



BACKGROUND AND PURPOSE

Impervious and Pervious. Land development permanently alters the way in which stormwater flows across a site due to grading, compaction, and the installation of impervious cover. Impervious cover or areas are man-made areas that cannot absorb water from rain or snow. Driveways, rooftops, patios, sport courts, tennis courts, adjustable Pergolas, and pools, for example, are considered impervious; surfaces such as decks, lawn, or gardens, where the rainwater is allowed to soak into the ground, are not considered impervious. Impervious area increases the amount of rainwater runoff and can cause flooding.

Impervious Area Limits. In an attempt to reduce the impacts caused by impervious cover, the City of Kirkwood requires, in accordance with Municipal Code *Chapter 5, Article VI. Infill Development Storm Water Management*, that stormwater management measures be utilized when constructing a new home, driveway or addition that is the greater of one of the following requirements (designated as the Contributing Drainage Area):

1. Creates 1,000 square feet or greater of new impervious surface (Net Additional Impervious = Proposed Impervious Area - Existing Impervious Area) area or
2. Causes the Proposed Impervious Area to be twenty-five (25) percent or greater of the total lot area.

The purpose of this document is to provide guidelines for selecting and installing the appropriate stormwater management measures when constructing a home. The City acknowledges these regulations will not solve all stormwater related issues within the City; however, this is a reasonable effort to reduce impacts of development on stormwater.

Design Standards. This guideline employs simplified design standards more applicable to the homeowner/builder experience, thus avoiding the necessity for complex engineering calculations and analysis. This guideline is meant to complement the use of the Metropolitan St. Louis Sewer District (MSD) Rules and Regulations and Engineering Design Requirements for Sanitary Sewer and Stormwater Drainage Facilities, February 2018, or most current version, which must be used for sites that propose more than one (1) acre of land disturbance.

The City reserves the right to:

- Require a Missouri Licensed Professional Engineer (PE) or Professional Landscape Architect (PLA) seal on the drawings when more complex land disturbances involving any of the following:
 - Cut/fill at or near a property line that could cause erosion, ponding, or other damage to adjoining property
 - Deep cuts and/or fill (exceeding 5 feet)
 - Large quantity of cut and/or fill (exceeding 250 CY)
 - Engineered or compacted fill proposed for future foundation support
 - Alterations to an existing piped drainage system
 - Creation of a new piped drainage system
 - Disturbance and/or drainage may impact a nearby sinkhole
 - Sinkhole evaluation and/or treatment needed
 - Disturbance is close to or within a flood plain or stream buffer
- Require MSD review and approval of certain projects that are less than one (1) acre of land disturbance.

Required Inspections. During and after construction of the stormwater management facilities, the City requires that two inspections (Initial and final) of the facilities take place and will be performed by a City Project Manager, City Engineer, or his or her designee. These inspections, an initial and final, will take place both during and after the construction has commenced. To schedule your inspection(s), contact 314-822-5822 at least 48 hours before.



How do I know when MSD Plan Review and Permitting is Required?

MSD Plan Review and Permitting Required Instances:

- 1.) MSD has identified a stormwater or sanitary project on the parcel or in the nearby area
- 2.) Sites where there are downstream storm water problems, flooding, erosion, seepage
- 3.) Overland flow issues, contours indicate a possible overland flow path, the site is in a “valley” area or low spot, there has never been a house on this lot previously
- 4.) Lots near low spots/dips in the road
- 5.) Proposed development is in close proximity to existing sewer facilities and/or easements, the sewer/easement is within a 1:1 zone of influence (see Figure 1) of the proposed building/footing, or there has never been a house on this lot previously
- 6.) If there are any known issues with shared sewer laterals or sewer laterals that are crossing other properties
- 7.) There is no public sanitary sewer adjacent/available to directly serve the lot being developed (“directly” means that a sanitary lateral connection can be made to the public sewer without the lateral crossing another property)
- 8.) Development in or near possible sinkhole areas, or development that will affect or is tributary to sinkhole areas
- 9.) Any project that disturbs one acre or more
- 10.) Any project where property line changes are proposed
- 11.) Other items/instances as determined by the City and/or MSD
- 12.) If unsure, please contact MSD Development Review, as follows:
 - a. For most of the City, it is the West Team (Grand Glaize, Sugar Creek, and Gravois Creek Watersheds) projects, Bob Miller 314-335-2053 or ramill@stlmsd.com;
 - b. For the upper Northeastern part of the City, it is the East Team (Deer Creek Watershed) projects, Mark Kuelker 314-335-2064 or mkuelker@stlmsd.com .

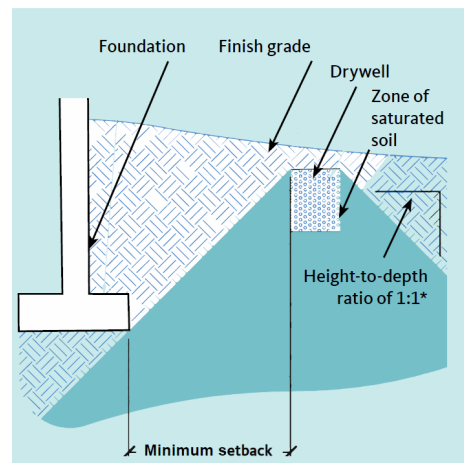


Figure 1
Assessing appropriate setbacks for drywells.
* Height-to-depth ratio varies with soil type.
Consult a geotechnical engineer for an appropriate assumption.

For stormwater complaints regarding MSD, please contact their Customer Service by phone at 314-768-6260 or by email at <https://msdprojectclear.org/contact-us/> .

What is the estimated plan review time?

The City will take approximately 10 business days after the ARB meeting date to perform an initial review of your submittal and return comments to you. Additional review time will be needed if MSD review is required and for each additional City review. The process flow chart for review can be viewed in Appendix G.

What is the frost depth for the area?

Saint Louis County Department of Transportation states the frost depth as 30 inches. It is strongly suggested that the bottom of aggregate dry wells, underdrains, or Modified French Drains be at least 30 inches below finish grade so that water will continue to drain down during winter weather conditions.



REQUIREMENTS AND PRINCIPLES OF INFILL RESIDENTIAL STORMWATER MANAGEMENT

The following section provides, in a question and answer format, the necessary information for understanding the requirements and process for submittal.

What types of residential projects require Stormwater Management?

The following activities are required to install stormwater management Green Infrastructure Practices / Best Management Practices (BMP) on site (greater of the two):

- Projects creating one thousand (1,000) square feet or more of net additional impervious area, or
- Projects causing the total impervious area on the lot to be twenty-five (25) percent or greater, whichever is greater

These projects can be anything that increases the impervious area of your property that meets the above requirements (for example: new home construction, building an addition, swimming pool, driveway expansion, patio, sport court, or detached garage).

What types of residential projects do not require stormwater management?

As long as Projects create less than one thousand (1,000) square feet of net additional impervious area:

- If a lot's existing impervious area is less than twenty-five (25) percent of the total lot area and a proposed improvement does not increase the total impervious area above twenty-five (25) percent, the lot is exempt from compliance with Municipal Code *Chapter 5, Article VI. Infill Development Storm Water Management.*
- If a lot's existing impervious area is greater than twenty-five (25) percent than the total lot area and a proposed improvement does not increase the total impervious area above the existing impervious area, the lot is exempt from compliance with Municipal Code *Chapter 5, Article VI. Infill Development Storm Water Management.*

What are the principles for managing stormwater on residential developments?

Residential developments are not required to provide the same types of stormwater management as commercial projects; however, certain requirements must be met to ensure that stormwater runoff does not overwhelm existing stormwater infrastructure; impact water quality in our streams; or negatively impact adjacent property. The key principles for managing stormwater from a residential lot are:

- Proper grading and erosion control techniques during construction;
- Reliance on infiltration only where the water table or bedrock layer is at least two feet below the bottom of the practice in use;
- Proper installation and maintenance of downspouts, channels, or any other sources of concentrated flow; and
- Runoff reduction (see section below).

What is Runoff Reduction?

The term 'Runoff Reduction' means the interception, evapotranspiration, infiltration, or capture of stormwater runoff. Examples of runoff reduction techniques on a single-family residential development include any appropriate combination of the following techniques termed Green Infrastructure Practices:

1. Routing downspouts to underground dry wells,
2. Directing sheet flow to adequately sized vegetated filter strips / areas (also known as Amended Soil), or any appropriate combination of techniques,



3. Routing downspouts to Modified French Drains,
4. Replacing traditional impervious surfaces not on public Right-of-Way (driveways, patios, etc.) with pervious paving,
5. Installing a rain garden or bioretention area,
6. Credit for Existing Trees.

The goal of these techniques is to reduce the volume of runoff generated by the first 1.14 inches of rain (the 90th percentile rainfall event as determined by STL MSD -see <https://www.stlmsd.com/what-we-do/stormwater-management/bmp-toolbox/stormwater-quality>) and is called the “First Flush”. **First flush** is the initial [surface runoff](#) of a rainstorm. During this phase, [water pollution](#) entering [storm drains](#) in areas with high proportions of [impervious surfaces](#) is typically more [concentrated](#) compared to the remainder of the storm. Consequently, these high concentrations of [urban runoff](#) result in high levels of pollutants discharged from storm sewers to [surface waters](#) . Other BMPs that employ runoff reduction techniques may be used in lieu of these techniques with proper documentation of design criteria, details, and maintenance. When specified, the 2-year and 100-year, 24-hour rainfall amounts of 3.1” and 7.2”, respectively, are to be used (source: THE METROPOLITAN ST. LOUIS SEWER DISTRICT RULES AND REGULATIONS AND ENGINEERING DESIGN REQUIREMENTS FOR SANITARY SEWER AND STORMWATER DRAINAGE FACILITIES FEBRUARY 1, 2018).

How are Runoff Reduction techniques sized on residential developments?

Applicants can meet this requirement by following the practices in this technical guidance document to design an appropriate stormwater management plan. The amount of volume to be reduced on site is directly related to the drainage area contributing runoff to the treatment technology.

What are installation restrictions in BMP construction?

1. During Cold Weather (a period when the average daily ambient temperature is below 40°F (5°C) for more than 3 successive days.):
 - a. Do not use frozen materials.
 - b. Do not use materials mixed or coated with ice or frost.
 - c. Do not build on frozen work.
2. During Wet Weather:
 - a. Do not build on wet, saturated, unstable, or muddy subgrade.
3. Ground Water Table and Bedrock:
 - a. Must be at least 2 feet of cover above the ground water table or any dense rock from the bottom of any excavated BMP.
4. BMP’s must not be constructed:
 - a. Over any buried utility line, septic drain fields, or sink holes;
 - b. Beneath driveways or structures (i.e., garage, shed, pool, residence, etc.);
 - c. Less than the specified setback distance for the BMP
 - i. Within a minimum of three (3) feet from all other utilities unless a greater setback is required by the utility company. All utilities (for instance water, sewer, gas, CATV, Fiber-Optic, and electric) must be shown on the plan so setbacks can be verified.
 - ii. Discharge from a BMP must a minimum of ten (10) feet from property lines except for:
 - (1)** House roof or foundation drains, which may be discharged within two feet of the house foundation;
 - (2)** Discharge into an open natural swale or creek on the same property.



- d. Within 50 feet from the top of any slope 3:1 (H:V) or greater.
- 5. When discharging water, never:
 - a. Route surface water onto adjoining property,
 - b. Route surface water into a sanitary sewer,
 - c. Cross property lines with any discharge system without an easement, and
 - d. Route so that it causes an erosion problem or nuisance.

What materials are used in BMP construction?

While there are some proprietary materials, like dry well tanks, there are common materials used throughout this manual.

Goesynthetics.

Weed Barrier (Optional). The geosynthetic used shall be a needle-punched, heat-treated, polypropylene, nonwoven landscape fabric designed specifically to act as a weed barrier, separator and drainage filter. This geosynthetic shall be inert to biological degradation and resistant to naturally encountered chemicals, alkalis, and acids. Equivalent products are Mirafi® Mscape E, Propex GEOTEX 351, or Thrace-LINQ 130EX or an approved equal is acceptable.



PROPERTY	TEST METHOD	MEASUREMENT
Minimum Weight <input type="text" value="Typical"/>	ASTM D-5261	3.5 oz/y ²
Minimum Grab Tensile Strength	ASTM D-4632	90 lbs
Maximum Elongation @ Break	ASTM D-4632	50 %
Minimum CBR Puncture	ASTM D-6241	260 lbs
Minimum Trapezoidal Tear	ASTM D-4533	40 lbs
Maximum Apparent Opening Size ^(1,2)	ASTM D-4751	50 US Sieve
Minimum Permittivity ⁽¹⁾	ASTM D-4491	2 Sec ⁻¹
Minimum Water Flow Rate ⁽¹⁾	ASTM D-4491	150 g/min/f ²
Minimum UV Resistance @ 500 Hours	ASTM D-4355	70 %
⁽¹⁾ At the time of manufacturing. Handling, storage, and shipping may change these properties.		
⁽²⁾ Maximum average roll value (MaxARV).		

Separation. The geosynthetic used in this manual to separate materials and allow subsurface drainage are a non-woven AASHTO M 288, Class 3 or an MSD Type 4. This fabric must be a needle-punched nonwoven polypropylene geotextile.

Non-Woven Geotextile should consist of the following properties:

- a. Grab Tensile Strength (ASTM-D4632) ≥ 120 lbs
- b. Mullen Burst Strength (ASTM-D3786) ≥ 225 psi
- c. Flow Rate (ASTM-D4491) ≥ 95 gal/min/ft²
- d. UV Resistance after 500 hrs (ASTM-D4355) ≥ 70%
- e. Heat-set or heat-calendared fabrics are not permitted



- Pre-Approved products available in the area are:
 - Mirafi 140 N, Propex GEOTEX 401, SRW NW4.5, or Thrace-LINQ 140EX.

Polyester Filter sock. The filter sock, placed around perforated pipe, acts as a filter barrier that screens out problem-causing sand and sediment to help keep high flowing performance in drainage pipe. Deposits can build up inside, greatly reducing water flow or completely clogging the drain line. Filter socks shall meet ASTM D6707 Standard Specification for Circular-Knit Geotextile for Use in Subsurface Drainage Applications.

- A pre-approved product available in the area is:
 - Drain-Sleeve Filter fabric sock for perforated drain pipe.

Aggregates.

For dry wells, underdrains, base course for permeable pavers, and Modified French Drains the use of a clean and washed ASTM No.57 crushed stone is required. This stone size averages from ½-inch to 1-1/2 inches in diameter and has an assumed porosity of 40 percent.

For permeable paver bedding course, a substitute for leveling purposes in the upper three-inch layer of the base below a prefabricated dry well tank, or backfill over a top of a dry well tank, a clean and washed ASTM No. 8 stone or 1/3-inch to 3/8-inch diameter pea gravel is used.

Mulch Layer. A mulch layer consisting of 2-3 inches of non-floatable organic mulch (fine shredded hardwood (cypress) mulch, pine straw, or leaf compost) should be included on the surface of the rain garden. Pine bark and wood chips should not be used.

Compost. As a component for Vegetated Filter Strip (amended soil option), the following are the compost material requirements.

Compost shall be mature, stable, weed free, and produced by aerobic decomposition of organic matter. Compost feedstock may include, but is not limited to: agricultural, food or industrial residuals; class A biosolids as defined in the EPA CFR Title 40, Part 503; yard trimmings, or source-separated municipal solid waste. The product must not contain any visible refuse or other physical contaminants, substances toxic to plants, or over 5% sand, silt, clay or rock material by dry weight. The product shall possess no objectionable odors. The product must meet all applicable USEPA CFR, Title 40, Part 503 Standards for Class A biosolids. The moisture level shall be such that no visible water or dust is produced when handling the material. The following are a list of products considered pre-approved for use:



COMPOST SUPPLIERS				
Company	Product	Location	Email	Phone
Fick Supply Service	Grow Green Compost	501 N. Eatherton Rd Wildwood, Missouri 63005	Candice@ficksupply.com	(636) 532-4978
Hansen's Tree Services & Environmental Wood Resources	Magic Bean Compost	1628 Kemmar Ct O'Fallon, Missouri 63366	chad@hansenstree.com	(636) 379-1830
		1730 Cecos Lane Arnold, Missouri 63010		(636) 287-1130
St. Louis Composting	Black Gold	– Fort Bellefontaine 13060 County Park Rd Florissant, Missouri 63034	dgavlick@stlcompost.com	(314) 355-0052
		– Pacific 18900 Franklin Rd. Pacific, Missouri 63069		(636) 271-3352
		– Valley Park 39 Old Elam Ave Valley Park, Missouri 63088		(636) 861-3344
Compost submitted for use must carry the Certified Compost Seal of Testing Acceptance				



Testing. Prior to delivery of any compost to the site and as part of shop drawing review, the contractor shall provide the following documentation at the initial inspection to the Kirkwood City Inspector:

- feedstock percentage in the final compost product
- a statement that the compost meets federal and state health and safety regulations
- a statement that the composting process has met time and temperature requirements
- a copy of the lab analysis, less than four months old, performed by a Seal of Testing Assurance Certified Laboratory verifying that the compost meets the physical requirements as described in Table 1.

Table 1. Physical Requirements for Compost

Parameter	Range	Testing Method
pH	5.0-8.5	TMECC 4.11A
Soluble Salt Concentration	< 10dS/m	TMECC 4.10-A
Moisture	30-60% wet weight basis	SMEWW 2540B
Organic Matter	30-65% dry weight basis	TMECC 5.07-A
Total Nitrogen (N)	>1.00% dry weight basis	TMECC 04.02-D
Phosphate (P ₂ O ₅)	>0.50% dry weight basis	TMECC 04.03-A
Potash (K ₂ O)	>0.10% dry weight basis	TMECC 04.04-A
Particle Size	95% pass through 5/8" screen or smaller	TMECC 2.02-B
Stability (Carbon Dioxide evolution rate)	>80% relative to positive control	TMECC 5.08-B
Maturity (Seed emergence and seedling vigor)	>80% relative to positive control	TMECC 5.05-A
Physical contaminants (man made inerts)	<1% dry weight basis	TMECC 3.08-A
Chemical contaminants	Meet or exceed US EPA Class A standard, 40 CFR § 503.13, Tables 1 and 3 levels:	
Arsenic	< 41 ppm	TMECC 4.06-AS
Cadmium	< 39 ppm	TMECC 4.06- <u>CD</u>
Copper	< 1,500 ppm	TMECC 4.05-CU
Lead	< 300 ppm	TMECC 4.06-PB
Mercury	< 17 ppm	TMECC 4.06-HG
Molybdenum	< 75 ppm	TMECC 4.05-MO
Nickel	< 420 ppm	TMECC 4.06-NI
Selenium	< 100 ppm	TMECC 4.06-SE

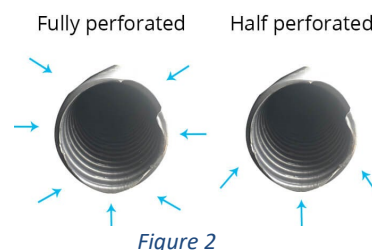


Parameter	Range	Testing Method
Zinc	< 2,800 ppm	TMECC 4.06-ZN
Biological contaminants (pathogens)	Meet or exceed US EPA Class A standard, 40 CFR § 503.32(a) levels:	
Fecal coliform	< 1,000 MPN per gram, dry weight basis	TMECC 7.01

Recommended compost testing methodologies and sampling procedures are provided in **Test Methods for the Examination of Composting and Compost (TMECC)** and **Standard Methods for the Examination of Water and Wastewater**. See <https://www.compostingcouncil.org/page/tmecc> and <https://www.standardmethods.org/about/>, respectively, for additional information.

Pipe.

For use in dry wells, underdrains and connecting downspouts, pipes are used. Pipes shall be rigid and durable and made of Schedule 40 PVC or HDPE and have either a 4-inch or 6-inch inside diameter. Pipes are solid when connecting downspouts to dry wells or exiting dry wells to a discharge point. Pipes used in an aggregate system, such as a dry well, Modified French Drain, or underdrain are perforated. Pipe with circular perforations are to be located in the trench as per Figure 2. Pipe inside diameters shall be considered 4-inches when the pipe diameter is not specified.



Source: <https://www.idpipes.co.uk/knowledge/land-drainage/perforations-up-or-down.html>

Installations Below Frost Line (30" or more below final grade):

PVC Pipe. Schedule 40 Perforated PVC pipe will be constructed of PVC 1120 Type 1 Grade 1, with a cell class of 12454B, per ASTM D1784 (AASHTO M 304-19). Perforated underdrain shall be wrapped with a polyester fabric sock meeting ASTM D6707.

Installations Above Frost Line (Less Than 30" below final grade):

HDPE Pipe. HDPE pipe will be constructed of rigid dual wall smooth interior and annular exterior corrugations HDPE pipe meeting the requirements of ASTM F 810 MS (AASHTO M 252-18, Type S, Class 1 or 2 perforations). Perforated underdrain shall be wrapped with a polyester fabric sock meeting ASTM D6707.

Products Pre-approved for use.

- ADS 3000 Triple Wall pipe.
- ADS N-12 ST IB Dual Wall pipe meeting ASTM F2648.

Exceptions Allowing Schedule 40 PVC pipe. Emitters and vertical extensions for observation wells and dry well tanks as per the manufacturer’s guidelines.

Pipe End Treatments. Pipes ends need to be capped when terminated in one of the following methods:

Underdrain Outlet Protection.

- **Daylighted.** Rodent screen shall be press formed of 3 or 4 mesh, 21 gauge or heavier, stainless steel or hot-dipped galvanized wire screen or approved equivalent to provide a cup-shaped screen, which will provide a friction tight fit when inserted into the drain outlet.
- **Connection to Stormwater Inlet or Manhole.** A hole, slightly larger than the outside diameter of the pipe, shall be drilled or precast in structure. The underdrain shall extend a minimum of six (6) inches past the inside wall of the structure. Then the underdrain shall be grouted on both the inside and outside of the structure and allowed to properly cure. Once the grout is properly cured, the underdrain shall be trimmed off as close as possible



to the inside of the structure. A rodent screen shall be installed as per above. MSD pre-approval (permit) is required.

- **All Other.**
 - **Popup Emitter**
 - An emitter is opened by the hydrostatic pressure of water flowing through the drainpipe. As flow diminishes, the Emitter closes again. The special patented design allows the emitter to open with a negligible amount of pressure. Since the emitter is closed during dry weather, debris and rodents cannot enter the drainpipe. The emitter has a 90 degree bend elbow with a ¼-inch leach hole at the bottom. The last 5 feet of pipe before the emitter shall be a perforated underdrain (installed with geosynthetic and drainable aggregate) to allow water to drain and not freeze in the pipe during cold weather conditions (See Appendix D for typical section). **Minimum spacing between multiple emitters is 15 feet.**
 - **Terminal End.**
 - The terminal end on the upstream or downstream pipe (into a dry well) shall be capped with a manufacturer-approved cap.

Permeable Pavers.

The contractor shall obtain the concrete paver manufacturer’s certification that the paving units supplied to construct the Permeable Pavers meet the requirements in ASTM C936 Standard Specification for Solid Interlocking Concrete Paving Units. The following Material Suppliers and products are considered pre-approved:

Midwest Block and Brick	ROMANSTONE
Building Product Corp.	ECO BRICK
Belgard Hardscapes	AQUA ROC™, AQUA-BRIC

SUBMITTAL INFORMATION

What needs to be submitted?

1. **Computations.** The first step is to submit computations to verify that a BMP is required. The following information is needed to provide an official determination:
 - a. Existing impervious area, square feet
 - b. Proposed impervious area, square feet
 - c. Net Increase in impervious area, square feet
 - d. Lot size, square feet
 - e. Lot Size*0.25
 - f. The Contributing Drainage Area is the greater of the following:
 - i. Proposed Impervious Area – Lot Size*0.25, in square feet; or
 - ii. Net Increase in impervious area (1,000 square feet or greater), square feet

Once it is determined that a BMP will be required you can move to the next step.

2. **Plans.** In addition to any submittal requirements as specified by the City’s permit submittal process, applicants must develop a site plan that includes the following items:



- Location, configuration and finished elevations for existing and proposed impervious areas;
 - Contributing Roof Drainage Area for each downspout connected to a BMP
- Proposed drainage infrastructure in Right-Of-Way;
- Location of Trees;
- Lot/building layout with dimensions;
- Existing and proposed ground contours and elevations at no more than 2-foot intervals;
 - Direction of flow for swales, overland flow and pipe
 - Percent fall of pipe or BMP
- Sanitary and storm sewer structures and easements;
- All utilities (for instance water, sewer, gas, CATV, Fiber-optic, electric, underground pet fences, irrigation systems) must be shown on the plan so setbacks or conflicts can be verified.
- Location, configuration, and finished floor elevations for existing and proposed building structures;
- Location, configuration, and finished elevations for existing and proposed paved areas;
- Location and type of erosion and sediment control practices in conformance with the City Code;
- Selected and completed Green Infrastructure Control & Practice Tear Sheets;
- Site infiltration test results, when performed. A tear-off sheet is included in Appendix A of this document.

Pertinent to stormwater, the following guidance applies to all designs -

- Stormwater runoff from the first 1.14 inches of rainfall must be captured on site and dissipated through the use of infiltration, evapotranspiration or alternate use (e.g. irrigation). It cannot run off the site.
- No person shall direct stormwater or sump pump water through a pipe, culvert or drain, which discharges within ten (10) feet of the adjacent property line except for:

(1) House roof or foundation drains, which may be discharged within two feet of the house foundation;

(2) Discharge into an open natural swale or creek on the same property.

[SOURCE: Ord. No. 10378, 1-5-2017]

- Details of all Green Infrastructure Controls/BMPs shall be attached to the site plan using, where possible, specification sheets from this document or sets of plans of equal detail and coverage.
- **Default Infiltration Rate (IR).** Should you choose not to perform infiltration testing as outlined in Appendix A, your site infiltration rate will automatically be recorded as **0.05 inches/hour (in/hr)** which excludes some BMP's as being applicable and others will require an underdrain. See Appendix D for details on constructing an underdrain. The following is a list of BMPs for several ranges of infiltration rates:
 - 0.05 in/hr ≤ IR ≤ 0.25 in/hr
 - Dry Well with 10% increase in volume
 - Vegetative Filter Strip (Amended Soil Option) with underdrain
 - Permeable pavers with underdrain
 - Rain Garden with underdrain
 - Tree Credit
 - 0.25 in/hr < IR ≤ 0.50 in/hr
 - Dry Well



- Vegetated Filter Strip (Amended Soil Option)
- Modified French Drain
- Permeable Pavers
- Rain Garden
- Tree Credit
- 0.50 in/hr < IR
 - Dry Well
 - If IR > 0.50 in/hr the storage volume may be decreased by 10 percent for every 0.50 in/hr of IR increase above 0.50 in/hr.
 - Vegetated Filter Strip (Conventional or Berm option)
 - Modified French Drain
 - Permeable Pavers
 - Rain Garden
 - Tree Credit
- **Rounding.** In each of the tear-off calculation sheets, the rounding of values should conform to the following requirements:
 - Volume: Round up to the nearest cubic foot.
 - Length and Width: Round to the nearest whole foot.
 - Depth: Round to the nearest half (0.5) foot.
 - Area: Roundup to the nearest whole square foot.
 - Infiltration Rate: to nearest 0.05 in/hr.
- 3. Maintenance Agreement.** Once the plans and computations are approved you will receive an email with the approved plans and a blank copy of the Maintenance Agreement, which is to be completed by you and the City, and then filed by you with the Saint Louis County Recorder of Deeds. A notary is available at City Hall by appointment. Please call 314-822-5822 to schedule either your notarization or City notarization.

What needs to be included in the Stormwater BMP Maintenance Agreement?

The City requires single-sided sheets (8.5" x 11" size for recording) that include the following to be submitted with the Stormwater BMP Maintenance Agreement. All lettering is to be at least eight (8)-point print (#80 "Leroy" lettering guide). Recording fees, paid by the property owner, can be estimated from the Saint Louis County Missouri Recorder of Deeds web site at: <https://stlouiscountymo.gov/st-louis-county-departments/revenue/recorder-of-deeds/price-list/>.

- Grantor (Landowner) and City Notarized Stormwater BMP Maintenance Agreement
 - Recording Cover Sheet
 - Date of Document
 - Grantor Name(s) (Property Owner(s))
 - Property Address
 - County Locator Number (see St. Louis County Revenue Property Information: <https://revenue.stlouisco.com/ias/searchinput.aspx>)
 - Subdivision Name and Brief Legal Description
 - Maintenance Agreement:
 - Property Address
 - Date of Document: Day, Month, and Year
 - Grantor Name(s)
 - County Locator Number



- Deed Book and Page Numbers
- Subdivision Name and Brief Legal Description
- Name of Plan (from permit; i.e., New Home Construction, Garage Addition)
- Maintenance Agreement
- Landowner Notarized Signature(s) Page
 - Bring photo id if using city notary
- City Notarized Signature Page
- **Supporting Exhibits.** Date of most recent revision of maintenance agreement exhibit is indicated in the lower left corner. Suggest using the worksheets in this manual when possible. Attach to Maintenance Agreement:
 - Drainage Calculations:
 - (L) Lot Size, square feet
 - (EI) Existing impervious area, square feet
 - (II) Improved impervious area, square feet
 - (C) Contributing Drainage Area, square feet
 - $C = II - 0.25 * L$
 - For adding new or modifying an existing sump, add 175 square feet to C.
 - Infiltration Rate (See Appendix A), inches / hour (optional)
 - Default Infiltration Rate is 0.05 inches/hour
 - Sizing computations for each BMP
 - Typical Section(s) for each temporary and permanent BMP
 - Site plan, with:
 - North Arrow
 - Scale
 - Property Lines
 - Contour lines (2-foot spacing maximum)
 - Right of Way information; such as name, width, road, street, railroad, creek, etc. is indicated, if applicable.
 - Existing Easements, stormwater and sanitary sewer structures
 - Location and dimension of each BMP:
 - Include temporary erosion control and
 - Slope and location of pipe(s) that connects to BMP or discharges from BMP
 - Setback distance(s) for BMP
 - Direction of water flow and BMP slope, in percent
 - Proprietary BMP
 - Installation and Maintenance Guidelines

What does the applicant do with the completed notarized Stormwater BMP Maintenance Agreement?

- **Recording Options:**
 - **In Person.** The applicant then takes the notarized Maintenance Agreement, with supporting exhibits, to the Saint Louis County Recorder of Deeds and pays the required fees to have it recorded. The Recorder of Deeds published fee schedules are located at <https://stlouiscountymo.gov/st-louis-county-departments/revenue/recorder-of-deeds/price-list/>. The Recorder of Deeds Division is located on the fourth floor of the Lawrence K. Roos County Government Building located at:
 - 41 South Central Avenue, Clayton, MO 63105-1799.



- Staff will check your Maintenance Agreement document for the minimum statutory requirements for recording, but **cannot**:
 - Verify that the document fulfills the intentions of the party recording the document;
 - Give legal advice;
 - Perform deed searches;
 - Complete or fill out/type deed forms;
 - Supply blank legal forms;
 - Determine ownership of a property.
- **By mail. USPS mail or Drop-Off the original notarized document:** Recorder of Deeds, 41 S Central Ave, Clayton, MO 63105. Please include a check or money order made payable to 'ROD' for the cost of the deed recording. The original will be returned to you within one week of the recording date.
- **Title Company.** A local title company can record the Maintenance Agreement with the Recorder of Deeds. The title company will charge an additional fee for this service.
- **Electronic Recording.** Follow guidelines on County Web Page: <https://stlouiscountymo.gov/st-louis-county-departments/revenue/recorder-of-deeds/erecording/> .
- The applicant then returns a copy of the receipt (in-person or by email) to the Assistant City Engineer, who will in turn notify the Deputy Building Commissioner. Make sure the address is on the receipt as the County does not identify the receipt. In 7-14 days, the Recorder of Deeds will issue a hard copy of the recorded agreement. A copy of this agreement is to be submitted by the applicant (in-person or by email) to the Assistant City Engineer. No initial inspection will be scheduled until the City has received a recorded copy of the maintenance agreement.
- **Note: BMP inspections are not granted until a recorded maintenance agreement is received. Occupancy permits are not granted until a recorded maintenance agreement is received and all stormwater BMP's have been final-inspected and approved by Engineering. Inspections are to be scheduled on days when the City Hall is open for Business. Please contact 314-822-5822 at least 48 hours prior to date of inspection for scheduling.**

What is in the rest of this manual?

The remainder of the document contains:

- (1) A set of six information/specification sheets, one for each of the six recommended Green Infrastructure Controls/BMPs. For each, the last two pages are a tear-off set of specifications that can be filled in and attached to construction plans.
- (2) Appendix A that describes how to conduct infiltration testing.
- (3) Appendix B that describes the types of vegetation recommended for those Controls that feature vegetation as part of the treatment approach.
- (4) Appendix C that describes how to determine adequate flow area.
- (5) Appendix D that provides details when an underdrain is required.
- (6) Appendix E is the pretreatment detail.
- (7) Appendix F is the ordinance these guidelines are based upon.
- (8) Appendix G is the stormwater review process.
- (9) Appendix H is a graphic displaying stormwater pollution prevention for single-lot residential sites.

MAINTENANCE AND INSPECTIONS

- Each of the six Green Infrastructure Controls/BMPs information/specification sheets contains information regarding general maintenance that is required for each BMP. The property owner is required to maintain their



BMP's in proper working condition. The Maintenance Agreement allows City access at reasonable times for regular or special evaluations to ensure BMP's are properly maintained and in working condition.

- Inspections will be conducted by the City and scheduled in advance with the property owner at the following intervals:
 - Requested by property owner:
 - During construction (initial and final),
 - Requested by city:
 - One-year after construction of the BMP is completed, and
 - Three-year intervals after the one-year inspection.
- See the Operations & Maintenance Manual for:
 - Construction inspection checklists, for both during construction and after completion;
 - Construction inspection intervals;
 - Additional maintenance information and inspection checklists.

To view Operations & Maintenance Manual and other helpful information visit the City website at: <https://www.kirkwoodmo.org/government/departments/public-services/engineering/stormwater>.