\ (3.4)\ (10) = 27.2$ cfs
90 min	$i = 3.1$	$Q_{in} = 0.80\ (3.1)\ (10) = 24.8$ cfs

The Maximum Storage Volume in cubic feet (cf) is determined by deducting the volume of runoff released during the time of inflow from the total outflow for each storm duration.

$$V = (time \times Q_{in} \times 60\ s/min) - (0.5 \times (time + T_c) \times Q_{out} \times 60\ s/min) \qquad (5.10)$$

15 min Storm Inflow 15 (61.6) (60) = 55,440 cf
Outflow 0.5 (30)(21.0)(60) = 18,900 cf

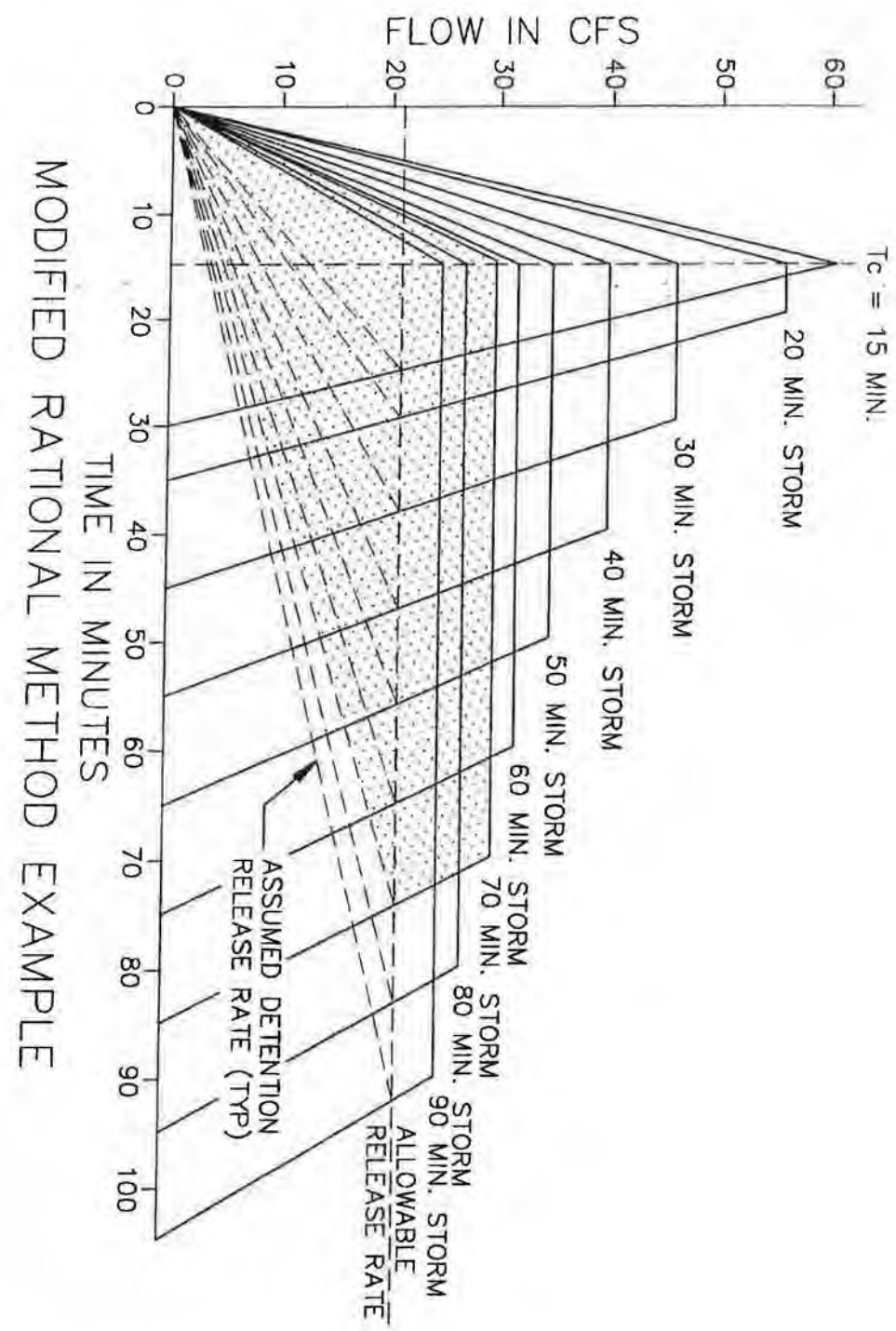
20 min Storm Inflow 20 (56.0) (60) = 67,200 cf
Outflow 0.5 (35)(21.0)(60) = 22,050 cf
Storage 45,150 cf

30 min Storm Inflow 30 (46.4) (60) = 83,520 cf
Outflow 0.5 (45)(21.0)(60) = 28,350 cf
Storage 55,170 cf

40 min Storm Inflow 40 (40.0) (60) = 96,000 cf
Outflow 0.5 (55)(21.0)(60) = 34,650 cf
Storage 61,350 cf

50 min Storm Inflow 50 (35.2) (60) = 105,600 cf
Outflow 0.5 (65)(21.0)(60) = 40,950 cf
Storage 64,650 cf

FIGURE 5-6. Example Problem, Modified Rational Method.



C:\City of Ft Smith\Engineering\Meeker\ Dentention Details.dwg 02/18/08-10:25 RBR Model

CONCEPT OF DETENTION POND MODIFIED RATIONAL METHOD EXAMPLE STANDARD DETAIL CITY OF FORT SMITH, ARKANSAS	The City of Fort Smith ARKANSAS	Project: Date: FEN. 2008 Scale: NONE Drawn By: RBR

60 min Storm Inflow 60 (32.0) (60) = 115,200 cf
Outflow 0.5 (75)(21.0)(60) = 47,250 cf
Storage 67,950 cf

70 min Storm Inflow 70 (29.6) (60) = 124,320 cf
Outflow 0.5 (85)(21.0)(60) = 53,550 cf
Storage 70,770 cf

80 min Storm Inflow 80 (27.2) (60) = 130,560 cf
Outflow 0.5 (95)(21.0)(60) = 59,850 cf
Storage 70,710 cf

90 min Storm Inflow 90 (24.8) (60) = 133,920 cf
Outflow 0.5 (105)(21.0)(60) = 66,150 cf
Storage 67,770 cf

Step 3: Route design storm hydrograph through the stormwater pond using the Modified Puls Routing Method or another approved method, based on final stormwater pond and release structure design. Computer programs to accomplish this are readily available.

5.2.2.5 Stormwater Detention Analysis Software

The City will allow the use of the following software or an acceptable equal approved by the Engineering Department for the analysis of storm water detention facilities: HEC-HMS, HEC-1, PondPack.

5.2.3 *Outlet Works*

Stormwater ponds shall be provided with effective outlet works. Safety considerations shall be an integral part of the design of all outlet works. Plan view and sections of the structure with adequate details shall be included in the plans.

The riser structure selected shall have documented evidence that it will control the 10-, 25-, 50-, and 100-year storm events. Generally, the full range of frequency control is achieved by selecting the 100-year and an intermediate frequency, such as the 10-year flood. Documented evidence shall also be provided that the riser will control the WQ_v if the stormwater pond is used to meet this requirement. The riser shall also be located within the embankment for maintenance access, safety and aesthetics. Access to the riser is to be provided by lockable manhole covers (the principal spillway opening can be "fenced" with pipe or rebar at 8 inch intervals for safety purposes). The principal spillway shall also be equipped with a trash rack that provides access for maintenance.

A non-clogging low flow orifice must be provided for the WQ_v. The low flow orifice shall have a minimum diameter of 3 inches, and shall be adequately protected from clogging by an

acceptable external trash rack. The preferred method is a submerged reverse-slope pipe that extends downward from the riser to an inflow point one foot below the normal pool elevation. Alternative methods are to employ a broad crested rectangular weir or a V-notch weir protected by a half-round CMP that extends at least 12 inches below the normal pool. Horizontal perforated pipe protected by geotextile and gravel shall not be used. Vertical perforated pipes shall not be used.

The emergency spillway may either be combined with the outlet works or be a separate structure or channel meeting the following criteria:

- Emergency spillways shall be designed so that their crest elevation is 0.5 feet or more above the maximum water surface elevation in the detention facility attained by the 100-year storm event *(1)*.

- In cases where the emergency spillway is not regulated by either State or Federal agencies, the emergency spillway shall be designed to pass the 100-year storm with 1 foot of freeboard (or as designated) from the design stage to the top of dam, assuming zero available storage in the basin and zero flow through the primary outlet *(1)*.

Each stormwater pond shall have a drain pipe that can completely or partially drain the pond. The drain pipe shall have an elbow within the pond to prevent sediment deposition, and a diameter capable of draining the pond within 24 hours. The pond drain should be sized one pipe size greater than the calculated design diameter. Care shall be exercised during pond drawdowns to prevent downstream discharge of sediments or anoxic water and rapid drawdown. The Engineering Department shall be notified before draining a pond.

The pond drain shall be equipped with an adjustable valve (typically a handwheel activated knife or gate valve). Valve controls shall be located inside of the riser at a point where they (a) will not normally be inundated and (b) can be operated in a safe manner. To prevent vandalism, the handwheel should be chained to a ringbolt, or other fixed object

Sharp-crested weir flow equations for no end contractions, two end contractions and submerged discharge conditions are presented below, followed by equations for broad-crested weirs, V-notch weirs, and orifices, or combinations of these facilities. If culverts are used as outlets works, procedures presented in the Culverts Chapter should be used to develop stage-discharge data. When analyzing release rates, the tailwater influence of the principal spillway culvert on the control structure (orifice and/or weirs) must be considered to determine the effective head on each opening. Slotted riser pipe outlet facilities shall not be used.

5.2.3.1 Sharp-Crested Weirs

A sharp-crested weir with no end contractions is illustrated in Figure 5-7. The discharge equation for this configuration is *(4)*:

$$Q = [3.27 + 0.4(H/H_c)]\ LH^{1.5} \tag{5.3}$$

where:
Q = discharge, ft^3/s
H = head above weir crest excluding velocity head, ft
H_c = height of weir crest above channel bottom, ft
L = horizontal weir length, ft

A sharp-crested weir with two end contractions is illustrated in Figures 5-7 and 5-8. The discharge equation for this configuration is *(4)*:

$$Q = [3.27 + 0.4(H/H_c)]\ (L - 0.2H)\ H^{1.5} \tag{5.4}$$

where: Variables are the same as Equation 5.1.

A sharp-crested weir will be affected by submergence where the tailwater rises above the weir-crest elevation. The result will be that the discharge over the weir will be reduced. The discharge equation for a sharp-crested submerged weir is *(3)*:

$$Q_S = Q_f(1 - (H_2/H_1)^{1.5})^{0.385} \tag{5.5}$$

where:
Q_s = submergence flow, ft^3/s
Q_f = free flow, ft^3/s
H_1 = upstream head above crest, ft
H_2 = downstream head above crest, ft

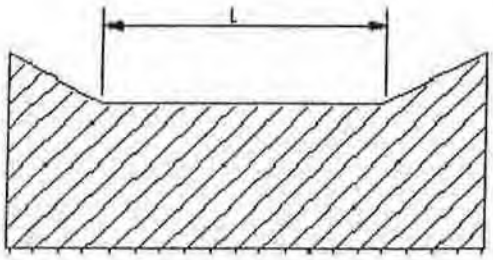


FIGURE 5-7.
Sharp-Crested Weir (No End Contractions)

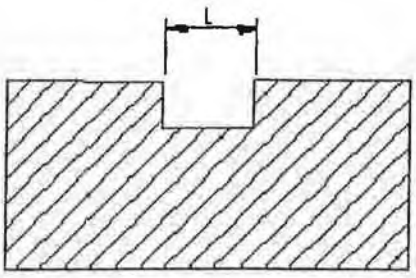


FIGURE 5-8.
Sharp-Crested Weir (Two End Contractions)

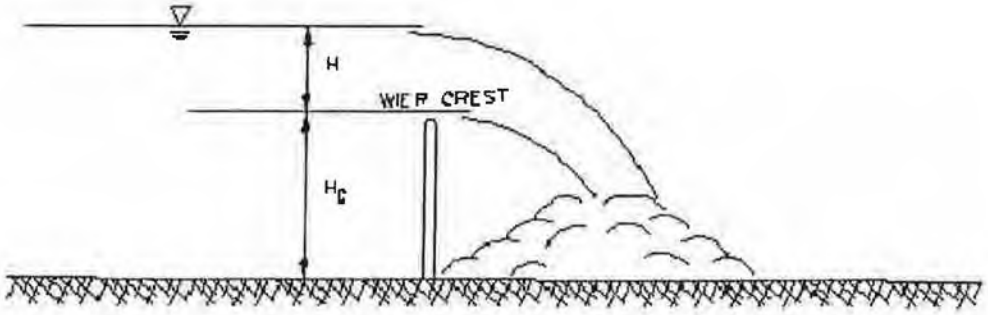


FIGURE 5-9. Sharp-Crested Weir and Head

5.2.3.2 Broad-Crested Weirs

The equation generally used for the broad-crested weir is *(3)*:

$$Q = CLH^{1.5} \tag{5.6}$$

where:
Q = discharge, ft^3/s
C = broad-crested weir coefficient
L = broad-crested weir length, ft
H = head above weir crest, ft

If the upstream edge of a broad-crested weir is so rounded as to prevent contraction and if the slope of the crest is as great as the loss of head due to friction, flow will pass through critical depth at the weir crest; this gives the maximum C value of 3.087. For sharp corners on the broad-crested weir, a minimum C value of 2.6 should be used. Additional information on C values as a function of weir crest breadth and head is given in Table 5-1.

TABLE 5-1. Broad-Crested Weir Coefficient *C* Values as a Function of Weir Crest Breadth and Head (ft)

Measured Head, H^1 (ft)	Breadth of the Crest of Weir (ft)										
	0.50	0.75	1.00	1.50	2.00	2.50	3.00	4.00	5.00	10.00	15.00
0.2	2.80	2.75	2.69	2.62	2.54	2.48	2.44	2.38	2.34	2.49	2.68
0.4	2.92	2.80	2.72	2.64	2.61	2.60	2.58	2.54	2.50	2.56	2.70
0.6	3.08	2.89	2.75	2.64	2.61	2.60	2.68	2.69	2.70	2.70	2.70
0.8	3.30	3.04	2.85	2.68	2.60	2.60	2.67	2.68	2.68	2.69	2.64
1.0	3.32	3.14	2.98	2.75	2.66	2.64	2.65	2.67	2.68	2.68	2.63
1.2	3.32	3.20	3.08	2.86	2.70	2.65	2.64	2.67	2.66	2.69	2.64
1.4	3.32	3.26	3.20	2.92	2.77	2.68	2.64	2.65	2.65	2.67	2.64
1.6	3.32	3.29	3.28	3.07	2.89	2.75	2.68	2.66	2.65	2.64	2.63
1.8	3.32	3.32	3.31	3.07	2.88	2.74	2.68	2.66	2.65	2.64	2.63
2.0	3.32	3.31	3.30	3.03	2.85	2.76	2.27	2.68	2.65	2.64	2.63
2.5	3.32	3.32	3.31	3.28	3.07	2.89	2.81	2.72	2.67	2.64	2.63
3.0	3.32	3.32	3.32	3.32	3.20	3.05	2.92	2.73	2.66	2.64	2.63
3.5	3.32	3.32	3.32	3.32	3.32	3.19	2.97	2.76	2.68	2.64	2.63
4.0	3.32	3.32	3.32	3.32	3.32	3.32	3.07	2.79	2.70	2.64	2.63
4.5	3.32	3.32	3.32	3.32	3.32	3.32	3.32	2.88	2.74	2.64	2.63
5.0	3.32	3.32	3.32	3.32	3.32	3.32	3.32	3.07	2.79	2.64	2.63
5.5	3.32	3.32	3.32	3.32	3.32	3.32	3.32	3.32	2.88	2.64	2.63

[1]Measured at least $2.5H$ upstream of the weir.

Source: Reference *(3)*.

5.2.3.3 V-Notch Weirs

The discharge through a V-notch weir can be calculated from the following equation *(3)*:

$$Q = 2.5 \tan(q/2)H^{2.5} \quad (5.7)$$

where:

Q = discharge, ft^3/s
q = angle of V-notch, degrees
H = head on apex of notch, ft

5.2.3.4 Orifices

Pipes smaller than 12 in. may be analyzed as a submerged orifice if H/D is greater than 1.5. For square-edged entrance conditions:

$$Q = 0.6A(2gH)^{0.5} \quad (5.8)$$

where:

Q = discharge, ft^3/s
A = cross-section area of pipe, ft^2
g = acceleration due to gravity, 32.2 ft/s^2
D = diameter of pipe, ft
H = head on pipe, from the center of pipe to the water surface, ft *

* Where the tailwater is higher than the center of the opening, the head is calculated as the difference in water surface elevations.

5.2.4 *Discharge Systems*

For site-specific runoff, the effectiveness of local stormwater ponds used for detention can be acknowledged in the design of any onsite downstream drainage facilities, assuming that the stormwater ponds comply with all criteria and that they are properly constructed and maintained.

In the case of regional stormwater ponds, sizing of the system below the control structure shall be for the total improved peak runoff tributary to the structure, with no allowance for detention unless approved in writing by the Engineering Department.

In the event the Engineer desires to incorporate the flow reduction benefits of existing upstream stormwater ponds, the following field investigations and hydrologic analysis shall be required:

- A field survey of the existing physical characteristics of both the outlet structure and ponding volume. Any departure from the original engineer's design must be accounted for. If a dual use for the stormwater pond exists, then this also must be accounted for.

- A comprehensive hydrologic analysis that simulates the attenuation of the contributing area ponds. This should not be limited to a linear additive analysis, but rather should consist of a network of hydrographs that considers incremental timing of discharge and potential coincidence of outlet peaks.

Please note that under no circumstances will the previously approved construction plans of the upstream pond or ponds suffice as an adequate analysis. While the responsibility of the individual site or subdivision plans rests with the Engineer of Record, any subsequent engineering analysis must assure that all the incorporated ponds work collectively.

5.2.5 *Conveyance Criteria*

Conveyance shall be provided which does not cause erosion. Primary outlet works, emergency spillways, and conveyance system entrances to stormwater ponds shall be equipped with energy dissipating devices as necessary to limit erosion on receiving channels *(1)*.

5.2.5.1 Inlet Protection

A forebay shall be provided at each inlet, unless the inlet provides less than 10% of the total design storm inflow to the pond. Inlet areas shall be protected to reduce erosion.

5.2.5.2 Adequate Outfall Protection

Outfalls shall be constructed such that they do not increase erosion or have undue influence on the downstream geomorphology of the stream.

Flared pipe sections that discharge at or near the stream invert or into a step-pool arrangement shall be used at the spillway outlet.

The channel immediately below the pond outfall shall be modified to prevent erosion and conform to natural dimensions in the shortest possible distance, typically by use of large rip-rap placed over filter cloth.

A stilling basin or outlet protection shall be used to reduce flow velocities from the principal spillway to non-erosive velocities.

If a pond daylights to a channel with dry weather flow, care should be taken to minimize tree clearing along the downstream channel, and to reestablish a forested riparian zone in the shortest possible distance. Excessive use of rip-rap should be avoided to reduce stream warming.

5.2.5.3 Pond Liners

When a pond is located in karst topography, gravelly sands or fractured bedrock, a liner may be needed to sustain a permanent pool of water. If geotechnical tests confirm the need for a liner, acceptable options include: (a) 6 to 12 inches of clay soil (minimum 15% passing the #200 sieve and a minimum permeability of 1×10^{-5} cm/sec), (b) a 30 ml poly-liner (c) bentonite, or (d) use of chemical additives (see NRCS Agricultural Handbook No. 387, dated 1971, or Engineering Field Manual).

5.2.6 *Water Quality Criteria*

5.2.6.1 Pretreatment Criteria

Each stormwater pond used to meet water quality requirements shall have a sediment forebay or equivalent upstream pretreatment. The forebay shall consist of a separate cell, formed by an acceptable barrier.

The forebay shall be 4 to 6 feet deep. It shall be sized to contain 0.1 inches of runoff per impervious acre of contributing drainage. The forebay storage volume counts toward the total WQ_v requirement. Exit velocities from the forebay shall be non-erosive.

Direct maintenance access for appropriate equipment shall be provided to the forebay. The bottom of the forebay may be hardened (e.g., using concrete, paver blocks, etc.) to make sediment removal easier.

A fixed vertical sediment depth marker should be installed in the forebay to measure sediment deposition over time.

5.2.6.2 Treatment Criteria

Stormwater ponds used to meet water quality requirement shall be designed to capture and treat the computed WQ_v through any combination of permanent pool, extended detention (ED) or wetland. Stormwater ponds shall release the WQ_v over a minimum period of 24-hours and within a maximum of 72-hours.

It is generally desirable to provide water quality treatment off-line when topography, head and space permit (e.g., apart from stormwater quantity storage).

Water quality storage can be provided in multiple cells. Performance is enhanced when multiple treatment pathways are provided by using multiple cells, longer flowpaths, high surface area to volume ratios, complex microtopography, and/or redundant treatment methods (combinations of pool, ED, and wetland).

If a micropool extended detention pond is constructed, the micropool shall be sized to contain 0.1 inches per impervious acre of contributing drainage.

5.2.7 *Landscaping Criteria*

5.2.7.1 Landscaping Plan

A landscaping plan for a stormwater pond and its buffer shall be prepared to indicate how aquatic and terrestrial areas will be vegetatively stabilized and established.

Wherever possible, wetland plants should be encouraged in a pond design, either along the aquatic bench (fringe wetlands), the safety bench and side slopes (ED wetlands) or within shallow areas of the pool itself.

The best elevations for establishing wetland plants, either through transplantation or volunteer colonization, are within six inches (plus or minus) of the normal pool.

The soils of a pond buffer are often severely compacted during the construction process to ensure stability. The density of these compacted soils is so great that it effectively prevents root penetration, and therefore, may lead to premature mortality or loss of vigor. Consequently, it is advisable to excavate large and deep holes around the proposed planting sites, and backfill these with uncompacted topsoil.

As a rule of thumb, planting holes should be 3 times deeper and wider than the diameter of the rootball (of balled and burlap stock), and 5 times deeper and wider for container grown stock. This practice should enable the stock to develop unconfined root systems. Avoid species that require full shade, are susceptible to winterkill, or are prone to wind damage. Extra mulching around the base of the tree or shrub is strongly recommended as a means of conserving moisture and suppressing weeds.

5.2.7.2 Pond Buffers and Setbacks

Pond buffers can be important in providing ample space for access and safety. The buffer can be planted or left in trees to discourage resident goose populations.

A pond buffer shall be provided that extends 25 feet outward from the maximum water surface elevation of the pond. The pond buffer shall be contiguous with other buffer areas, that are required by existing regulations (e.g., stream buffers). An additional setback may be provided to permanent structures.

Woody vegetation may not be planted on or allowed to grow within 15 feet of the toe of the embankment and 25 feet from the principal spillway structure.

Existing trees should be preserved in the buffer area during construction. It is desirable to locate forest conservation areas adjacent to ponds. To discourage resident geese populations, the buffer can be planted with trees, shrubs and native ground covers.

5.2.8 *Ownership of Stormwater Ponds*

Ownership of stormwater ponds in residential subdivisions accepted by the City shall be vested in the City of Fort Smith with the filing of the final plat. The Developer shall warrant the operation of the drainage system for 2 years after acceptance by the City by a Maintenance Bond provided by the Developer's Contractor or the Developer. The bond shall be required to be extended until 2 years after all phases of the subdivision or development that substantially drain into the stormwater pond are completed.

Ownership of stormwater ponds in commercial, industrial, private subdivisions, and non-residential areas shall be vested in the property owner.

5.2.9 *Maintenance of Stormwater Ponds*

When ownership of a stormwater pond is not vested in the City of Fort Smith, the maintenance responsibility for a pond and its buffer shall be vested with a responsible party by means of a legally binding and enforceable maintenance agreement that is executed as a condition of plan approval or the permitting process.

Stormwater ponds, when required, are to be built in conjunction with storm sewer installation and/or grading. Since these facilities are intended to control increased runoff, they must be partially or fully operational soon after the clearing of the vegetation. Silt and debris connected with construction activities shall be removed periodically from the detention area and control structure to maintain the facility's storage capacity.

Maintenance of stormwater ponds is divided into two components – short term maintenance and long term maintenance. Requirements for both are discussed in the following sections. Requirements for maintenance access are also discussed below.

5.2.9.1 Short Term Maintenance

For public stormwater ponds, short term or annual maintenance is the responsibility of the developer or property owners' association for two years after acceptance of the final plat or filing of the last subdivision phase that substantially adds storm water to a stormwater pond. The items considered short term maintenance are as follows:

- Sediment removal
- Outlet cleaning
- Mowing
- Herbicide Spraying
- Litter Control

5.2.9.2 Long Term Maintenance

Long term maintenance includes removal of sediment from the basin and outlet structure. Studies show that to be needed once every 5 to 10 years. Sediment removal in the forebay shall occur when 50% of the total forebay capacity has been lost. Where the City has accepted the stormwater pond, the City is responsible for long term maintenance. Where basins are not accepted by the City, the property owner is responsible for the long term maintenance.

5.2.9.3 Maintenance Access

A maintenance right of way or easement shall extend to the stormwater pond from a public road. Maintenance access shall be at least 20 feet wide; have a maximum slope of no more than 15%; and should be appropriately stabilized to withstand maintenance equipment and vehicles. The maintenance access shall extend to the forebay, safety bench, riser, and outlet and be designed to allow vehicles to turn around.

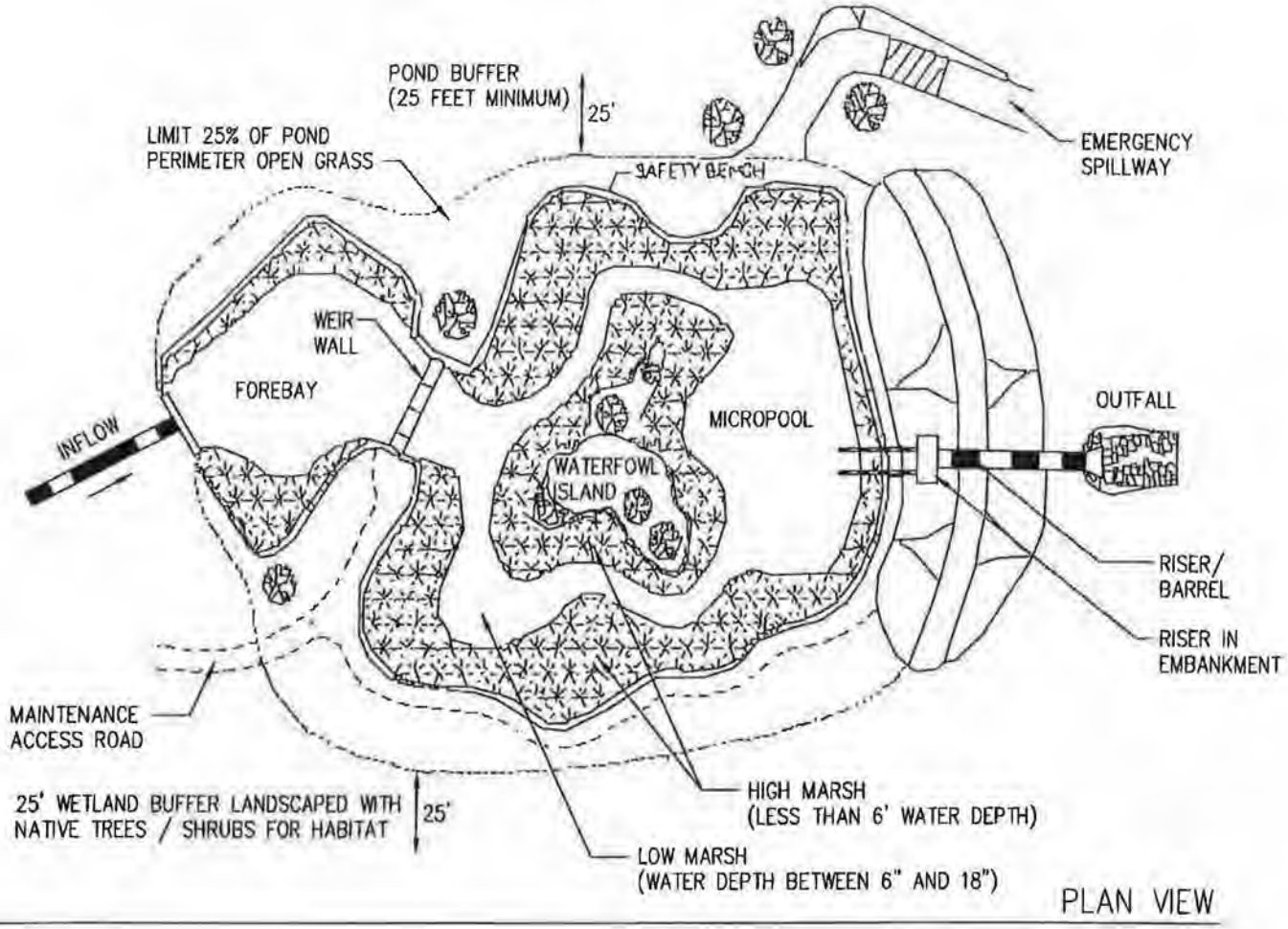
5.3 DESIGN CRITERIA – WETLANDS

Stormwater wetlands are practices that create shallow marsh areas to treat urban stormwater and often incorporate small permanent pools and/or extended detention storage to achieve the full WQ_v. Design variants include:

- Shallow Wetland (Figure 5-10)
- ED Shallow Wetland (Figure 5-11)
- Pond/Wetland System (Figure 5-12)
- "Pocket" Wetland (Figure 5-13)

Stormwater wetlands may be used in residential, private, commercial, and industrial subdivisions and developments to meet the detention and WQ_v requirements.

All of the pond criteria presented in 5.2 DESIGN CRITERIA – STORMWATER PONDS also apply to the design of stormwater wetlands. Additional criteria that govern the geometry and establishment of created wetlands are presented in this section.



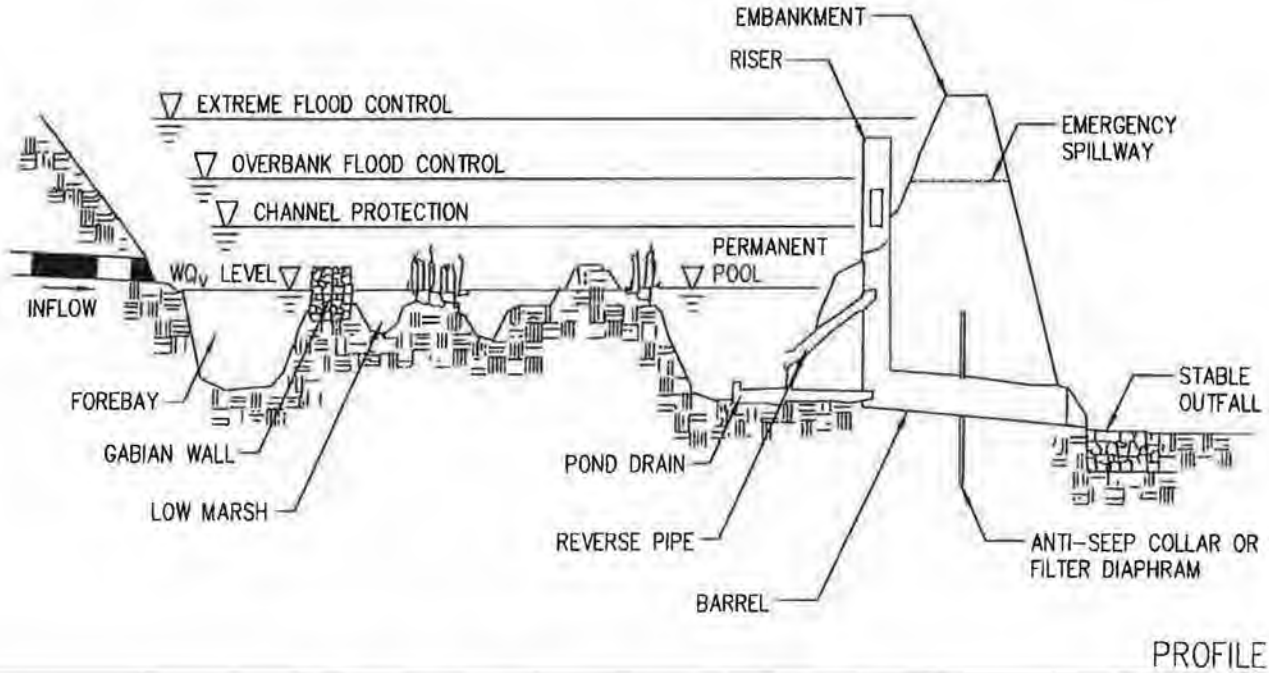
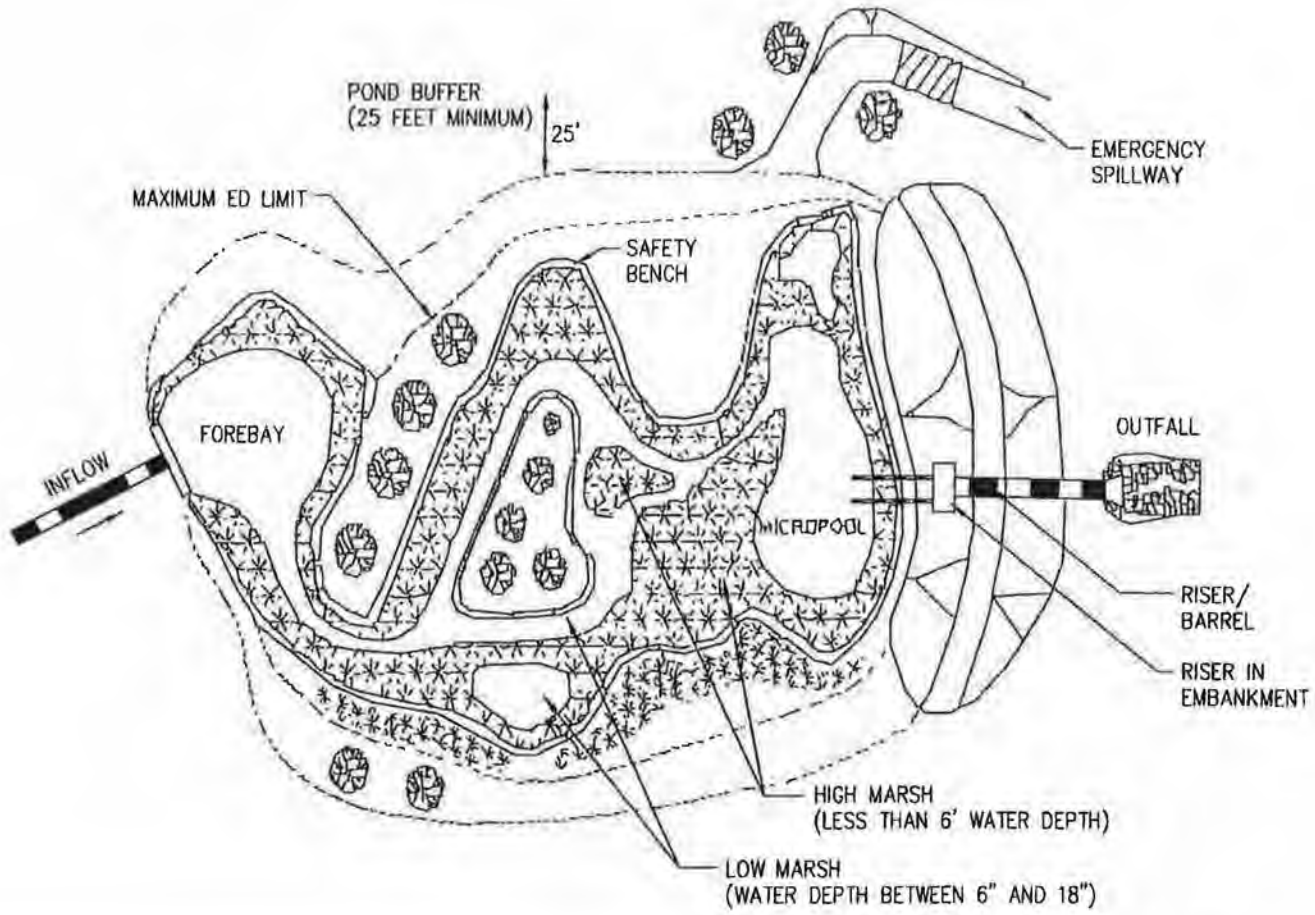


FIGURE 5-10. Shallow Wetland



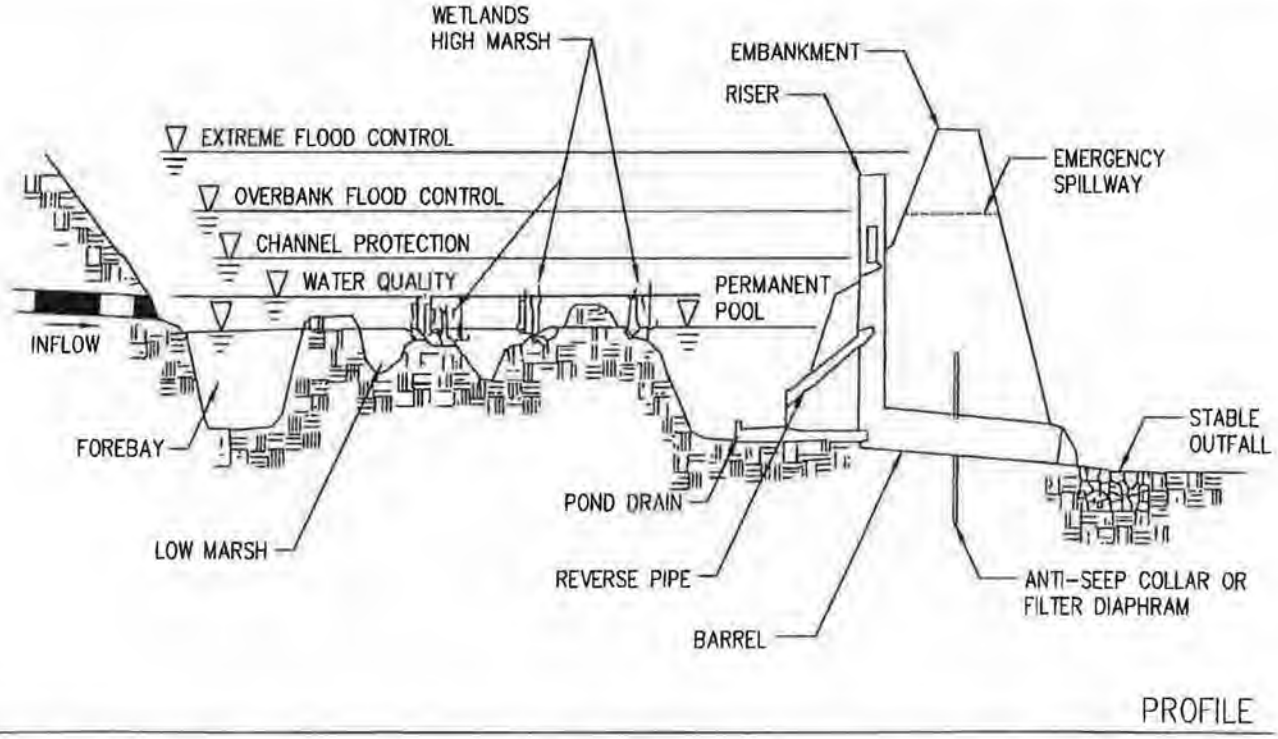


FIGURE 5-11. Extended Detention Shallow Wetland

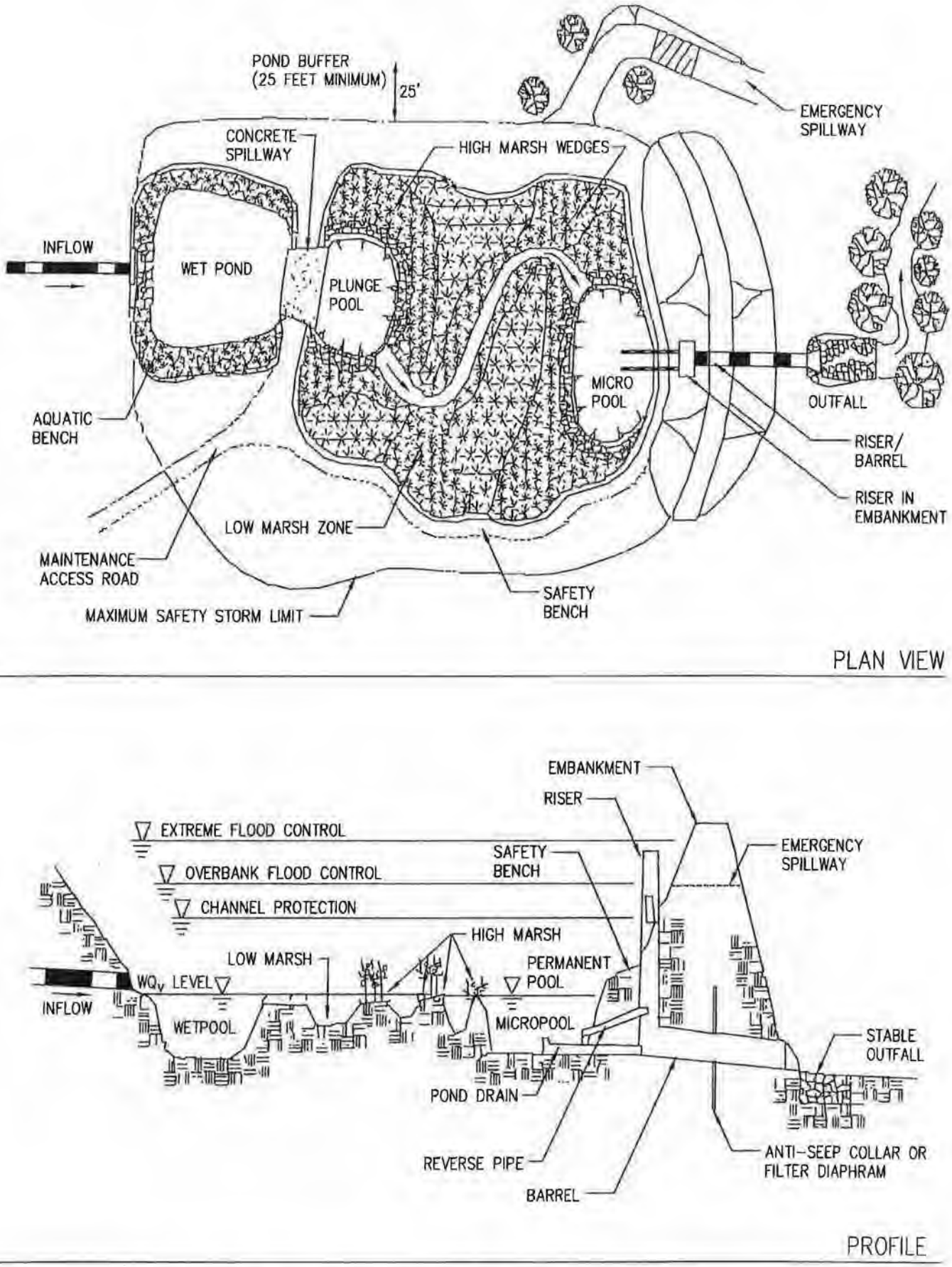
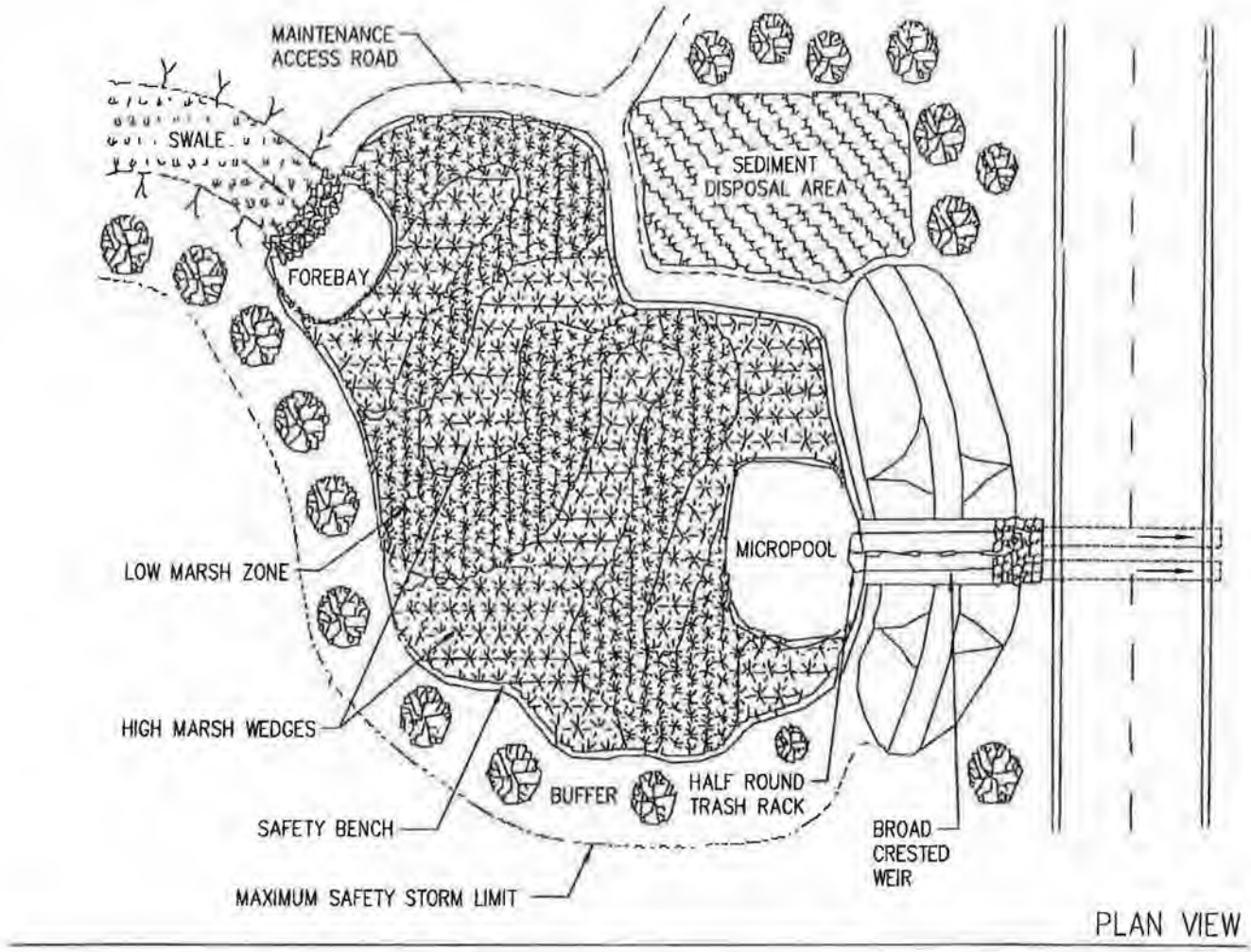


FIGURE 5-12. Pond/Wetland System



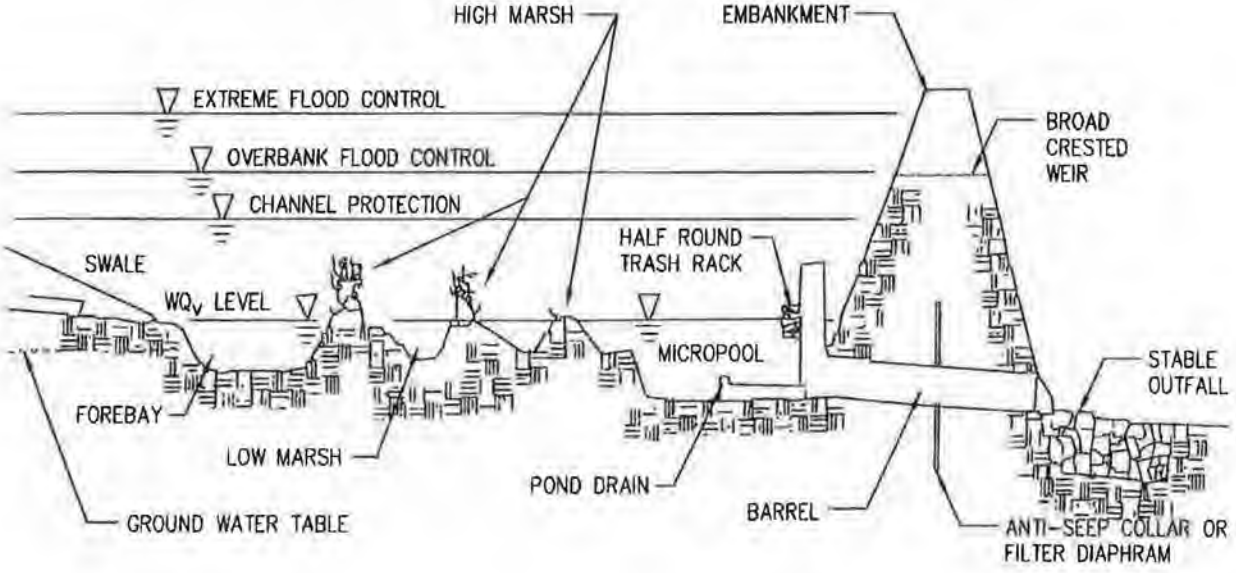


FIGURE 5-13. "Pocket" Wetland

5.3.1 *Feasability Criteria*

A water balance shall be performed to demonstrate that a stormwater wetland can withstand a significant drought at summer evaporation rates without completely drawing down.

Stormwater wetlands shall not be located within existing jurisdictional wetlands.

5.3.2 *Conveyance Criteria*

Flowpaths from the inflow points to the outflow points of stormwater wetlands shall be maximized. A minimum flowpath of 2:1 (length to relative width) shall be provided across the stormwater wetland. This path may be achieved by constructing internal berms (e.g., high marsh wedges or rock filter cells).

Microtopography is encouraged to enhance wetland diversity.

5.3.3 *Pretreatment Criteria*

Sediment regulation is critical to sustain stormwater wetlands. Consequently, a forebay shall be located at the inlet, and a micropool shall be located at the outlet. For forebay design criteria, consult 5.2 DESIGN CRITERIA – STORMWATER PONDS.

A micropool three to six feet deep shall be used to protect the low flow pipe from clogging and prevent sediment resuspension.

5.3.4 *Treatment Criteria*

The surface area of the entire stormwater wetland shall be at least one percent of the contributing drainage area (1.5% for shallow marsh design).

At least 25% of the WQ_v shall be in deepwater zones with a depth greater than four feet. The forebay and micropool may meet this criteria. In addition, the deepwater zones serve to keep mosquito populations in check by providing habitat for fish and other pond life that prey on mosquito larvae.

A minimum of 35% of the total surface area can have a depth of six inches or less, and at least 65% of the total surface area shall be shallower than 18 inches.

The bed of the wetland shall be graded to create maximum internal flow path and microtopography.

If extended detention is utilized in a stormwater wetland, the WQ_v -ED volume shall not comprise more than 50% of the total WQ_V, and its maximum water surface elevation shall not extend more than three feet above the permanent pool.

To promote greater nitrogen removal, rock beds may be used as a medium for growth of wetland plants. The rock should be one to three inches in diameter, placed up to the normal pool elevation, and open to flow-through from either direction.

5.3.5 *Landscaping Criteria*

A landscaping plan shall be provided that indicates the methods used to establish and maintain wetland coverage. Minimum elements of a plan include: delineation of pondscaping zones, selection of corresponding plant species, planting plan, sequence for preparing wetland bed (including soil amendments, if needed) and sources of plant material.

Structures such as fascines, coconut rolls, straw bales, or filter fence can be used to create shallow marsh cells in high energy areas of the stormwater wetland.

The landscaping plan should provide elements that promote greater wildlife and waterfowl use within the wetland and buffers.

A wetland plant buffer shall extend 25 feet outward from the maximum water surface elevation, with an additional 15 foot setback to structures.

5.3.6 *Wetland Establishment*

The most common and reliable technique for establishing an emergent wetland community in a stormwater wetland is to transplant nursery stock obtained from aquatic plant nurseries. The following guidance is suggested when transplants are used to establish a wetland.

Plant only during the transplanting window. Wetland plants need a full growing season to build root reserves needed to get through the winter. If at all possible, plants should be ordered at least three months in advance to ensure the availability of the desirable species.

The optimal depth requirements for several common species of emergent wetland plants are often six inches or less.

To add diversity to the wetland, five to seven species of emergent wetland plants should be planted.

No more than half the wetland surface area needs to be planted. If the appropriate planting depths are achieved, the entire wetland should be colonized within three years.

The wetland area should be subdivided into separate planting zones of more or less constant depth.

One plant species should be planted within each flagged planting zone, based on approximate depth requirements.

Individual plants should be planted 18 inches on center in clumps.

Post-nursery care of wetland plants is very important in the interval between delivery of the plants and their subsequent planting, as they are prone to dessication. Stock should be frequently watered and shaded while on-site.

A wet hydroseed mix should be used to establish permanent vegetative cover in the buffer outside the permanent pool. For rapid germination, scarify the soil to ½ inch prior to hydroseeding. Alternatively, grass species can be used as a temporary cover for the wet species.

Because most stormwater wetlands are excavated to deep subsoils, they often lack the nutrients and organic matter needed to support vigorous growth of wetland plants. At these sites, three to six inches of topsoil or wetland mulch should be added to all depth zones in the wetland from one foot below the normal pool to six inches above. Wetland mulch is preferable to topsoil if it is available.

The stormwater wetland should be staked at the onset of the planting season. Depths in the wetland should be measured to the nearest inch to confirm original planting zones. At this time, it may be necessary to modify the pondscaping plan to reflect altered depths or the availability of wetland plant stock. Surveyed planting zones should be marked on an "as-built" or design plan, and located in the field using stakes or flags. The wetland drain should be fully opened at least three days prior to the planting dates (which should coincide with the delivery date for the wetland plant stock).

Wetland mulch is another technique to establish a wetland plant community which utilizes the seedbank of wetland soils to provide the propagules for marsh development. The majority of the seedbank is contained within the upper six inches of the donor wetland soils. The mulch is best collected at the end of the growing season. Best results are obtained when the mulch is spread three to six inches deep over the high marsh and semi-wet zones of the wetland (-6 inches to +6 inches relative to the normal pool).

In some cases, the use of "volunteer wetlands," allowing cattails and phragmites to colonize may be appropriate.

Donor soils for wetland mulch should not be removed from natural wetlands.

5.3.7 *Ownership of Wetlands*

Ownership of stormwater wetlands in residential subdivisions accepted by the City shall be vested in the City of Fort Smith with the filing of the final plat. The Developer shall warrant the operation of the drainage system for 2 years after acceptance by the City by a Maintenance Bond provided by the Developer's Contractor or the Developer. The bond shall be required to be extended until 2 years after all phases of the subdivision or development that substantially drain into the stormwater wetland are completed.

Ownership of stormwater wetlands in commercial, industrial, private subdivisions, and non-residential areas shall be vested in the property owner.

5.3.8 *Maintenance of Wetlands*

Stormwater wetlands shall be required to meet all the maintenance requirements found in Section 5.2.9 *Maintenance of Stormwater Ponds.* In addition, stormwater wetlands shall also be required to meet the criteria below.

5.3.8.1 Minimum Coverage

If a minimum coverage of 50% is not achieved in the planted wetland zones after the second growing season, a reinforcement planting will be required.

5.4 DESIGN CRITERIA – STORMWATER INFILTRATION

Stormwater infiltration practices capture and temporarily store the WQ_v before allowing it to infiltrate into the soil over a two day period. Design variants include:

- Infiltration Trench (Figure 5-14)
- Infiltration Basin (Figure 5-15)

Extraordinary care must be taken to assure that long-term infiltration rates are achieved through post construction inspection and long-term maintenance.

Stormwater infiltration practices may be used in private, commercial, and industrial subdivisions and developments to meet the WQ_v requirement. In certain limited cases, with proper documentation, they may also be used in private, commercial, and industrial subdivisions and developments to meet the detention requirement.

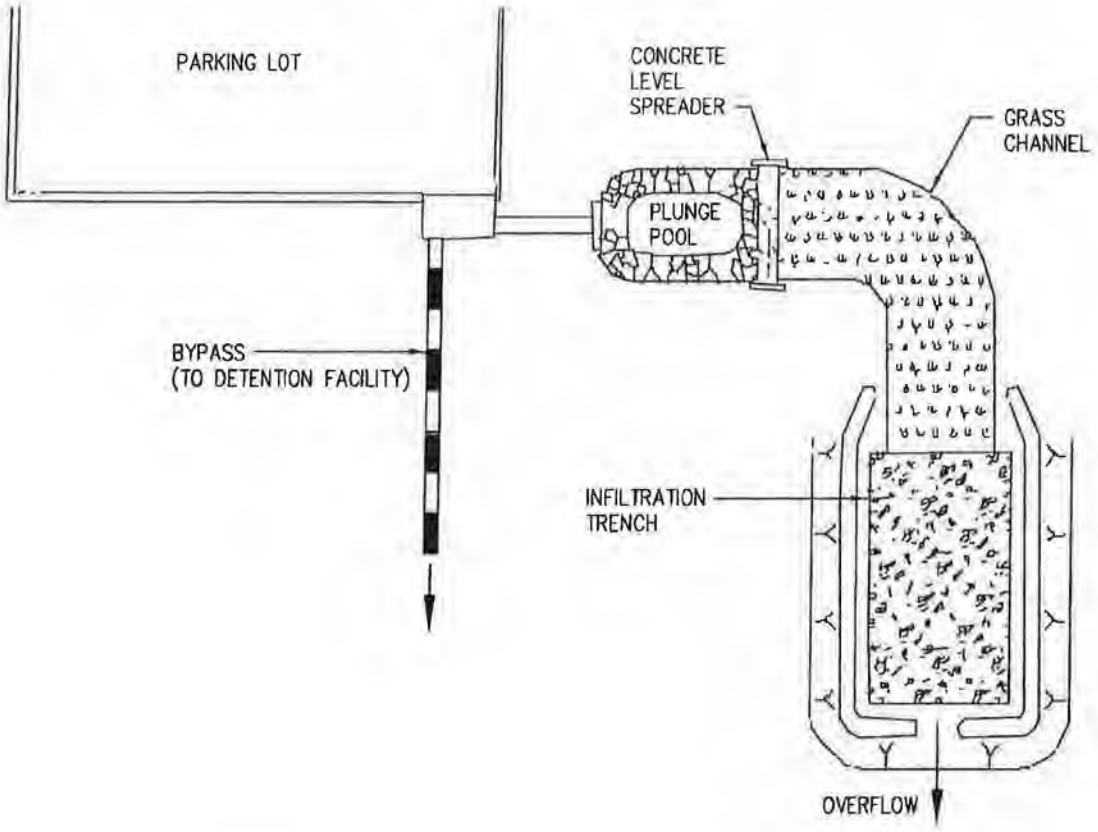
5.4.1 *Feasibility Criteria*

To be suitable for infiltration, underlying soils must have an infiltration rate (f_c) of 0.52 inches per hour or greater, as initially determined from NRCS soil textural classification, and subsequently confirmed by field geotechnical tests. The minimum geotechnical testing is one test hole per 5000 sf, with a minimum of two borings per facility (taken within the proposed limits of the facility).

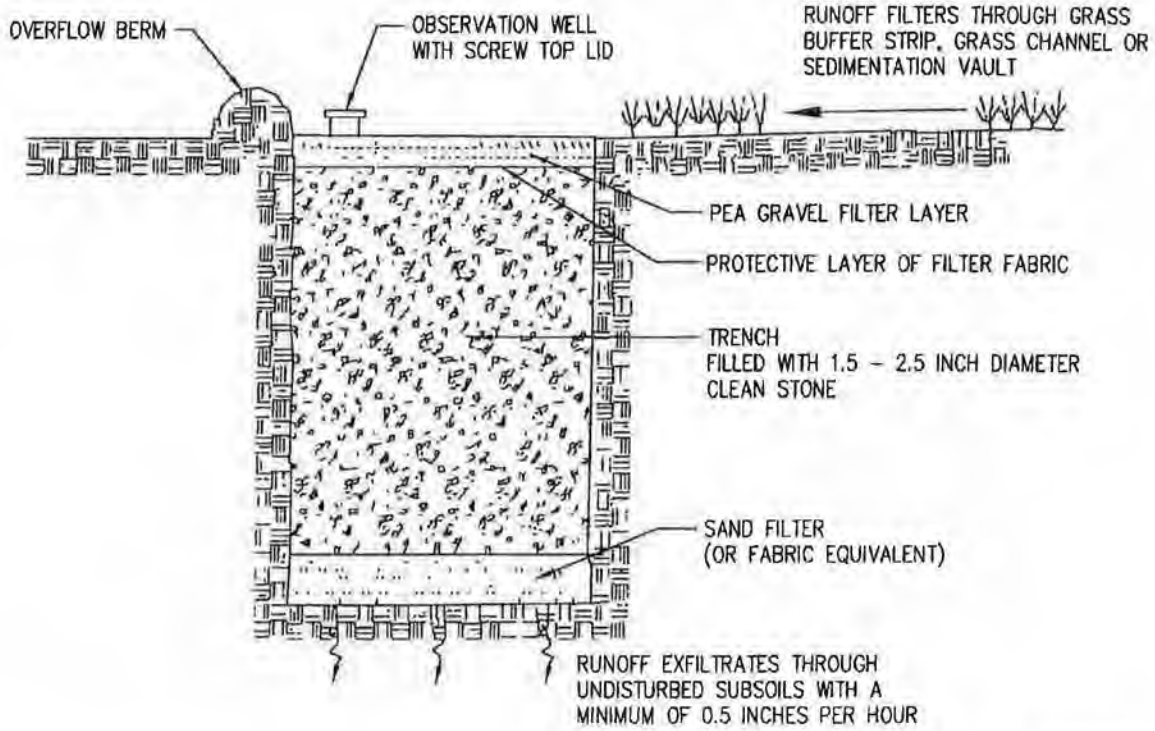
Soils shall also have a clay content of less than 20% and a silt/clay content of less than 40%.

Infiltration cannot be located on slopes greater than 6% or within fill soils.

To protect groundwater from possible contamination, runoff from designated hotspot land uses or activities cannot be infiltrated.

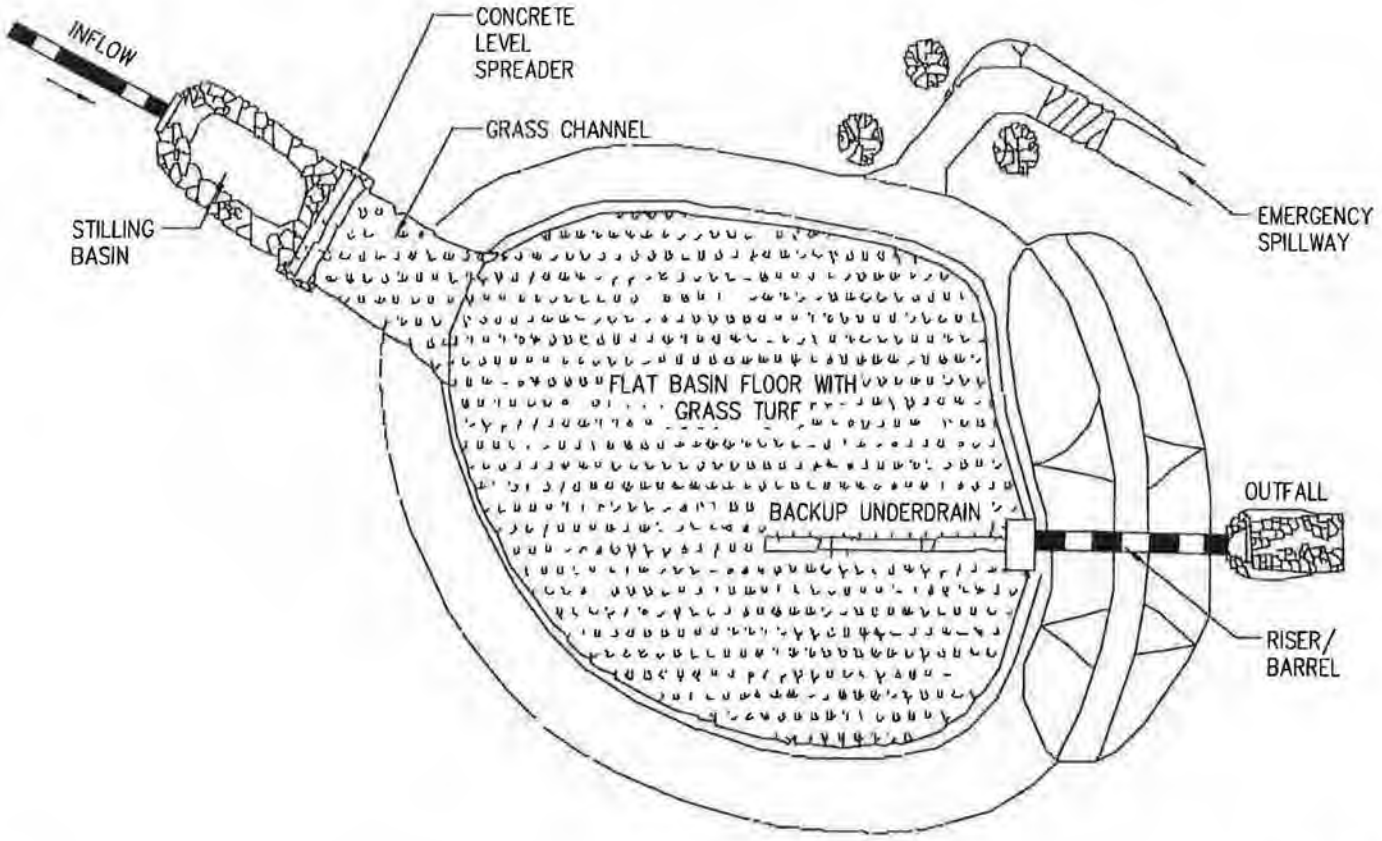


PLAN VIEW

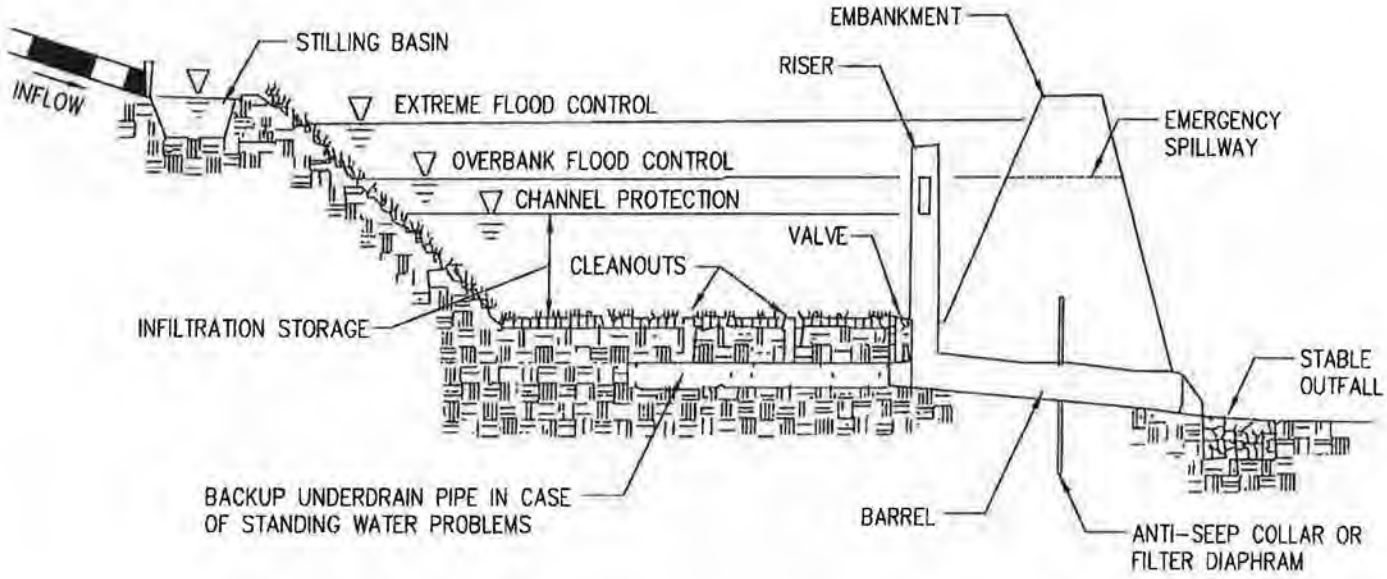


SECTION

FIGURE 5–14. Infiltration Trench



PLAN VIEW



PROFILE

FIGURE 5-15. Infiltration Basin

The bottom of the infiltration facility shall be separated by at least four feet vertically from the seasonally high water table or bedrock layer, as documented by on-site soil testing.

Infiltration facilities can be located at least 100 feet horizontally from any water supply well.

Infiltration practices cannot be placed in locations that cause water problems to downgrade properties. Infiltration facilities must be setback at least 25 feet down-gradient from structures.

The maximum contributing area to an individual infiltration practice shall be less than 5 acres.

5.4.2 *Conveyance Criteria*

The overland flow path of surface runoff exceeding the capacity of the infiltration system can be evaluated to preclude erosive concentrated flow during the overbank events. If computed flow velocities exceed the non-erosive threshold, a overflow channel shall be provided to a stabilized water course.

All infiltration systems should be designed to fully de-water the entire WQ_v within 48 hours after the storm event.

If runoff is delivered by a storm drain pipe or along the main conveyance system, the infiltration practice must be designed as an off-line practice. Pretreatment shall be provided for storm drain pipes systems discharging directly to infiltration systems.

Adequate stormwater outfalls shall be provided for the overflow associated with the ten year design storm event (non-erosive velocities on the down-slope).

5.4.3 *Pretreatment Criteria*

5.4.3.1 Pretreatment Volume

A minimum pretreatment volume of at least 25% of the WQ_v must be provided prior to entry to an infiltration facility, and can be provided in the form of a sedimentation basin, sump pit, grass channel, plunge pool or other measure.

Exit velocities from pretreatment chambers shall be non-erosive (5 fps) during the two year design storm. If the f_c for the underlying soils is greater than 2.00 inches per hour, 50% of the WQ_v shall be treated by another method prior to entry into an infiltration facility.

5.4.3.2 Pretreatment Techniques to Prevent Clogging

Each infiltration system can have redundant methods to protect the long term integrity of the infiltration rate. Three or more of the following techniques must be installed in every facility:

- grass channel

- grass filter strip (minimum 20 feet and only if sheet flow is established and maintained)
- bottom sand layer
- upper filter fabric layer
- use of washed bank run gravel as aggregate

The sides of infiltration practices shall be lined with an acceptable filter fabric that prevents soil piping.

5.4.4 *Treatment Criteria*

Infiltration practices shall be designed to exfiltrate the entire WQ_v through the floor of each practice.

Infiltration practices are best used in conjunction with other practices, and often a stormwater pond is still needed downstream to meet the detention requirement.

A porosity value (V_v/V_t) of 0.32 can be used to design stone reservoirs for infiltration practices.

5.4.5 *Landscaping Criteria*

A dense and vigorous vegetative cover shall be established over the contributing pervious drainage areas before runoff can be accepted into the facility. Infiltration trenches shall not be constructed until all of the contributing drainage area has been completely stabilized.

5.4.6 *Ownership of Stormwater Infiltration*

Ownership of stormwater infiltration practices in commercial, industrial, private subdivisions, and non-residential areas shall be vested in the property owner.

Stormwater infiltration practices may not be used in residential subdivisions.

5.4.7 *Maintenance of Stormwater Infiltration*

The maintenance responsibility for a stormwater infiltration system shall be vested with a responsible party by means of a legally binding and enforceable maintenance agreement that is executed as a condition of plan approval or the permitting process.

Infiltration practices must never serve as a sediment control device during site construction phase. In addition, the Erosion and Sediment Control plan for the site shall clearly indicate how sediment entry will be prevented from entering the infiltration site. Normally, this is done by using diversion berms around the perimeter of the infiltration practice, along with immediate vegetative stabilization and/or mulching.

An observation well shall be installed in every infiltration trench, consisting of an anchored six-inch diameter perforated PVC pipe with a lockable cap installed flush with the ground surface.

Direct access shall be provided to infiltration practices for maintenance and rehabilitation. If a stone reservoir or perforated pipe is used to temporarily store runoff prior to infiltration, the practice shall not be covered by an impermeable surface.

Infiltration designs shall include dewatering methods in the event of failure. This can be accomplished with underdrain pipe systems that accomodate drawdown.

5.5 DESIGN CRITERIA – STORMWATER FILTERING SYSTEMS

Stormwater filtering system capture and temporarily store the WQ_v and pass it through a filter bed of sand, organic matter, soil or other media. Filtered runoff may be collected and returned to the conveyance system, or allowed to partially exfiltrate into the soil. Design variants include:

- Surface Sand Filter (Figure 5-16)
- Underground Sand Filter (Figure 5-17)
- Perimeter Sand Filter (Figure 5-18)
- Organic Filter (Figure 5-19)
- Bioretention (Figure 5-20)

Stormwater filtering systems may be used in private, commercial, and industrial subdivisions and developments to meet the WQ_v requirement. Filtering systems shall not be designed to provide the detention requirement. Filtering practices shall be combined with a separate facility to provide detention.

5.5.1 *Feasibility Criteria*

Most stormwater filters normally require two to six feet of head. The perimeter sand filter (Figure 5-18), however, can be designed to function with as little as one foot of head.

The maximum contributing area to an individual stormwater filtering system shall be less than 10 acres.

Sand and organic filtering systems are generally applied to land uses with a high percentage of impervious surfaces. Sites with imperviousness less than 75% shall require full sedimentation pretreatment techniques.

5.5.2 *Conveyance Criteria*

If runoff is delivered by a storm drain pipe or is along the main conveyance system, the filtering practice shall be designed off-line.

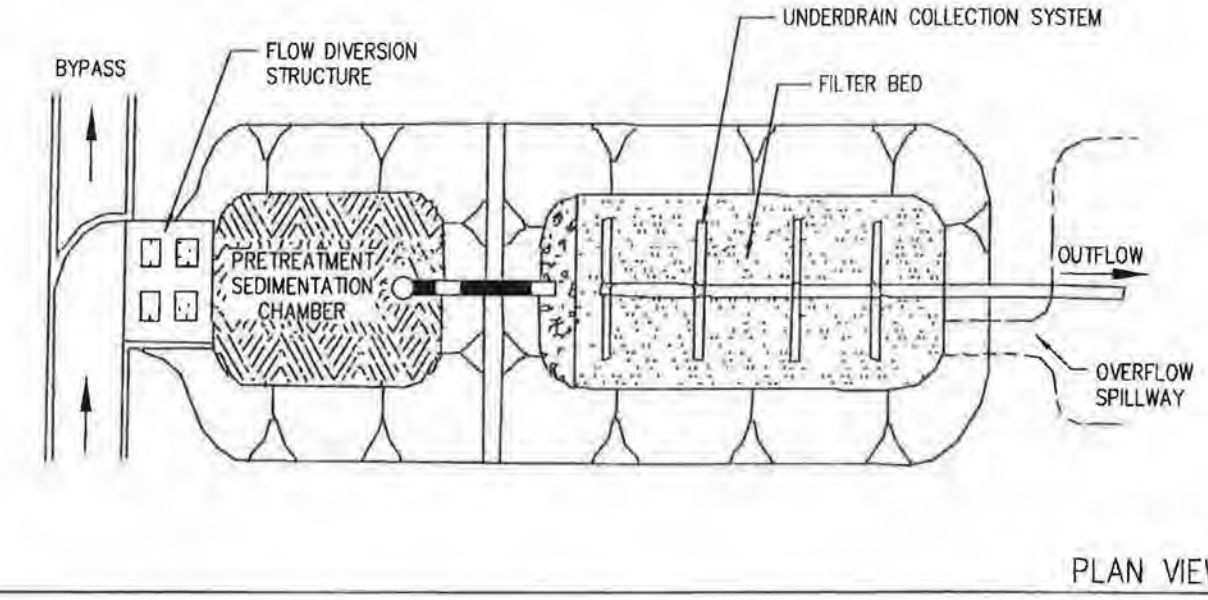
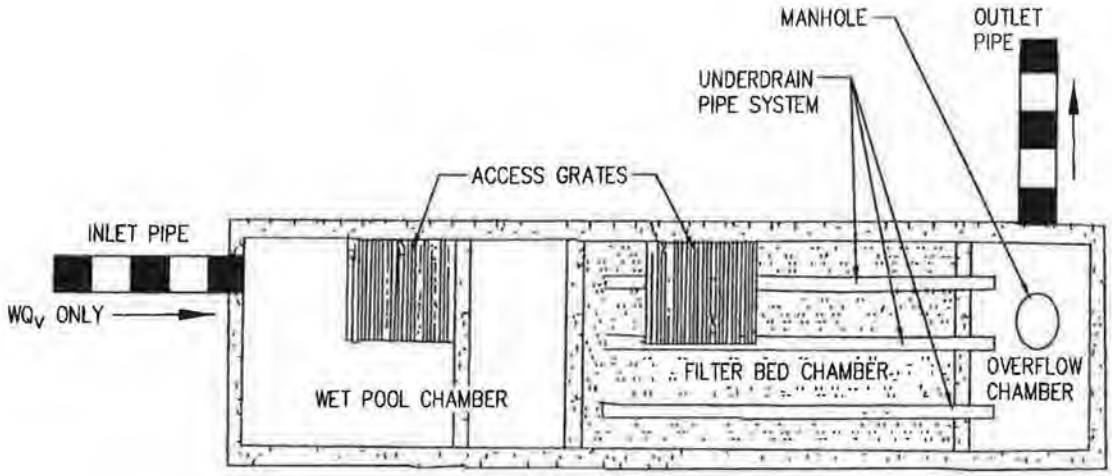
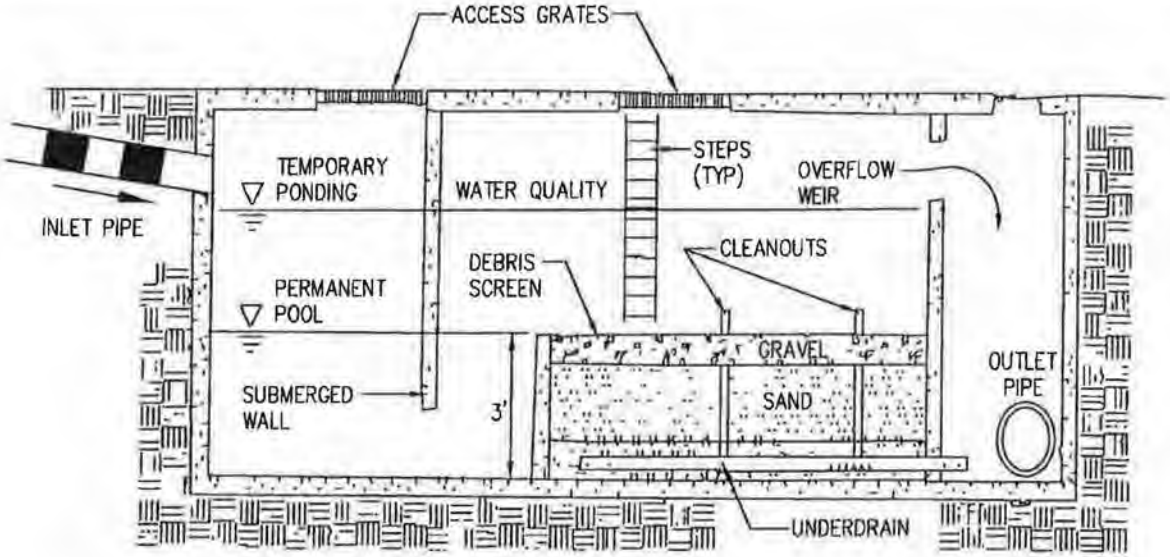
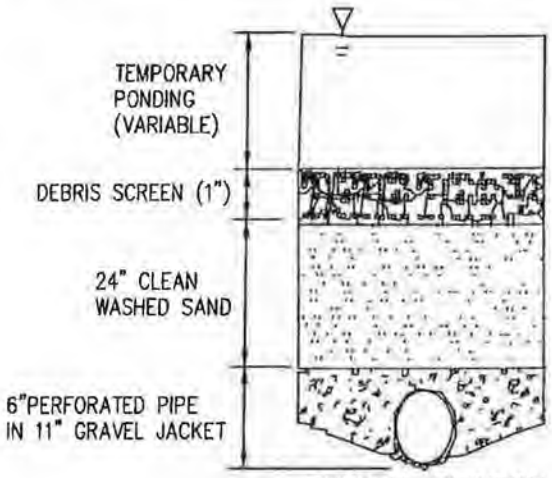


FIGURE 5-16. Surface Sand Filter



PLAN VIEW





TYPICAL SECTION

PROFILE

FIGURE 5-17. Underground Sand Filter

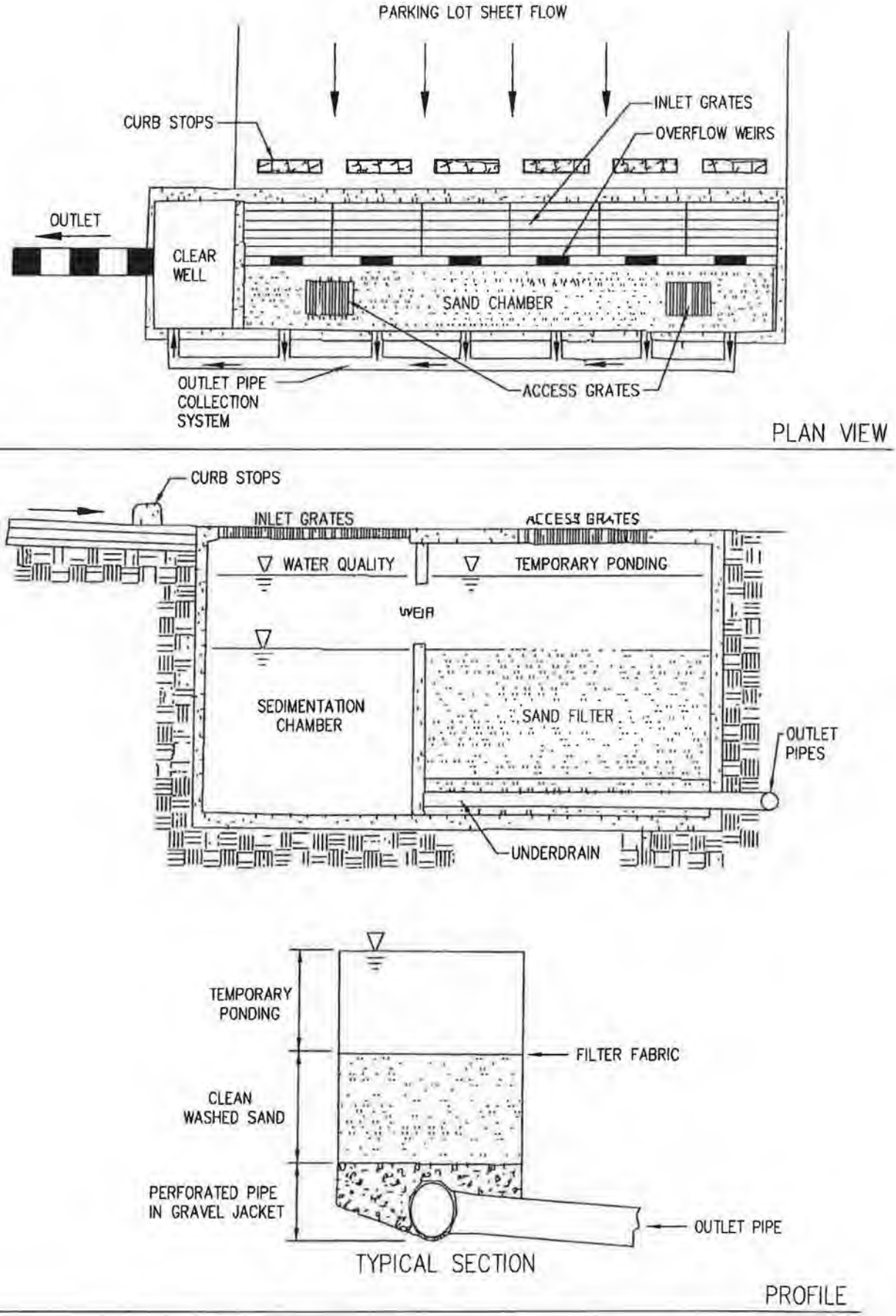
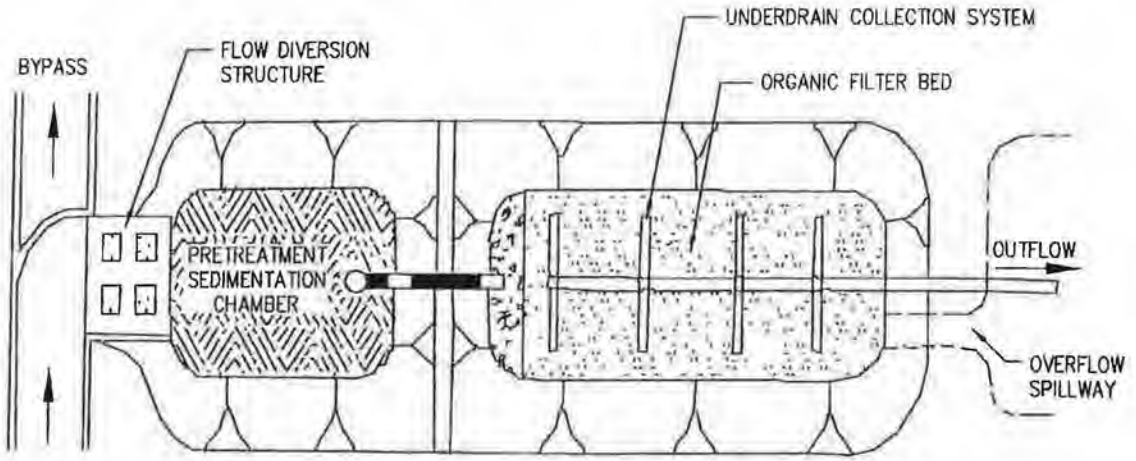
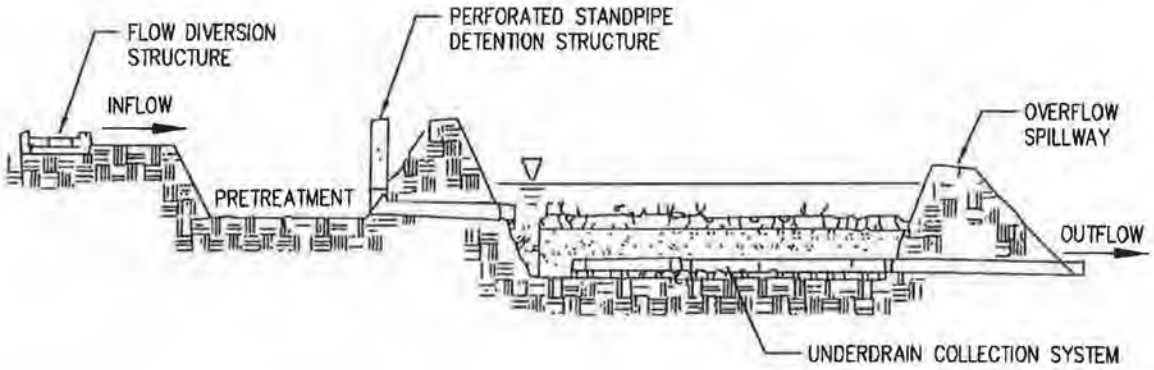
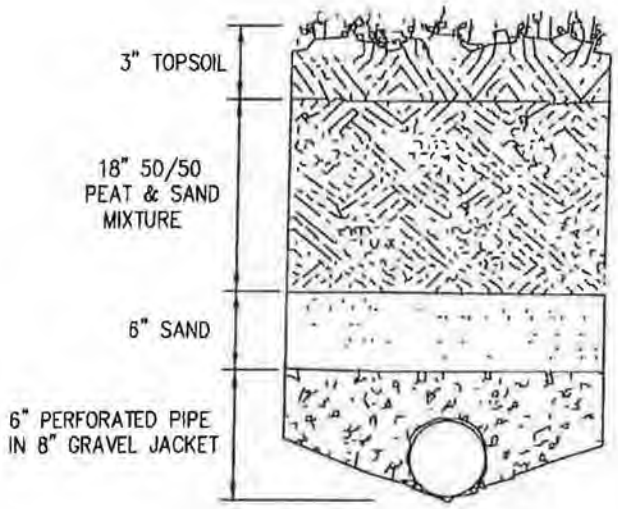


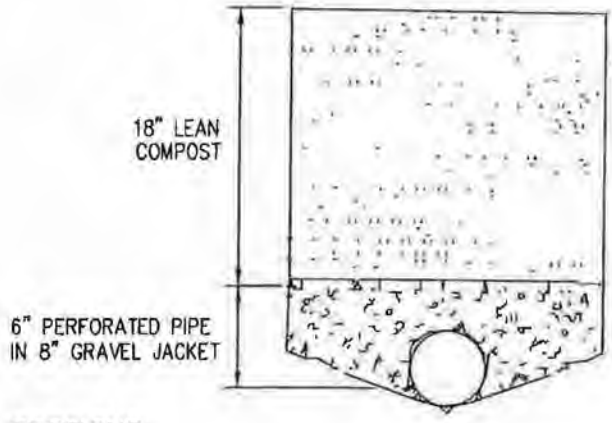
FIGURE 5–18. Perimeter Sand Filter



PLAN VIEW







TYPICAL SECTIONS

PROFILE

FIGURE 5-19. Organic Filter

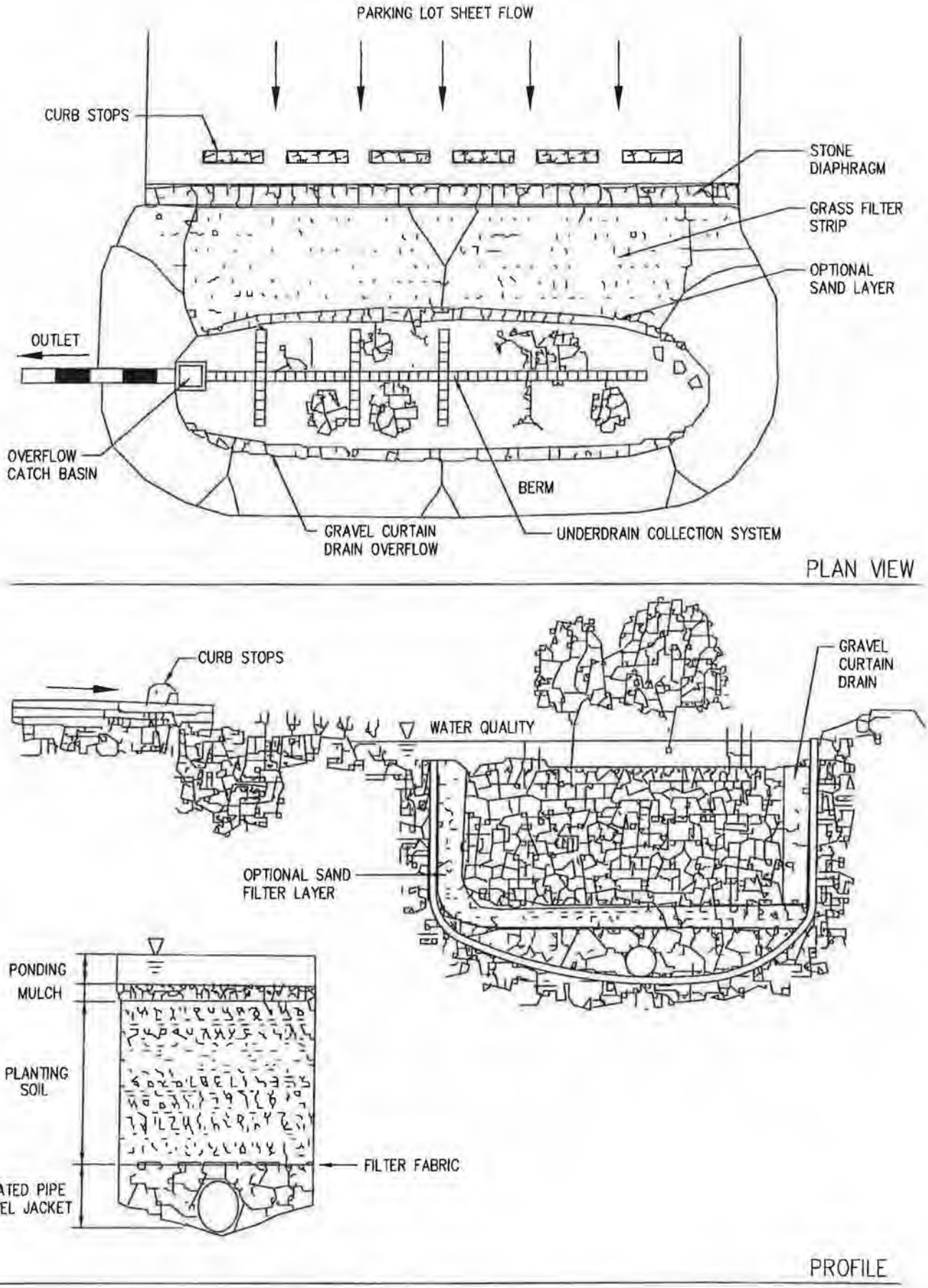


FIGURE 5–20. Bioretention

5.5.3 *Pretreatment Criteria*

Dry or wet pretreatment shall be provided prior to filter media equivalent to at least 25% of the computed WQ_v. The typical method is a sedimentation basin that has a length to width ratio of 2:1. The Camp-Hazen equation is used to compute the required surface area for sand and organic filters requiring full sedimentation for pretreatment *(9)* as follows:

The required sedimentation basin area is computed using the following equation:

$$A_s = (Q_o/W) = Ln\ (1\text{-}E) \qquad (5.9)$$

Where:

A_s = Sedimentation basin surface area (ft^2)
E = sediment trap efficiency (use 90%)
W = particle settling velocity (ft/sec)
use 0.0004 ft/sec for imperviousness (I) 75%
use 0.0033 ft/sec for I > 75%
Q_o = Discharge rate from basin = (WQ_v/24 hr)

Equation reduces to:

$$A_s = (0.066)\ (WQ_v)\ ft^2 \text{ for I } 75\% \qquad (5.10)$$

$$A_s = (0.0081)\ (WQ_v)\ ft^2 \text{ for I} > 75\% \qquad (5.11)$$

Adequate pretreatment for bioretention systems is provided when all of the following are provided: (a) grass filter strip below a level spreader, (b) gravel diaphragm and (c) a mulch layer. In this regard, bioretention systems are fundamentally different from other filtering practices.

5.5.4 *Treatment Criteria*

The entire treatment system (including pretreatment) shall temporarily hold at least 75% of the WQ_v prior to filtration.

The filter media shall consist of a medium sand (meeting ASTM C-33 concrete sand). Media used for organic filters may consist of peat/sand mix or leaf compost. Peat shall be a reed-sedge hemic peat.

The filter bed shall have a minimum depth of 18" with the following exception: The perimeter filter may have a minimum filter bed depth of 12".

The filter area for sand and organic filters shall be sized based on the principles of Darcy's Law. A coefficient of permeability (k) shall be used as follows:

- Sand: 3.5 ft/day *(5)*
- Peat: 2.0 ft/day *(7)*
- Leaf compost: 8.7 ft/day *(6)*
- Bioretention Soil: 0.5 ft/day *(6)*

Bioretention systems shall consist of the following treatment components: A four foot deep planting soil bed, a surface mulch layer, and a 6" deep surface ponding area.

The required filter bed area is computed using the following equation

$$A_f = (WQ_v)\,(d_f) / [\,(k)\,(h_f + d_f)\,(t_f)] \qquad (5.12)$$

Where:

A_f = Surface area of filter bed (ft^2)
d_f = filter bed depth (ft)
k = coefficient of permeability of filter media (ft/day)
h_f = average height of water above filter bed (ft)
t_f = design filter bed drain time (days)
(1.67 days or 40 hours is maximum for sand filters, 48 hours for bioretention)

5.5.5 *Landscaping Criteria*

A dense and vigorous vegetative cover shall be established over the contributing pervious drainage areas before runoff can be accepted into the facility.

Surface filters can have a grass cover to aid in the pollutant adsorption. The grass should be capable of withstanding frequent periods of inundation and drought.

Landscaping is critical to the performance and function of bioretention areas. Therefore, a landscaping plan must be provided for bioretention areas.

Planting recommendations for bioretention facilities are as follows:

- Native plant species should be specified over non-native species.
- Vegetation should be selected based on a specified zone of hydric tolerance.
- A selection of trees with an understory of shrubs and herbaceous materials should be provided.
- Woody vegetation should not be specified at inflow locations.
- Trees should be planted primarily along the perimeter of the facility.

5.5.6 *Ownership of Stormwater Filtering Systems*

Ownership of stormwater filtering systems in commercial, industrial, private subdivisions, and non-residential areas shall be vested in the property owner.

Stormwater filtering systems may not be used in residential subdivisions.

5.5.7 *Maintenance of Stormwater Filtering Systems*

The maintenance responsibility for a stormwater filtering system shall be vested with a responsible party by means of a legally binding and enforceable maintenance agreement that is executed as a condition of plan approval or the permitting process.

Sediment should be cleaned out of the sedimentation chamber when it accumulates to a depth of more than six inches. Vegetation within the sedimentation chamber shall be limited to a height of 18 inches. The sediment chamber outlet devices shall be cleaned/repaired when drawdown times exceed 36 hours. Trash and debris shall be removed as necessary.

Silt/sediment shall be removed from the filter bed when the accumulation exceeds one inch. When the filtering capacity of the filter diminishes substantially (i.e., when water ponds on the surface of the filter bed for more than 48 hours), the top few inches of discolored material shall be removed and shall be replaced with fresh material. The removed sediments should be disposed in an acceptable manner.

A stone drop of at least six inches shall be provided at the inlet of bioretention facilities (Figure 5-19) (pea gravel diaphragm). Areas devoid of mulch should be re-mulched on an annual basis. Dead or diseased plant material shall be replaced.

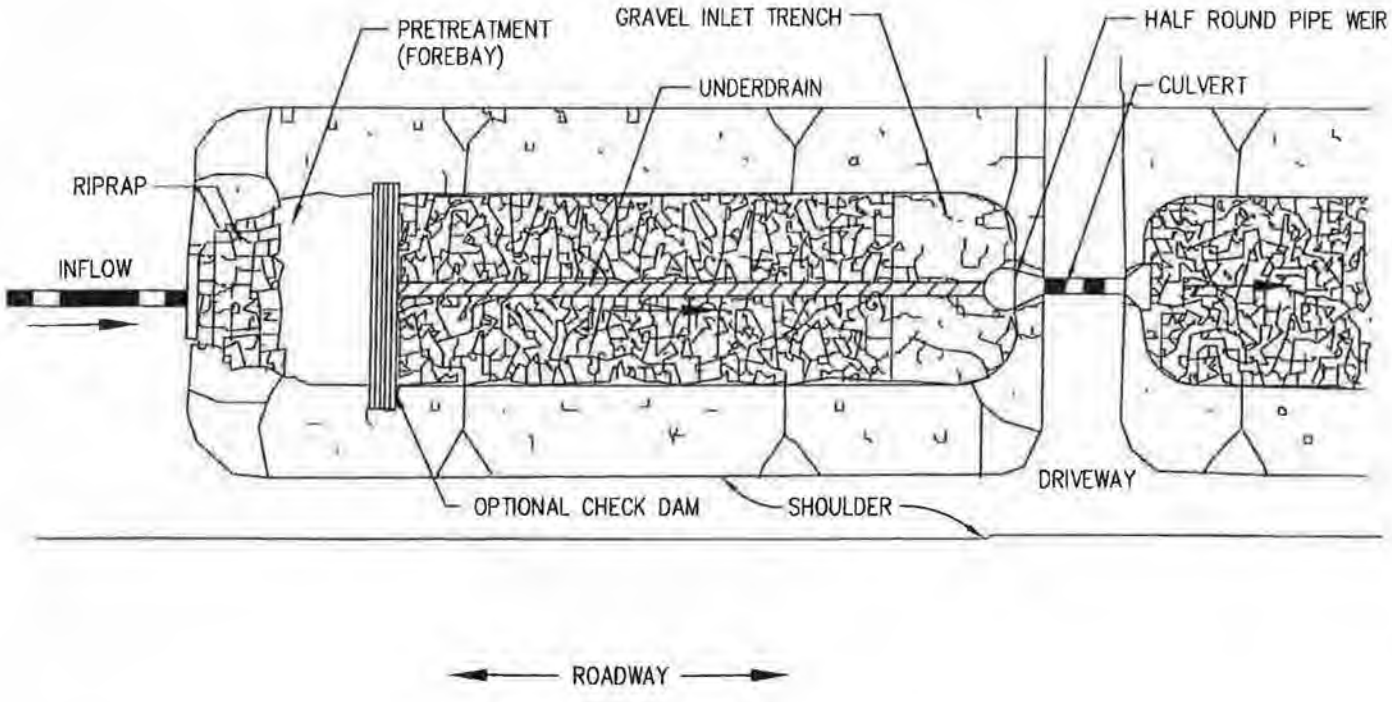
Direct maintenance access shall be provided to the pretreatment area and the filter bed.

5.6 DESIGN CRITERIA – OPEN CHANNEL SYSTEMS

Open channel systems are vegetated open channels that are explicitly designed to capture and treat the full WQ_v within dry or wet cells formed by checkdams or other means. Design variants include:

- Dry Swale (Figure 5-21)
- Wet Swale (Figure 5-22)
- Grass Channels (Figure 5-23)

Dry swales and grass channels may be used in residential, private, commercial, and industrial subdivisions and developments to meet the WQ_v requirement. Wet swales may only be used in private, commercial, and industrial subdivisions and developments. Open channel systems shall not be designed to provide the detention requirement. Open channel systems shall be combined with a separate facility to provide detention.



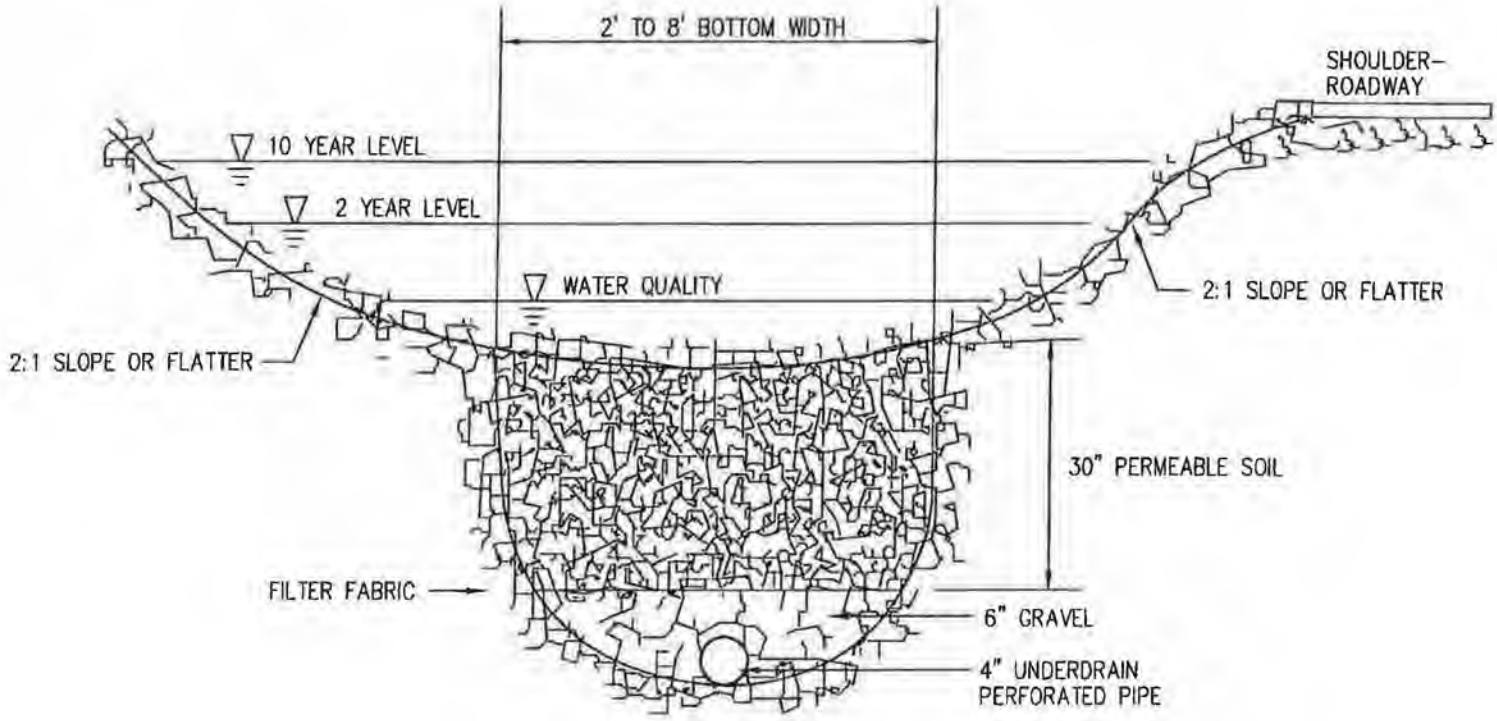
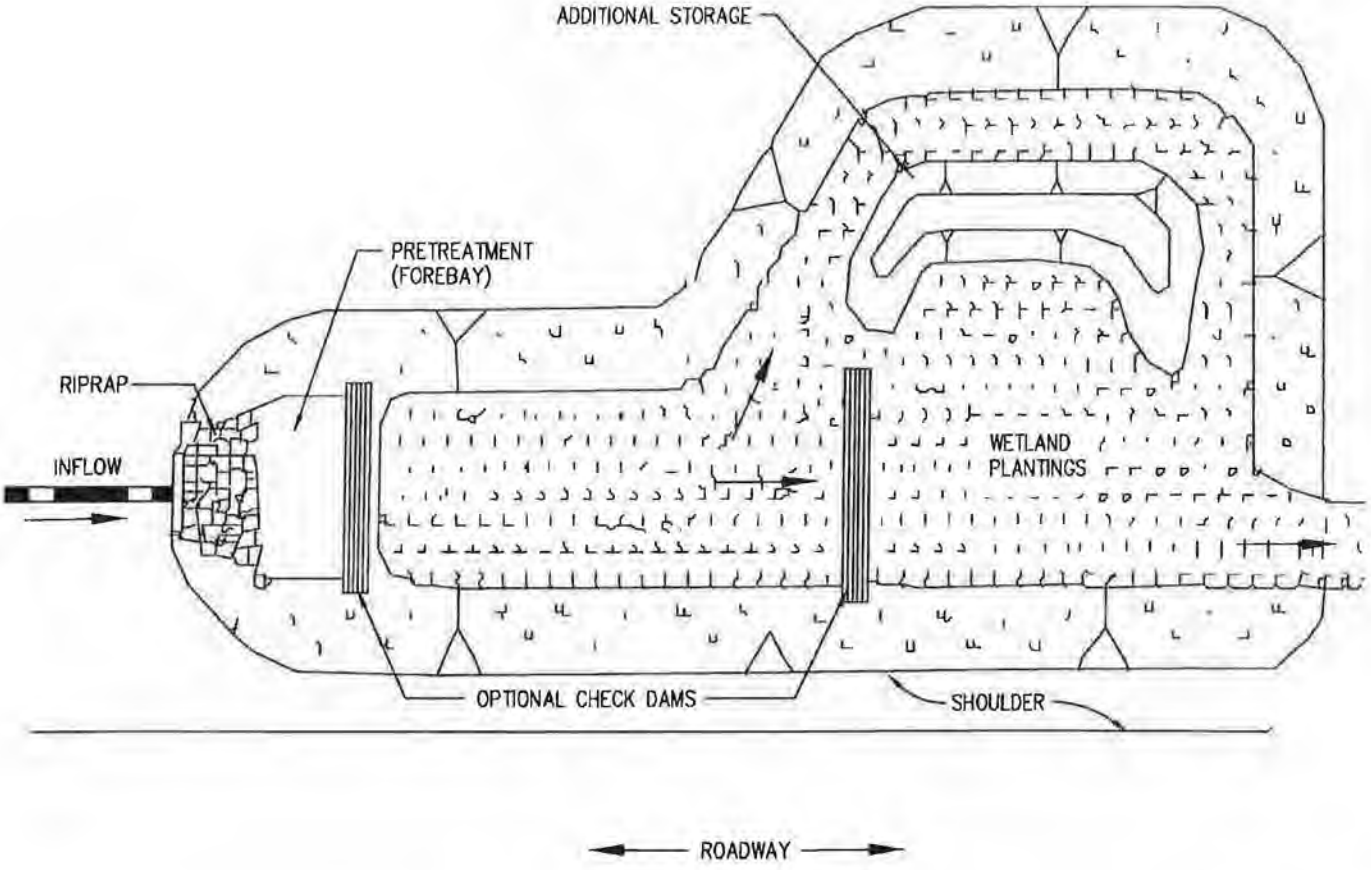


FIGURE 5–21. Dry Swale



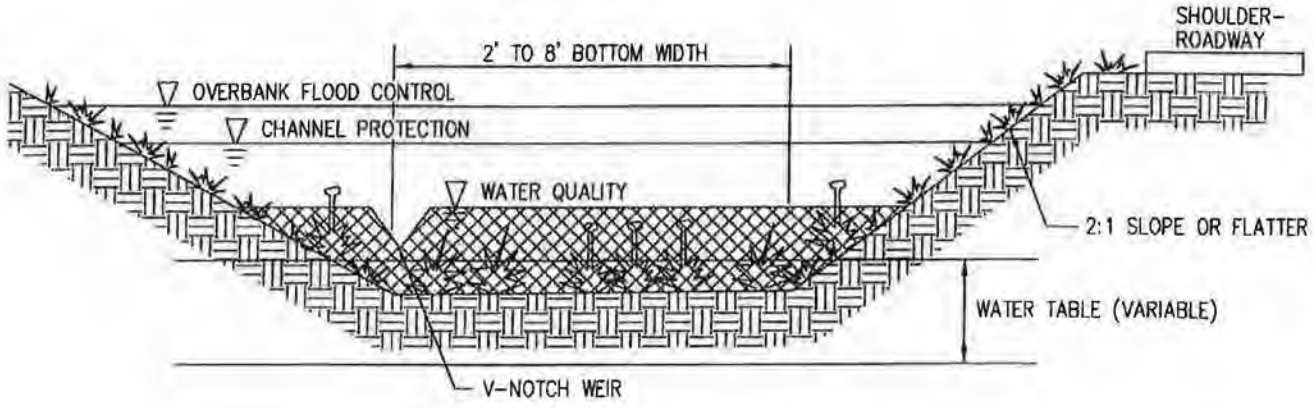
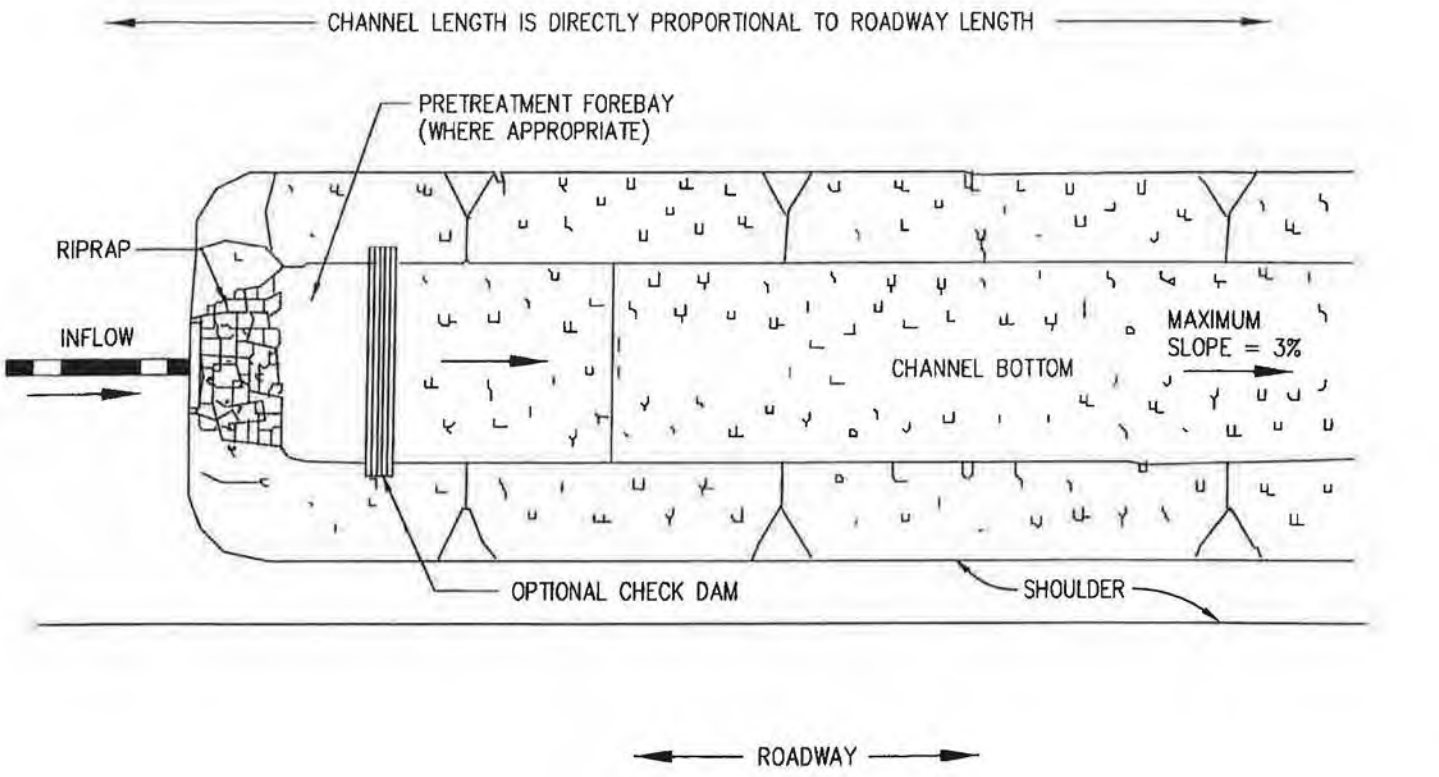
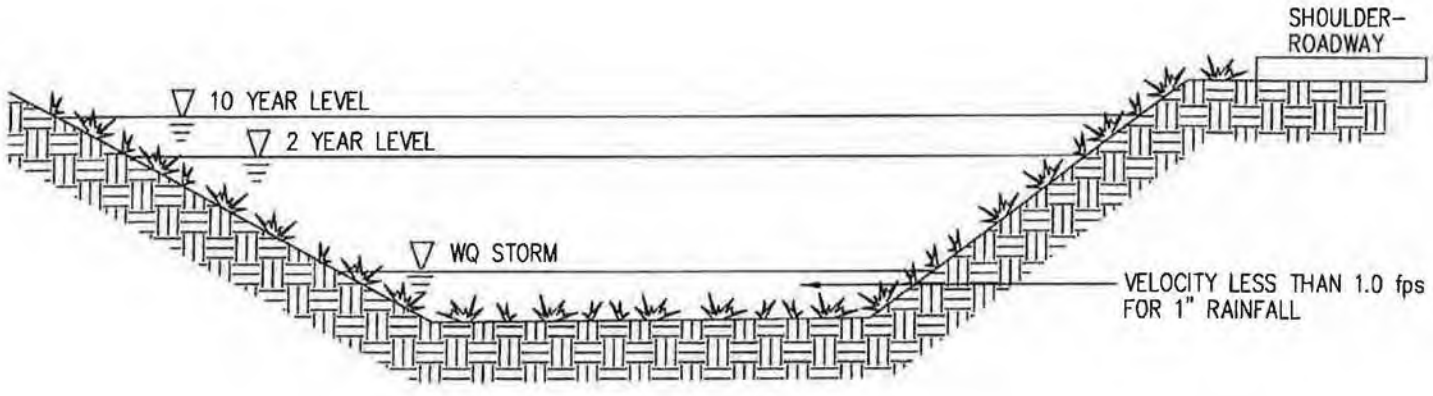


FIGURE 5-22. Wet Swale



PLAN VIEW



SECTION

FIGURE 5-23. Grass Channels

5.6.2 *Conveyance Criteria*

The peak velocity for the 2 year storm must be non-erosive.

Open channels shall be designed to safely convey the ten year storm with a minimum of one (1.0') foot of freeboard.

Channels shall be designed with moderate side slopes for most conditions. Side slopes shall not be steeper than 4:1.

The maximum allowable temporary ponding time within a channel shall be less than 48 hours.

Open channel systems which directly receive runoff from impervious surfaces shall have a 6 inch drop onto a protected shelf (pea gravel diaphragm) to minimize the clogging potential of the inlet.

An underdrain system shall be provided for the dry swale to ensure a maximum ponding time of 48 hours.

5.6.3 *Pretreatment Criteria*

Pretreatment of 0.1 inch of runoff per impervious acre storage shall be provided. This storage is usually obtained by providing checkdams at pipe inlets and/or driveway crossings.

A pea gravel diaphragm and gentle side slopes shall be provided along the top of channels to provide pretreatment for lateral sheet flows.

5.6.4 *Treatment Criteria*

Dry and wet swales should be designed to temporarily store the WQ_v within the facility to be released over a maximum 48 hour duration.

Open channels should have a bottom width no wider than 8 feet to avoid potential gullying and channel braiding.

Dry and wet swales should maintain a maximum ponding depth of one foot at the "mid-point" of the channel, and a maximum depth of 18" at the end point of the channel (for storage of the WQ_v).

Grass channels should be designed to retain the water quality volume in the practice for a minimum of 10 minutes, with no greater than a 1.0 fps velocity.

Please note that the grass channel design is the only practice with a "rate-based" design. The designer determines the peak flow rate from the water quality storm event, and then uses

Manning's equation to ensure that the velocity required to retain flow can be achieved with the channel's cross section and slope.

5.6.5 *Landscaping Criteria*

Wet swales shall not be used for residential developments as they can create potential nuisance or mosquito breeding conditions.

Landscape design shall specify proper grass species and wetland plants based on specific site, soils and hydric conditions present along the channel.

5.6.6 *Ownership of Open Channel Systems*

Ownership of dry swales and grass channels in residential subdivisions accepted by the City shall be vested in the City of Fort Smith with the filing of the final plat. The Developer shall warrant the operation of the drainage system for 2 years after acceptance by the City by a Maintenance Bond provided by the Developer's Contractor or the Developer. The bond shall be required to be extended until 2 years after all phases of the subdivision or development that substantially drain to the dry swale or grass channel are completed.

Ownership of dry swales, grass channels, and wet swales in commercial, industrial, private subdivisions, and non-residential areas shall be vested in the property owner.

Wet swales may not be used in residential subdivisions.

5.6.7 *Maintenance of Open Channel Systems*

When ownership of an open channel system is not vested in the City of Fort Smith, the maintenance responsibility for the system shall be vested with a responsible party by means of a legally binding and enforceable maintenance agreement that is executed as a condition of plan approval or the permitting process.

Open channel systems and grass filter strips should be mowed as required during the growing season to maintain grass heights in the 4 to 6 inches range. Wet swales, employing wetland vegetation, do not require frequent mowing of the channel.

Sediment build-up within the bottom of the channel or filter strip should be removed when 25% of the original WQ_v volume has been exceeded.

5.7 DESIGN CRITERIA – SUBSTANDARD STP'S

Substandard STP's are not considered "stand alone" practices for stormwater treatment, and therefore, the acceptable STP's listed above must be considered first. However, substandard STP's may be used as pretreatment for one of the acceptable STP methodologies listed previously.

Site difficulties may prevent the use of acceptable STP's for treatment, especially with redevelopment projects. When site difficulties prevent the use of the acceptable STP's, combinations of substandard STP's may be utilized to form a "treatment train." This "treatment train" must be able to remove at least 80% of the TSS. Where appropriate, data must be submitted from the manufacturers of substandard STP's documenting the performance capabilities of the structures.

5.7.1 *Dry Extended Detention Ponds*

All of the pond criteria presented in 5.1 GENERAL and 5.2 DESIGN CRITERIA – STORMWATER PONDS also apply to the design of dry extended detention ponds.

5.7.2 *Deep Sump Catch Basins*

The sump shall be no shallower than 24 inches below the invert of the outlet pipe. The deep sump catch basin immediately upstream of the storm drain outfall must also have a hood inside the basin attached to the outlet.

5.7.3 *Other Substandard STP's*

Other substandard STP's shall be designed according to current engineering practice and according to the manufacturers' recommendations, as applicable. All accompanying data and calculations documenting reasonableness of design shall be submitted to the Engineering Department for review and approval.

5.7.4 *Ownership of Substandard STP's*

5.7.4.1 Ownership of Dry Extended Detention Ponds and Deep Sump Catch Basins

Ownership of dry extended detention ponds and deep sump catch basins in residential subdivisions accepted by the City shall be vested in the City of Fort Smith with the filing of the final plat. The Developer shall warrant the operation of the drainage system for 2 years after acceptance by the City by a Maintenance Bond provided by the Developer's Contractor or the Developer. The bond shall be required to be extended until 2 years after all phases of the subdivision or development that substantially drain to the dry extended detention pond or deep sump catch basin are completed.

Ownership of dry extended detention ponds and deep sump catch basins in commercial, industrial, private subdivisions, and non-residential areas shall be vested in the property owner.

5.7.4.2 Ownership of Other Substandard STP's

Public ownership of other substandard STP's within residential subdivisions shall be considered on a "case by case" basis by the Engineering Department. If approved, ownership shall be vested in the City of Fort Smith with the filing of the final plat. The Developer shall warrant the

operation of the drainage system for 2 years after acceptance by the City by a Maintenance Bond provided by the Developer's Contractor or the Developer. The bond shall be required to be extended until 2 years after all phases of the subdivision or development that substantially drain to the STP are completed. If an STP is not approved for public ownership, it may not be used in a residential subdivision.

Ownership of other substandard STP's in commercial, industrial, private subdivisions, and non-residential areas shall be vested in the property owner.

5.7.5 *Maintenance of Substandard STP's*

5.7.5.1 Maintenance of Dry Extended Detention Basins

Dry extended detention basins shall be required to meet all the maintenance requirements found in Section 5.9.4 *Maintenance of Stormwater Ponds.*

5.7.5.2 Maintenance of Other Substandard STP's

When ownership of a substandard STP is not vested in the City of Fort Smith, the maintenance responsibility for the STP shall be vested with a responsible party by means of a legally binding and enforceable maintenance agreement that is executed as a condition of plan approval or the permitting process.

Maintenance requirements for substandard STP's shall be in accordance with manufacturer's recommendations or specifications established by design engineer if the manufacturer's recommendations are unavailable.

5.8 STP SCREENING MATRICES

This section presents matrices that can be used as a screening process for selecting the best STP or group of STPs for a development site. The matrices presented can be used to screen practices in a step-wise fashion. Screening factors include:

- Land Use
- Stormwater Management Capability
- Pollutant Removal

5.8.1 *Land Use*

This matrix (see Figure 5-24) allows the designer to make an initial screen of practices most appropriate for a given land use.

Rural. This column identifies STPs that are best suited to treat runoff in rural or very low density areas.

Residential. This column identifies the best treatment options in medium to high density residential developments.

Roads and Highways. This column identifies the best practices to treat runoff from major roadways and highway systems.

Commercial Development. This column identifies practices that are suitable for new commercial development

Hotspot Land Uses. This last column examines the capability of an STP to treat runoff from designated hotspots. An STP that receives hotspot runoff may have design restrictions, as noted.

Ultra-Urban Sites. This column identifies STPs that work well in the ultra-urban environment, where space is limited and original soils have been disturbed. These STPs are frequently used at redevelopment sites.

5.8.2 *Stormwater Management Capability*

This matrix (see Figure 5-25) examines the capability of each STP option to meet stormwater management criteria. It shows whether an STP can meet requirements for:

Water Quality. The matrix tells whether each practice can be used to provide water quality treatment effectively. For more detail, consult the Pollutant Removal matrix in section 5.8.3.

Recharge. The matrix indicates whether each practice can provide groundwater recharge, however, it should be noted that groundwater recharge is not a requirement.

Channel Protection. The matrix indicates whether the STP can typically provide channel protection storage, however, it should be noted that channel protection is not a requirement.

Quantity Control The matrix shows whether an STP can typically meet the overbank flooding criteria for the site. Again, the finding that a particular STP cannot meet the requirement does not necessarily mean that it should be eliminated from consideration, but rather is a reminder that more than one practice may be needed at a site (e.g., a bioretention area and a downstream stormwater detention pond).

FIGURE 5-24. STP Selection Matrix, Land Use.

STP GROUP	STP DESIGN	Rural	Residential	Roads and Highways	Commercial / High Density	Hotspots	Ultra Urban
Pond	Micropool ED	○	○	○	◗	①	●
	Wet Pond	○	○	○	◗	①	●
	Wet ED Pond	○	○	○	◗	①	●
	Multiple Pond	○	○	◗	◗	①	●
	Pocket Pond	○	◗	○	◗	●	●
Wetland	Shallow Marsh	○	○	◗	◗	①	●
	ED Wetland	○	○	◗	◗	①	●
	Pond/Wetland	○	○	●	◗	①	●
	Pocket Marsh	○	◗	○	◗	●	●
Infiltration	Infiltration Trench	◗	◗	○	○	●	◗
	Shallow T-Basin	◗	◗	◗	◗	●	◗
Filters	Surface Sand	●	◗	○	○	②	○
	Underground SF	●	●	◗	○	○	○
	Perimeter SF	●	●	◗	○	○	○
	Organic SF	●	◗	○	○	②	○
	Pocket Sand Filter	●	◗	○	○	②	○
	Bioretention	◗	◗	○	○	②	○
Open Channels	Dry Swale	○	◗	○	◗	②	◗
	Wet Swale	○	●	○	●	●	●
	Grass Channel	○	◗	○	◗	●	◗

○	Yes. Good option in most cases.
◗	Depends. Suitable under certain conditions, or may be used to treat a portion at the site.
●	No. Seldom or never suitable.
①	Acceptable option, but may require a pond liner to reduce risk of groundwater contamination.
②	Acceptable option, if not designed as an exfilter.

Note: Infiltration practices, filtering practices, and wet swales may not be used in residential subdivsions or developments.

FIGURE 5-25. STP Selection Matrix, Stormwater Management Capability.

STP GROUP	STP DESIGN	WATER QUALITY?	RECHARGE?	CHANNEL PROTECTION?	FLOOD CONTROL?
Pond	Micropool ED	○	●	○	○
	Wet Pond	○	●	○	○
	Wet ED Pond	○	●	○	○
	Multiple Pond	○	●	○	○
	Pocket Pond	○	●	○	○
Wetland	Shallow Marsh	○	●	○	○
	ED Wetland	○	●	○	○
	Pond/Wetland	○	●	○	○
	Pocket Marsh	○	●	○	❷
Infiltration	Infiltration Trench	○	○	❷	❸
	Shallow I-Basin	○	○	❷	❸
Filters	Surface Sand	○	❶	❷	●
	Underground SF	○	●	●	●
	Perimeter SF	○	●	●	●
	Organic SF	○	❶	●	●
	Pocket Sand Filter	○	❶	●	●
	Bioretention	○	❶	❷	●
Open Channels	Dry Swale	○	❶	●	●
	Wet Swale	○	●	●	●
	Grass Channel	❷	❷	●	●

○	Practice generally meets this stormwater management goal.
●	Practice can almost never be used to meet this goal.
❶	Provides recharge only if designed as an exfilter system.
❷	Practice may partially meet this goal, or under specific site and design conditions.
❸	Can be used to meet flood control in rare conditions, with very cobbly or highly infiltrative soils.

Note: Only stormwater ponds and wetlands may be used in residential subdivisions or developments for flood control. Only stormwater ponds, wetlands, dry swales, and grass channels may be used in residential subdivisions or developments for water quality.

5.8.3 *Pollutant Removal*

This matrix (see Table 5-2) examines the capability of each STP option to remove specific pollutants from stormwater runoff. The matrix includes data for:

- Total Suspended Solids
- Total Phosphorous
- Total Nitrogen
- Metals
- Bacteria

TABLE 5-2. STP Selection Matrix, Pollutant Removal Efficiencies.

STP Selection Matrix. Pollutant Removal (Acceptable STP's)					
STP Group	**TSS**	**TP**	**TN**	**Metals[1]**	**Bacteria**
Ponds	80	51	33	62	70
Wetlands	76	49	30	42	78[2]
Filters[3]	86	59	38	69	37[2]
Infiltration	95[2]	70	51	99[2]	N/A
Open Channels[4]	81	34[2]	84[2,5]	61	-25[2]
(Sub-Standard STP's)					
STP Group	**TSS**	**TP**	**TN**	**Metals[1]**	**Bacteria**
Dry Extended Detention Ponds	61	19	31	26-54	N/A
Deep Sump Catch Basins	32	N/A	N/A	N/A	N/A
Water Quality Inlets[7]	35	5	20	5	N/A
Hydrodynamic Structures[7]	21	17	5[6]	17	N/A
Filter Strips (75 ft width)	54	-25	-27[6]	47	N/A
Filter Strips (150 ft width)	84	40	20[6]	55	N/A

1: Average of zinc and copper. Zinc only for infiltration and sub-standard STP's.
2: Based on fewer than five data points.
3: Excludes vertical sand filters and filter strips.
4: Highest removal rates for dry swales

5: No data available for grass channels 6: Nitrate + Nitrite 7: Percentages will vary. Refer to manufacturer for specific removal percentages. N/A: Not applicable. Data not available

5.9 STORMWATER CREDITS

The purpose of the stormwater credit system is to provide incentive to developers, engineers, and builders to implement better site design and locate new development in a manner that causes less impact to aquatic resources. By taking advantage of the credit system, developers and builders can reduce the stormwater management quality requirements. The credit system directly translates into cost savings to the developer by reducing the water quality volume that has to be captured and treated.

This section presents two broad types of credits: Site Design Credits and Watershed Credits. Site design credits act as incentives to encourage *Better Site Design* techniques by reducing required water quality volumes on site. Watershed credits are reductions or exemptions from stormwater management requirements to support watershed goals such as redevelopment or watershed zoning.

5.9.1 *Site Design Credits*

Site design credits allow developers to reduce or eliminate requirements for *Water Quality* in exchange for implementation of these non-structural site design elements. The credits are calculated as volumes that are based on the fraction of the total site area or site impervious area affected by the credit.

Specific design credits detailed in this section include the following:

- Conservation of Natural Areas
- Reforestation
- Rooftop Disconnection
- Non-Rooftop Disconnection
- Green Rooftops

5.9.1.1 Conservation of Natural Areas

This stormwater credit rewards protection of natural vegetation or critical resource areas on site. This credit may be given when natural areas are conserved at development sites, thereby retaining their pre development hydrologic and water quality characteristics. Examples of natural area conservation areas include:

- forest retention areas
- jurisdictional wetlands

- other lands in protective easement (floodplains, open space, steep slopes)

Under the credit, a designer can subtract conservation areas from total site area when computing the water quality volume.

The credit for the water quality volume can be based on the site area in natural conservation, such that:

$$C_{WQ} = (A_{NA}/A)(WQ_v) \quad (5.13)$$

Where:

C_{WQ} = Natural Area Credit for Water Quality (ac-ft)
A_{NA} = Natural Conservation Area (acres)
A = Total Site Area (acres)
WQ_v = Original Water Quality Volume (ac-ft)

The water quality volume can then be reduced by the value of C_{WQ}. The example in Figure 5-26 illustrates how this credit would be applied.

5.9.1.2 Reforestation

This credit is similar to the credit for *Conservation of Natural Areas*, except that it rewards active reforestation, rather than preservation of existing forest. This credit can apply to both *reforestation* and *afforestation*. The credit for afforestation shall be weighted higher because the afforestation implies a net increase of forest cover on the site, while reforestation only compensates for trees cleared on site.

A reforestation credit shall be applied where tree planting is used to supplement existing tree cover, or to compensate for forest cleared during development. The areas in reforestation and afforestation can be applied to water quality volumes.

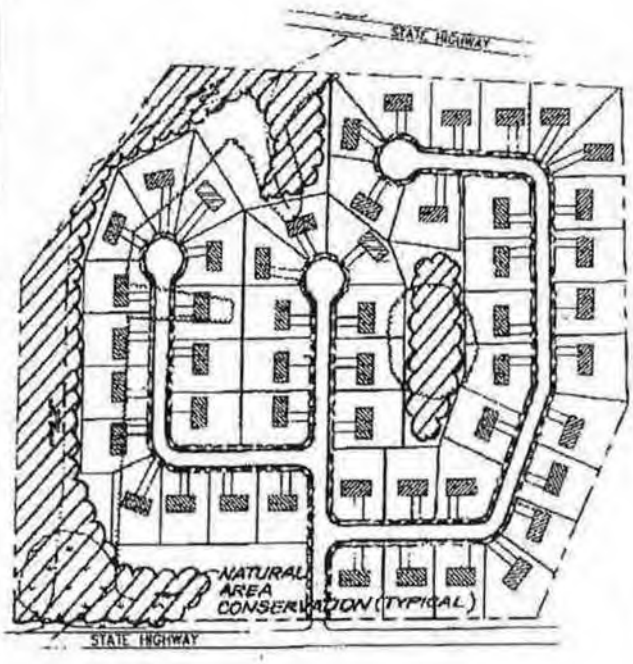
In order to receive credit, the following criteria must be met:

- Tree species used for afforestation or reforestation shall be native to the City of Fort Smith, and selected from a list of approved species established by the Parks Department.
- Reforestation shall be guaranteed with a performance bond, letter of credit, or similar surety measure. The bond shall be returned after two successful growing seasons.
- Plantings shall be from nursery stock, at a minimum of 1.5" diameter at chest height.

Natural Area Conservation Credit Example

Site Data: 51 Single Family Lots
Area = 38 ac
Conservation Area = 7.0 ac

Original WQ_v = 1.08 ac-ft



Computation of Stormwater Credits

C_{WQ} = (7.0 / 38)(1.08 ac-ft) = 0.20 ac-ft

WQ_v = 1.08 ac-ft – 0.20 ac-ft = 0.88 ac-ft

FIGURE 5-26. Example, Natural Area Conservation Credit.

The credit for the water quality volume can be expressed based on the area in reforestation and afforestation, such that:

$$C_{WQ} = (1.5A_A+0.5A_R)/A)(WQ_v) \quad (5.14)$$

Where:

C_{WQ} = Reforestation Credit for Water Quality (ac-ft)
A_A = Afforestation Area (acres)
A_R = Reforestation Area (acres)
A = Total Site Area (acres)
WQ_v = Original Water Quality Volume (ac-ft)

The water quality volume can then be reduced by the value of C_{WQ}. The example in Figure 5-27 illustrates how this credit would be applied.

5.9.1.3 Rooftop Disconnection

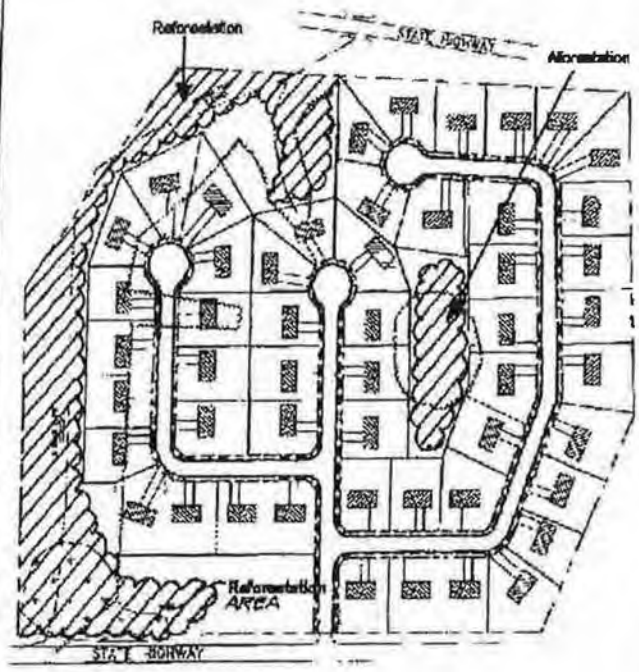
This credit can be applied to encourage disconnection of rooftops, thus promoting overland treatment of these surfaces. Credits can be applied to water quality requirements. In order to receive the credit, disconnections must meet the following criteria:

- The rooftop cannot be a designated hotspot.
- Disconnection must ensure no basement seepage.
- The contributing length of rooftop to a discharge location shall be 75 feet or less.
- The rooftop contributing area shall be no more than 1,000 sq. feet per disconnection.
- The length of the "disconnection" shall be equal to or greater than the contributing rooftop length.
- Disconnections will only be credited for residential lot sizes greater than 6000 sq. ft.
- The entire vegetative "disconnection" shall be on a slope less than or equal to 3.0%.
- The disconnection must drain continuously through a vegetated channel, swale, or through a filter strip to the property line or STP.
- Downspouts must be at least 10 feet away from the nearest impervious surface to discourage "re-connections."
- Disconnections are encouraged on relatively permeable soils (HSGs A and B) without soil testing.
- In less permeable soils (HSGs C and D), the water table and permeability shall be tested by a geotechnical engineer to determine if a spreading device is needed to provide sheetflow over grass surfaces. In some cases, dry wells, french drains or other temporary underground storage devices may be needed to compensate for a poor infiltration capability.
- For those rooftops draining directly to a stream buffer, one can only use either the rooftop disconnection credit or the stream buffer credit, not both.

Reforestation Credit Example

Site Data: 51 Single Family Lots
Area = 38 ac
Reforestation Area = 5.0 ac
Afforestation Area = 2.0 ac
Impervious Area = 13.8 ac

Original WQ_v = 1.08 ac-ft



Computation of Stormwater Credits

C_{WQ} = [((1.5 x 2.0 ac) + (0.5 x 5.0 ac)) / 38ac] x 1.08 ac-ft = 0.16 ac-ft

WQ_v = 1.08 ac-ft – 0.16 ac-ft = 0.92 ac-ft

FIGURE 5-27. Example, Reforestation Credit.

The water quality credit can be calculated with the following equation:

$$C = (A_{DR}/A_I)WQ_v \quad (5.15)$$

Where:

C = Rooftop Disconnection Credit (ac-ft)
A_{DR} = Disconnected Roof Area (acres)
A_I = Site Impervious Area (acres)
WQ_v = Original Water Quality Volume.

The water quality volume would both be reduced by the credit (C). The example in Figure 5-28 illustrates how this credit would be applied.

FIGURE 5-28. Example, Rooftop Disconnection Credit.

Rooftop Disconnection Credit Example

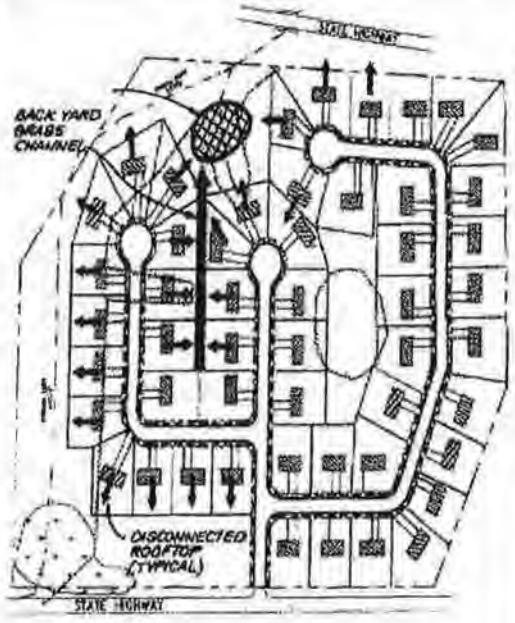
Site Data: 51 Single Family Lots
Area = 38 ac
Original Impervious Area = 13.80 ac

# of Disconnected Rooftops = 22
Original WQ_v = 1.08 ac-ft

22 Lots Disconnected
(2500 sq ft each)

Net impervious area reduction

(22)(2500) / (43560) = 1.3 ac



Computation of Stormwater Credits

C = (1.3 / 13.8)(1.08 ac-ft) = 0.10 ac-ft

WQ_v = 1.08 ac-ft – 0.10 ac-ft = 0.98 ac-ft

5.9.1.4 Non-Rooftop Disconnection

This credit is applied to credit disconnection of other impervious surfaces by encouraging drainage to overland treatment such as swales or filter strips. In order to receive the credit, disconnections must meet the following criteria:

- The maximum contributing impervious flow path length shall be 75 feet.
- Runoff cannot come from a designated hotspot.
- The disconnection must drain continuously through a vegetated channel, swale, or filter strip to the property line or STP.
- The length of the "disconnection" must be equal to or greater than the contributing length.
- The entire vegetative "disconnection" shall be on a slope less than or equal to 3.0%.
- The surface imperviousness area to any one discharge location cannot exceed 1,000 ft^2.
- Disconnections discharging over relatively permeable soils (HSGs A and B) do not require geotechnical testing.
- If the site has less impermeable soils (HSGs C and D), testing by a geotechnical engineer is needed to determine if a spreading device, such as a french drain, gravel trench or other temporary storage device is needed to compensate for poor infiltration capability.

The water quality credit can be calculated with the following equation:

$$C = (A_D/A_I)WQ_v \quad (5.16)$$

Where:

C = Non-Rooftop Credit (ac-ft)
A_D = Disconnected Impervious Area (acres)
A = Total site area (acres)
A_I = Site Impervious Area (acres)
WQ_v = Original Water Quality Volume.

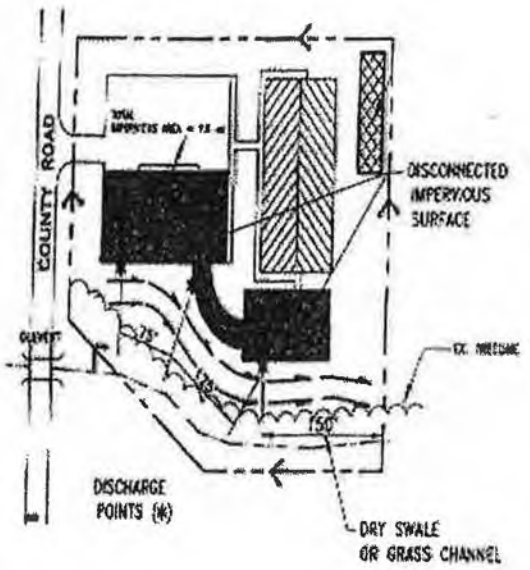
The water quality volume can then be reduced by the credit (C). The example in Figure 5-29 how this credit would be applied.

Non-Rooftop Disconnection Credit Example

Site Data: Community Center
Area = 3.0 ac
Original Impervious
Area = 1.9 ac = 63.3%

Original $WQ_v = 6,752\ ft^3$

0.8 ac of surface
imperviousness disconnected



Computation of Stormwater Credits

$C = (0.8 / 1.9)(6,752\ ft^3) = 2,843\ ft^3$

$WQ_v = 6,752\ ft^3 - 2,843\ ft^3 = 3,909\ ft^3$

FIGURE 5-29. Example, Non-Rooftop Disconnection Credit.

5.9.1.5 Green Rooftop Credit

The term "green rooftops" refers to a few practices that detain and treat stormwater runoff on rooftops using vegetation on the roof surface. Several different options exist, including variations on the type of vegetation used, and the specific design of the green roof. The criteria presented below are adapted from the Portland Stormwater Manual criteria for the Eco-Roof. In order to receive the credit, green rooftops must meet the following criteria:

- The system shall include a 6" soil bed, with a silt loam texture.
- The soil bed shall be underlain with a 2" gravel layer, and these two layers shall be separated by a layer of filter fabric.
- An impermeable layer shall be placed between the rooftop and the gravel layer.
- The roof shall have a maximum slope of 25%
- The roof shall be designed to hold an additional 25 lbs/sf, beyond minimum regional design criteria
- Vegetation shall be established within two growing seasons.
- Vegetation should require minimal fertilization, watering and pesticides.
- A 2" mulch layer shall be immediately placed above the soil layer to prevent erosion.
- The vegetation and mulch layer shall be maintained at least quarterly, removing dead vegetation and eroded mulch.
- If the rooftop is used as an amenity (e.g., a rooftop sitting area) as well as to detain stormwater, credit shall only be applied to pervious sections of the rooftop.
- The credit shall only apply for businesses where owners sign a maintenance agreement.

The water quality credit can be calculated with the following equation:

$$C = (A_{GR}/A_I)WQ_v \quad (5.17)$$

Where:

C = Green Rooftop Credit (ac-ft)
A_{GR} = Green Rooftops (acres)
A_I = Site Impervious Area (acres)
WQ_v = Original Water Quality Volume (ac-ft)

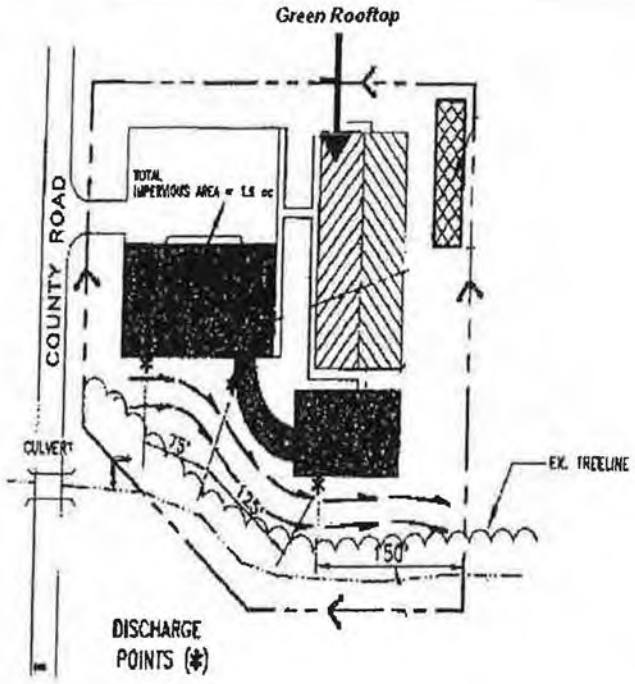
The water quality volume is then reduced by the credit, C. The example in Figure 5-30 illustrates how this credit would be applied.

Green Rooftop Credit Example

Site Data: Community Center
Area = 3.0 ac
Original Impervious
Area = 1.9 ac = 63.3%

Original $WQ_v = 6{,}752\ ft^3$

0.5 ac of green rooftops



Computation of Stormwater Credits

$C = (0.5 / 1.9)(6{,}752\ ft^3) = 1{,}777\ ft^3$

$WQ_v = 6{,}752\ ft^3 - 1{,}777\ ft^3 = 4{,}975\ ft^3$

FIGURE 5-30. Example, Green Rooftop Credit.

5.9.2 *Watershed Credits*

Watershed credits focus on the location of the development, rather than on the design of the site. They reward developers who locate in areas that result in less impact to water resources by encouraging development in already urbanized or highly degraded areas. Three watershed credits are presented in this section:

- Watershed Zoning
- Infill
- Redevelopment

5.9.2.1 Watershed Zoning

This credit reduces stormwater management requirements in developments that support a strategy of *watershed zoning* by locating in subwatersheds that are designated as *non-supporting*. A watershed Zoning Credit can be awarded to developments that meet the following criteria:

- Must be located in a subwatershed with greater than 25% impervious cover
- Shall not contribute more than 5% impervious cover to the subwatershed, or to the drainage of any 2nd order or larger stream.

The water quality credit received is a function of the impervious cover fraction in the subwatershed, times the water quality volume. This credit will not be given if the development is located in a watershed that discharges directly to a stream with a published Total Maximum Daily Load (TMDL). Furthermore, this credit will not be given if it is found that the development will impact a relatively high quality reach within the subwatershed.

5.9.2.2 Infill Credit

The infill credit acts as an incentive for developing infill lots, as opposed to greenfields away from existing development. Infill development results in lower infrastructure costs, fewer miles driven, and a net reduction in impervious cover creation when compared with greenfield development.

An infill credit can be applied to all sites that are built within the current sewer envelope, and are smaller than 5 acres for residential development, and 2 acres for commercial or industrial uses. Sites that meet these criteria can receive a 20% water quality credit. This credit will not be given if the development is located in a watershed that discharges directly to a stream with a published TMDL. Furthermore, this credit will not be given if it is found that the development will impact a relatively high quality reach within the subwatershed.

5.9.2.3 Redevelopment Credit

The redevelopment credit encourages development on sites that have previous commercial, industrial, or residential land use. The credit allows reduction in required treatment and

management volumes, depending on the existing conditions at the site. For redevelopment projects, treatment is only required for the additional stormwater generated on site.

The redevelopment credit may be awarded for all redevelopment sites. The water quality credit is based on pre-developed impervious cover. The credit can be expressed as:

$C = I_P WQ_v$
Where:
C = Credit (ac-ft)
I_P = Pre-Developed Impervious Cover

This credit can then be subtracted from the water quality volume.

Redevelopment Credit Example
Consider a site with a pre-developed impervious cover of 25% and a water quality volume of 10,000 ft^3.
Redevelopment Credit Calculation $C = (10{,}000\ ft^3)(25\%) = 2{,}500\ ft^3$ $WQ_v = 10{,}000\ ft^3 - 2{,}500\ ft^3 = 7{,}500\ ft^3$

It should be noted that stormwater treatment is not required for redevelopment projects less than one acre in size or projects where the impervious area will not be increased.

5.10 REFERENCES

(1) American Public Works Association, Kansas City Metropolitan Chapter. *Division V, Construction and Material Specifications, Section 5600 Storm Drainage Systems and Facilities*, February 2006.

(2) Arkansas Soil and Water Conservation Commission. *Title VII, Rules Governing Design and Operation of Dams*. October 1993.

(3) Brater, E. F. and H. W. King. *Handbook of Hydraulics*. 6th edition. McGraw Hill Book Company, New York, NY, 1976.

(4) Chow, V. T. *Open Channel Hydraulics*. McGraw Hill Book Company, New York, 1959.

(5) City of Austin, TX. 1988. Water Quality Management. Environmental Criteria Manual. Environmental and Conservation Services. Austin, TX.

(6) Claytor, R.A., and T.R. Schueler. 1996. Design of Stormwater Filtering Systems. The Center for Watershed Protection, Silver Spring, MD.

(7) Galli, F. 1990. Peat-Sand Filters: A Proposed Stormwater Management Practice for Urban Areas. Metropolitan Washington Council of Governments. Washington, DC.

(8) US Soil Conservation Service (SCS). August 1981. Technical Release No. 60, "Earth Dams and Reservoirs", as Class "C" structures.

(9) Washington State Department of Ecology (WSDE). 1992. Stormwater Management Manual for the Puget Sound Basin. Olympia, WA.

APPENDIX 5A

40 CFR 122.26(b)(14) Subpart (i) – (xi)

(Source: ADEQ)

INDUSTRIAL FACILITIES THAT MUST SUBMIT APPLICATIONS FOR STORM WATER PERMITS

40 CFR 122.26(B)(14) Subpart	Description	
(i)	Facilities subject to storm water effluent limitations guidelines, new source performance standards, or toxic pollutants effluent standards under 40 CFR, Subchapter N [except facilities which are exempt under category (xi)].	
(ii)	Facilities classified as:	
	SIC 24 (EXCEPT 2434)	Lumber and Wood Products
	SIC 26 (EXCEPT 265 and 267)	Paper and Allied Products
	SIC 28 (EXCEPT 283 and 285)	Chemicals and Allied Products
	SIC 29	Petroleum and Coal Products
	SIC 311	Leather Tanning and Finishing
	SIC 32 (except 323)	Stone, Clay and Glass Products
	SIC 33	Primary Metal Industries
	SIC 3441	Fabricated Structural Metal
	SIC 373	Ship and Boat Building and Repairing

40 CFR 122.26(B)(14) Subpart	Description
(iii)	Facilities classified as SIC 10 through 14, including active or inactive mining operations and oil and gas exploration, production, processing, or transmission facilities that discharge storm water contaminated by contact with, or that has come into contact with, any overburden, raw material, intermediate products, finished products, byproducts, or waste products located on the site of such operations. SIC 10 Metal Mining SIC 11 Anthracite Mining SIC 12 Coal Mining SIC 13 Oil and Gas Extraction SIC 14 Nonmetallic Minerals, except Fuels
(iv)	Hazardous waste treatment, storage, or disposal facilities, including those that are operating under interim status or a permit under Subtitle C of the Resource Conservation and Recovery Act (RCRA).
(v)	Landfills, land application sites, and open dumps that receive or have received any industrial wastes including those that are subject to regulation under subtitle D or RCRA.

40 CFR 122.26(B)(14) Subpart	Description
(vi)	Facilities involved in the recycling of material, including metal scrap yards, battery reclaimers, salvage yards, and automobile junkyards, including but limited to those classified as: SIC 5015 — Motor Vehicle Parts, Used SIC 5093 — Scrap and Waste Materials
(vii)	Steam electric power generating facilities, including coal-handling sites.
(viii)	Transportation facilities which have vehicle maintenance shops, equipment cleaning operations, or airport de-icing operations. Only those portions of the facility that are either involved in vehicle maintenance (including vehicle rehabilitation, mechanical repairs, fueling, and lubrication), equipment cleaning operations, or airport de-icing operations, or which are otherwise listed in another category, are included. SIC 40 — Railroad Transportation SIC 41 — Local Suburban Transit SIC 42 (except 4221-25) — Motor Freight and Warehousing SIC 43 — U.S. Postal Service SIC 44 — Water Transportation SIC 45 — Transportation by Air SIC 5171 — Petroleum Bulk Stations and Terminals

40 CFR 122.26(B)(14) Subpart	Description
(ix)	Treatment works treating domestic sewage or any other sewage sludge or wastewater treatment device or system, used in the storage, treatment, recycling, and reclamations of municipal or domestic sewage, including lands dedicated to the disposal of the sewage sludge that are located within the confines of the facility, with a design flow of 1.0 million gallons per day or more, or required to have an approved pretreatment program under 40 CFR Part 403. Not included are farm lands, domestic gardens, or lands used for sludge management where sludge is beneficially reused and which are not physically located in the confines of the facility, or areas that are in compliance with Section 405 of the Clean Water Act.
(x)	Construction activity including clearing, grading, and excavation activities except operations that result in the disturbance of less than 5 acres of total land area and those that are not part of a larger common plan of development or sale. *

40 CFR 122.26(B)(14) Subpart	Description	
(xi)	Facilities under the following SICs [which are not otherwise included in categories (ii)-(x)], including only storm water discharges where material handling equipment or activities, raw materials, intermediate products, final products, waste materials, byproducts, or industrial machinery are exposed to storm water. *	
	SIC 20	Food and Kindred Products
	SIC 21	Tobacco Products
	SIC 22	Textile Mill Products
	SIC 23	Apparel and Other Textile Products
	SIC 2434	Wood Kitchen Cabinets
	SIC 25	Furniture and Fixtures
	SIC 265	Paperboard Containers and Boxes
	SIC 267	Converted Paper and Paper Board Products (except containers and boxes)
	SIC 27	Printing and Publishing
	SIC 283	Drugs
	SIC 285	Paints, Varnishes, Lacquer, Enamels
	SIC 30	Rubber and Misc. Plastics Products
	SIC 31 (except 311)	Leather and Leather Products
	SIC 323	Products of Purchased Glass
	SIC 34 (except 3441)	Fabricated Metal Products
	SIC 35	Industrial Machinery and Equipment, except Electrical
	SIC 36	Electronic and Other Electric Equipment
	SIC 37 (except 373)	Transportation Equipment

40 CFR 122.26(B)(14) Subpart	Description	
	SIC 38	Instruments and Related Products
	SIC 39	Miscellaneous Manufacturing Industries
	SIC 4221	Farm Products Warehousing and Storage
	SIC 4222	Refrigerated Warehousing and Storage
	SIC 4225	General Warehousing and Storage

Source: Federal Register, Volume 55, Number 222, Page 48065, November 16, 1990.

* On June 11, 1992, the U.S. Court of Appeals for the Ninth Circuit remanded the exemption for construction sites of less than five acres in Category (x) and for manufacturing facilities in category (xi) which do not have materials or activities exposed to storm water to the EPA for further rulemaking. (Nos. 90-70671 & 91-70200).


BURNS McDONNELL