

**MCM #5**

**POST-CONSTRUCTION STORMWATER  
MANAGEMENT PROGRAM**

**Stormwater Management Plan**

**For The City of Kearney**

**June 2017**

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**CITY OF  
KEARNEY  
HEART OF NEBRASKA**



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# 1. Introduction

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

The City of Kearney will continually evaluate the Post-Construction Stormwater Management ordinance for needed revisions that may be used to reduce pollutants in stormwater runoff from new development and redevelopment.

There are five content areas in the Post-Construction Storm Water Management Plan (PCSMP):

- 1) Minimum Site Performance Standards
- 2) Platting and Site Plan Review
- 3) Maintenance of Controls
- 4) Tracking Controls
- 5) Inspection and Enforcement

A Post-Construction Stormwater Management Plan Submittal Checklist will be needed to be submitted with design plans and be recorded by the City of Kearney. That PCSMP Checklist is attached as **Appendix A**.

A list of all city owned Post-Construction stormwater treatment facilities (STF's) and an inspection of the STF's will be completed as part of the program. The functional longevity and low costs of maintenance for the long term will be primary considerations during the review process.

Educational materials will continue to be distributed to members of the development community. Providing technical guidance for the design and maintenance requirements for structural and non-structural controls will be some of the focus.

## 2. Minimum Site Performance Standards

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The City of Kearney will require new and redevelopment projects to satisfy minimum site performance standards that address water quality. The process for calculating the minimum water quality control volume is “WQCV” and the process for finding the water quality volume discharge rate is “ $Q_{wq}$ .” The methodology is based on average daily rainfall data gathered regionally and applied to three zones across the state (Table 1). From that data the runoff amount is calculated and applied to the treatment drainage area to get the WQCV or  $Q_{wq}$ .

### **New Development**

New development requirements apply to those areas which are being platted for development or have been platted but not built and are within the Kearney’s MS4 boundary (ETJ).

*Example 1) A parcel that had not been platted or zoned for development (i.e. agricultural land) is being platted as a subdivision for single family residential and is greater than 1 acre. The subdivision would be required to meet the minimum standard set forth herein for new development.*

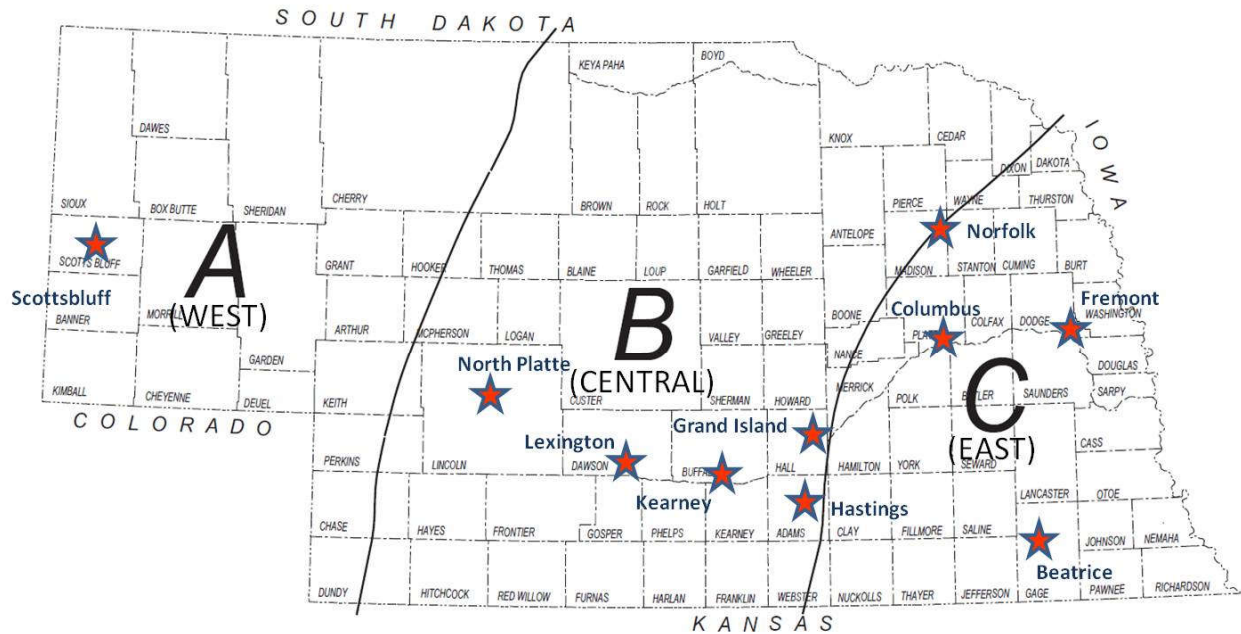
*Example 2) Several parcels are being replatted for development and the total area being replatted is greater than 1 acre. The replatted parcels would **NOT** be required to follow new development standards.*

### **Redevelopment**

Redevelopment requirements apply to those areas which have been platted and built within Kearney’s MS4 boundary.

*Example 1) A parcel that included a structure that was purchased and demolished by the City or other entity, and was sold or deeded over to a new property owner for constructing his or her own building. Site disturbance is greater than 1 acre. This site would be required to meet the minimum standard set forth herein for redevelopment.*

*Example 2) A parcel with a building has been sold and is being converted into a new use with expanded parking. Site disturbance is greater than 1 acre. This parcel would be subject to requirements for redevelopment.*



# NEBRASKA

Adapted from NDOR Drainage and Erosion Control Manual Ch. 1

Rainfall amounts by region for new and redevelopment are provided in Table 1. These values will be used to calculate runoff and water quality control volume (WQCV).

Table 1.

Applicable Region	Rainfall, P	
	80 <sup>th</sup> Percentile Event	70 <sup>th</sup> Percentile Event
<b>A (West)</b>	0.61"	0.44"
<b>B (Central)</b>	0.72"	0.53"
<b>C (East)</b>	0.83"	0.62"

## Minimum Design Criteria

STF's must be sized to handle the appropriate WQCV or equivalent water quality discharge rate to properly treat stormwater. Best Management Practices include retention-based stormwater treatment facilities that typically require or encourage using infiltration, evapotranspiration, or harvest practices to control a specified volume of stormwater within each development site.

The regulatory logic of controlling volume is that the stormwater pollutants contained in the volume of runoff captured are prevented from reaching the receiving water, and the remaining volume that does reach the receiving water is less polluted and erosive to the receiving waterbody.

The regulatory logic of controlling discharge rate is that the stormwater pollutants contained in stormwater runoff can be reasonably treated and the volume that does reach the receiving water is less polluted and erosive to the receiving waterbody.

**The City of Kearney permits a variety of STF’s to be developed for Post-Construction Stormwater Treatment. These can be applied in a dry environment or a wet environment, to a variety of sized projects. A list of these can be found in Appendix C and includes:**

## STF Suitability

STF	Residential	Commercial	Block	Neighborhood
Bioretention Area		x	x	x
Bioswale	x	x	x	x
Dry Retention		x	x	x
Filter Strip	x	x	x	x
Grassed Swale	x	x	x	x
Infiltration Trench	x	x	x	
Rain Garden	x	x	x	
Underground Storage		x		
Wet Detention		x	x	x
Roof Drain Filters		x		

\*The City of Kearney may be amenable to other forms of STF’s if properly presented

STF’s must be designed in concordance with an approved design manual that provides minimum design criteria and considerations. Here is a list of design guides manuals from around Nebraska that are acceptable to use in the general use of STF’s:

- City of Omaha, “*Omaha Regional Stormwater Design Manual- Chapter 8: Stormwater Best Management Practices*” <http://omahastormwater.org/orsdm/>
- City of Lincoln, “*Drainage Criteria Manual- Chapter 8: Stormwater Best Management Practices*” <http://lincoln.ne.gov/city/pworks/watershed/dcm/>
- NDOR, “*Drainage and Erosion Control Manual- Chapter 3: Stormwater Treatment within MS4 Communities*” <http://dot.nebraska.gov/media/3920/chapter-3-stormwater-treatment.pdf>
- Urban Drainage and Flood Control District (UDFCD), “*Urban Storm Drainage Criteria Manual, Volume 3: Stormwater Quality*” <http://udfcd.org/volume-three>

Keeping in mind with these Design Manuals, the City of Kearney provides the following requirements:

### Infiltration Rates

Minimum infiltration rate shall be **0.5 in/hr**

Maximum infiltration rate shall be **12 in/hr**

## Infiltration Cells

Infiltration cells should incorporate conditioned soils to reduce the quantity of select material needed to provide treatment in a bioretention garden/basin. This method is described in the Omaha Regional Stormwater Design Manual and NDOT Drainage and Erosion Control Manual.

## Drain Time and Control Valves

A design drain time of **24 hours** will be used for all STF's that use a water quality control volume to provide treatment and control of runoff. Control valves shall be placed in underdrains to allow for adjustments to the drain time as needed.

## Cleanouts

Cleanouts shall be provided on all underdrains to assist with providing needed maintenance.

## Pretreatment

Measures shall be incorporated that prevent sediment from depositing in STF's during and after construction. Pretreatment of stormwater runoff through barriers, grass buffers or forebays is **recommended** on all STF's.

## **Landscaping**

The following resources have been provided to assist in the design of landscaping for a project. It is strongly suggested that a landscape architect or designer assist with plant selection and landscape design.

- UNL Extension, "Stormwater Management: Plant Selection for Rain Gardens in Nebraska" <http://www.ianrpubs.unl.edu/epublic/live/g1759/build/g1759.pdf>
- UNL Extension, "Nebraska Bioretention and Rain Garden Plants Guide" <http://marketplace.unl.edu/extension/ec1261.html>
- NDOR, "Plan for the Roadside Environment" <http://www.transportation.nebraska.gov/environment/docs/road-env-plan-total.pdf>
- NDOR, "Roadside Flowers and Grasses" <http://www.transportation.nebraska.gov/environment/flowers.html>
- NDOR, "Roadside Vegetation Establishment and Maintenance" [http://www.transportation.nebraska.gov/environment/docs/veg-manual\\_2014.pdf](http://www.transportation.nebraska.gov/environment/docs/veg-manual_2014.pdf)
- "The Seed", A Publication of the Nebraska Statewide Arboretum, Fall 2008 <http://arboretum.unl.edu/documents/The%20Seed%20Water%20in%20Landscape.pdf>

## Water Quality Volume

Design criteria to meet minimum site performance standards for new and redevelopment are expressed as the runoff from a specified percentile rainfall event applied across the treatment drainage area. The minimum WQCV for new and redevelopment can be calculated as follows:

$$\text{WQCV} = P \times (0.05 + 0.009 \times \% \text{Imp}) \times A \times 1/12 \times 43,560$$

Where, P = rainfall depth, in (from Table 1)

A = treatment drainage area, ac

%Imp = maximum percent imperviousness (expressed as a whole number not as a decimal) for proposed zoning type (varies by community)

The following example illustrates use of the WQCV equation:

Example 1) A 4.2 acre parcel in Kearney was purchased to construct a storage facility. The parcel is one of 4 in a new development that was zoned limited industrial district (M-1). Light industrial zoning in Kearney has a maximum impervious percentage of 90%. On that parcel, 2.4 acres will be disturbed to construct the facility. An additional 0.4 acres, also zoned M-1, drain directly onto the site from adjacent property. The WQCV for the site is calculated as follows:

$$\text{WQCV} = 0.72'' \times (0.05 + 0.009 \times 90) \times (2.4 \text{ ac}) \times 1/12 \times 43,560 = 5,395 \text{ cubic feet}$$

Maximum Impervious Percentage		
City Code Chapter	Zoning Use Class	%
15	AG Agricultural District	NA
16	RR-1 Rural Residential	NA
18	RR-2 Rural Residential	30%
19	R-1 Urban Residential	45%
20	R-2 Urban Residential	55%
21	R-3 Urban Residential	55%
22	R-4 Urban Residential	55%
23	RM Mobile Home Res.	60%
24	UC Mixed Use Urban	70%
25	C-O Office District	80%
26	C-1 Limited Commercial	80%
27	C-2 Community Commercial	80%
28	CBD Center Mixed Use District	100%
29	C-3 General Commercial	90%
30	BP Business Park	80%
31	M-1 Limited Industrial	90%
32	M-2 General Industrial	90%
42	ND-1 Pioneer Park	70%



Water Quality Discharge Rate ( $Q_{wq}$ )

STF's that are sized based on a flow rate (i.e. swales, filter strips, manufactured systems, etc.) shall use the water quality volume discharge rate ( $Q_{wq}$ ). The  $Q_{wq}$  is the peak runoff from the design water quality volume rainfall event. This peak runoff equivalent shall be calculated using the Natural Resources Conservation Service (NRCS) Curve Number (CN) procedure. The calculation is based on the 80<sup>th</sup> percentile rainfall event depth by region, a 24 hour duration storm event, and a time of concentration of 5 minutes. The area used is the impervious surface only within the treatment drainage area.

**Table 2**

Table 2 has been prepared to provide the  $Q_{wq}$  in each Region for sites with up to 6 acres of impervious area. These values shall be used to size STF's for the area of impervious surface within a given treatment drainage area. For sites greater than 6 acres, the designer shall use the Table 2 has been prepared to provide the  $Q_{wq}$  in each Region for sites with up to 6 acres of impervious area.

Impervious Area (Acres)	$Q_{wq}$ (cfs)			Impervious Area (Acres)	$Q_{wq}$ (cfs)			Impervious Area (Acres)	$Q_{wq}$ (cfs)		
	West	Central	East		West	Central	East		West	Central	East
0.2	0.1	0.2	0.2	2.2	1.5	1.9	2.2	4.2	2.9	3.6	4.2
0.4	0.3	0.3	0.4	2.4	1.6	2.0	2.4	4.4	3.0	3.7	4.4
0.6	0.4	0.5	0.6	2.6	1.8	2.2	2.6	4.6	3.2	3.9	4.6
0.8	0.5	0.7	0.8	2.8	1.9	2.4	2.8	4.8	3.3	4.1	4.8
1.0	0.7	0.8	1.0	3.0	2.1	2.5	3.0	5.0	3.4	4.2	5.0
1.2	0.8	1.0	1.2	3.2	2.2	2.7	3.2	5.2	3.6	4.4	5.2
1.4	1.0	1.2	1.4	3.4	2.3	2.9	3.4	5.4	3.7	4.6	5.4
1.6	1.1	1.4	1.6	3.6	2.5	3.0	3.6	5.6	3.8	4.7	5.6
1.8	1.2	1.5	1.8	3.8	2.6	3.2	3.8	5.8	4.0	4.9	5.8
2.0	1.4	1.7	2.0	4.0	2.7	3.4	4.0	6.0	4.1	5.1	6.0

# 3. Platting and Site Plan Review

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STF's must be accounted for in ANY platting or building permit for land development after August 31<sup>st</sup>, 2017 within its MS4 boundary. STF's will NOT be allowed within the Right Of Way. The City of Kearney began a public involvement process with local leaders, engineers, the development community and the general public on January 1, 2016 that will lead to the adoption of the "Post-Construction Stormwater Management Program (PCSMP)" no later than August 31<sup>st</sup>, 2017. The City of Kearney will implement requirements for the Post-Construction stormwater management program that have been set in place prior to this date and have been accepted by the EPA.

Provision of stormwater management education is an ongoing requirement for the City of Kearney and will continue as long as the program is in place. Initial goals for education will be developing an awareness of the purpose for permanent stormwater treatment and the requirements proposed by the City. Over time, education goals will transition to educating stakeholders about project specific requirements for individual applications and sharing information about best practices with the engineering community and public.

Development and redevelopment projects follow a review and approval process with the City and the City must stand behind the minimum standards in place at the time development plans were submitted. Projects that have already been platted and begun the development review process and have achieved acceptance according to minimum development standards by September 1<sup>st</sup>, 2017 will have the option, but not the requirement, to include permanent stormwater treatment facilities. All new development projects without a Preliminary Plat or building permit approved will be required to meet the 80% design storm event standard after August 31<sup>st</sup>, 2017. All redevelopment projects, as defined in this document, will be required to meet the 70% design storm event standard after August 31<sup>st</sup>, 2017. Stormwater treatment practices submitted to the City for approval after this date must meet all design requirements, application submittals, and plan review listed in this program document.

## **After 8/31/2017:**

**Proposed Redevelopment:** (Applies to lands which have been platted and previously built upon) Stormwater Treatment Facilities must be accounted for on any proposed redevelopment project if it has **not** already submitted a complete preliminary plat or building permit for approval. Proposed redevelopment projects that are exempt from treatment are those that have already submitted a complete plat, preliminary plat or building permit for approval. Any non-exempt projects must account for a 70<sup>th</sup> Percentile Rain Event.

**Proposed New Development:** (Applies to lands which are being platted for development or have been platted but have not previously been built upon) Stormwater Treatment Facilities must be accounted for on any proposed new development project that has **not** already submitted a complete preliminary plat or building permit for approval. Proposed new development projects that are exempt from treatment

are those that have already submitted a complete final plat, preliminary plat or building permit for approval. Any non-exempt projects must account for an 80<sup>th</sup> Percentile Rain Event.

After 8/31/2017:  Must treat if:	80% Rainfall Event	70% Rainfall Event	Exempt from Treatment
<b>Proposed Redevelopment:</b> <i>(Applies to lands which have been platted and previously built upon)</i>	<i>Redevelopment does not apply the 80% rainfall event standard.</i>	Any proposed redevelopment project <b>has not already submitted</b> a complete preliminary plat or building permit for approval.	Any proposed redevelopment <b>has already submitted</b> a complete plat, preliminary plat or building permit for approval.
<b>Proposed New Development:</b> <i>(Applies to lands which are being platted for development or have been platted but have not previously been built upon)</i>	Any proposed new development project <b>has not already submitted</b> a complete preliminary plat or building permit for approval.	<i>New development does not apply the 70% rainfall event standard.</i>	Any proposed new development project <b>has already submitted</b> a complete final plat, preliminary plat or building permit for approval.

# **Procedures**

## **Platting**

For major subdivision applications drainage and post-construction shall be discussed at the pre-application conference. This would be followed by an initial review of the general design at the preliminary platting stage and detailed design carrying over into final design review.

The plat applicant shall identify, through the Subdivision Agreement or other City-approved means, whether post-construction stormwater management facilities will be (1) constructed by each lot owner on their own lot (Lot Level STF's); (2) constructed for the subdivision by the developer with reimbursement sought from individual lot builders (Neighborhood STF's); (3) mitigated off-site at regional facilities (Regional STF's), or (4) addressed by other means approved by the City. Any other conditions agreed to between the two parties, including inspections, maintenance, and funding of maintenance shall be included in that agreement.

## **Building Permits**

When seeking a building permit, the City will need to investigate how drainage and post-construction stormwater management is being handled. If Lot Level STF's are required per the Subdivision Agreement or other agreement, then the lot builder will need to develop and have approved a drainage study, post-construction stormwater management plan, and maintenance agreement. A maintenance agreement for an individual lot shall include provisions for maintenance that shall be binding on all subsequent owners.

## **Submittals**

### **Post-Construction Stormwater Management Plan (PCSMP) Submittal**

The PCSMP submittal will include the following components:

#### **Plans**

Plans showing topographic survey information along with proposed grading, stormwater infrastructure (including STF's), pavement, and structures shall accompany any PCSMP submittal. Specifically, plans shall include the following information:

- Site topography including existing contours, property lines and easements, utilities, and site features such as existing water bodies, trees and shrubs, pavement and other structures
- Proposed contours
- Proposed inlets, storm sewer, culverts, and drainageways
- Proposed STF's and/or detention facilities

- Proposed roadways, parking, building footprints, and other structures

A table shall be provided in construction drawings that include, for each STF; (1) a location identifier, (2) the type of STF, (3) the location for each STF in latitude/longitude format, (4) the drainage area, and (5) the water quality volume/water quality volume discharge rate. The designer shall differentiate between the amount required by design and the amount that will be provided.

Placing the STF's on the Erosion and Sediment Control sheet of the plans would aid in the organization of the process. Requiring isolation of the STF location via some sort of perimeter control BMP would minimize the compaction of the STF location.

Any discrepancies should be discussed with and approved by the City. The information shall be provided on drawings in a format that is consistent with the following:

STF Identification Number	STF Type	STF Location (Lat/Long)	Drainage Area (Acres)	Design WQCV (cf) or Q <sub>WQ</sub> (cfs)	WQCV (cf) or Q <sub>WQ</sub> (cfs) Provided

Preliminary submittals required by the City will include preliminary information. Final plans shall be representative of the intended construction bid package.

### **Calculations**

All calculations for water quality volume and water quality volume discharge rate shall be submitted to the City as part of the site development drainage study. Calculations shall be completed as described herein for the appropriate STF's. Design criteria specific to the various STF's shall also be shown in the drainage study (i.e. calculations for drain down and infiltration).

When combining stormwater detention with STF's, the designer shall provide calculations that address both water quality volume and stormwater detention requirements using methodology approved by the community.

STF's shall be clearly shown on the drainage map along with other stormwater infrastructure and drainage basin boundaries.

### **Certification of Permanent STF's**

Prior to construction of STF's there will be required an inspection of the property for validation of proper placement of planned STF's. To ensure the correct construction and implementation

process of the STF, an inspection will be needed for verification. These inspections will be completed by someone of the Director of Public Work's choosing or a professional civil engineer in the State of Nebraska.

Upon completion of a project the City shall be provided a written certification, by qualified personnel, stating that the completed project is in compliance with the approved Final Drainage Plan. Qualified personnel shall be a professional civil engineer licensed in the State of Nebraska or person(s) under the direct supervision of a professional engineer licensed in the State of Nebraska.

For commercial and industrial construction, certification will be required before a Certificate of Occupancy is granted (unless authorized by the community). All applicants shall submit "as built" plans certified by a professional engineer licensed in the State of Nebraska once final construction is completed. A final inspection by the City (or qualified personnel) of all post-construction STF's shall be required before a Certificate of Occupancy will be issued or any public infrastructure is accepted.

## 4. Maintenance of Controls

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Stormwater Treatment Facilities (STF's) or permanent Best Management Practices (BMP's) located on private property shall be owned and operated by the owner(s) of the property on which the STF is located; unless the City of Kearney agrees in writing that a person or entity other than the owner shall own or operate such STF. This is stated as such in the City Code as 9-1626 "Post-Construction Requirement of Permanent BMP's."

As a condition of approval of the STF, the owner shall also maintain the STF in perpetuity to its design capacity unless or until the City shall relieve the property owner of that responsibility in writing. The obligation to maintain the STF shall have been memorialized on a subdivision plat, annexation plat, development agreement, subdivision agreement or other form acceptable to the City and recorded by the City with the project records.

The City shall continue to maintain public storm sewer infrastructure including public STF's. Each homeowners association of a subdivision or individual lot owner shall maintain post-construction STF's. When public infrastructure improvements are constructed by the City, such as with the widening of a major arterial or other public improvement, the City shall take responsibility for maintenance of the STF unless otherwise specified in a maintenance agreement.

Multiple 'Maintenance Agreement' forms are available in [Appendix B](#). These forms outline the legal agreement the City of Kearney has with the original owner of the STF's in discussion. There are two agreements; the form can either acknowledge responsibility is in the hands of a home-owners (or developers) association/partnership/corporation, or the City of Kearney.

# 5. Tracking Controls

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The City of Kearney will maintain a current inventory of all post-construction structural stormwater control measures installed and implemented at newly developed and redeveloped sites, including both public and private sector sites located within the permit area. In the “Post-Construction Stormwater Management Plan (PCSMP) Submittal Checklist” there is a chart that the developer is required to fill out. This chart shall provide information on each Stormwater Treatment Facility (STF). An ‘STF Identification Number;’ The Type of STF; The specific Lat/Long of each STF; Drainage Area (Acres); Design Water Quality Volume (cf) or Water Quality Volume Discharge Rate (cfs); Finally- the Water Quality Volume or Water Quality Volume Discharge Rate Provided.

This chart will be handed in to the City of Kearney Public Works Department upon acceptance of STF’s in developed site. It is also part of the PCSMP Submittal Checklist, Appendix A.

STF Identification Number	STF Type	STF Location (Lat/Long)	Drainage Area (Acres)	Design WQCV (cf) or Q <sub>WQ</sub> (cfs)	WQCV (cf) or Q <sub>WQ</sub> (cfs) Provided



# 6. Inspection and Enforcement

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## *Inspection*

The City of Kearney requires the ‘Inspection of STF’s’ on new development or redevelopment. Prior to construction of STF’s there will be required an inspection of the property for validation of proper placement of planned STF’s. To ensure that the correct construction and implementation process are being used for the STF, an inspection will be needed for verification. These inspections will be completed by someone of the Director of Public Work’s choosing or a civil engineer licensed in the State of Nebraska.

Self- inspections, performed by the STF/property owner, are submitted by owner of project within 90-days following municipal approval of completed project and shall consist of identifying each STF and reporting if maintenance is needed or has been done. The frequency of self-inspections should be no longer than three years following the previous self-inspection. There are different STF Inspection forms found in [Appendix D](#).

The importance of these inspections cannot be over-emphasized. It is necessary to determine which type of STF is being installed, whether it’s based on Volume or Flow Rate. Each STF should have details to aid in the construction process. Designs for these STF’s address specific materials and compactions for a reason.

For Municipal/Capital Improvement projects, inspections will completed by the City for each completed project within 90-days following municipal approval of each completed project. Also, if a request is submitted by the public and/or there has been a failure of the owner to submit a routine self-inspection, the City will perform an inspection within fourteen (14) days of the request.

## *Enforcement*

The City of Kearney has an ordinance enacted as it relates to the enforcement of STF responsibility of maintenance and of proper penalties for any violations of said ordinance. Chapter 9, Article 16, Division V (Enforcement) addresses the process regarding the violations, enforcement and penalties as it pertains to complying with any of the requirements of this Article. The City Code for Post-Construction Stormwater Management can be found in this document as [Appendix E](#).