# City of Wichita

Drivers, Framework and Regulations Overview

*December 7th, 2010*

## Topics

- Drivers for Change
- Regulations Overview – What's New
- Design Manual Overview – What's New

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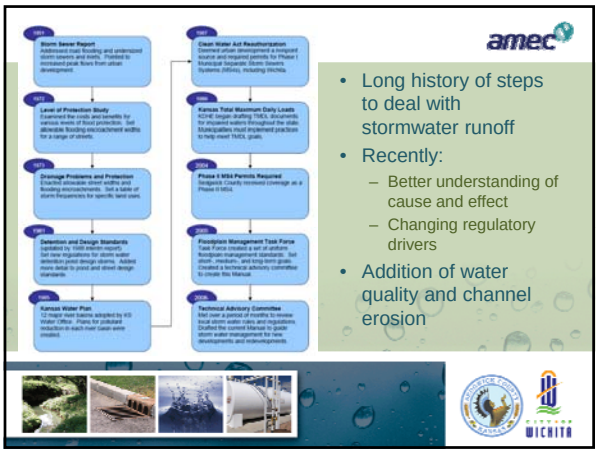



## Why now, why this?

amec

- Easy answer: The Local Government is making us…
- Because:
  - they are experiencing repeated problems and
  - new regulations are here and coming
- What are the local drivers and concerns:

WICHITA

## Current standards do not:

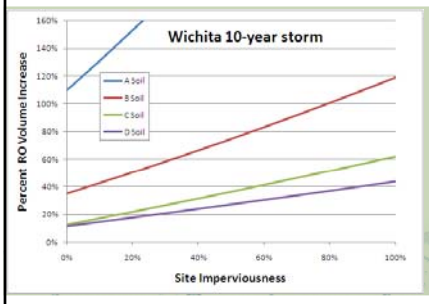
amec

- limit flooding to predevelopment conditions

Cowskin Br. 1998

WICHITA

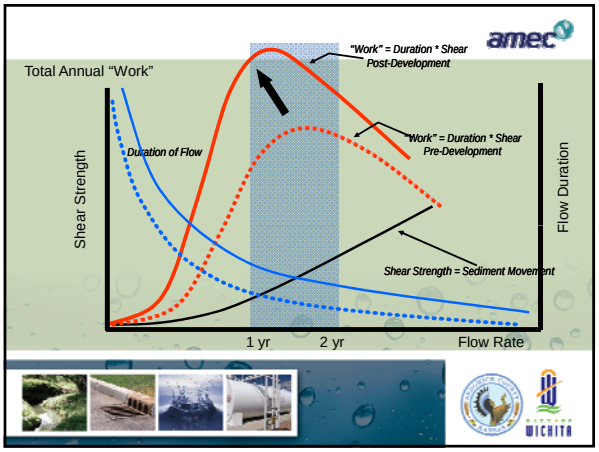
## We must deal with volume increases

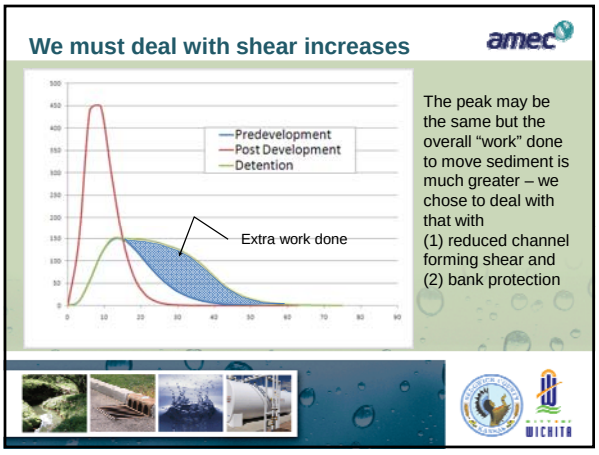



The flatter the slope the more volume control comes into play in flooding – we chose to deal with volume by (1) checking downstream and (2) floodplain storage accounting

## Current standards do not:

- limit flooding to predevelopment conditions
- prevent downstream channel erosion


Total Annual "Work"
"Work" = Duration * Shear
Post-Development
"Work" = Duration * Shear
Pre-Development
Duration of Flow
Shear Strength
Flow Duration
Shear Strength = Sediment Movement
1 yr
2 yr
Flow Rate

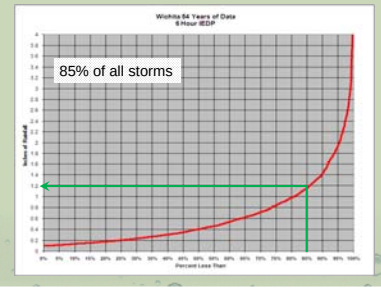

We must deal with shear increases
Predevelopment
Post Development
Detention
Extra work done
The peak may be the same but the overall "work" done to move sediment is much greater – we chose to deal with that with
(1) reduced channel forming shear and
(2) bank protection

## Current standards do not:

- limit flooding to predevelopment conditions
- prevent downstream channel erosion
- reduce pollution in runoff

The Dell 2007

## We must design to remove pollutants

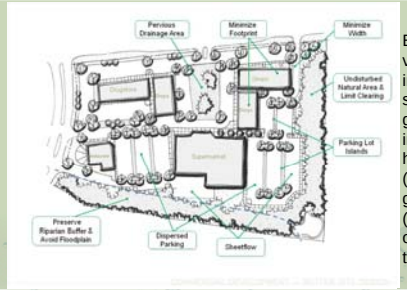



We are using an approach that:
(1) avoids monitoring,
(2) seems to work OK
(3) is accepted by regulators
– we presume if you follow design criteria you will meet the standard, and that the standard is adequate.

## Current standards do not:

- limit flooding to predevelopment conditions
- prevent downstream channel erosion
- reduce pollution in runoff
- encourage green designs for non-residential

## We can choose to design for less impact



Because small volumes become important, thoughtful site design can greatly reduce impacts – so we have:
(1) provided detailed guidance
(2) provided an optional reduction in the WQv

## Current standards do not:

- limit flooding to predevelopment conditions
- prevent downstream channel erosion
- reduce pollution in runoff
- encourage green designs
- protect our Riverfront

Riverfest 2009

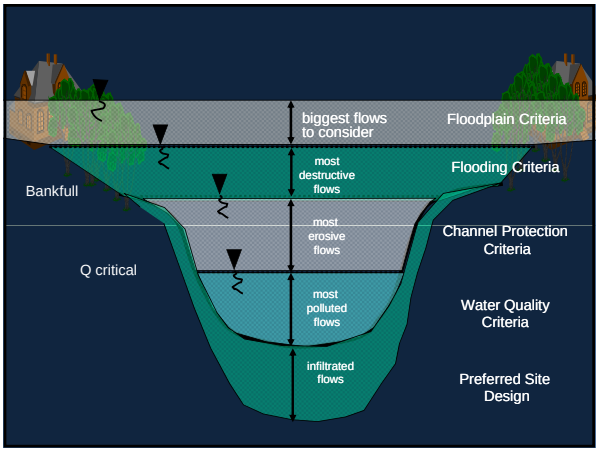
**Our hope is that the accumulated results will make a change**

## "I know, I know… its agriculture"

**They have a stronger lobby than cities**

## Topics

- Drivers for Change
- Regulations Overview – What's New
- Design Manual Overview – What's New




## Five main things:

1. Encouragement to use Preferred site Design
2. Water quality requirements
3. Channel protection requirements
4. Flood control requirements
5. Use of the manual mandated – i.e. many new methods or charts, etc.

## Want to balance the needs of four parties:

- Developers
  - Consistent
  - Implementable
  - Cost effective
- Staff
  - Protect the public
  - Long-term effectiveness
  - Encourage sound practices
- Regulators & Environmentalists
  - Effective at reducing pollution
  - Meet standards
- Owners
  - Not hard to maintain
  - Maintain property value

## Water Quality in Ordinance:

1. Water quality treatment and downstream channel protection shall be required of owners of new developments and redevelopments that cause a land disturbance greater than or equal to one (1) acre, including projects that cause a land disturbance less than one (1) acre that are part of a larger common plan of development or sale.

- Sec. 16.32.091
- Water Quality
- Downstream channel protection
- Disturbance of one acre or more
- Specific rules for redevelopment
- Details in design manual

## Water Quantity in Ordinance:

A. Applicability. Storm water runoff peak discharge analysis and control shall be required for new developments and redevelopments that will create or add one (1) acre or greater of impervious cover, including projects that have less than one (1) acre in impervious cover that are part of a larger common plan of development or sale that will result in one (1) acre or greater of impervious cover.

- Sec. 16.32.092
- Water Quantity
- Impervious cover of one acre or more
- Details in design manual

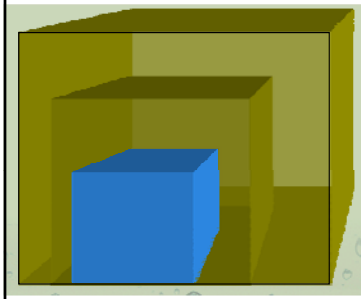
## And…

- Can be watershed based – director's discretion
- Must meet State and Federal standards
- Must use design manual criteria
- Waivers at discretion of director:
  - Your flow handled by another
  - Compliance is adverse
  - Meet criterion another way

## How is this translated into policy?

Volume 1

## Water Quality Volume

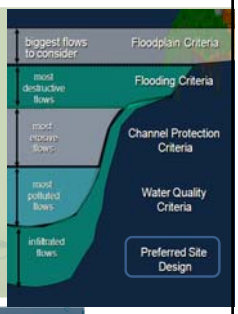


1. Standard site design produces a big WQv
2. I reduce the WQv with Preferred Site Design strategies
3. I obtain WQv Reductions through specific qualifying designs
4. I treat the remaining WQv volume with structural controls to a set standard

## Step 1A – Site Layout Using Preferred site Design Concepts

## Preferred Site Design

- Vol 1 § 3.3
  - Optional not a requirement
  - 17 General design techniques
  - Special designs can reduce the WQv
  - May also reduce CN and peak flow
    - Lag time
    - Impervious area




## Step 1B – Calculate WQv

## "You treat this much water volume"

A simple equation:

$$WQv = P*Rv*A/12 \quad ac\text{-}ft$$

Where: P = 85% rainfall depth = 1.2"
Rv = Table 4-13
A = site area in acres

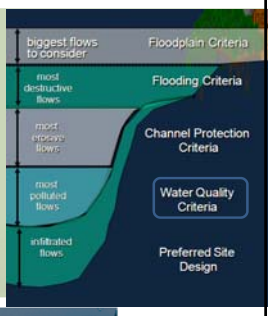
## Water Quality Treatment


## Step 1C – Calculate Reductions in WQv

## Reductions in WQv

***Certain of the techniques are so effective that, given certain design constraints, they double dip:***

1. Reduce the WQv through natural infiltration
2. Reduce TSS through both volume loss and vegetative filtering



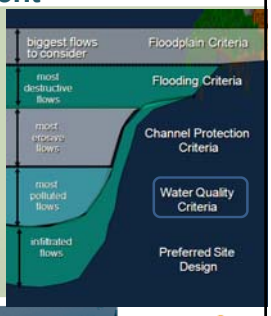

## 

**Table 2-2 Methods to Reduce the $WQ_v$**

| Practice | Description |
|---|---|
| **Reduction 1:** Natural Area Conservation | Undisturbed natural areas are conserved on a site, thereby retaining their pre-development hydrologic and water quality characteristics. |
| **Reduction 2:** Vegetated Stream Buffers | Storm water runoff is treated by directing sheet flow runoff through a naturally vegetated or wooded buffer as overland flow. |
| **Reduction 3:** Specially Engineered Vegetated Channels | Engineered vegetated channels are used to provide storm water treatment. |
| **Reduction 4:** Overland Flow Filtration/Infiltration Zones | Overland flow filtration/infiltration zones are incorporated into the site design to receive runoff from rooftops and other small impervious areas. |
| **Reduction 5:** Environmentally Sensitive Large Lot Subdivisions | A group of site design techniques are applied to low density residential development. |

## Water Quality Treatment

- Vol 1 § 3.2
  - Treat RO from 85% storm (1.2") to…
  - …reduce TSS by 80% by…
  - …using approved structural controls.




## Step 1D – Treat Remaining WQv with Structural Controls

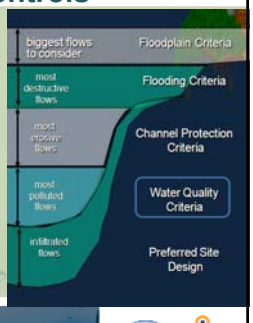
## 80% TSS Standard

- Base goal is site-based TSS removal chosen to be 80% for typical urban runoff
  - Typical urban runoff has 100 mg/l TSS
  - Typical undeveloped area has 20 mg/l TSS
  - That is an 80% reduction
- Applied NOT a numeric standard but a "best available technology" standard

## Currently Approved Controls

Table 3-1 TSS Removal % for Structural Facilities

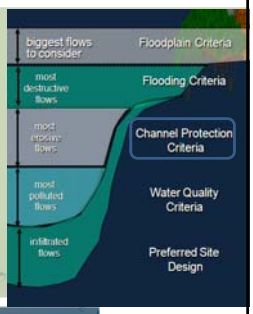
| Structural Facility | TSS Removal % |
|---|---|
| Storm Water Pond | 80 |
| Dry Extended Detention Pond | 60 |
| Enhanced Swale | 90 |
| Grass Channel | 50 |
| Infiltration Trench | 90 |
| Soakage Trench | 90 |
| Vegetative Filter Strip | 50 |
| Surface Sand Filter | 80 |
| Organic Filter | 80 |
| Bioretention Area | 85 |
| Storm Water Wetland | 75 |
| Proprietary Manufactured Device | device-specific |
| Gravity Oil/Water Separator | device-specific |
| Alum Treatment | 90 |
| Green Roof | installation-specific |




## Step 2 – Protect Downstream Channel From Erosion

## Channel Protection

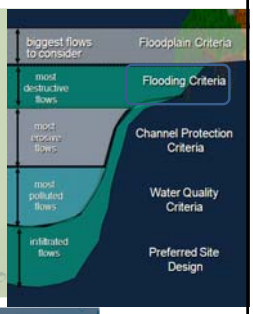
- Vol 1 § 3.5
  - Reduce shear below critical through ED of 1-year storm for 24-hours or…
  - Retain 1-year volume difference on site




## Step 3 – Design Water Quantity Conveyance on and through the Site

## Vol 2. Chapter 5

- Gutters
- Inlets
- Sewers
- Culverts
- Bridges
- Channels
- Outlets & Dissipaters

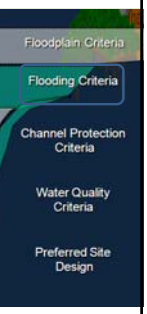



## Step 4 – Design Water Quantity (Peak Flow) Reduction

## Step 5 – Make Sure it Works by Checking Downstream

## Stormwater Quantity

- Vol 1 § 3.6
  - 2-year, 5-year, 10-year, 25-year and 100-year return frequency, 24-hour duration storm
  - Must look downstream 10% to be sure it works




## These criteria are combined into a green design process – going green is not mandatory, meeting the standard is.

## City of Wichita

Overview of the Design Manual

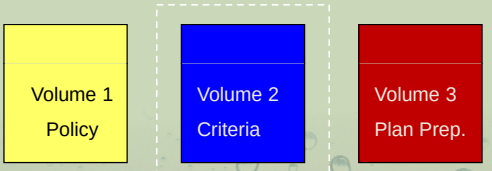
*December 7th, 2010*

## Overview

- Comprehensive urban stormwater management manual
- Guidance for local governments, development community and public
- Three-volume document covering stormwater policy, design criteria, and plan preparation

## Manual Format

Organized as a three volume document:




## General Contents of Vol. 2

- 1 - Integrated Site Design Overview
- 2 - Preferred Site Design
- 3 - Storm Water Controls
- **4 – Hydrology**
- 5 – Hydraulics
- 6 – Floodplain Mgmt.

- Appendices
  - A – Manning's n
  - B – Rainfall Table
  - C – Rational C
  - D – Wind Roses
  - E – Stormwater Controls Screening
  - F – Acronym List
  - G – References