



OVERLAND PARK
K A N S A S

Planning and Development Services
Public Works

2021

DESIGN AND CONSTRUCTION STANDARDS

Volume 1 - Design Criteria

TABLE OF CONTENTS

Section I - General Requirements

- A. Authority
- B. Variances
- C. Adoption of Standards

Section II – Design Criteria

A. Public Streets and Private Alleys	1
1. Standards Adopted by Reference	1
2. Street Classification	1
3. Right of Way Design Standards: Table I	2
4. Geometric and Pavement Design Standards: Table II	3
5. Planned Residential Zoning District Public Street Standards: Table III	4
6. Standard Drawings	7
7. Construction Specifications	7
B. Stormwater Conveyance Facilities	7
1. Adopted Standards by Reference	7
2. Amendments to Adopted Standard	7
a. Section 5601.2 Definitions	7
b. Section 5601.3 General Requirements	7
c. Section 5601.5 System Types and Applications	7
d. Section 5601.8.A. Protection of Property	11
e. Section 5602.2 Computational Methods for Runoff	11
f. Section 5602.3 Runoff Coefficients	12
g. Section 5604.1.B. Configuration (Inlet Design)	12
h. Section 5604.1.D. Grate Inlets	12
i. Section 5604.1.E. Landscape Drains	13
j. Section 5605.3 Stream Preservation and Buffer zones	13
k. Section 5605.12.C. Bank Stabilization Projects	13
l. Section 5606.1 Easements	14
m. Section 5606.2 Capacity	14
n. Section 5606.7 Pipe Materials (Encl Pipe Systems)	14
o. Section 5606.8 Conduit Length and End Protection (Encl Pipe Systems)	15
p. Section 5606.9 Concrete Box Culvert Design (Encl Pipe Systems)	15
q. Section 5607.2.A. Engineered Channels	15
r. Section 5607.10 Concrete Lined-Ditch (Engineered Channels)	15
s. Section 5608.4.A.2. Dams	16
t. Section 5608.4.B.2 Temporary Storage Volume	16

u.	Section 5608.4.C. Release Rate	16
v.	Section 5608.4.D. Detention Basin Size	16
w.	Section 5608.4.E. Primary Outlet Works	17
x.	Section 5608.4.I. Low Flow Bypass (Performance Criteria)	17
y.	Section 5608.5.A.4. and B.3. Side Slopes	17
z.	Section 5608.5.F Underground Storage (Detention Methods)	17
aa.	Section 5608.5.G. Appearance (Detention Methods)	19
bb.	Section 5609.2 Standard Drawings (Plan Requirements)	19
3.	Standard Drawings	20
4.	Construction Specifications	20
C.	Stormwater Treatment Facilities	20
1.	Standards Adopted by Reference	20
2.	Amendments to Adopted Standard	20
a.	Dedicated Stream Corridors	20
b.	Stormwater Treatment Facilities in Highly Visible Areas	22
c.	Native Vegetation Area Requirements	22
d.	Buffalo Grass Sod	23
e.	Minimum Easement and Setback Requirements	23
f.	Setbacks for Infiltration Facilities	23
g.	Setbacks for Natural Conveyance Swales and Native Vegetation Swales	24
h.	Setbacks from Thoroughfares	24
i.	Access Route	24
j.	Maintenance for Basins and Ponds	24
k.	Setbacks for Non-Residential Developments	24
l.	Protection of Property	24
m.	Pip discharges into STFs with a Permanent Pool	24
n.	Minimum Freeboard Requirement for Overflow Structures	25
o.	Percolation Testing Requirement	25
p.	Mulch Netting Requirement	25
q.	Sediment Forebay Requirement	26
r.	Section 4.2 Level of Service Determination for Infill/Redevelopment	26
s.	Section 7.7 Signage	31
t.	Section 8.1.2 General Application	31
u.	Section 8.1.4 Design Consideration	31
v.	Section 8.15.2.4 Vegetation	31
w.	Appendix B, Section B.2	31
x.	Appendix B, Section B.2	31
3.	Standard Drawings	33
4.	Construction Specifications	33

D. Erosion and Sediment Control	34
1. Standards Adopted by Reference	34
2. Amendments to Adopted Standards	34
a.- b. Section 5101.4 Designer Qualifications	34
c. Section 5104.7 Sediment Basin Embankment and Spillway Detail	34
d.-r. Section 5105 Design Checklist	34
s. Section 5106.5B Typical Written Sequence	36
t. Section 5107.5 Stockpiles	36
u.-v. Section 5108.5 Silt Fence	36
w.-x. Section 5108.6 Other Linear Sediment Control Devices	37
y.-z. Section 5108.7 Inlet Protection	37
aa. Section 5109.1 Sediment Basin – General	37
bb. Section 5109.2 Sediment Basin – Placement Restriction	37
cc. Section 5109.3 Sediment Basin – Embankment	37
dd.-ff. Section 5109.6 Sediment Basin – Dewatering	37
gg.-ll. Section 5156.1 Sediment Basin – Freeboard and Spillways	37
mm.-nn. Section 5110.3 Diversion Dikes, Gradient Terraces, and Slope Drains	38
oo. Section 5111.2 Inactive Area	38
pp. Section 5111.6 Interior Sediment Control	38
3. Additional Guidance	38
4. Errors and omissions	39
5. Standard Drawings	39
E. Private Drives, Parking Areas, and Private Sitework Outside Public Right-of-Way	39
1. Design Standards	39
2. Alternate Paving Materials	39
3. Private Drive and Parking Area Pavement Design Standards: Table IV	40
4. Private Retaining Walls	41
F. Streetlighting	41
1. Standards Adopted by Reference	41
2. Thoroughfare, Super-Collector, and Collector Streets: Table V	41
a. Functional Street Classification Definitions	42
b. Pedestrian Conflict Area Definitions	42
3. Local Streets: Figure I, Figure II, Figure III	42
4. Intersection Lighting Criteria: Table VI, Figure IV	44
5. Approved Lighting Equipment	45

a.	Residential Streets	45
b.	Collector Streets	45
c.	Thoroughfare Streets	46
6.	Standard Drawings	46
7.	Construction Specifications	46
G.	Permanent Traffic Control Signing	46
1.	Standards Adopted by Reference	46
2.	Design Criteria	46
3.	Traffic Sign Design Criteria	46
H.	Access Management	46
1.	General	46
2.	Definitions: Figure I, Figure II	47
3.	Access Locations	48
4.	Number of Access Points	48
5.	Access Point Widths	49
6.	Access Point Alignment	49
7.	Throat Length	50
8.	Sight Distance	50
9.	Common Drives and Internal Access	50
10.	Turn Lanes	50
11.	Median Break Spacing	50
12.	Special Criteria for Selected Thoroughfare Corridors	50
I.	Manual of Infrastructure Standards (RESERVED)	52
Section III – Attachments		53
A.	Attachment A: Stream Riparian Corridor Quality Evaluation	54
B.	Attachment B: Overland Park KS Soil Infiltration Protocol	58
C.	Attachment C: Outdoor Play Area Infiltration Trench Sizing Guidelines	67

SECTION I – GENERAL REQUIREMENTS

A. Authority

In accordance with Section 13.10.020 and 15.10.100 of the Overland Park Municipal Code, the City Engineer is authorized to adopt standards for public street improvements, stormwater conveyance facilities, streetlighting, private alleys, parking lots, and driveways. In accordance with Section 16.210.040 of the Municipal Code, the Director of Planning and Development Services is authorized to adopt standards for stormwater treatment facilities. In accordance with Section 16.200.030 of the Municipal Code, the Director of Planning and Development Services is authorized to adopt standards for erosion and sediment control.

All of the standards authorized to be adopted by Sections 13.10.020, 15.10.100, 16.200.030 and 16.210.040 have been consolidated into this Design and Construction Standards Manual.

B. Variances

The City may approve waivers or variances to specific requirements of these standards when deemed appropriate and justified by engineering considerations. Variances or waivers to these Standards shall be requested to the responsible City Staff person indicated in Section A above. Appeals to decisions about variance requests to these standards are to the Governing Body through a process as stated in the applicable ordinance section.

City Staff is not authorized to grant variances from ordinance requirements. Such variance requests must be made to the Governing Body in accordance with the ordinance requirements.

C. Adoption

The Director of Planning and Development Services and the Public Works Director jointly adopt these erosion and sediment control standards and stormwater treatment standards this **1st** day of July, **2021**.

Jack D. Messer, P.E.
Director, Planning and Development Services

Tony Hofmann, PMP
Director, Public Works

The City Engineer hereby adopts this Design Criteria for public streets, stormwater conveyance facilities, streetlighting, private alleys, parking lots, and driveways this **1st** day of July, **2021**.

Lorraine Basalo, P.E.
City Engineer

SECTION II – DESIGN CRITERIA

A. Public Streets and Private Alleys

1. Standards Adopted by Reference: Adoption of the [Standard Specification for State Road & Bridge Construction](#), Kansas Department of Transportation, 2015 edition; [English Bridge Design Manual](#), Volume III, Kansas Department of Transportation, 2009 edition; [A Policy of Geometric Design of Highways and Streets](#), American Association of State Highway Transportation Officials, 2011 edition; Manual of Uniform Traffic Control Devices, Federal Highway Administration as adopted by KDOT; provisions of the American National Standard Practice for Roadway Lighting as prepared by the Illuminating Engineering Society of North America (IESNA).
2. Street Classifications: The following street classifications are used in Tables I and II, located at the end of this design criteria, to determine street geometric and right-of-way design standards:
 - a. Thoroughfare: A street providing for through traffic movement with intersections at grade and direct access to abutting property, except as stated in 18.460.180, and on which geometric design and traffic control measures are used to expedite the safe movement of through traffic.
 - b. Super Collector: A street providing for through traffic movement and the collection and distribution of traffic from thoroughfares to lower traffic volume streets or directly to traffic destinations.
 - c. Collector: A street providing for the collection and distribution of traffic from thoroughfares to lower traffic volume streets or directly to traffic destinations.
 - d. Local Residential: A street providing for direct access to abutting land and local traffic movements.
 - e. Industrial: A street providing for direct access to abutting land and for local traffic movements for industrial park or land designated for industrial or business park use.
 - f. Commercial: A street providing for the collection and distribution of traffic through designated commercial areas. Street width shall depend upon projected traffic volumes, anticipated usage characteristics, and available right-of-way.
 - g. Apartment: A street abutting land designated for a density higher than two-family residential.
 - h. Alley: A private means of access typically located at the rear or side of abutting properties and usually serving as a secondary means of access to those properties.
 - i. Loop Street: A through-street that intersects with the same street at both ends.
 - j. “L” Street: A through-street that intersects with two different streets that are roughly perpendicular to each other.

3. Right of Way Design Standards:

TABLE I RIGHT-OF-WAY DESIGN STANDARDS									
STREET CLASSIFICATION	STREET/RIGHT-OF-WAY CRITERIA					CUL-DE-SAC CRITERIA			
	ROW Width	Min. Street Width(1)	Curb & Gutter	ROW Improvements		Max. Length(3)	Min. Radius of ROW at Bulb	Min. Radius of Pavement at Bulb(1)	Min. Radius of Island(4)
				Sidewalks(2)	Street Lights				
THOROUGHFARE									
(a) Single Roadway	80' - 90'	48'(5)	Type B	Both Sides	City Installed				
(b) Dual Roadway	120'	80'(5)	Type B	Both Sides	City Installed				
SUPER COLLECTOR	80' - 100'	36'-52'(5)	Type B	Both Sides	City Installed				
COLLECTOR	60'	36'(5)	Type A	Both Sides	Developer Responsibility				
LOCAL RESIDENTIAL STREET	50'	26'(6), 28'	Type A	One Side(7)	Developer Responsibility	500'(8), 1000'	50'	39'	11'
INDUSTRIAL STREET	60'	36'(5)	Type B	Only on Thor., Collectors and Perimeter Sts.	Developer Responsibility	1000'	60'	48'	Island Not Permitted
COMMERCIAL OR APARTMENT STREET	60'	36'(5)	Type B	Both Sides	Developer Responsibility	1000'	60'	48'	Island Not Permitted
COMMERCIAL OR APARTMENT STREET WITH ON-STREET DIAGONAL PARKING (9)	80'	58' (5) (9)	Type B	Both Sides - 7' foot minimum width when on back of curb	Developer Responsibility	N/A	N/A	N/A	N/A
RESIDENTIAL ESTATE (RE) DISTRICT									
COLLECTOR	70' (Plus 10' util. & grading easement each side)	32'	None Required	None Required	May be Deleted at Option of the Developer				
LOCAL RESIDENTIAL STREET	60' (Plus 10' util. & grading easement each side)	24'	None Required Except for Cul-de-sac Islands	None Required	May be Deleted at Option of the Developer	1000'	50'	37'	11'
(1) Measured "back-to-back" of the curb and gutter section, except in Residential Estates (RE) District when measured from the edge of the pavement surface. (2) Sidewalk locations are established in OPMC Sec. 18.460.270. (3) Maximum cul-de-sac length is established in OPMC Sec. 18.460.090. Measured from the "near side" of the right-of-way line at the intersecting street to the center of the cul-de-sac bulb. (4) Applicable only where a landscaped center island (curb and gutter section required) is constructed at the cul-de-sac bulb section. Measured from the center of the cul-de-sac bulb to the back of the island curb and gutter section. (5) Additional widening may be required at major intersections. (6) Refer to the Overland Park Site Design Standards, Sec. 6.11.7, for details on situations where a 26' wide pavement is permitted. (7) Refer to OPMC Sec. 18.245.050 for sidewalk requirements in the PRN Zoning District. (8) Refer to OPMC Sec. 18.460.090 for details on situations where the maximum cul-de-sac length is 500'. (9) A 58 foot road section allows for a 18 foot parking lane (45 degree angle) and two 11 foot through lanes. Alternate configurations will be considered on a case by case basis.									

4. Geometric and Pavement Design Standards:

TABLE II GEOMETRIC AND PAVEMENT DESIGN STANDARDS										
STREET CLASSIFICATION	HORIZONTAL/VERTICAL ALIGNMENT						PAVEMENT DESIGN			
	Design Speed	Maximum Gradient(1)	Minimum Gradient(1)	Minimum Radius of Horizontal Curves	Min. Sight Distance on Vertical Curves	Min. Tangent Length on Reverse Curves(2)	Crown	Option 1 Full Depth Asphalt		Option 2 Concrete
								Base	Surface	
THOROUGHFARE										
(a) Single Roadway	35 mph	6%	1%	525'(3)	250'	N/A	0.25"/ft.	10" (7)	2"	9" NRDJ
(b) Dual Roadway	45 mph	6%	1%	1050' (3)	360'	N/A	0.25"/ft.	10" (7)	2"	9" NRDJ
SUPER COLLECTOR	35 mph	6%	1%	525'(3)	250'	N/A	0.25"/ft.	10" (7)	2"	9" NRDJ
COLLECTOR	30 mph	8%(4)	1%(5)	350'(6)	200'	100'	0.25"/ft.	7"(4)	2"	8" NRDJ
LOCAL RESIDENTIAL STREET (9)	25 mph	8%	1%(5)	200'(6)	155'	50'	0.25"/ft.	6"	2"	7" Plain
INDUSTRIAL STREET	30 mph	6%	1%	350'(6)	200'	100'	0.25"/ft.	8"	2"	8" NRDJ
COMMERCIAL OR APARTMENT STREET (8)	30 mph	6%	1%	350'(6)	200'	100'	0.25"/ft.	8" (8)	2" (8)	8" NRDJ
(1) Gradients outside the standards shall be permitted only upon approval of the City Engineer										
(2) Tangent not required where radius of either horizontal curve is greater than 500 feet.										
(3) The City Engineer may permit reduced requirements if super-elevation is used or if speed limits are lowered so that the proposed radius complies with AASHTO requirements.										
(4) When a collector or local street adjoins industrial, commercial, or apartment uses, the standards for commercial, industrial, or apartment uses shall be followed. For streets in MXD Zoning Districts see geometric requirements from Section 9.1 of the Mixed Use Design Standards.										
(5) Ditch streets in the Rezoning district shall have 2% minimum ditch grades.										
(6) Variances may be granted by the Governing Body for short sections of streets in order to facilitate economical platting of subdivisions.										
(7) Base thickness and roadway section designs may vary and are subject to approval by the City Engineer.										
(8) On street diagonal parking is allowed for Commercial, Office, and Multifamily zoning districts for collector and lesser streets. When on-street diagonal parking is utilized, the parking lanes shall be constructed of PCC pavement of the same thickness as the through lane. When on-street diagonal parking is utilized, long uninterrupted runs of parking shall be avoided. Landscape islands, raised pedestrian islands, or other features a minimum of 8 feet in width, shall be used to avoid uninterrupted parking runs of more than 15 stalls.										
(9) Vertical curves on local streets at their intersection with unimproved thoroughfare roadways which approach a stop condition at the intersection may use comfort curve criteria for 5 mph under the design speed at sag vertical curves. If the sag comfort curve criteria is used, one additional streetlight shall be installed approximately 150' away from the stop-controlled intersection along the sag comfort curve with a maximum of 175' away, but no closer than 100' from the nearest streetlight which is otherwise required. This criteria may be used elsewhere with prior approval by the City Engineer.										

5. Planned Residential Zoning District Public Street Standards: Multiple-owner residential developments within the RP-1, RP-1A, RP-1N, RP-2, RP-3 or PRN Zoning Districts are those residential developments within those zoning districts where individual units are intended to be sold to multiple owners, either as separate lots or as condominiums. The primary means of access within a Multiple-Owner Residential Development, which will carry the highest volumes of traffic to and through the development, shall be shown as public streets. Driveways that serve single units, access routes and parking areas that serve small clusters of units, and all alleys shall be shown as private. The City Engineer shall make the final determination for each development at the time of preliminary development plan or final development plan approval, as applicable. The Design Standards include in Table III shall apply.

These standards shall apply to all new applications for preliminary plan approval submitted after the effective date of these standards. Any projects that obtained preliminary plan approval before the effective date of these standards and for which applications for revised preliminary plan approval are submitted after the effective date of these requirements may be subject to these standards. At the time of Planning Commission and City Council review of the application a determination will be made as to whether or not the standards will apply, based on the specific design of the proposed plan and its relationship to any existing portions of the development.

TABLE III
STREET & ALLEY DESIGN STANDARDS – MULTIPLE-OWNER
RESIDENTIAL DEVELOPMENTS IN THE
RP-1, RP-1A, RP-1N, RP-2, RP-3, RP-4 AND PRN ZONING DISTRICTS

STREET TYPE	RP-1, RP-1A, RP1-N and PRN Single-Family Detached	RP-2, RP-3, RP-4, All Other PRN
STREET (Public)		
Pavement Width (B/B)		
Local		
Undivided With Alley	28 ft.	28 ft.
All Cul-de-sacs	28 ft.	28 ft.
Undivided Without Alley – Parking Both Sides	26 ft. ⁽¹⁾ & 28 ft.	28 ft.
Divided With Alley	22 ft. each side	24 ft. each side w/ 6 ft. curb ext.
Divided Without Alley	22 ft. each side	24 ft. each side w/ 6 ft. curb ext.
Collector		
Undivided	36 ft.	36 ft.
Divided With Alley	24 ft. each side	24 ft. each side w/ 6 ft. curb ext.
Divided Without Alley	22 ft. each side	24 ft. each side w/ 6 ft. curb ext.
Right-of-Way Width		
Local		
Cul-de-sac, Loop Street Serving < 60 Units and < 1000 Feet Long or “L” Street Serving < 40 Units and < 800 Feet Long ⁽²⁾	40 ft. ⁽³⁾	40 ft. ⁽³⁾
Undivided	50 ft.	50 ft.
Divided With Alley	80 ft.	84 ft.
Divided Without Alley	80 ft.	80 ft.
Collector		
Undivided	60 ft.	60 ft.
Divided With Alley	84 ft.	84 ft.
Divided Without Alley	80 ft.	84 ft.
Minimum Corner Radius		
Local/Local Intersections	25 ft.	25 ft.
Local/Collector Intersections	25 ft.	25 ft.
Local/Thoroughfare and Collector/Thoroughfare Intersections	30 ft.	30 ft.
(1) 26 ft. width permitted only within parameters established by City’s Site Design Standards (2) Not permitted for PRN developments (sidewalks required on both sides of street) (3) 10 ft. utility easement required adjacent to right-of-way on side of street opposite the sidewalk		

TABLE III (Cont.)		
STREET TYPE	RP-1, RP-1A, RP1-N and PRN Single-Family Detached	RP-2, RP-3, RP-4, All Other PRN
Minimum Centerline Radius		
Local	200 ft.	200 ft.
Loop Street Serving < 60 units, < 1000 Feet Long or “L” Street Serving < 40 Units and < 800 feet long	100 ft.	150 ft.
Cul-de-sac	100 ft. (4)	150 ft.
Collector	415 ft.	415 ft.
Curb Type		
Local		
Undivided With Alley	B	B
Undivided Without Alley	A	B
Divided With Alley	B	B
Divided Without Alley	A	B
Collector		
Undivided With Alley	B	B
Undivided Without Alley	A	B
Divided With Alley	B	B
Divided Without Alley	A	B
Head-in parking		
Local	Permitted on side of street without sidewalk (2)	Permitted on side of street without sidewalk (2)
Collector Street	Not Permitted	Not Permitted
ALLEY (Private)		
Pavement Width (B/B)		
Lots With Street Frontage	15 ft.	15 ft.
Lots Without Street Frontage	20 ft. (5)	20 ft. (5)
Easement Width		
Lots With Street Frontage	20 ft.	20 ft.
Lots Without Street Frontage	25 ft.	25 ft.
Minimum Corner Radius		
Alley/Alley Intersections	30 ft.	30 ft.
Alley/Local and Alley/Collector Intersections	20 ft.	20 ft.
Minimum Centerline Radius		
Lots With Street Frontage	50 ft.	75 ft.
Lots Without Street Frontage	75 ft.	75 ft.
Curb Type		
Lots With Street Frontage	A	A
Lots Without Street Frontage	A + ribbon edge	A + ribbon edge
Minimum Grade	1%	1%
Maximum Grade	10%	10%
(2) Not permitted for PRN developments (sidewalks required on both sides of streets). (4) Ninety-degree turns permitted (5) 15 ft. b-b alley + 2.5 ft. ribbon edge each side.		

6. Standard Drawings: See Standard Details.
7. Construction Specifications: All public and private street construction performed pursuant to these design criteria shall utilize construction specifications and details approved by the City.

B. Stormwater Conveyance Facilities

1. Adopted Standards by Reference: Adoption of KC-APWA Section 5600 by Reference. [Division V - Design Criteria, Section 5600 - Storm Drainage Systems and Facilities](#) (Section 5600) of the Standard Specifications and Design Criteria, published by the Kansas City Metropolitan Chapter of the American Public Works Association (KC-APWA), is hereby adopted by reference as the Design Criteria for the City, except as amended in the following sections. This adoption shall apply to the revision of Section 5600 adopted KC- APWA on February 15, 2006. Any future revisions of Section 5600 shall not be in force until adopted in writing by the City Engineer.

2. Amendments to Adopted Standards: The following amendments to Section 5600 shall apply to stormwater conveyance facilities within the City:

- a. Section 5601.2 Definitions. The following definitions are revised or added:

Engineered swale: An intentionally graded swale with dimensions established by an engineer to convey a calculated quantity of stormwater runoff at a given slope. (Refer to item number 2.c.7. for requirements.)

Natural conveyance swale: An intentionally graded swale system designed as a series of broad, shallow, flat-bottomed channels with a dense stand of native vegetation covering the side slopes and channel bottoms, which slowly conveys stormwater runoff while trapping pollutants, promoting infiltration, and reducing flow velocities.

Swale: A shallow, broad, smoothly-graded channel or depressed area along the surface of a lawn or yard that directs and conveys stormwater, where the frequency and volume of discharge is generally low enough to maintain turf.

- b. Section 5601.3 General requirements and Applicability. General requirements and applicability shall be as set forth in [OPMC15.10](#) and [18.365](#). The exceptions given in KC-APWA 5601.3. A. and B., do not apply.
- c. Section 5601.5 System Types and Applications. Delete this entire section and replace with the following:
 - i. **General Guidelines**: Methods of conveyance for storm drainage systems shall be as set forth in OPMC 15.10.200.
 - ii. **Studies**: Preliminary and final stormwater management studies are required on private

development within the City. Requirements for such studies are set forth in [ES Policy 3-01](#), "Stormwater Management Studies", current revision, as adopted by the Administrator of Engineering Services.

- iii. **Stream Corridors:** When used or required, stream corridors shall be designated and preserved in accordance with [Chapter 18.365](#) of the Overland Park Municipal Code. Dedication of stream corridors is the preferred method of handling drainage whenever a defined stream exists, regardless of drainage area.
- iv. **Pipe System Standards:** When enclosed pipe systems are allowed and used, the pipe shall be designed to accommodate the 10% storm, and any excess flow above the pipe capacity that would occur in a 1% storm shall be conveyed by the overflow system. Unless specifically approved by the City, the overflow system must be designed assuming that only the 10% storm is carried by the pipe, even if the pipe system itself has greater theoretical capacity, including but not limited to pipe systems designed for the full 1% storm. (Note: From 1965 to 2004, the City utilized a 20% storm standard for pipe system capacity. When constructing a pipe and overflow swale system that connects to previously installed infrastructure, the engineer must consider the actual capacity of the receiving system. Special adjustments to pipe, inlet, and swale capacities to accommodate these connections are subject to approval by the City.)
- v. **Natural Conveyance Swale Standards:** Natural conveyance swales may be used when they are part of an overall system for stormwater treatment as required under [Chapter 16.210](#) of the Municipal Code and designed in accordance with the Design and Construction Standards. Enclosed pipe systems may transition to natural conveyance swales at the edge of dedicated stream corridors in accordance with KC-APWA 5605.6.D. When natural conveyance swales are used, the swale shall be designed to accommodate the 10% storm within a designated tract. Natural conveyance swales shall have an average minimum longitudinal slope of 2% measured from the beginning of the swale to the discharge point, and shall have a minimum length equal to 100' or the width of the dedicated stream corridor, whichever is greater. The maximum permissible velocity for the 10% storm shall be limited to 6 ft/s at the swale discharge point to prevent excessive channel erosion. The 1% storm shall be routed through the development in accordance with Amendment No. 4 of these design criteria. A minimum of 1.0 foot of freeboard shall be provided between the lowest opening into habitable structures and the energy grade line of flow for the 1% storm. Natural conveyance swales may only be used for drainage areas 25 acres or less, with the natural swale transitioning to a dedicated stream corridor at or before the 25 acre point. Natural conveyance swales shall lie within a dedicated common tract that is a minimum of thirty (30) feet wide.

Generally, if a natural conveyance swale is used, the swale shall be maintained continuously until it outlets to a dedicated stream corridor or other stormwater treatment facility. For drainage areas less than 5 acres, a natural conveyance swale may discharge into an enclosed pipe system.

Natural conveyance swales will be privately owned and maintained as set forth in item number 2.c.6.f. of these design criteria.

Requirements for beginning a conveyance system: A storm sewer pipe and inlet system or natural conveyance system shall generally begin when the drainage area exceeds two acres or when more than six platted lots (a partial lot counts as one) are contributing to the storm water discharge. The City may require more stringent criteria for development projects that discharge surface storm water into an existing development. Single family and duplex subdivisions have the following additional requirement: Overland or concentrated surface flow paths across grassed areas shall not exceed 450 feet, at which point a curb, inlet, or natural conveyance swale shall intercept the drainage; unless otherwise approved by the City.

Upstream of these limits, surface drainage shall be handled in accordance with lot grading requirements as indicated in item number 2.c.8. of these design criteria.

vi. **Public System:**

(a. The storm sewer system will be accepted for public maintenance when constructed by City approved plans and public easements are dedicated if:

- (1. The proposed line is a continuation downstream of an existing City system, or
- (2. The proposed line accepts drainage from a public right-of-way, or
- (3. The proposed line is located in a single-family subdivision with public streets.

(b. If the proposed line in a non-single-family development drains an area that lies totally within private property under a single ownership*, the line shall remain private and no easement is to be taken until the connection with a public inlet or junction box. A Right-of-Way Work Permit or approved plans are required to connect a private storm sewer into a public system on right-of-way or public easement. If a storm drainage line intercepts water from other properties under separate ownership, then the line shall be public, thereby providing the upstream owners with a right to connect.

*For the purposes of this item, a development plan or plat which proposes multiple separate lots indicates the intent of multiple ownership and shall not be considered a single ownership.

(c. Bridges and culverts on private streets or private drives which are not connected with an enclosed storm sewer system shall be private, regardless of whether the area draining to the structure includes public right-of-way or private property on multiple ownerships. Such structures must still be built to public storm sewer standards.

- (d. The City may make exceptions to these criteria and accept structures that would otherwise be designated private if it is determined that the failure of the structure would endanger nearby public infrastructure, pose an obvious threat to flooding of neighboring property, or if access to the development project is necessary for orderly development.
 - (e. Development projects that include private streets and private drives will be reviewed on a case-by-case basis with the intent to apply Items #1-4 above EXCEPT a private storm sewer system may be constructed which crosses future ownership lines within the project's limits, provided all future property owners are given the rights to connect to the private system and maintenance responsibility of the private system is established in a recorded document.
 - (f. All stormwater treatment facilities that serve any development shall be private, regardless of whether the area draining to the facility includes public right-of-way or private property on multiple ownerships. No public drainage easements will be accepted for stormwater treatment facilities within private development projects.
- vii. **Engineered Swales:** Whenever a pipe system meeting the requirements of item number 2.c.4. is constructed, it shall be accompanied by an engineered swale to accommodate overflows. The overflow system shall be explicitly designed by the engineer. Critical cross sections of swales shall be dimensioned and shown on the plans, along with hydraulic calculations showing the design depths, cross sectional area of flow and discharges. Crossing points and ponding depth at streets shall be calculated. All overflow swales shall be designed with a minimum 2.5% slope. Easements are only dedicated for the enclosed storm sewer system pipe, and are not extended to include engineered swales that lie beyond typical easement limits. A minimum of 1.0 foot of freeboard shall be provided between the lowest opening into habitable structures and the energy grade line of flow of the system for the 1% storm. The City may require that engineered swales be provided in areas not served by a pipe system if conditions warrant.
- viii. **Lot Grading in General:** All areas to be developed shall be graded so as to provide positive drainage toward the receiving storm sewer system. The minimum slope of overland surface drainage in the direction of flow should generally be 2.5% or greater. Obstructions in the width of flow shall be avoided, as shall low points that create standing water, unless the low points have been specifically designed and approved as stormwater treatment facilities. Overall grading shall be smoothly contoured. Subdivision plans shall show drainage area boundaries and flow areas sufficient to convey the lot grading intent. These grading requirements do not apply to areas of the site that are located in a natural stream corridor or which are otherwise intended to be preserved in a natural, undeveloped state.
- ix. **Stormwater Detention:** Requirements for stormwater detention shall be as set forth in

OPMC 15.10 and Section 5608, as amended, and ES Policy 3-01 "Stormwater Management Studies". When evaluating downstream flooding problems for detention requirements, the potential problem area will be evaluated during a 1% storm event. In locations where a comprehensive watershed study has previously been completed, these comprehensive studies can be referenced as appropriate. A project located within a stormwater detention study area which does not meet the exceptions provided in OPMC 15.10 must construct storm water detention facilities or provide an engineering analysis showing storm water detention on their site would be detrimental to the flooding conditions.

- x. **Water Quality BMPs:** Refer to OPMC 16.210 for stormwater treatment facility requirements. Design criteria for any such stormwater treatment facilities must be developed individually for each proposed project based on "C. Stormwater Treatment Facilities".
- xi. **Floodplains:** Additional requirements related to Special Flood Hazard Areas (SFHA) as defined by FEMA Flood Insurance Rate Maps (FIRM) are contained in OPMC 18.360.
- d. Section 5601.8.A. Protection of Property. Delete this entire section and replace with the following:

“Storm drainage systems shall be designed to protect buildings from flood damage in the 1% or more frequent storms. A minimum of 1.0 foot of freeboard between the lowest opening into a building and the energy gradeline of the adjacent flow shall be provided. Accessory buildings are sometimes provided less protection, as approved by the City.

Property not reserved or designed for stormwater treatment or conveying storm water shall be protected from frequent inundation through the provision of storm drainage systems as prescribed in Amendment 3 of this document. Elements of such systems include public and private pipe systems, overflow swales, stormwater treatment facilities, natural streams and good lot grading practices.”

- e. Section 5602.2 Computational Methods for Runoff: Change the following:

Section 5602.2.A: Change the first sentence to “Watersheds less than 160 acres:”

Section 5602.2.B: Add to the end of the first sentence, "SCS Type II may be used for watersheds less than 160 acres. HEC-HMS shall be used to evaluate watersheds 160 acres and greater using storm distributions and precipitation estimates as directed by the City."

Section 5602.2. Add the following paragraph:

“5602.2.F. Johnson County Watershed Studies: When working in areas where an approved Johnson County Flood Study has been completed, the City Engineer may waive the

requirement for conducting a separate hydrologic analysis and the estimates available from the study used instead. The Design Engineer for development projects may use the Johnson County Flood Study results as supplemental information when establishing the 1% storm elevations for their development site and when investigating the downstream system as required in [ES Policy 3-01](#), “Stormwater Management Studies”; however, the Johnson County Flood Studies are not a substitute for the design engineer’s own conclusions.

- f. Section 5602.3. Runoff Coefficients. Add the following language to this section:

“The antecedent moisture condition (AMC) shall be set at 2-3/4 for the 1% storm and less frequent storms and shall be set at II for all other storms.”

- g. Section 5604.1.B Configuration (inlet Design). Delete this entire section and replace with the following:

Minimum dimensions for curb inlets shall be as shown in the Standard Details as adopted by the City Engineer. The dimensions given in this paragraph are not applicable.

- h. Section 5604.1 Inlet Design. Add the following paragraphs:

“D. Grate Inlets: Plastic drainage inlets/manholes/junction boxes as well as grate inlets, slotted drains, trench drains, and similar structures shall not be constructed on any public storm sewer system without approval of the City Engineer. Plastic (PVC) drainage inlets, manholes and junction boxes as well as grate inlets, slotted drains, and trench drains are discouraged on private storm drainage systems, but may be allowed when site constraints make construction of a curb inlet or side opening area inlet impractical. In such cases, plastic drainage inlets/manholes/junction boxes, grate inlets, slotted drains and trench drains may be approved if all of the following conditions are met:

- i. When used in parking areas, ponding depth must not exceed 7-inches in depth in parking stalls or 9-inches in drive aisles during the 1% storm event assuming that the inlet or drain is 100% blocked.
- ii. A minimum of 1-foot freeboard to any building opening is maintained during the 1% storm event assuming that the inlet is 100% blocked.
- iii. For unpaved areas, the inlet or drain is in a mowed/maintained area to minimize blockages by vegetative debris.
- iv. A standard curb or area inlet must be provided within the limits of the property downstream of the plastic drainage inlet, grate inlet, slotted drain, or trench drain that will intercept the design flow in the event that the inlet/drain is 100% blocked. This condition will be waived where overflows from a blocked inlet/drain will discharge to a stream corridor, improved or unimproved drainage ditch, or other drainage facility capable of

conveying the overflow and not negatively impact other property owners or street right of way.

- v. Plastic drainage inlets, manholes, and junction boxes shall be a minimum diameter of 18-inches in diameter.
- vi. Plastic drainage inlets, manholes, and junction structures shall generally be located outside of vehicular areas.
- i. Section 5604.1.E. Landscape Drains: Private landscape drainage facilities which may include grated plastic drain basins, small diameter plastic pipe, and similar inlets may be used only in areas where an enclosed storm drainage system is not required by the City's Design and Construction Standards. These locations include areas where the cumulative system drainage is less than 2.0 acres, and where an enclosed pipe system is not required to meet building freeboard or parking lot maximum depth requirements.

Typical applications where a landscape drain system may be approved include; athletic fields, playgrounds, lawn areas around non-residential buildings, golf courses, pedestrian plazas, and similar areas. Landscape drains shall be designed in accordance with the following conditions:

- i. Where approved, landscape drains shall utilize 8-inch minimum diameter pipe to minimize blockage. Since such systems are not a required component of the storm drainage system and are not relied upon to provide property protection, there is no minimum design storm interval associated with such systems.
- ii. When landscape drains are utilized in sump locations near buildings, an overflow path shall be provided that meets freeboard requirements assuming that the landscape drainage system is non-functional.
- iii. When landscape drains discharge to a storm drainage system, the receiving storm drainage system shall be designed assuming that the landscape drainage system is non-functional.
- iv. Landscape drains may be permitted to connect to the public storm drainage system upon approval by the City Engineer and issuance of a Right of Way Work Permit. Any connections to the public system will require the owner to execute a maintenance agreement.
- j. Section 5605.3 Stream Preservation and Buffer Zones. Stream preservation and buffer zone requirements shall be as set forth in [OPMC 18.365](#). The default approach given in Section 5605.3.B. is not applicable.
- k. Section 5605.12.C. Bank Stabilization Projects: After the second sentence, add the following requirement:

“A geotechnical report shall be provided that analyzes the failure mode of the streambank and provides recommendations to stabilize the bank. The recommendations in the report shall conform to references noted in KCAPWA 5605.12.F or as approved by the City Engineer.”

- l. Section 5606.1 Easements: Delete the first paragraph and replace with the following:

“Permanent easements shall be dedicated to the City for operation and maintenance of the storm drainage facilities. The minimum easement width shall be whichever is greater: 20 feet OR the outside width of the pipe or conveyance structure plus a total of 15 feet, rounded up to the nearest increment of 5 feet. The easement shall extend a minimum of 20 feet past the end of any storm sewer outlet structure for access and maintenance.”

- m. Section 5606.2 Capacity: Delete the paragraph and replace with the following:

“Capacity shall be determined in accordance with Section 5603. Minimum design pipe size shall be 15-inch in diameter. When site conditions or clearances will not accommodate a 15-inch pipe, the City may approve a 12-inch diameter pipe. For partially full pipe flow, Figure 5606-1 can be used to obtain hydraulic parameters of the flow.”

- n. Section 5606 Enclosed Pipe Systems. Add new paragraph:

"5606.7 Pipe Materials: Reinforced concrete pipe shall be used for underground storm sewer construction. Pre-cast concrete storm sewers shall be equipped with restrained joints where discharging into natural streams or engineered channels. Restrained joint designs shall be approved by the City and shall be installed in accordance with manufacturer recommendations. Toe walls shall be provided on all storm sewers discharging into natural streams or engineered channels.

High-density polyethylene (HDPE) pipe may be used for storm sewer systems located outside of the public street right-of-way in the following circumstances only:

- i. Private stormwater conveyance systems if the pipe dimension is between 12" and 60" in diameter. HDPE storm sewer larger than 48" shall require special inspections by the owner.
- ii. Privately maintained underground stormwater detention facilities, without limitations on pipe diameter.
- iii. Privately maintained post construction water quality best management practices, with a minimum 6" pipe diameter.
- iv. Private driveway culverts in the street right-of-way along unimproved thoroughfares when approved by the City.

- o. Section 5606 Enclosed Pipe Systems. Add new paragraph:

"5606.8 Conduit Length and End Protection: Where enclosed systems (including culverts) are placed under roadways, they shall extend to at least the limits of the street right-of-way or, in RE Districts with ditched streets, to fit the roadway ditches and grading. Proper handrails for pedestrian protection shall be provided at outlet locations for all enclosed systems if the vertical pipe dimension is 42" diameter or larger."

- p. Section 5606 Enclosed Pipe Systems. Add new paragraph:

"5606.9 Concrete Box Culvert Design: Box culverts shall be constructed of reinforced concrete and shall be designed to support all dead, live and impact loads imposed thereon. A Professional Engineer, registered in the State of Kansas, shall submit bridge load rating calculations and other engineering data as determined by the City Engineer. Concrete boxes shall be designed as specified in the [Kansas Department of Transportation \(KDOT\) Design Manual](#), except that wingwalls shall be designed and constructed as independent structures from the box culvert.

Wingwall footings shall be founded a minimum of 3'-6" below the groundline. A Concrete Box Culvert design can be obtained from KDOT through the use of the RCB/RFB Request form. Other alternate design elements may be approved by the City. All cast in place box culverts shall be built with a minimum 3" seal course on a 6" aggregate base, except as exempted by the City Engineer when excavating in rock. All box culverts shall have a minimum interior height of 5 feet and a minimum interior width of 5 feet to facilitate maintenance access. Box culverts shall have handrails installed to City standards along the headwall and wingwall. The railing shall meet AASHTO requirements for geometry and loading. Box culverts meeting the definition of a "Bridge Box" in the KDOT Design Manual shall have a plaque installed designating the structure number. Plaque design and structure number shall be obtained from the City. The plaque shall be installed in the northwest inside barrel corner. An NBIS bridge inspection shall be required prior to acceptance. This inspection shall be performed by a KDOT pre-qualified bridge inspector."

- q. Section 5607.2.A Engineered Channels. Delete the last sentence beginning, "Generally, easements shall be required..." Refer to item number II.B.5 "Natural Conveyance Swales" for the handling of easements on swales.

- r. Section 5607 Engineered Channels. Add new paragraph:

"5607.10 Concrete-Lined Ditch: While concrete-lined ditches are no longer approved for general use, if such channels are approved, they shall conform to the requirements of this paragraph. The paved ditch must have either vertical or sloping sides. If the walls are vertical, the height shall be limited to 24 inches. If the sides are sloped, the maximum slope shall be 1.5 horizontal to 1.0 vertical. Maximum sod slope allowed above the concrete lining shall be 3

horizontal to 1 vertical. The minimum width of the bottom portion of the paved ditch shall be four feet and shall slope a minimum of 1.5 inch vertical to 1.0 foot horizontal toward the center of the bottom portion. A "V" or half-moon type insert may be shaped in the center of the bottom slab, but the top width of the "V" or half-moon shall be limited to one foot and its depth to 6 inches. The minimum thickness of the reinforced concrete shall be 5 inches. Cut-off walls extending a minimum of two feet below the liner shall be constructed at the upstream and downstream ends of the channel and at intervals not exceeding 250 feet in length. Designed energy dissipation structures or similar stabilization will be required to stabilize the section of unimproved ditch at the discharge end of the lined section."

- s. Section 5608.4.A.2 General Provisions. Add the following sentence:

"These criteria shall apply to all dams (including farm ponds) that are greater than 10 feet in height."

- t. Section 5608.4.B.2 Temporary Storage Volume. Delete this section and replace with the following:

"5608.4.B.2. Temporary Storage Volume: For preliminary approvals, the City may accept an estimate that reserves an effective detention volume of 10,000 cubic feet per acre detained. This method may not be used for final calculations, and the developer bears all risk for redesign should such estimate prove inadequate."

- u. Section 5608.4.C Release Rate. Delete this section and replace with the following:

"5608.4.C. Release Rate: The maximum allowable release rate of stormwater runoff originating within the proposed development shall be limited to an amount that will not cause or increase downstream flooding within that tributary in a 1% or more frequent flood. Release rates for the 50%, 10%, & 1% storms shall be limited to the pre-development conditions. Such allowable release rate shall be approved by the City based on a study of the tributary area and the downstream drainage system. The engineer shall submit to the City all existing and proposed site data and special studies necessary to approve the release rate. Such data may include existing and proposed grades, site plans, utilities, hydrologic calculations, downstream analyses, and special studies to determine the effect of development. Sizing of detention basins for redevelopment shall be based upon existing site conditions. The rate of discharge from a detention facility and the rate of discharge of stormwater runoff from areas of the development not controlled by the detention facility shall not collectively exceed the maximum release rate approved by the City."

- v. Section 5608.4.D.1 Detention Basin Size. Add following to the end of the section:

"5608.4.D. Detention Basin Size: The engineer may evaluate the detention pond using a 24-hour SCS Type II frequency storm, less the discharged volume released at the permissible rates."

- w. Section 5608.4.E Primary Outlet Works. Delete this section and replace with the following:

“5608.4.E. Primary Outlet Works: The primary outlet works for detention basins shall be discharged to a receiving system to prevent downstream erosion and avoid unreasonable nuisance flows. Receiving systems approved by the City Engineer include storm sewer systems with adequate capacity such as pipe systems, natural conveyance swales, roadside ditches, natural streams, or stormwater treatment facilities.”

- x. Section 5608.4 Performance Criteria. Add new paragraph:

“5608.4.I. Low Flow Bypass: Storm sewers shall not discharge into earthen dry bottom detention basins unless design considerations have been included to accommodate lower flows.”

- y. Sections 5608.5.A.4. and B.3. Side Slopes. Delete both sections and replace with the following:

“5608.5.A.4. Side Slopes: Side slopes shall conform as closely as possible to regraded or natural land contours. If side slopes exceed 20%, both erosion control and safety measures shall be provided. In no case shall earthen slopes exceed 33% at any point. If vertical walls are used, the basin must be fenced, with steps, ramps, or other means of egress provided.”

- z. Section 5608.5 Detention Methods. Add new paragraph:

“Section 5608.5.F. Underground Storage: The use of underground storage to meet detention requirements is discouraged by the City of Overland Park. Whenever possible, flood control storage shall be provided in depressed open areas with a provision for emergency overflows. However, underground storage is allowed in commercial, mixed-use, multi-family residential, and industrial sites. Generally, underground detention systems should be constructed from pre-cast or cast-in-place concrete, reinforced concrete pipe, polypropylene pipe, or high-density polyethylene pipe. Concrete and high-density polyethylene pipe shall meet Overland Park standard specifications. Alternative shapes and sizes shall be subject to review and approval of the City Engineer on a case-by-case basis.

The property owner of record shall be responsible for the design, performance, operation, and maintenance of underground storage facilities for on-site detention. Underground storage facilities shall not be located within public street right-of-way or utility easements, and shall meet the setback requirements set forth in Section 5608.2.A.

The following minimum design requirements must be met before an underground storage facility will be considered for approval:

- i. Before entering an underground detention system, surface water shall pass through a pre-treatment system. Surface water shall be directed to a stormwater treatment facility that removes trash, debris, and sediment, such as an oil/grit separator, sediment forebay, or grass filter strip.

- ii. An engineer registered in the state of Kansas shall provide calculations or manufacturer's certification (based upon independent testing) stating that the system meets HS-20 loading requirements. It is the ultimate responsibility of the design engineer to seek verification from the manufacturer that these structural requirements are met.
- iii. The underground storage facility must be constructed of durable materials with a typical 75-year lifetime.
- iv. Design measures must be taken to trap and store sediments in locations where cleanout and maintenance can be easily performed.
- v. The underground storage facility must provide a minimum of two (2) points of access for maintenance from the surface. Forty-eight (48) inch minimum manhole shafts at each access point shall be provided. If regular maintenance requires entering the facility, then a fixed ladder must be installed at each inspection location. A thirty (30) inch manhole frame and cover can be used at grade with a concrete collar where subject to wheel loads. Otherwise, access shall be secured with a bolted grate or solid cover to prevent unauthorized entry.
- vi. A detailed drawing that indicates how the facility will drain into the outfall structure shall be provided. The underground storage facility may only discharge stormwater through a restricted outlet, and the outlet structure shall be accessible from the surface.
- vii. The system must drain completely within 24 hours.
- viii. The underground storage facility shall have a means of being dewatered for inspection and maintenance purposes.
- ix. The storage volume of any underground detention facility shall not be reduced by more than 10% due to the accumulation of silt and sediment. All designs shall include a visual marker that is set at an elevation less than or equal to 10% of the storage volume to clearly indicate the depth of sediment accumulation at which clean-out is required.
- x. A backfill detail shall be provided that includes material and compaction requirements. For circular pipes, particular care shall be given to the area under haunches and to the springline of the storage pipe.
- xi. An engineer registered in the state of Kansas shall provide calculations showing that failure of the underground storage facility will (a) not jeopardize adjacent existing or proposed structures for the development and/or (b) not collapse soil beyond property boundaries. In lieu of calculations, the designer may assume that the plane of failure is a 1:1 angle of repose from the outside edge of the underground structure plus two (2) feet. For circular pipes, the outside edge of the structure is defined as the springline of the

pipe. Structures shall be designed to resist uplift pressures.

- xii. The following statement shall appear on all plans which include the use of an underground storage facility:

“All underground storage facilities shown on this project shall be maintained by the property owner. These underground storage facilities shall be modified, upgraded, or replaced with similar or other appropriate devices/measures by the property owner when they cease to drain the water within a 24-hour period.”

- xiii. If a proprietary system is used, the design and installation shall conform to the manufacturer’s standards and specifications.

- xiv. Open-bottom underground detention with a gravel or rock bed is allowed if the following additional criteria are met:

- (a. Areas served by the detention basin must be permanently stabilized prior to discharging flows into the basin to prevent sediment laden water from entering the gravel/rock bed area.
- (b. Areas served by the basin must be fully developed upon completion of the basin. No vacant but developable land shall drain into the basin to prevent future site construction from introducing sediment laden water into the gravel/rock matrix.
- (c. A sedimentation chamber or pre-treatment device shall be installed and sized to hold the first ½” of runoff prior to entering the open-bottom system.
- (d. A report with photos must be provided showing interior television inspections of the chamber system with the initial and all subsequent detention certifications.
- (e. The assumed void space provided by gravel/stone matrix shall be reduced by 25 percent to account for future sedimentation within the gravel/stone matrix.

- aa. Section 5608.5.G. Detention Methods. Add new paragraph:

“5608.5.G. Appearance: Pipes, drainage structures, outlet works, or other necessary structural features of detention ponds shall be devised so as to be minimum in number and inconspicuous. Screening and/or landscaping shall be included and shall be in accordance with plans sealed by a licensed architect or landscape architect.”

- bb. Section 5609.2 General. Delete the third sentence and replace with the following:

“Standard drawings of the City shall be included in the plan sets (i.e. not by reference only) and shall not be altered or edited, unless such edits are clearly distinguished from the original

standard and have been specifically approved by the City.”

3. Standard Drawings: See Standard Details.
4. Construction Specifications: All public and private stormwater conveyance construction performed pursuant to these design criteria shall utilize construction specifications and details approved by the City.

C. Stormwater Treatment Facilities

1. Standards Adopted by Reference: Adoption of the Mid-America Regional Council and American Public Works Association [Manual of Best Management Practices for Stormwater Quality](#) (MARC BMP Manual) by Reference per [Municipal Code Chapter 16.210: Manual of Best Management Practices](#), published by the Mid-America Regional Council (MARC) and the Kansas City Metropolitan Chapter of the American Public Works Association (KC- APWA), is hereby adopted by reference as the Design Criteria for the City, except as amended in the following sections. This adoption shall apply to the October 2012 edition of the Mid-America Regional Council and American Public Works Association Manual of Best Management Practices for Stormwater Quality (MARC BMP Manual) and all appendices.
2. Amendments to adopted Standard: The following amendments to the MARC BMP Manual shall apply to stormwater treatment practices within the City:
 - a. Dedicated Stream Corridors:
 - i. **Limited Application Stormwater Treatment Facilities within a required Stream Corridor.** It is recognized that Stormwater Treatment Facilities are intended to protect the health and quality of streams and riparian corridors, and thus should be implemented within development sites rather than within dedicated stream corridors. However, certain STF's (described below) that maintain or enhance the character and function of a stream corridor may be included as part of the Stormwater Management Plan under the following conditions:
 - (a. Stream Corridors with a drainage area larger than 40 acres:
 - (1. Installation of natural conveyance swales or native vegetation swales to convey stormwater to the main stream channel when it is not practical to convert such flows into sheet flow (as approved by the Director).
 - (2. Installation of vegetated filter strips to treat flows entering the stream corridor. Constructed filter strips shall be limited to the outer 1/3rd of required the minimum stream corridor width as defined under [Chapter 18.365](#) of the Municipal Code. Generally, trees within the dedicated stream corridor should not be removed in order to construct filter strips.

- (b. Stream Corridors with a drainage area less than 40 acres:

Any STF approved for stream corridors with a drainage area larger than 40 acres (as described above) may be constructed. Additionally, extended detention wetlands may be constructed provided that 90% or more of the tributary area to the facility is contained within the development boundary, or if 90% or more of the upstream watershed has been previously developed.

- (c. Value Ratings:

Natural Conveyance Swales: Apply a treatment train value rating of 6.25 to the tributary area from the swale that enters into the designated stream corridor that will be treated by the “native vegetation preserved or established”.

Vegetated Filter Strip: Apply the value rating as described above in the MARC BMP Manual to upland areas tributary to a vegetated filter strip.

- ii. Additional Treatment Credit for Stream Corridor and Native Vegetation Areas Practices shall be as follows:

Contiguous dedicated stream corridors and Native vegetation areas used for stormwater treatment credit shall receive the following Value Ratings:

- (a. Less than ½ acre receives no value rating credit.
- (b. Between ½ and 2 acres receive a value rating of 6.0.
- (c. Between 2 and 5 acres receive a value rating of 10.25.
- (d. Over 5 acres receive a value rating of 11.0.

All dedicated stream corridor areas regardless of area, will receive a value rating of the greater of a-d above or 9.25, whichever is greater. Similarly, any contiguous areas adjacent to dedicated stream corridor areas will receive a minimum value rating of 9.25 or a-d above, whichever is greater. For dedicated native vegetation areas that are contiguous with another native vegetation area under a different ownership or parcel, stream corridor, or similar permanently preserved area, the value rating shall be based upon the acreage of the contiguous preserved area from a-d above.

b. Stormwater Treatment Facilities in Highly Visible Areas:

The following is a list of typical standards for stormwater treatment facilities when they are located between buildings and the public right-of-way, or when the facility is readily visible from adjacent developments and/or to the general public:

- i. The facility shall be bordered with a permanent edging material that is designed to remain in place and will be apparent to the public and maintenance providers. Edging materials shall be stone, pre-cast concrete, sidewalk, or curbing. Alternatives may be acceptable and are subject to the approval of the Planning and Development Services Department, the Planning Commission, or the Governing Body.
- ii. The plant materials palette shall be simple. The maximum number of different varieties of plants shall be five. Small facilities shall have fewer different species.
- iii. Individual plants shall be appropriately spaced based on the size of plant when mature.
- iv. Plants shall be evenly distributed to avoid bare spots in planting areas.
- v. Establishment of native plants by seeding will not be allowed.
- vi. All plant materials shall meet the minimum size requirements listed in Chapter 16.450.060 of the Unified Development Ordinance.
- vii. Minimum size plant materials shall be as follows:
 - Forbs and grasses: 3-inch deep cell plugs or larger
 - Shrubs: 3-gallon container or larger
 - Trees: 2-inch caliper or larger
- viii. The plant selection shall show interest throughout the growing season.
- ix. Non-native plant materials may be used to supplement landscaping in high visibility areas, particularly at the edges of parking lots or other paved areas where trees and shrubs are desired to be present all year long.

Plant material shall be placed in groups or clusters and designed so that tall growing materials are behind lower growing materials as viewed from the public right-of-way, from adjacent properties, or from specific view sheds.

c. Native Vegetation Area Requirements (preserved, enhanced, or newly planted):

Any development that proposes to preserve, enhance, or plant a native vegetation area shall meet the following requirements:

- i. The following criteria shall be met for an existing area to be considered “native vegetation” for water quality mitigation. Any development that proposes to preserve native vegetation on site (including those areas intended to be dedicated stream corridors) shall provide an evaluation of the existing vegetation that is signed and sealed by a landscape architect registered in the state of Kansas confirming the necessary criteria.
 - Contiguous stream corridors or other permanently preserved areas can be counted towards the designated area requirement.
 - The designated area shall contain > 25% of the area covered by native species (tree, shrub, and/or grasses and forbes).
 - The area shall be free of noxious weeds and invasives or those species shall be eliminated prior to initial certification.
 - The area shall not contain greater than 50 ft² of contiguous bare area.
 - ii. All native vegetation areas shall be setback from all property lines a minimum of fifteen (15) feet.
 - iii. The minimum width of any native vegetation area shall be fifty (50) feet.
 - iv. All native vegetation areas in single family residential subdivisions shall be located in a minimum sixty-five foot wide tract dedicated on the plat.
- d. Buffalo Grass:
- Buffalo grass is strictly prohibited in any stormwater treatment mitigation planting plan.
- e. Minimum Easement and Setback Requirements:
- Access for maintenance shall be provided per Municipal Code [16.210](#) for all stormwater treatment facilities. STFs shall not be located in utility easements unless approved by the Director per O.P.M.C. 16.210.050. E. In addition, minimum setbacks from buildings shall be provided to ensure desirable site designs and to prevent potential water damage to buildings. The following establishes minimum easement and setback dimensions for STFs installed under the Code:
- f. **Setbacks for Infiltration Facilities:** Any facility that causes water to pond and infiltrate into the subsurface after a rainfall event shall be located a minimum of 20 feet away from any residential structure, measured from the design WQv pool elevation to the outside face of the structure. Facilities may be allowed to be closer to residential structures if no basements are constructed. Representative STFs include bioretention cells and infiltration basins. Rain gardens

installed to treat stormwater from individual residential building lots shall generally be located a minimum of 10 feet away from any residential structure and located on the downslope side of the building.

- g. **Setbacks for Natural Conveyance Swales and Native Vegetation Swales:** The design WQv pool elevation shall be located a minimum of 20 feet from any residential structure with a basement.
- h. **Setbacks from Thoroughfares:** All STFs shall be set back a minimum of 10 feet from all property lines adjacent to thoroughfares.
- i. **Access Route:** All stormwater treatment facilities shall maintain a minimum 15- foot wide access route from a paved public access route. The access routes for each facility shall be provided in the Stormwater Treatment Facility Maintenance Agreement for the property.
- j. **Maintenance for Basins and Ponds:** A 15-foot wide maintenance access strip with a maximum 5:1 slope shall be provided around the perimeter of ponds and basin-type stormwater treatment facilities (see examples below). Additionally, a 20-foot minimum setback shall be provided from the 1% design storm water surface elevation in such facilities to all residential structures. Examples of ponds and basin-type stormwater treatment facilities as defined in the MARC BMP Manual include:
 - Extended Detention Wetlands
 - Extended Wet Detention
 - Extended Dry Detention Basins
 - Wet Ponds
- k. **Setbacks for Non-Residential Developments:** The City recognizes that higher density developments (office, retail, mixed-use, etc.) may require stormwater treatment facilities to be placed closer to buildings than noted above for residential construction. In these cases, the Design Engineer shall show that the facilities are completely separated from the building foundation to address geotechnical and structural concerns, including but not limited to sub-drainage, differential movement and shrink/swell factors.
- l. **Protection of Property:** In addition to the above setback requirements, the 1% design storm shall be routed through all stormwater treatment systems to ensure minimum freeboard requirements are met as described in Section II-B.d.
- m. **Pipe discharges into STFs with a Permanent Pool:**

Any pipe that discharges into a STF with a permanent pool shall outlet into the facility at least six (6) inches above the normal pool elevation to avoid excessive siltation at the pipe entrance location.

n. Minimum Freeboard Requirement for Overflow Structures:

Any STF that includes an overflow structure in the design shall provide a minimum of six (6) inches of freeboard between the overflow structure elevation and the lowest adjacent pavement elevation to ensure that the runoff does not bypass the facility.

o. Percolation Testing Requirement:

Percolation test results are required to be submitted to the Engineering Services Division prior to the approval of a Rezoning, Special Use Permit, Preliminary Plat, Preliminary Development Plan, or Revised Preliminary Development Plan application for any proposed infiltration type STFs. These types of stormwater treatment facilities shall NOT be allowed in Hydrologic Soil Group (HSG) “D” as classified by the USDA Natural Resource Conservation Service and shall be set back a minimum of twenty feet from any paved surface to allow for proper infiltration. Examples of infiltration type STFs as defined in the MARC BMP Manual include:

- Rain Gardens
- Filtration Basins
- Infiltration Trenches
- Sand Filters

Follow the Overland Park Soil Infiltration Testing Protocol (Attachment B), and submit test results with the Preliminary Stormwater Management Study for review and approval by the Engineering Services Division.

p. Mulch Netting Requirement:

Photodegradable or biodegradable plastic netting shall be placed over any STF that requires the installation of mulch for vegetation establishment. The following guidelines shall apply to all mulch netting installations:

- i. The rolls of netting should be placed from the top of slope to the bottom of slope. It is preferred that the rolls are not constructed in a horizontal direction across the slope face. The rolling should follow the water flow direction.
- ii. At the top of slope, bury the end of each roll in a trench at least 8 inches deep. The trench should then be backfilled and tamped.
- iii. Overlap the sides of the rolls at least 4 inches, and make sure there is at least 3 feet of overlap when an uphill roll joins a downhill roll. The uphill roll should overlap the downhill roll.
- iv. Extend the netting beyond the edge of the mulched area at least 1 foot at the sides and 3 feet at the top and bottom.
- v. The plastic netting shall be secured to the ground using “U” shaped biodegradable staples or stakes in accordance with the manufacturer’s recommendations.

- vi. Staples or stakes should be driven perpendicularly into the slope face. Place them approximately 3 feet apart down the sides and center of the roll, and not more than 1 foot apart at the upper end of a roll or at the end overlap of two rolls.
- q. Sediment Forebay Requirement:
- A staff gage or other fixed vertical sediment depth marker is required to be installed in all sediment forebays to the indicated depth of sediment accumulation at which clean-out is required.
- r. Section 4.2 The Level of Serviced Method: The following deletions and additions shall be applied:
- i. Delete the steps provided for previously developed sites that are incrementally being modified in Section 4.2 and replace with the following:
- **STEP 1** – Determine the actual increase in impervious surface for the site’s post-development condition.
 - **STEP 2** – This step does not apply to infill and redevelopment in the City of Overland Park. Delete this step from the calculation procedure.
 - **STEP 3** – Determine the Total Value Rating required for the site in the proposed post-development condition by multiplying the amount of new impervious surface by a LOS of 7.0.
- ii. Section 4.2.1. Predevelopment and Post Development Conditions. Delete the second to the last paragraph on Page 4-6 and replace with the following:
- “Because space constraints and higher development costs can significantly affect the feasibility of site development in established areas of the city, infill and redevelopment sites will be evaluated differently compared to new (greenfield) development sites. For the purposes of this section, “infill” and “redevelopment” are defined in [Chapter 16.210](#) of the O.P.M.C. If there is lawfully installed gravel paving located on an existing site, it will be considered an impervious surface for water quality purposes. Lawfully installed gravel areas are those that conform with Section 18.410.075 of the OPMC. The water quality impact is determined by measuring the change in impervious surface for the site and multiplying the amount of new impervious area (in acres) by a Level of Service of 7.0 (100% impervious) to establish the Level of Service required for the site. Example 3 at the end of this section illustrates the Level of Service determination for a hypothetical site.”
- iii. Delete Table 4.3.
- iv. Delete Worksheet 1A and replace with the following:

WORKSHEET 1A: REQUIRED LEVEL OF SERVICE - DEVELOPED SITE

Project:

By:

Date:

Location:

Checked:

1. Postdevelopment Impervious Condition

Postdevelopment Impervious Area Description	Acres
Total:	

2. Minimum Required Total Value Rating of BMP Package

Total Value Rating = 7.0 (LS) x Total Impervious Area

VR =

(5. Delete Pages 4-35 and 4-36 (Example 3), and replace with the following:

WORKSHEET 1A: REQUIRED LEVEL OF SERVICE - DEVELOPED SITE

Project: **BMP Manual Example No. 3**
Location: Townsville, Missouri

By: ABC Date: 4/1/2009
Checked: Date:

1. Postdevelopment Impervious Condition

Postdevelopment Impervious Area Description	Acres
Building	0.43
Parking	2.02
Access Drives	0.28
Total:	2.73

2. Minimum Required Total Value Rating of BMP Package

Total Value Rating = 7.0 (LS) x Required Treatment Area VR = **19.11**

WORKSHEET 2: DEVELOP MITIGATION PACKAGES(S) THAT MEET THE REQUIRED LS

Project: **BMP Manual Example No. 3**

By: **ABC**

Date: **4/1/2009**

Location: **Townsville, Missouri**

Checked:

Date:

Sheet: **1 of 1**

1. Required LS (New Dev., Wksht 1) or Total VR (Redev., Wksht 1A):

19.11

Note: Various BMPs may alter CN of proposed development, and LS; recalculate both if applicable.

2. Proposed BMP Option Package No. **1**

Cover/BMP Description	Treatment Area	VR from Table 4.4 or 4.6 ¹	Product of VR x Area
Building into bioretention	0.43	8.50	3.66
Parking/lawn into native veg. swale	2.02	4.00	8.08
Native vegetation - reestablished	0.75	9.25	6.94
Bioretention	0.20	8.50	1.70
Total ² :	3.40	Total:	20.37

*Weighted VR: **19.11** =total product/total area

¹ VR calculated for final BMP only in Treatment Train

² Total treatment area cannot exceed 100 percent of the actual site area

* Blank in redevelopment

Meets required LS (Yes/No)?

YES

(If No, or if additional options are being tested, proceed below.)

3. Proposed BMP Option Package No. **2**

Cover/BMP Description	Treatment Area	VR from Table 4.4 or 4.6 ¹	Product of VR x Area
Building	0.43	0.00	0.00
Parking into porous pavement	2.02	7.50	15.15
Native vegetation - reestablished	0.50	9.25	4.63
Total ² :	2.95	Total:	19.78

*Weighted VR: **19.78** =total product/total area

¹ VR calculated for final BMP only in Treatment Train

² Total treatment area cannot exceed 100 percent of the actual site area

* Blank in redevelopment

Meets required LS (Yes/No)?

YES

(If No, or if additional options are being tested, move to next sheet.)

- s. Section 7.7 Signage: Replace the last paragraph of Section 7.7 with the following:

“Informational signage is recommended at readily visible locations along the perimeter of preserved or established native vegetation defined as effective elements of the Stormwater Management Plan (i.e. filter strips, restored or enhanced stream corridors, native vegetation swales, bioretention areas, etc.) in order to prevent routine mowing and other practices not in conformance with the approved Maintenance Plan for the site. If signage is provided, locations shall be shown on the Stormwater Treatment Facility Mitigation Plan. The size and type of sign shall meet the requirements of [Chapter 18.440](#) of the Overland Park Municipal Code.

- t. Section 8.1.2 General Application: Delete the second to the last sentence and replace with the following:

“The contributing drainage area to any rain garden shall be limited to one (1) acre unless otherwise approved by the Director.”

- u. Section 8.1.4 Design Considerations: Add the following:

- i. Rain gardens shall be located such that a perforated underdrain can be installed to connect to a suitable discharge location (i.e. structure or other daylight location) if it is determined that the facility fails to function as designed at any time.

- v. Section 8.15.2.4 Vegetation: Add the following:

Existing outer zones (outer 1/3rd) of dedicated stream corridors that are already established with grassy vegetation can function as a filter strip and be included as part of the Stormwater Management Plan provided that the filter strip zones meet the design requirements for minimum length and maximum allowable inflow approach lengths described in this section. Plantings may be installed outside and adjacent to the stream corridor in order to expand existing vegetated filter strip lengths and meet these requirements. Constructed filter strips can only be located in “poor” quality areas as defined by the Overland Park Stream Riparian Corridor Quality Evaluation (Attachment A).

- w. Appendix B, Section B.2. Update the last bullet to read the following:

Dog Kennels/Doggie Daycare, and Veterinary Clinics with Outdoor Play Areas (Section B.2.12)

- x. Appendix B, Section B.2. Add the following:

“B.2.12 Dog Kennels and Doggie Daycare Facilities with Outdoor Play Areas

B.2.12.1 Management Practices

The following section discusses the allowed options related to managing wash water from dog kennels and doggie daycare facilities where outdoor play areas are permitted:

B.2.12.1.1 Sanitary Sewer System

Connect to the sanitary sewer system.

- This option requires the installation of solid walls or compatible fencing around the perimeter of the play area to prevent windblown water from entering into the facility.
- A curb or other water-tight barrier shall be installed around the perimeter of the play area to prevent any off-site areas from draining into the facility.
- A roof structure shall be provided with sufficient overhang to prevent windblown rain from entering into the facility. A roof overhang of at least one foot shall be provided for every two foot of vertical opening above the fence or wall.

B.2.12.1.2 Open Grass Area

Provide an open grass area based on a minimum 540 sq. ft.* per dog that is surrounded by fencing constructed of an approved material that is a minimum of six feet in height.

- In no case shall the open grass area be smaller than ¼ of an acre.
- A minimum twenty foot setback shall be required from any storm drainage structures or downslope paved areas to allow for infiltration.
[*http://www.richmondindiana.gov/Assets/Kennel+Standards.pdf](http://www.richmondindiana.gov/Assets/Kennel+Standards.pdf)

B.2.12.1.3 Holding Tank

Install a holding tank that will be pumped out on a regularly scheduled basis.

- A maintenance schedule is required to be reviewed and approved by staff.
- The tank capacity shall be sized assuming 3.2 gallons/dog/day pressure wash usage.*
[*http://veterinarybusiness.com/dvm360.com/determining-water-consumption-animal-care-facilities](http://veterinarybusiness.com/dvm360.com/determining-water-consumption-animal-care-facilities)
- The tank shall be sized to have a minimum 5-day holding capacity, but shall not be less than 2,000 gallons.
- The tank shall be located at least 10' from any part of a building.

- The tank shall be adjacent to an all-weather access road or drive so that a pumper may drive pumping equipment to within 10' of the servicing manhole.
- A high water warning device shall be installed so that it activates 1-foot below the inlet pipe. The device shall either be an audible or illuminated alarm inside the building.
- The tank shall have an access manhole extended to finished grade.
- The tank shall include a valve system that can divert rainwater and avoid overloading the system during rain events.
- The design of the holding tank shall be such that any overflow backs up into the outdoor play area and does not create an illicit discharge onto public rights-of-way.

B.2.12.1.4 Artificial Grass Area

Install an appropriately sized permeable artificial grass area over a gravel infiltration trench. (See Attachment C for sizing guidelines).

- A percolation test shall be required to determine feasibility.
- This type of facility shall not be allowed in areas that are classified as Hydrologic Soil Group D by the USDA Natural Resources Conservation Service.
- A minimum twenty-foot setback shall be required from any paved surface to allow for infiltration.

B.2.12.2 Exemptions

The above standards and recommendations for dog kennels and doggie daycare facilities with outdoor play areas do not apply to the following:

- Fenced outdoor turf play area amenities associated with single family residential neighborhood subdivisions.
- Fenced outdoor turf play area amenities associated with apartment complexes or multi-family developments.
- Fenced outdoor turf play areas associated with veterinary clinics where boarding is an ancillary use."

3. Standard Drawings: Standard Drawings shall be in accordance with the MARC BMP Manual and as approved by the City.
4. Construction Specifications: All stormwater treatment facility construction performed pursuant

to these design criteria shall utilize construction specifications and details provided in the MARC BMP Manual and as approved by the City.

D. Erosion and Sediment Control

1. Standards adopted by Reference: [Division V - Design Criteria, Section 5100 - Erosion and Sediment Control](#) (Section 5100) of the Standard Specifications and Design Criteria, published by the Kansas City Metropolitan Chapter of the American Public Works Association (KC-APWA), is hereby adopted by reference as the Design Criteria for the City, except as amended below. This adoption shall apply to the revision of Section 5100 adopted and approved by KC-APWA on September 15th, 2010. Any future revisions of Section 5100 shall not be in force until adopted by the City in writing. The ultimate standard of the City is that practices used in the field perform without failure, and work together as part of integrated systems to prevent sediment from leaving the construction zone and to prevent sediment from contaminating downstream waterways. **Practices which fail to perform in the field shall be replaced with more effective substitutes, regardless of prior City reviews.** Innovations which engineers or contractors propose which have a high likelihood of improving performance are encouraged and will be considered by the City. All such innovations require City approval for use.
2. Amendments to Adopted Standards: The following exceptions shall apply:
 - a. Section 5101.4 Designer Qualifications: Insert the following language after “professional engineer” in the first paragraph:

“..., landscape architect, or Certified Professional of Erosion and Sediment Control...”
 - b. Section 5101.4 Designer Qualifications:. Delete items A, B, and C, and replace with the following:

“Eight (8) hours combined classroom and web-based training with exam and a minimum of four (4) hours of training within the past 24 months. Qualifications shall be provided upon request.”
 - c. Section 5104.7 Sediment Basin Embankment and Spillway Detail. Paragraph G. Delete this section and replace with the following:

“Method of surface dewatering shall be provided. Dewatering holes in the riser pipe are prohibited.”
 - d. Section 5105 Design Checklist: Table 1, Item 2. Delete this item and replace with the following:

“Designer is a Licensed Professional Engineer, Landscape Architect, or Architect in the State of Kansas or Certified Professional of Erosion and Sediment Control with relevant continuing education in erosion and sediment control.”

- e. Section 5105 Design Checklist: Table 1, Item 26. Delete the first sentence and replace with the following:

“A grading detail is provided for inlet protection when a sump pit is used.”
- f. Section 5105 Design Checklist: Table 1, Item 27. Insert the following language after “1.5 feet higher than the”:

“lowest point of the treatment length.”
- g. Section 5105 Design Checklist: Table 1, Item 55. Delete all language after “across the drainageway”.
- h. Section 5105 Design Checklist: Table 1, Item 57. Delete “practicable” and replace with the following: “achieving final grade”.
- i. Section 5105 Design Checklist: Table 1, Item 61. Insert the following language after the first sentence:

“The sediment basin shall be maintained until the upstream drainage area achieves final stabilization (as defined by KDHE) in accordance with [APWA Specification Section 2150](#). Interim stabilization using annual vegetation does not meet this requirement.”
- j. Section 5105 Design Checklist: Table 1, Item 68. Delete “rock” and replace with the following: “stabilized”.
- k. Section 5105 Design Checklist: Table 1, Item 70. Delete the first sentence and insert the following language after “drainage way”: “and limits of disturbance”.
- l. Section 5105 Design Checklist: Table 1. Add a new Item 72 that reads as follows:

“Housekeeping measures identified in APWA Specification 2152 such as trash (solid waste), chemical toilets, fuel & chemical containment, and contractor staging area are provided.”
- m. Section 5105 Design Checklist: Table 2, Item 6. Delete this item and replace with the following:

“Riser information includes the riser and drain pipe location and diameters.
[Dewatering holes are not allowed]”
- n. Section 5105 Design Checklist: Table 2, Items 7.A. & B. Delete these items and replace with the following:

“Dewatering provisions are accomplished by surface dewatering such as a skimmer, and a dewatering rate is identified that will drain the basin in 24-48 hours.”

- o. Section 5105 Design Checklist: Table 2, Item 9. Delete all language after “of the embankment, and” and replace with the following:

“lined to withstand the 4% design storm flow”.
- p. Section 5105 Design Checklist: Table 3. Add a new Item 8 that reads as follows:
“Sediment traps shall not be located in stream buffers.”
- q. Section 5105 Design Checklist: Table 5. Under “Conveyance Item Diversion Dike”, delete “21” and replace with the following: “14”.
- r. Section 5105 Design Checklist: Table 6. Delete this table and replace with the following “Table 6 Inactive Area Approved Cover Types”:

Cover	Mud Free Surface	Allowed for Sheet Flow*
Seed with erosion control blanket		All slopes
Compost mulch with seed		Mild to moderate slopes
Compost mulch without seed		Mild to moderate slopes-winter only
Sod		All slopes*
Final landscape planting and mulch		All slopes*
Seed with bonded fiber matrix		All slopes with municipal approval
Seed with straw mulch		Mild slopes
Seed with spray applied mulch		Mild to moderate slopes; also steep slopes-winter only
Erosion control blanket without seed		Mild to moderate slopes; also steep slopes-winter only
Crushed stone, gravel, or millings		Mild slope only
Pavement or pavement base course		Mild slope only
Building floor slab		Mild slope only
Steep slopes are steeper than 15% and have a change in elevation between top and toe of more than 3 feet. Moderate slopes are flatter than 15% or with less than 3 feet elevation change between top and toe. Mild slopes are flatter than 5% *Concentrated flow is subject to analysis. See Section 5110.4.C.		

- s. Section 5106.5.B. Typical Written Sequence: Item No. 5 shall not apply.
- t. Section 5107.5 Stockpiles: In the first sentence, insert the following language after stockpiles: “at least 50 feet away”.
- u. Section 5108.5 Silt Fence: Add “Sediment” at the beginning of the second sentence of the first paragraph.

- v. Section 5108.5 Silt Fence: Paragraph.B. Delete “a short distance” from the second sentence and replace with the following:

“between 6 feet to 10 feet as shown on the City of Overland Park Standard Detail”.
- w. Section 5108.6 Other Linear Sediment Control Devices: Paragraph C shall not apply.
- x. Section 5108.6 Other Linear Sediment Control Devices: Paragraph D delete the third sentence.
- y. Section 5108.7 Inlet Protection: Section A.1 delete the second sentence.
- z. Section 5108.7 Inlet Protection: Section C shall not apply.
- aa. Section 5109.1 General. Insert the following language after the first sentence:

“A sediment basin is required, where feasible, for each drainage area with 10 or more acres disturbed at one time.”
- bb. Section 5109.2 Placement Restriction: Insert the following language at the end of the paragraph:

“Sediment basins shall be fenced using construction fence or other material for safety reasons and shall include warning signs reading: “Danger – KEEP OUT”.”
- cc. Section 5109.3 Embankment: Add the following sentence at the end of the paragraph:

“The primary spillway outlet pipe shall have a minimum of two (2) anti-seep collars connected to the barrel and shall be watertight. They shall be generally placed in the middle third of the embankment and within the saturated zone.”
- dd. Section 5109.6 Dewatering: Delete all of the language after “skimmer” in the second sentence and replace with the following: “or other surface dewatering method”.
- ee. Section 5109.6 Dewatering: The third sentence shall not apply.
- ff. Section 5109.6 Dewatering: Paragraph B shall not apply.
- gg. Section 5156.1 Freeboard and Spillways: Paragraph D.3. Delete “0.5” from the fourth sentence and replace with the following: “1”.
- hh. Section 5156 Freeboard and Spillways: Paragraph D.2. Delete “seeded” from the second sentence and replace with the following: “stabilized”.
- ii. Section 5156 Freeboard and Spillways: Paragraph D.3. Delete “seeded or lined” from the fourth sentence and replace with the following: “stabilized”.

- jj. Section 5156.1 Freeboard and Spillways: Paragraph E. Delete the first sentence and replace with the following:

“Outlet protection is required at the riser discharge, the open channel overflow discharge point, and where they rejoin the natural flow path.”
 - kk. Section 5156.1 Freeboard and Spillways: Paragraph E. Add the following sentence to the end of this section:

“The concentrated flow path in between these points needs to conform with Section 5110.4 Erosion Resistant Conveyance, subsections C & D.”
 - ll. Section 5156.1 Freeboard and Spillways: Delete Figure 1 and replace with the City of Overland Park Standard Detail for Sediment Basins.
 - mm. Section 5110.3 Diversion Dikes, Gradient Terrace, and Slope Drains. Paragraph A. Delete the first sentence and replace with the following:

“Up-slope perimeter diversion: Drainage areas can be diverted around the construction area.”
 - nn. Section 5110.3 Diversion Dikes, Gradient Terrace, and Slope Drains: Paragraph D. Delete “21” and replace with the following: “14”.
 - oo. Section 5111.2 Inactive Area Defined: Delete the last sentence and replace with the following:

“Inactive areas usually occur whenever there is a pause or change in the location of grading or excavation. Inactive areas then require stabilization in the parts of the site just vacated.”
 - pp. Section 5111.6 Interior Sediment Control: Delete the last sentence and replace with City of Overland Park Erosion and Sediment Control Note #8:

“Silt fences and erosion control BMPs which are shown along the back of curb must be installed within two weeks of curb backfill and prior to placement of base asphalt. Exact locations of these erosion control methods may be field adjusted to minimize conflicts with utility construction; however, anticipated disturbance by utility construction shall not delay installation.”
3. Additional Guidance: Where there is a contradiction between specific materials or installation requirements included in Section 5100 and the Standard Drawings and Specifications which follow in this document, the Standard Drawings and Specifications shall govern. Any item discussed in Section 5100 which is prohibited for use by the Standard Drawings and Specifications is not allowed.

4. Errors and Omissions: Section 5100 may contain errors and omissions. Final approval of specific erosion and sediment control designs lies with the City. Professional judgment shall be used in applying these design standards.
5. Standard Drawings: In addition to the City of Overland Park Standard Details for erosion and sediment control, the following additional erosion and sediment control details are acceptable:
 - a. Standard Drawings for Temporary Water Pollution Control approved by the Kansas Department of Transportation (KDOT) are also acceptable for use in appropriate situations.

E. Private Drives, Parking Areas, and Private Sitework Outside Public Right-of-Way

1. Design Standards for Private Drives and Parking Areas: These standards shall apply to new construction and reconstruction of all private drives and parking areas outside of public right-of-way, as determined by the Director of Planning and Development Services, except for driveways serving individual units and residential developments located in the A, R-1, R-1A, RE, RP-OE and RP-OS zoning districts. Routine maintenance of pavement areas in private developments shall not be subject to these requirements. Any application for building permit or site development permit approval submitted after the effective date of these standards shall be subject to these standards.

A typical pavement section shall be included on the construction plans. For the proposed development, the City recommends that a geotechnical report be completed. This report should include recommendations for the types of suitable soils under the proposed parking area and recommended pavement thicknesses. If a geotechnical report is not provided, the minimum design standards included in Table IV may be used in lieu of a pavement design. These minimum standards are not implied to represent an adequate paving section for all applications. The Developer's engineer shall be responsible for selecting a pavement design suitable for site specific conditions.

2. Alternative Paving Materials: In accordance with Unified Development Ordinance Chapter 18.430.020, alternate all-weather, dust free permeable paving materials may be approved by the Director of Planning and Development Services when used as part of a stormwater treatment facility. Design criteria for such alternate pavement designs shall meet the requirements of Section II-C. Stormwater Treatment Facilities, of this Design and Construction Standards Manual.

3. Private Drive and Parking Area Pavement Design Standards:

<p>Table IV PRIVATE DRIVE AND PARKING AREA PAVEMENT DESIGN AND CONSTRUCTION STANDARDS</p>		
Pavement Area	Asphalt Alternative	Concrete Alternative
Parking Areas	6" Asphalt 9" Compacted Subgrade ¹ with Treatment ² or 6" AB-3 Aggregate Base	6" Unreinforced Concrete ³ 6" AB-3 Aggregate Base
Drive Aisles	8" Asphalt 9" Compacted Subgrade ¹ with Treatment ² or 6" AB-3 Aggregate Base	6" Unreinforced Concrete ³ 6" AB-3 Aggregate Base
Major Access Ways ⁴	10" Asphalt 9" Compacted Subgrade ¹ with Treatment ² or 6" AB-3 Aggregate Base	8" Unreinforced Concrete ³ 6" AB-3 Aggregate Base
Private Alleys – Single Family and Two Family Residential	8" Asphalt 9" Compacted Subgrade ¹ with Treatment ² or 6" AB-3 Aggregate Base	6" Unreinforced Concrete ³ 6" AB-3 Aggregate Base
Private Alleys – Others ⁵	10" Asphalt 9" Compacted Subgrade ¹ with Treatment ² or 6" AB-3 Aggregate Base	8" Unreinforced Concrete ³ 6" AB-3 Aggregate Base
<p>¹ Compacted subgrade shall be compacted to 95% Maximum Standard Density. ² Compacted subgrade shall be treated with either 15% Flyash, 4% Cement, or 5% Lime. ³ Minimum concrete strength shall be 4,000 psi. ⁴ Major Access Ways are the access route or routes that are designed to be the primary means of access within a private development, or which will carry the highest volumes of traffic to and through a development, or which will serve truck access areas. The Director of Planning and Development Services shall make the final determination as to which access routes will be designated as Major Access Ways. ⁵ Other areas include private alleys in multi-family, non-residential and mixed-use developments.</p>		

4. Private Retaining Walls: All privately maintained retaining walls on private property shall require sealed engineering drawings and shall meet the requirements of Section 1807.2 of the International Building Code. Special inspections shall be provided by the owner as applicable from Section 1705 of the International Building Code. Retaining walls meeting either of the following conditions are exempt from these requirements:
 - a. Retaining walls less than 4 feet in height measured from the bottom of the footing grade to the top of the wall and not supporting a surcharge.
 - b. “Landscape” retaining walls that do not support buildings, paved areas, or other structures that would be negatively impacted or create a hazard if the wall failed.

F. Streetlighting

The following criterion has been established for the design of all City-owned streetlighting whether it is for developer projects or CIP projects.

1. Standards Adopted by Reference: The American National Standard Practice for Roadway Lighting, Illuminating Engineering Society of North America, RP-8-14, as herein modified.
2. Thoroughfare, Super-collector, and Collector Streets: The following streetlighting design criteria will be used for all thoroughfare streets and collector streets, whether improved or unimproved, as identified on the latest edition of the City of Overland Park “Official Street Map”, regardless of the number of through travel lanes and auxiliary lanes, and the “Future Development Master Plan” available from the Planning and Development Services Department. However, streets in the southern portion of the city that were part of the adopted South Overland Park Transportation Plan and are being designed and constructed as interim thoroughfare improvements will not require streetlighting systems with the exception of maintaining any legacy systems already in place.

Street and Pedestrian Classification		Luminance Criteria			
Functional Street Classification	Pedestrian Conflict Area	Minimum Maintained Average (L_{avg}) (cd/m ²)	Maximum Uniformity Ratio ($L_{avg}:L_{min}$)	Maximum Uniformity Ratio ($L_{max}:L_{min}$)	Maximum Veiling Luminance Ratio ($L_{Vmax}:L_{avg}$)
Thoroughfare	High	1.2	3.0:1	5.0:1	0.3:1
	Medium	0.9	3.0:1	5.0:1	0.3:1
	Low	0.6	3.5:1	6.0:1	0.3:1
Collector	High	0.8	3.0:1	5.0:1	0.4:1
	Medium	0.6	3.5:1	6.0:1	0.4:1
	Low	0.4	4.0:1	8.0:1	0.4:1

a. Functional Street Classification Definitions:

- i. The functional street classifications are defined on the latest edition of the City of Overland Park “Official Street Map”.
- ii. The collector street classification includes super-collectors, residential collector streets, apartment streets, commercial streets, and industrial streets.

b. Pedestrian Conflict Area Definitions:

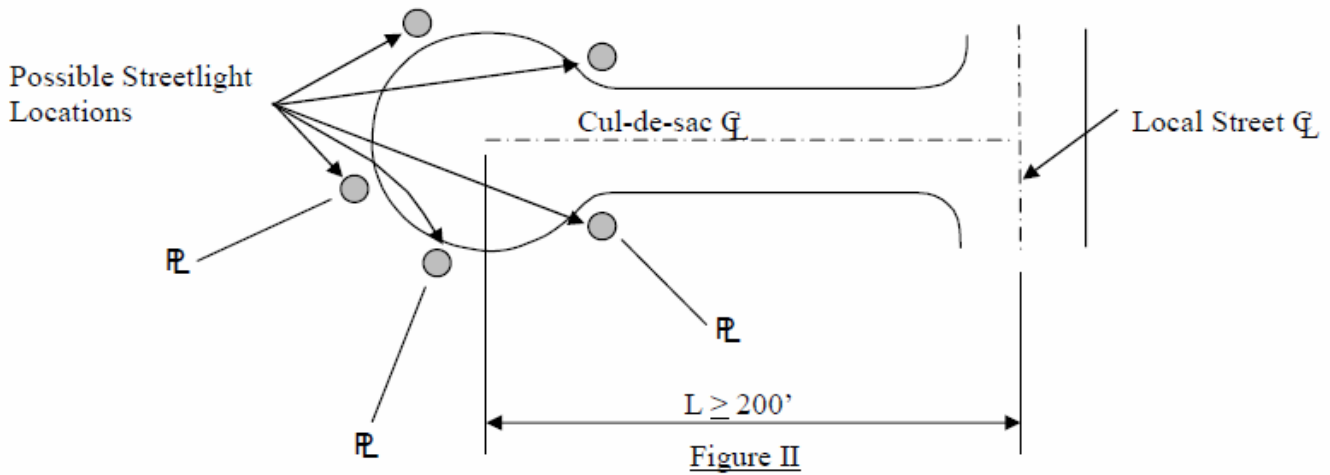
- i. The “high” pedestrian conflict area includes areas where significant numbers of pedestrians are expected to be on the sidewalks or crossing the streets during darkness. These are typically areas that are in the “Non-residential Category” zoned for “commercial” or “mixed-use”, such as retail areas, near theaters, or major pedestrian generators.
- ii. The “medium” pedestrian conflict area includes areas such as libraries, apartments, neighborhood shopping and schools which would be considered in the “Non-residential Category” and zoned as either “public and semi-public”, or in the “Residential Category” that would be zoned as either “high density” or “medium-high density”.
- iii. The “low” pedestrian conflict area includes areas in the “Residential Category” zones as “medium density” or “low density”, such as single family residential housing or duplexes.

3. Local Streets: The following design criterion has been established for local streets.

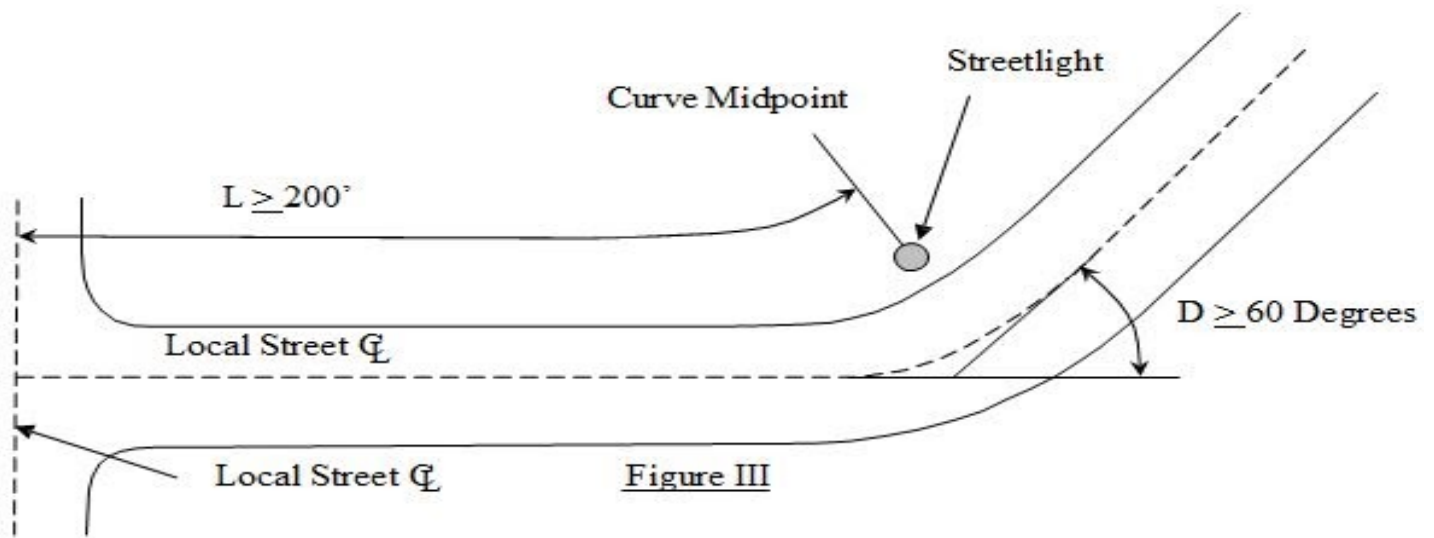
- a. Since June 11, 1979, City policy has been to not continuously light such streets. Only “partial” or “safety” lighting is provided.
- b. Lights on local streets will be installed at the following locations:
 - i. At intersection corners with other local streets. (See Figure I)
 - ii. Streetlights should generally be installed on the same side of the street as the sidewalk unless there are significant utility or storm sewer conflicts. Any variance from this practice should be approved by the engineer or project manager.
 - iii. Where an intersection has a light pole located at the corner but the luminaire is oriented toward the direction of the primary local street, a second light pole may be located on the secondary local street oriented in the direction of its centerline as long as the light pole is installed greater than 50’ from the back of curb line on the primary local street extended, and it is not on the same corner as the light oriented toward the

primary street. (See Figure I)

- iv. Within the cul-de-sac bulb when the cul-de-sac street is longer than 200 feet measured from the centerline of the intersecting streets to the center of the cul-de-sac bulb. (See Figure II)



- v. At changes of alignment of 60° or more which are 200 feet or more from an intersection, measured from the intersection of the local street centerlines, to the middle of the curve radius along the centerline of the local street. (See Figure III)



- vi. Minimum number of mid-block lights in order to achieve a desired pole spacing of

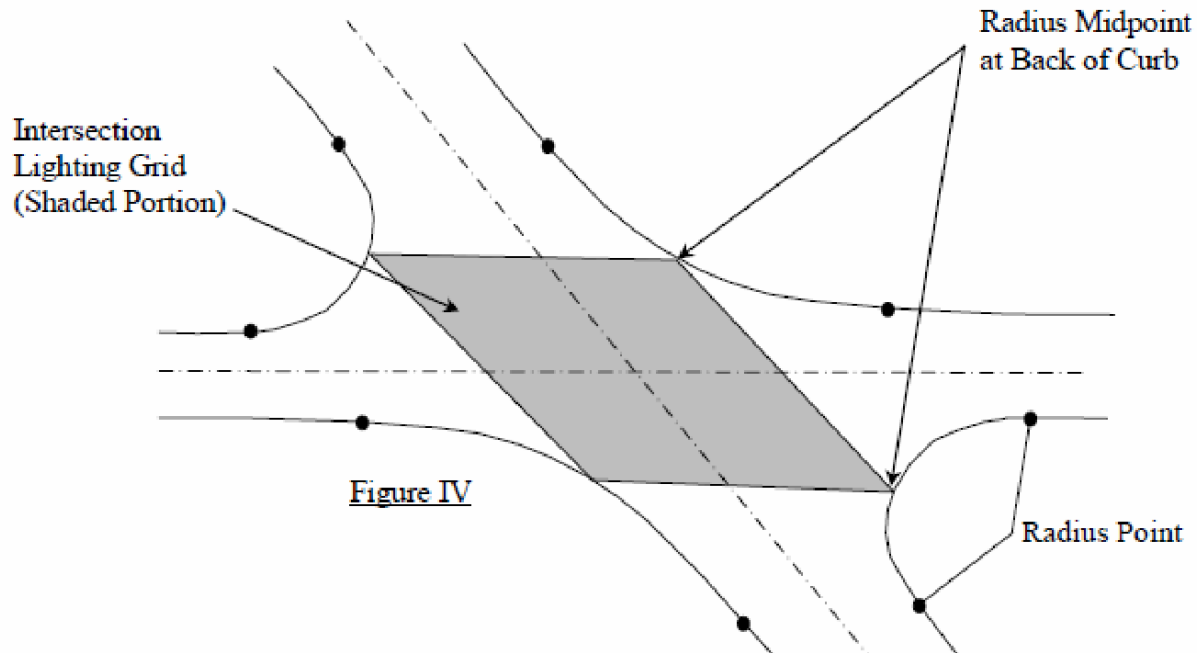
approximately 250 feet. The maximum spacing between lights should not exceed 280 feet and the minimum spacing between lights should not be less than 225 feet unless otherwise approved by City staff.

4. Intersection Lighting Criteria: The following design criteria have been established for the illumination at street intersections.

*Intersection lighting analysis is not required for local/local street intersections. The criterion is satisfied if a light is placed at each intersection.

Table VI: Illuminance for Intersections				
Functional Street Classification	Average Maintained Illumination at Pavement by Pedestrian Area Classification (lux / fc)			Maximum Uniformity Ratio (E _{avg} :E _{min})
	High	Medium	Low	
Thoroughfare / Thoroughfare	34.0 / 3.4	26.0 / 2.6	18.0 / 1.8	3.0:1
Thoroughfare / Collector	29.0 / 2.9	22.0 / 2.2	15.0 / 1.5	3.0:1
Thoroughfare / Local	26.0 / 2.6	20.0 / 2.0	13.0 / 1.3	3.0:1
Collector / Collector	24.0 / 2.4	18.0 / 1.8	12.0 / 1.2	4.0:1
Collector / Local	21.0 / 2.1	16.0 / 1.6	10.0 / 1.0	4.0:1
*Local / Local	NA	NA	NA	NA

- a. The intersection lighting grid is defined as the quadrilateral whose adjacent sides intersect at the midpoint of the curb radii at the back of curb. (See Figure IV)
- b. The amount of light should be proportional to the classification of the intersecting streets and be equivalent to the sum of the values used for each separate street.
- c. If an intersecting street is illuminated above the recommended value, then the intersection illumination value should be increased proportionately.
- d. Intersections of collector and thoroughfare streets with local streets should be illuminated according to Table 2 above since illuminance and luminance criteria has not been established for continuously lighting local streets.



5. Approved Lighting Equipment: All streetlighting equipment shall be in accordance with the Standard Details and Approved Materials List.
 - a. Residential Streets:
 - i. Luminaires shall be post-top roadway luminaires meeting the current standard of the City of Overland Park.
 - ii. Lamps shall be LED (100 watt HPS equivalent), per the City of Overland Park Approved Materials List.
 - iii. Poles shall be round aluminum poles for 15-foot mounting heights.
 - b. Collector Streets:
 - i. Luminaires shall be LED roadway luminaires meeting the current standards of the City of Overland Park.
 - ii. Luminaires shall be Class C LED's (250 watt HPS equivalent, Class D LED's (150 watt HPS equivalent) or Class E LED's (100 watt HPS equivalent), respectively per the City of Overland Park Approved Materials List .
 - iii. Poles shall be round aluminum poles for 30-foot mounting heights with 6', 8', or 12' mounting arms.

c. Thoroughfare Streets:

- i. Luminaires shall be LED roadway luminaires meeting the current standard of the City of Overland Park.
- ii. Luminaires shall be Class A LED's (400 watt HPS equivalent), Class B LED's (310 watt HPS equivalent), or Class C LED's (250 watt HPS equivalent), respectively per the City of Overland Park Approved Materials List.
- iii. Poles shall be round aluminum poles for 40-foot mounting heights with 6', 8', 10', 12', or 15' mounting arms.

6. Standard Drawings: See the City of Overland Park Standard Details.

7. Construction Specifications: All public and private street construction performed pursuant to these design criteria shall be in accordance with the City of Overland Park construction specifications approved by the City.

G. Permanent Traffic Control Signing

1. Standards Adopted by Reference: The Manual on Uniform Traffic Control Devices (MUTCD) current edition as adopted by the Kansas Department of Transportation (KDOT), as herein modified.
2. Design Criteria: The permanent traffic control signing for all classifications of streets shall be designed in accordance to the MUTCD, City of Overland Park standard details and the City of Overland Park Traffic Sign Design Guidelines available on the City of Overland Park web page at: http://ppm.opkansas.org/wiki/index.php/Traffic_Sign_Design_Guidelines.
3. Traffic Sign Design Criteria: The Traffic Sign Design Guidelines provide additional design guidance for select signs to achieve consistency of use. They provide guidance only and do not cover all signs that may be required for specific locations. Proper engineering judgment shall be used in the design of any permanent traffic control signing plan.

H. Access Management

1. General: For many years the City of Overland Park has been committed to the safe and efficient flow of traffic on its streets and within its developments. The design and construction of vehicular access drives to private developments and the internal arrangement of drives and parking areas impact both safety and efficiency. The following sections establish design standards for private driveways (excluding driveways serving single family homes and duplex units) to minimize the impacts of new developments on both street capacity and safety. It also addresses other issues related to access management.

2. Definitions:

- a. **Driveway Throat Length:** The distance along a driveway between the edge of the traveled way on the public street and the edge of the first intersecting cross-drive within the parking lot. Refer to Figure 1 for an illustration of driveway throat length.

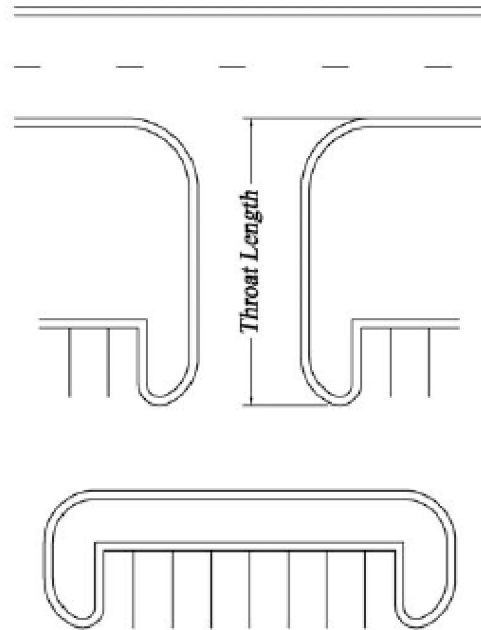


Figure 1

- b. **Functional Area of Intersection:** The physical area of a public street intersection (defined by the furthest extent of all curb return radii at the intersection), plus the longitudinal limits of any existing or planned auxiliary lanes, including any deceleration tapers. The functional area is determined using the following factors: distance traveled during perception-reaction time, deceleration distance as the drive maneuvers to stop, and queue storage. Refer to Figure 2 for an illustration of the functional area of an intersection.

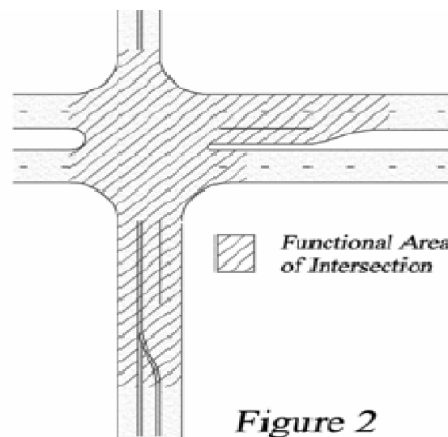


Figure 2

3. Access Locations:

- a. A full access point on an undivided thoroughfare should not be closer than 600 feet to a full access point, measured from outside edge of traveled way on the intersecting street to the centerline of the access point, to minimize impacts on safety and the capacity of the roadway.
- b. A partial access point on any thoroughfare should not be closer than 400 feet to a full access point, measured from outside edge of traveled way on the intersecting street to the centerline of the access point. The distance between partial access points along a thoroughfare should not be closer than 300 feet measured as described above. An access point should not be located within the functional area of an intersection to the maximum extent possible.
- c. Access points on collector, commercial, apartment and industrial streets should not be located closer than 300 feet to a thoroughfare or collector street, measured from outside edge of the traveled way on the intersecting street to the centerline of the driveway, to permit adequate storage and stacking of automobiles on the public street network. The distance between adjacent access points along a collector, commercial, apartment, or industrial street should not be closer than 150 feet, measured from the edge of each intersection. An access point should not be located within the functional area of an intersection to the maximum extent possible.
- d. Access points on local streets should not be located closer than 100 feet to an adjacent access point, measured from outside edge of traveled way on the intersecting street to the centerline of the driveway. An access point should not be located within the functional area of an intersection to the maximum extent possible. This requirement does not apply to residential driveways within single or two-family subdivisions.
- e. When existing site constraints do not allow access points on thoroughfare, collector, commercial, apartment or industrial streets as outlined in Sections 3.a. – 3.c. above, city staff may consider closer access spacing based on the following factors:
 - Roadway frontage
 - Existing access locations
 - Topography
 - Preservation of natural features
 - Sight distance constraints

It will be the responsibility of the designer to demonstrate how the development meets the above criteria.

4. Number of Access Points: Access points are essential to provide access to a development, but a balance needs to be struck between the access needs of a site and impacts on the safety and operation of the public street system. The following standards are maximums. The actual number of access points serving a development should be based on the real needs of the proposed land uses.

- a. The following maximum number of access points serving non-residential development shall be permitted on all collector, commercial, apartment, industrial and undivided thoroughfare streets:

Length of Frontage (in feet)	Maximum Number of Access Points
Up to 399	1
400 – 899	2
900 – 1399	3
1400 – 1899	4

(for each additional 500 feet of frontage, one additional access point)

- b. The following maximum number of access points serving non-residential development shall be permitted on all divided thoroughfare streets and on all unimproved thoroughfares expected to contain a raised median when improved in the future:

Length of Frontage (in feet)	Maximum Number of Access Points
Up to 699	1
700 – 1399	2
1400 – 2099	3
2100 – 2799	4

(for each additional 700 feet of frontage, one additional access point)

5. Access Point Width:

- a. Undivided access points:

Two-way access points – minimum 28 feet wide, back-to-back

One-way access point – minimum 20 feet wide, back-to-back

Maximum access point width – 40 feet, back-to-back

- b. Divided Access Points:

Each side – minimum 20 feet wide, back-to-back

Maximum width – to be determined by staff based on required number of lanes

6. Access Point Alignment: Access points should be either aligned with existing or proposed access points on the opposite side of the street or offset by a minimum distance of 150 feet. If an access point

will align with an existing or planned access point on the opposite side of the street, it should be designed so that its geometrics are compatible with those of the opposing access point.

7. **Throat Length:** On non-residential driveways sufficient throat length shall be provided to minimize impacts on the public street to which the access points connect and to provide for good internal circulation within the parking lot served by the development.

Throat length is generally based upon the number of trips generated by a development and the amount of vehicular stacking that will occur at the access point:

Number of Peak Hour Trips	Throat Length Requirements*
< 100	50'
101-199	100'
> 200	250'

* Longer throat lengths may be required based on staff review or Traffic Impact Study

8. **Sight Distance:** Providing adequate sight distance for vehicles exiting and entering an access point is an important safety consideration. All landscaping and site improvements proposed near site access points shall comply with the intersection design sight distance policies contained within the latest edition of “A Policy on Geometric Design of Highways and Streets” published by the American Association of State Highway and Transportation Officials.
9. **Common Drives and Internal Access:** The use of common drives and internal access between properties with compatible land uses is encouraged to minimize direct access off public streets, resulting in improved street capacity and reduced potential for accidents. In cases where access control is especially critical to the safe and efficient flow of traffic under existing or projected conditions, a requirement for the provision of common access easements may be included as a stipulation of approval.
10. **Turn Lanes:** The design of turn lanes (location, length, width and geometrics) shall be based on the results of an engineering analysis. The minimum turn lane length required is 150 feet.
11. **Median Break Spacing:** In order to balance traffic control and land access, median breaks on divided thoroughfares shall be planned with a one-quarter mile spacing. Requests for closer spacing of median breaks shall be permitted only when the specific need and feasibility have been clearly documented by a traffic engineering study and the City Council has approved the closer spacing.
12. **Special Criteria for Selected Thoroughfare Corridors:** Two areas of the city are subject to different sets of access management standards: the 135th Street Corridor, from Pflumm Road to east of Nall Avenue, and the area covered by the Downtown Form-Based Code. The requirements for the 135th Street Corridor are included in the 1998 update to the 1986 K-150 Corridor Study. All properties included within the boundaries of the Downtown Form-Based Code must comply with the standards

included in that document.

Future special planning areas may also be allowed to adopt alternate access management standards and criteria as determined by staff.

I. MANUAL OF INFRASTRUCTURE STANDARDS (RESERVED)

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SECTION III – ATTACHMENTS

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Overland Park, KS Stream Riparian Corridor Quality Evaluation

General

The Overland Park Stream Riparian Corridor Quality Rating (QR) is a standardized assessment of the quality of vegetation along stream corridors within the City of Overland Park. The Kansas Department of Wildlife and Parks, Subjective Evaluation of Terrestrial Wildlife Habitats, was used as a basis for the Quality Rating.

The QR is to be completed as an assessment tool to determine stream corridor quality in areas determined to be within the Overland Park Stream Corridor Ordinance (18.365). The evaluation process is described on the following pages and includes a field key. The QR results in a score of 0 to 11 and can be categorized to determine stream corridor quality as poor, fair or excellent and utilized as a basis for stream restoration and enhancement activities to gain stream corridor buffer credits (See results section below).

In general, the information provided serves as a standardized checklist for determining stream corridor quality. The QR should be completed by an individual with a demonstrated ability to complete habitat assessments and vegetation identification of Kansas flora. If professional judgment determines that habitat characteristics are different than those indicated by the key, or there exists a unique habitat or wildlife resource not adequately covered by the given criteria, a narrative description can be developed in the field and a quality rating made. Such field developed evaluations must be documented through a narrative description of the criteria used and attaching it to the field report.

Stream corridors dominated by invasive exotic or naturalized species should be rated lower than sites having native species historically indigenous to that landscape. Sites that have woody colonization due to the suppression of fire or other management effects should be rated lower. Subjectivity to account for these instances should be applied by selecting an appropriate value from the range of points in the "Species Groups" ratings.

Although trees often dominate stream corridors, other vegetative cover such as shrubs, vines, grasses, and forbs often are often found intermixed constituting the understory. The habitat value of the overall woodland is enhanced by the presence and abundance of these other vegetation types, as well as habitat provided by dead timber (standing/fallen) and other woody debris and leaf litter. Den trees are also included as a component in the evaluation because of the refuge and nesting habitat they provide to a variety of fauna.

Procedure

1. Review the species group and plant form components of the key. Traverse the tract sufficiently to obtain a reliable indication of vegetative composition and distribution. Circle tree species groups identified. A subjective measure of species abundance and species diversity should dictate the final rating within the range of scores provided.
2. Determine the presence of plant forms and record as abundant, common, sparse or absent. The rating selected should be determined by a combination of percent cover and species diversity throughout the entire stand.
3. Using the key, tabulate the applicable component points (40 points maximum). Determine the initial quality rating by dividing total component points by four (4).
4. Record an estimated corridor width and circle appropriate width value (WV).
5. Add the (WV) value to the Initial Quality Rating.
6. Determine other valuable habitats within the corridor and add to total points.
7. Provide a narrative description of any potential restoration and enhancement activities to the stream corridor.

Notes

- Identification of Threatened and Endangered species habitat as a valuable habitat must be accompanied by documentation from Kansas Department of Wildlife and Parks and/or U.S. Fish and Wildlife Service.
- Identification of wetlands as a valuable habitat should be accompanied by field mapping of wetlands.
- A valuable habitat rating of 1.0 may only be appropriate when critical habitat for threatened and endangered species is present and/or greater than 10% of the corridor is wetlands.
- The Quality Rating Form must be accompanied by an aerial photograph of the site. The location of data points and site photographs should be indicated on the aerial as a matter of reference. Final quality rating scores should also be noted in parentheses below the data location point. The aerial photograph may also be utilized to depict restoration and enhancement opportunities identified during the field survey.
- When the stream corridor being reviewed is not continuous and fragmented, a separate Quality Rating Form should be completed for each segmented habitat. Figure 1 provides an example of data collection points along a segmented stream corridor.
- Isolated areas with the potential for restoration and enhancement opportunities in an otherwise excellent quality corridor should be noted on the field sheets and depicted on the aerial photograph.

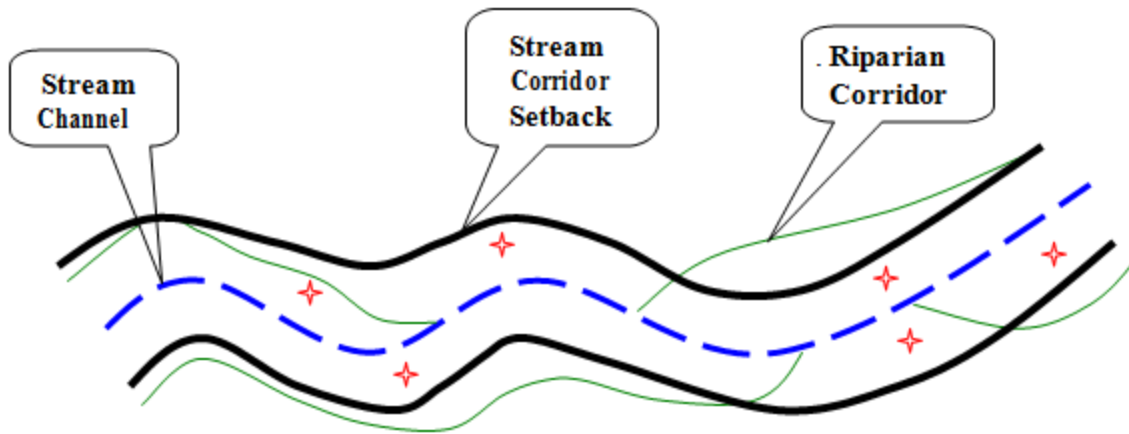


Figure 1: Example of Data Point Locations

✧ = Data Location Points

Rating Results

The Quality Rating can be used to further categorize the quality of vegetation and wildlife within a given stream corridor. The following categories are described as follows:

Category 1 (Quality Rating of 0-2.9) – A stream corridor with a Quality Rating of 0 - 2.9 can be considered a poor quality corridor. Approved stormwater BMPs may be implemented in these areas as well as restoration and enhancement activities.

Category 2 (Quality Rating of 3.0 – 5.9) - A stream corridor with a Quality Rating of 3.0 – 5.9 should be considered a fair quality corridor. Activities should be limited to restoration and enhancement activities.

Category 3 (Quality Rating of 6.0 – 11) – A stream corridor with a Quality Rating of 6.0 – 11 should be considered an excellent quality corridor. Minimal activity should be allowed in these areas with emphasis on preservation. Enhancement activities may be appropriate on a case-by- case basis.

Definitions

Riparian Corridor – Forested areas along streams.

Restoration – The process of restoring site conditions as they were before land disturbance.

Enhancement - Improvement on existing biological conditions.

Dbh – The outside bark diameter at breast height. Breast height is defined as 4.5 feet (1.37m) above the forest floor on the uphill side of the tree.

Abundant – A combination of percent cover and species diversity when the species are equally distributed throughout the stand and dominant.

Common – A combination of percent cover and species diversity when the species are equally distributed throughout the stand but not dominant.

Sparse – A combination of percent cover and species diversity when species occurrence is sporadic throughout the stand.

Den Trees - Den trees are live trees that contain holes or hollows large enough to shelter wildlife.

Submittal Requirements

The following information is required as a component to Overland Park's Stream Corridor Quality Rating:

- Investigators qualifications
- Completed Stream Riparian Corridor Quality Rating Form
- Aerial graphic depicting the location of data points and photo locations
- Photo log
- Supplemental data as needed to support findings (agency coordination, previous wetland delineation reports or resource studies, etc.)

Overland Park, KS Soil Infiltration Testing Protocol

Purpose of this Protocol

The soil infiltration testing protocol describes evaluation and field testing procedures to determine if infiltration stormwater treatment facilities (STFs) are suitable at a site, as well as to obtain the required data for infiltration STF design.

When to Conduct Testing

In accordance with Volume 1, Section II.C.2.f. of the Overland Park Design and Construction Standards, a soil investigation is required to be conducted prior to the approval of a Rezoning, Special Use Permit, Preliminary Plat, Preliminary Development Plan or Revised Preliminary Development Plan application approval.

Who Should Conduct Testing

Soil evaluation and investigation may be conducted by soil scientists, design engineers, professional geologists, and other qualified professional and technicians approved by the Director. The design engineer is *required* to directly observe the testing process to obtain a first-hand understanding of site conditions.

Importance of STF Areas

Sites are often defined as unsuitable for infiltration STFs due to proposed grade changes (excessive cut or fill) or lack of suitable areas. Many sites will be constrained and unsuitable for infiltration STFs. However, if suitable areas exist, these areas should be identified early in the design process and should *not* be subject to a building program that precludes infiltration STFs. An exemption should not be provided for “full build-outs” where suitable soils otherwise exist for infiltration.

Safety

As with all field work and testing, attention to all applicable Occupational Safety and Health Administration (OSHA) regulations and local guidelines related to earthwork and excavation is required. Digging and excavation should never be conducted without adequate notification through the Kansas One Call system (www.kansasonecall.com or 1-800-344-7233). Excavations should never be left unsecured or unmarked, and all applicable authorities should be notified prior to any work.

Infiltration Testing: A Multi-Step Process

Infiltration testing is a four-step process to obtain the necessary data for the design of the stormwater treatment mitigation plan. The four steps include:

1. Background Evaluation
 - Based on available published and site specific data
 - Includes consideration of proposed development plan
 - Used to identify potential STF locations and testing locations
 - Prior to field work (desktop)
2. Test Pit (Deep Hole) Observations
 - Includes multiple testing locations
 - Provides an understanding of sub-surface conditions
 - Identifies limiting conditions
3. Infiltration Testing
 - Must be conducted on site
 - Different testing methods available
4. Design Considerations
 - Determine suitable infiltration rate for design calculations
 - Consideration of STF drawdown
 - Consideration of peak attenuation

Step 1. Background Evaluation

Prior to performing testing and developing a detailed site plan, existing conditions at the site should be inventoried and mapped, including, but not limited to:

- Existing mapped soils and USDA Hydrologic Soil Group classifications.
- Existing geology, including depth to bedrock, karst conditions, or other features of note.
- Existing streams (perennial and intermittent, including intermittent swales), water bodies, wetlands, hydric soils, floodplains, alluvial soils, stream classifications, headwaters, and first order streams.
- Existing topography, slope, drainage patterns, and watershed boundaries.
- Existing land use conditions.
- Other natural or man-made features or conditions that may impact design, such as past uses of site, existing nearby structures (buildings, walls), abandoned wells, etc.
- A concept plan or preliminary layout plan for development should be evaluated, including:
 - o Preliminary grading plan and areas of cut and fill,
 - o Location of all existing and proposed water supply sources and wells,
 - o Location of all former, existing, and proposed onsite wastewater systems,
 - o Location of other features of note such as utility rights-of-way, water and sewer lines, etc.,
 - o Existing data such as structural borings, and
 - o Proposed location of development features (buildings, roads, utilities, walls, etc.)

In Step 1, the designer should determine the potential location of infiltration STF. The approximate location of these STF should be on the proposed development plan and serve as the basis for the location and number of tests to be performed on-site.

Important: If the proposed development is located on areas that may otherwise be a suitable STF location, or if the proposed grading plan is such that potential STF locations are eliminated, the designer is **strongly** encouraged to revisit the proposed layout and grading plan to adjust the development plan as necessary. Full build-out of areas suitable for infiltration STF should **not** preclude the use of STF for runoff volume reduction and groundwater recharge.

Step 2. Test Pits (Deep Holes)

A test pit (deep hole) allows visual observation of the soil horizons and overall soil conditions both horizontally and vertically in that portion of the site. An extensive number of test pit observations can be made across a site at a relatively low cost and in a short time period. The use of soil borings as a substitute for test pits is prohibited, as visual observation is narrowly limited in a soil boring and the soil horizons cannot be observed in-situ, but must be observed from the extracted borings.

A test pit (deep hole) consists of a backhoe-excavated trench, 2½-3 feet wide, to a depth of 6-7½ feet, or until bedrock or fully saturated conditions are encountered. The trench should be benched at a depth of 2-3 feet for access and/or infiltration testing.

At each test pit, the following conditions are to be noted and described. Depth measurements should be described as depth below the ground surface:

- Soil horizons (upper and lower boundary),

- Soil texture, structure, and color for each horizon,
- Color patterns (mottling) and observed depth,
- Depth to water table,
- Depth to bedrock
- Observance of pores or roots (size, depth),
- Estimated type and percent coarse fragments,
- Hardpan or limiting layers,
- Strike and dip of horizons (especially lateral direction of flow at limiting layers), and
- Additional comments or observations.

The Sample Soil Log Form at the end of this protocol may be used for documenting each test pit. At the designer's discretion, soil samples may be collected at various horizons for additional analysis. Following testing, the test pits should be refilled with the original soil and the topsoil replaced. A test pit should *never* be accessed if soil conditions are unsuitable or unstable for safe entry, or if site constraints preclude entry. OSHA regulation should always be observed.

It is important that the test pit provide information related to conditions at the bottom of the proposed infiltration STF. If the STF depth will be greater than 90 inches below existing grade, deeper excavation of the test pit will be required. The designer is cautioned regarding the proposal of systems that are significantly deeper than the existing topography, as the suitability for infiltration is likely to decrease. The design engineer is encouraged to consider reducing grading and earthwork as needed to reduce site disturbance and provide greater opportunity for stormwater management.

The number of test pits varies depending on site conditions and the proposed development plan. General guidelines are as follows:

- For single-family or multi-family developments with infiltration STFs within dedicated tracts, one test pit per STF is recommended.
- For large infiltration areas (basins or trenches in high-density residential, commercial, and industrial areas), multiple test pits should be evenly distributed at the rate of four to six pits per acre of STF area.

The recommendations above are guidelines. Additional tests should be conducted if local conditions indicate significant variability in soil types, geology, water table levels, depth and type of bedrock, topography, etc. Similarly, uniform site conditions may indicate that fewer test pits are required. Excessive testing and disturbance of the site prior to construction is not recommended.

Step 3. Infiltration Tests/Permeability Tests

A variety of field tests exist for determining the infiltration capacity of a soil. Laboratory tests are not recommended, as a homogeneous laboratory sample does not represent field conditions. Infiltration tests should be conducted in the field. Infiltration tests should not be conducted in the rain, within 24 hours of significant rainfall events (> 0.5 inches), or when the temperature is below freezing.

At least one test should be conducted at the proposed bottom elevation of the infiltration STF, and a minimum of two tests per test pit are recommended. Based on observed field conditions, the designer may elect to modify the proposed bottom elevation of a STF. Personnel conducting infiltration tests should be prepared to adjust test locations and depths depending on observed conditions.

Methodologies discussed in this protocol include:

- Double-ring infiltrometer tests.
- Percolation tests (such as for on-site wastewater systems)

There are differences between the two methods. A double-ring infiltrometer test estimates the vertical movement of water through the bottom of the test area. The outer ring helps to reduce the lateral movement of water in the soil from the inner ring. A percolation test allows water movement through both the bottom and sides of the test area. For this reason, the measured rate of water level drop in a percolation test must be adjusted to represent the discharge that is occurring on both the bottom and the sides of the percolation test hole.

Other testing methodologies and standards that are available but not discussed in detail in this protocol include (but are not limited to):

- Constant head double-ring infiltrometer.
- Testing as described in the *Maryland Stormwater Manual*, Appendix D.1, using five-inch diameter casing.
- ASTM 2003 Volume 4.08, Soil and Rock (I): Designation D 3385-03, Standard Test Method for Infiltration Rate of Soils in Field Using a Double- Ring Infiltrometer.
- ASTM 2002 Volume 4.09, Soil and Rock (II): Designation D 5093-90, Standard Test Method for Field Measurement of Infiltration Rate Using a Double-Ring Infiltrometer with a Sealed-Inner Ring.
- Guelph Permeameter.
- Constant Head Permeameter. (Amoozemeter).

Methodology for Double-Ring Infiltrometer Field Test

A double-ring infiltrometer consists of two

concentric metal rings. The rings are driven into the ground and filled with water. The outer ring helps prevent divergent flow. The drop-in water level or volume in the inner ring is used to calculate an infiltration rate.

The infiltration rate is the amount of water per surface area and time until which penetrates the soils. The diameter of the inner ring should be approximately 50- 70 percent of the diameter of the outer ring, with a minimum inner ring size of four inches. Double-ring infiltrometer testing equipment designed specifically for that purpose may be purchased. However, field testing for STF design may also be conducted with readily available materials.

Equipment for double-ring infiltrometer test:

Two concentric cylinder rings six inches or greater in height. Inner ring diameter should be equal to 50-70 percent of outer ring diameter (i.e. an eight-inch ring and a 12-inch ring). Material typically available at a hardware store may be acceptable.

- Water supply,
- Stopwatch or timer,
- Ruler or metal measuring tape,
- Flat wooden board for driving cylinder uniformly into soil,
- Rubber mallet, and
- Log sheets for recording data.

Procedure for double-ring infiltrometer test:

- Prepare level testing area.
- Place outer ring in place; place flat board on ring and drive ring into soil to a minimum depth of two inches.
- Place inner ring in center of outer ring; place flat board on ring and drive ring into soil to a minimum depth of two inches. The bottom rim of both rings should be at the same level.
- The test area should be presoaked immediately prior to testing. Fill both rings

with water to water level indicator mark or rim at 30-minute intervals for one hour. The minimum water depth should be four inches. The drop in the water level during the last 30 minutes of the presoaking period should be applied to the following standard to determine the time interval between readings:

- o If water level drop is two inches or more, use 10-minute measurement intervals.
- o If water level drop is less than two inches, use 30-minute measurement intervals.
- Obtain a reading of the drop in water level in the center ring at appropriate time intervals. After each reading, refill both rings to water level indicator mark or rim. Measurement to the water level in the center ring should be made from a fixed reference point and should continue at the interval determined until a minimum of eight readings are completed or until a stabilized rate of drop is obtained, whichever occurs first. A stabilized rate of drop means a difference of ¼ inch or less of drop between the highest and lowest readings of four consecutive readings.
- The drop that occurs in the center ring during the final period or the average stabilized rate, expressed as inches per hour, should represent the infiltration rate for that test location.

Methodology for Percolation Test

Equipment for percolation test:

- Post hole digger or auger,
- Water supply,
- Stopwatch or timer,
- Ruler or metal measuring tape,
- Log sheet for recording data,
- Knife blade or sharp-pointed instrument (for soil scarification),

- Coarse sand or fine gravel,
- Object for fixed-reference point during measurement (nail, toothpick, etc.).

Procedure for percolation test:

This percolation test methodology is based largely on the criteria for on-site sewage investigation of soils. A 24-hour pre-soak is generally not required as infiltration systems, until wastewater systems, will not be continuously saturated.

- Prepare level testing area.
- Prepare hole having a uniform diameter of 6-10 inches and a depth of 8-12 inches. The bottom and sides of the hole should be scarified with a knife blade or sharp-pointed instrument to completely remove any smeared soil surfaces and to provide a natural soil interface into which water may percolate. Loose material should be removed from the hole.
- (Optional) Two inches of coarse sand or fine gravel may be placed in the bottom of the hole to protect the soil from scouring and clogging of the pores.
- Test holes should be presoaked immediately prior to testing. Water should be placed in the hole to a minimum depth of six inches over the bottom and readjusted every 30 minutes for one hour.
- The drop in water level during the last 30 minutes of the final presoaking period should be applied to the following standard to determine the time interval between readings for each percolation hole:
 - o If water remains in the hole, the interval for readings during the percolation test should be 30 minutes.
 - o If no water remains in the hole, the interval for readings during the percolation test may be reduced to 10 minutes.

- After the final presoaking period, water in the hole should again be adjusted to a minimum depth of six inches and readjusted when necessary after each reading. A nail or marker should be placed at a fixed reference point to indicate the water refill level. The water level depth and hole diameter should be recorded.
- Measurement to the water level in the individual percolation holes should be made from a fixed reference point and should continue at the interval determined from the previous step for each individual percolation hole until a minimum of eight readings are completed or until a stabilized rate of drop is obtained, whichever occurs first. A stabilized rate of drop means a difference of ¼ inch or less of drop between the highest and lowest readings of four consecutive readings.
- The drop that occurs in the percolation hole during the final period, expressed as inches per hour, should represent the percolation rate for that test location.
- The average measured rate must be adjusted to account for the discharge of water from both the sides and bottom of the hole and to develop a representative infiltration rate. The average/final percolation rate should be adjusted for each percolation test according to the following formula:

$$\text{Infiltration Rate} = \frac{(\text{Percolation Rate})}{(\text{Reduction Factor})}$$

Where the Reduction Factor is given by**:

$$R_f = \frac{2d_1 - \Delta d}{DIA} + 1$$

Where:

d_1 = Initial Water Depth (in.)

Δd = Average/Final Water Level Drop (in.)

DIA = Diameter of the Percolation Hole (in.)

*** The area reduction factor accounts for the exfiltration occurring through the sides of the percolation hole. It assumes that the percolation rate is affected by the depth of water in the hole and that the percolating surface of the hole is in uniform soil. If there are significant problems with either of these assumptions, then other adjustments may be necessary.*

Step 4. Use Design Considerations Provided in the Infiltration STF

Table B.1

Sample Percolation Rate Adjustments

Perc. Hole Diameter, DIA (in.)	Initial Water Depth, D1 (in.)	Ave./Final Water Level Drop, Δd (in.)	Reduction factor, R_r
6	6	0.1	3.0
		0.5	2.9
		2.5	2.6
	8	0.1	3.7
		0.5	3.6
		2.5	3.3
	10	0.1	4.3
		0.5	4.3
		2.5	3.9
8	6	0.1	2.5
		0.5	2.4
		2.5	2.2
	8	0.1	3.0
		0.5	2.9
		2.5	2.7
	10	0.1	3.5
		0.5	3.4
		2.5	3.2
10	6	0.1	2.2
		0.5	2.2
		2.5	2.0
	8	0.1	2.6
		0.5	2.6
		2.5	2.4
	10	0.1	3.0
		0.5	3.0
		2.5	2.8

Additional Potential Testing – Bulk Density

Bulk density tests measure the level of compaction of soil, which is an indicator of a soil's ability to absorb rainfall. Developed and urbanized sites often have very high bulk densities and, therefore, possess limited ability to absorb rainfall (and have high rates of stormwater runoff). Vegetative and soil improvement programs can

lower the soil bulk density and improve the site's ability to absorb runoff and reduce runoff.

Macropores occur primarily in the upper soil horizons and are formed by plant roots (both living and decaying), soil fauna such as insects, the weather processes caused by movement of water, the freeze-thaw cycle, soil shrinkage due to desiccation of clays, chemical processes, and other mechanisms. These macropores provide an important mechanism for infiltration prior to development, extending vertically and horizontally for considerable distances. It is the intent of good engineering and design practice to maintain these macropores when installing infiltration STFs as much as possible. Bulk density tests can help determine the relative compaction of soils before and after site disturbance and/or restoration and should be used at the discretion of the designer/reviewer.

Soil Test Pit Log Sheet

Project: _____
Name: _____
Location: _____
Test Pit #: _____

Date: _____
Soil Series: _____
Other: _____

Horizon	Depth (in.)	Color	Redox Features	Textures	Notes (if applicable)	Boundary

NOTES:**REDOX FEATURES****Abundance***Few*..... > 2%*Common*..... 2 – 20%*Many*..... > 20%**Contrast***Faint*

Hue & chroma of matrix and redox are closely related.

Distinct

Matrix & redox features vary 1 – 2 units of hue and several units of chroma & value.

Prominent

Matrix & redox features vary several units in hue, value & chroma.

COARSE FRAGMENTS (% of profile)**15-35%**

gravelly

channery

cobbly

flaggy

stony

35-65% > 65%

very gravelly

very channery

very cobbly

very flaggy

very stony

extremely gravelly

extremely channery

extremely cobbly

extremely flaggy

extremely stony

BOUNDARY**Distinctness***Abrupt*..... < 1" (thick)*Clear*..... 1 – 2.5"*Gradual*..... 2.5 – 5"*Diffuse*..... > 5"**Topography***Smooth* – boundary is nearly level*Wavy* – pockets with width > depth*Irregular* – pockets with width < depth**HORIZONS**

O – organic layers of decaying plant and animal tissue (must be greater than 12-18% organic carbon, excluding live roots)

A (topsoil) – mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material

E – mineral horizon which the main feature is loss of silicate clay, iron, aluminum; must be underlain by a B (alluvial) horizon

B (subsoil) – mineral horizon with evidence of pedogenesis or illuviation (movement into the horizon)

C (substream) – the un-weathered geologic material the soil formed in; shows little or no sign of soil formation

Outdoor Play Area Infiltration Trench Sizing Guidelines

Assume 5 gallons/dog* is used for wash down.

*Design Daily Flow was taken from the Kentucky On-Site Sewage Disposal Systems design criteria (<http://www.lrc.state.ky.us/kar/902/010/085.htm>); 2012 IBC Private Sewage Disposal Code does not include dog kennels in Table 604.1(2).

In this example, we will assume there are 50 dogs.

50 dogs x 5 gal/dog x 3 wash downs/day = 750 gallons/day (Design Daily Flow)

Using the University of Missouri Extension guidelines* for sizing an absorption field, 120 gallons of flow/day is used for design purposes. Assume that the percolation rate of the native soil is 0.5 in/hr (Please note that a percolation test will be required for this type of facility).

*<http://extension.missouri.edu/p/EQ401>

The minimum absorption field area based on percolation rate is shown below:

Percolation rate inch	Required absorption area per 120 gallons of flow/day
less than or equal to 10 minutes	150 square feet
11 to 30 minutes	200 square feet
31 to 45 minutes	265 square feet
46 to 60 minutes	300 square feet
61 to 120 minutes	600 square feet

$\frac{750}{120} = 6.25$; $6.25 \times 600 = 3750$ square feet

The outdoor area must also account for rainwater that comes off of the outdoor play area.

Assume that the outdoor play area is 5,000 square feet (50' x 100').

In accordance with the MARC/APWA BMP Manual,

$$A = \frac{12(V)}{(P)(n)(t)}$$

Where

A = bottom area of the trench (square feet)

V = runoff volume to be infiltrated (cubic feet)

P = percolation rate of the surrounding native soil (in/hr)

n = void space fraction of the storage media (0.4 for clean stone)

t = retention time (48 - 72 hours)

Reference the BMP Manual to determine the volume of water to be infiltrated.

$$WQ_v = P \times R_v \text{ where } P = 1.37 \text{ inches and } R_v = 0.05 + 0.09(I)$$

I = site imperviousness = 0% for all outdoor play area examples.

$$R_v = 0.05 + 0.09(0) = 0.05$$

$$WQ_v = 1.37 \times 0.05 \times 5,000 \text{ sq. ft.} \times 12 \text{ in.} = 4,100 \text{ cu. ft.}$$

$$A = \frac{12(4,110)}{(0.5)(0.4)(72)} = 1,200 \text{ sq. ft.}$$

Create a site specific maximally effective trench depth based on the soil percolation rate, aggregate soil space, and the trench storage time using the following equation:

$$D = \frac{(P)(t)}{(n)(12)}$$

Where:

D = depth of trench (ft)

P = percolation rate of surrounding native soil (in/hr)

t = retention time (48 - 72 hours)

n = void space fraction in the soil media (0.4 for clean stone)

$$D = \frac{(0.5)(72)}{(0.4)(12)} = 7.5 \text{ ft}$$

In this example, the infiltration trench would need to be approximately 4,950 square feet to accommodate this facility.



OVERLAND PARK
K A N S A S

Planning and Development Services
Public Works

2021

DESIGN AND CONSTRUCTION STANDARDS