

Article 20: Erosion Control and Stormwater Management

Section 360: Purpose, Scope of Authority, Performance Guarantee and Approvals

- A. Purpose. The purpose of this document is to set forth minimum requirements and provide guidance and additional resources to facilitate control of soil erosion and stormwater on land that is undergoing development, to preserve the natural terrain and waterways within unincorporated Franklin County and to protect and further the public interest by regulating land disturbance in connection with the clearing and grading of land for construction related or other purposes. The guidelines will assist developers in the development of stormwater pollution prevention plans, but are not intended to act as a sole source regarding acceptable methods. Engineering professionals are encouraged to design innovative ways to address site specific conditions. With these regulations, the County will promote the coexistence of the natural environment with planned development. It is also the purpose of this Article to encourage responsible development and minimize the impacts of development.
- B. Scope of Authority. Any person, firm, corporation or business proposing to have land disturbance of one (1) acre or more within the unincorporated limits of Franklin County shall supply Franklin County Planning and Zoning with a Stormwater Pollution Prevention Plan (SWPPP), prepared by a professional engineer, certified professional in erosion and sediment control or other certified professional and a copy of the land disturbance permit issued by the Missouri Department of Natural Resources for the proposed project.
- C. Performance Guarantee. Prior to approval of the required stormwater plan and prior to the recording of a final subdivision plat, the Planning and Zoning Department shall require the applicant to submit a performance guarantee agreement as required by Appendix G.
- D. All erosion control and stormwater management methods shall be approved by the designated representative of Franklin County. If, at the discretion of Franklin County, additional engineering review is needed, the applicant shall be responsible for the additional cost.

Section 361: Sediment and Erosion Control

- A. Sediment and erosion control will be accomplished by applying conservation practices that will reduce the potential for damage from stormwater runoff. Control practices use trapping, filtering or diversion techniques to protect adjacent properties from land disturbance activities.
- B. Construction sites, where the area to be disturbed is one (1) acre or more, must apply for a stormwater discharge permit from the Missouri Department of Natural Resources. If required, the applicant must obtain and submit proof of a National Pollutant Discharge Elimination System (NPDES) stormwater permit to the County, before plans will be approved. Permit requirements are set forth in 10 CSR20-6.200 of the Missouri clean water laws.
- C. Sediment and erosion control shall be implemented whenever necessary to prevent damage to off-site property, drainage facilities or watercourses. Generally, standard vegetative and structural practices that filter, divert or promote the settlement of sediment particles from storm runoff shall be provided.
- D. The applicant shall submit a sediment and erosion control plan which must be approved by the County prior to preliminary plat approval. The plan shall include a contoured development map clearly indicating the pattern of surface water runoff, both upstream and downstream of the development, the existing and proposed grading contours and the planned sedimentation and erosion control facilities. The phasing of construction activities and the related phasing shall identify the sequence of construction activities and the related Best Management Practices (BMP) to include

clearing, installing BMP, rough grading, installing utilities, paving streets, final grading and vegetative cover. The County shall have the authority to require a revised plan to be submitted for approval at any time due to changing site conditions.

Section 362: Design Criteria.

- A. A development's stormwater drainage system shall be designed to:
1. Protect natural waterways.
 2. Convey upstream and on-site stormwater runoff to a natural watercourse or to a storm drainage facility.
 3. Provide protection from the design storm event and address the major storm so as to prevent major property damage and loss of life.
- B. All facilities shall be designed to carry a 10-year storm of a duration which produces the maximum peak flow rate of stormwater runoff. The stormwater conveyance system shall be designed to allow for a 100-year storm to pass through the subdivision without destroying or damaging property or inundating dwellings. Design information which substantiates both conditions shall be provided. See Figure "A" at the end of this Section for rainfall curves for the 2, 5, 10, 15, 20 and 100-year frequencies.
- C. The method of calculating and routing stormwater runoff shall be as stated herein. The drainage area shall consider all on- and off-site lands contributing to the proposed development's drainage system. Capacity for such facilities shall be based on the maximum potential water shed development permitted by the Zoning Ordinance. Either the Rational Method or the TR-55 Method for calculating stormwater runoff may be used for watersheds up to ten (10) acres. Figures "A" (runoff factors) and "B" (rainfall intensity) shall be utilized with the Rational Method. For watersheds larger than ten (ten) acres, the SCS TR-55 Method shall be utilized. Other methods to determine peak runoff must be approved by the designated representative of the County prior to acceptance.
1. Open channels consist of swales, ditches or depressions, both natural and manmade, that convey water. Channels shall be protected from scour and erosion by providing a channel lining adequate to sustain the velocity of the 10-year design storm. If velocities in channels exceed five (5) feet per second during 10-year design storms, then erosion control other than vegetation shall be provided in channel construction. Total accumulation contained by manmade berms/swales shall be a maximum of four (4) cubic feet per second.
 2. Manning's Equation shall be used for calculating the hydraulic capacity of open channels.
 3. Acceptable improvements to channels include fabrics, gabion lining, concrete channels, concrete slope paving, cribbing, bin walls, etc. The roughness coefficient for each material shall be per manufacturer or as indicated below:
 - n = 0.012 For cast-in-place concrete, box culverts and reinforced concrete pipe (RCP) over 48" in diameter.
 - n = 0.013 For concrete and smooth lined plastic pipes less than 48" in diameter.
 - n = 0.015 For vitrified clay pipe
 - n = 0.020 For grouted rip rap
 - n = 0.024 For corrugated metal pipe
 - n = 0.33 r gabion walled channels

4. Channels shall have the hydraulic capacity to carry the 10-year design storm runoff within the channel bed and banks. Out-of-bank flow may be permitted on land slopes parallel to the channel where it can be shown that no erosion damage or serious property damage will result. Channels function as part of the major drainage system and shall be evaluated for the 100-year design storm to determine the impacts of runoff on adjacent property. The channel's hydraulic capacity shall be increased where adjustments to channel geometry provide significant protection to adjacent properties during the 100-year event.
- D. Pipe sizes for closed conduit flow shall be based on the 10-year design storm runoff and minimum allowable velocities. The system shall provide for the cleaning of sediment and other deposits by maintaining a minimum velocity of three (3) fps during the 10-year storm.
1. Manning's Equation, the most common method of estimating the capacity and flow resistance in closed conduits shall be utilized.
 2. Closed conduit storm sewer systems shall convey the 10-year design storm to a point of discharge by gravity or pressure flow. In surcharge conditions, the hydraulic grade line shall be calculated to reflect losses in pipes and structures and shall not rise to an elevation greater than the three (3) feet above the top of the sewer or two (2) feet below the inlet sill, whichever is lower.
 3. Generally, gravity flow occurs where the capacity of pipe run exceeds the design flow and the outfall point does not control discharge. Storm sewer systems may be designed for pressure flow when the hydraulic grade line is above the crown of the pipe. The decision to design a pressure flow system may be based on aesthetics, the need to submerge outfalls, economics, limitations associated with reduced pipe sizes or grade constraints in outfalling the system.
- E. Inlets. Calculations shall be submitted to demonstrate the capacity of all inlets, such calculations must consider the cross-slope of the pavement, depth of water at the curb face, size of opening and the longitudinal grade of street. Street inlets and inlets in parking areas shall reduce the spread and depth of flow to acceptable levels during the 10-year design storm.
1. The acceptable level of flow for a minor access or local access street would maintain an eight (8) foot travel lane with a maximum one (1) inch depth.
 2. One clear ten (10) foot travel lane must be maintained for a collector street.
 3. Two (2) clear ten (10) foot travel lanes must be maintained for a major street.
 4. Any area inundated by water ponding at an inlet during the 10-year storm event shall be located within an easement or right-of-way. The effects of the 100-year storm event shall also be analyzed to insure no property damage or dangerous conditions result. Inlets located on continuous grades may be designed to permit a portion of flow to bypass the structure; however, calculations for the downstream structure must consider the bypass.
- F. Plans and calculations. A drainage map shall be developed from a base reproduction of the site plan or grading plan. The existing and proposed contours shall be shown, normally at two (2) foot intervals, for the subject property, extending off-site one hundred (100) feet or less as determined by the Department for proper design of the proposed improvements. Contour intervals other than the above shall be used as determined by the site topography. Only U.S.G.S. datum shall be used.

1. The location of existing and proposed property lines, streets, sinkholes, railroads, areas within the tract subject to inundation by stormwater and other significant natural features, such as wooded areas and rock formations, etc., shall be included on the map.
2. All existing and proposed stormwater facilities, such as inlets, manholes, pipes, culverts, bridges, channels, etc. and all existing and proposed improvements required for proper design review, such as pavement, buildings, etc., shall be included on the map.
3. The runoff details shall be required, showing individual flows for each existing and proposed structure and cumulative flows in pipes and gutters, including "Q" and area. The map shall show all bodies of water, such as ponds or lakes (including surface area and elevation) and all waterways (including their names or the names of creeks or rivers they flow into).
4. Lots shall be laid out so as to provide positive drainage away from all buildings. Individual lot drainage shall be shown and coordinated with the drainage pattern for the area and designed so that runoff from one (1) lot will not adversely affect an adjoining lot. All necessary grading to direct stormwater runoff shall be located within a drainage easement.
5. All computations, plans and specifications related to the implementation of this Section must be prepared and sealed by a professional engineer registered in the State of Missouri.

Section 363: Detention and Retention Facilities

- A. Maintenance. Each owner of the property being developed has the responsibility and duty to properly operate and maintain any stormwater management system for the life of the system. The responsibility of maintenance of the system in subdivision projects shall remain with the developer until the latter of such time as the stormwater management system escrow for such development has been released and the time at which the system has been accepted by a legally and properly established property owner's association.
- B. Storage capacity. The rates (pre-developed and post-developed) of runoff shall be determined for the 2, 20 and 100-year rainfall frequencies. The storm duration shall be the twenty-four (24) hour event when the SCSTR-55 method is utilized and a minimum twenty (20) minute event when the rational method is utilized. Rainfall data shall be determined using the most current twenty-four (24) hour rainfall data published by the National Weather Service (NWS) Technical Paper 40 (TP40). Storm water shall be detained on site or adjacent property under agreement and metered out at the rate of an undeveloped site for the above frequencies and minimum duration to prevent possible flooding and erosion downstream. Design criteria to establish this differential runoff rate shall be as provided in Subsection D "Design Criteria". Note that stormwater pipes shall be sized to carry the total developed tributary upstream water shed. No reduction in pipe size shall be permitted because of detention. Detention basin volume will be based on providing adequate storage for the 100-year storm event of the required duration. Each post-developed runoff hydrograph (2 and 100-year) shall be routed through the detention facility while satisfying the appropriate allowable release rate. The routing computation shall be based on an application of the continuity principle. The discharge rate shall be based on the maximum head conditions in the detention facility.
- C. Shared facilities and regional detention. The County retains the right to require on-site detention storage in all cases in which the proposed development will generate excess runoff that adversely affects the carrying capacity of the receiving watercourse and/or adversely affects adjoining property owners.

- D. Other Management Techniques: Management techniques other than detention facilities may be utilized by the development provided the techniques proposed meet the intent of this Section and provide a benefit to the watershed that equals or exceeds the benefit that a detention facility would provide. Such techniques would include pervious pavement systems and improved vegetation conditions.
- E. General design features.
1. Dry bottom basins. A stormwater detention facility, natural or artificial, which normally drains completely between spaced runoff events, may be constructed to temporarily detain the storm water runoff so that the rate at which it is released is the same rate as before development. The following features shall be incorporated into the design of any detention basin:
 - a. Freeboard. Detention storage areas shall have adequate capacity to contain the storage volume of tributary stormwater runoff with at least two (2) feet of freeboard above the water surface.
 - b. Outlet control works. Outlet works shall be designed to limit peak outflow rates from detention storage areas to or below peak flow rates that would have occurred prior to the proposed development.
 - c. Outlet works shall not include any mechanical components or devices and shall function without requiring attendance or control during operation, unless specifically approved by the County.
 - d. Emergency overflow/spillway. Emergency structure shall be provided to permit the safe passage of runoff generated in excess of the 100-year design storm event. Anti-vortex measures shall be provided.
 - e. Maximum depth. The maximum planned depth of stormwaters stored shall not normally exceed five (5) feet.
 - f. Side slopes. The maximum side slopes for gassed basins shall not normally exceed one (1) foot vertical for three (3) feet horizontal.
 - g. Limits of ponding. In no case shall the limits of maximum ponding be closer than thirty (30) feet horizontally from any building and less than two (2) feet vertically below the lowest sill elevation.
 - h. Interior drainage. The basin should be designed to drain within a twenty-four (24) hour period. Flows through the detention basin should be handled by paved ditch from inflow structure to outflow structure to minimize erosion.
 - i. Multipurpose basin. If the detention basin is to have other uses, the design of the basin bottom should include under drains to expedite drying of the bottom between runoff events.
 - j. Aesthetics. Designs should result in aesthetically pleasing configurations which will enhance public acceptability

2. Wet bottom basins. A stormwater retention facility, natural or artificial, which maintains a fixed minimum water elevation between runoff events. Wet bottom basins may also be used to temporarily detain the differential runoff from the development. In addition to the general design features enumerated above for dry bottom basins, the following features should also be incorporated into the design of any wet bottom basin:
 - a. Normal pool depth. In order to minimize weed growth, the normal pool depth should be four (4) foot minimum.
 - b. Depth for fish. If fish are to be kept in the pond, at least one-quarter ($\frac{1}{4}$) of the area of the permanent pool should have a minimum depth of ten (10) feet.
 - c. Facilities for emptying. In order to ease cleaning of the pond or shoreline maintenance, the pond design should include provisions for emptying the pond.
 - d. Low flow by-pass. The design of any pond may include a low flow by-pass channel or pipeline to divert runoff that can be accommodated by downstream drainage ways.
 - e. Side slopes below normal pool. The side slopes below the normal pool elevation may exceed the maximum side slope permitted above normal pool (3:1 slope). The design shall, however, include provisions for a safety ledge having a depth of water not greater than three (3) feet immediately adjacent to the shoreline.
 - f. Forebay. In order to minimize siltation of the pond, a forebay should be included in the design. Calculations for sediment volume and forebay sizing shall be submitted to the County
3. Rooftop storage. Detention storage may be met in total or in part by detention on roofs. Details of such design, which shall be included in the building permit application, shall include the depth and volume of storage, details of outlet devices and down drains, elevations of overflow provisions. Direct connection of roof drains to sanitary sewers is prohibited.
4. Parking lot storage. Paved parking lots may be designed to provide temporary detention storage of stormwater on all or a portion of their surfaces. Outlets will be designed so as to slowly empty the stored waters. Depth of storage shall be a maximum of eight (8) inches.
5. Other detention methods. All or a portion of the detention storage may also be provided in underground or surface detention facilities, to include basins, tanks or swales, etc. Emergency overflow conditions shall be considered in all methods.

F. Plans and calculations.

1. The following must be submitted for the design of a detention facility:
 - a. Elevation versus discharge relationship for the basin.
 - b. Elevation versus storage relationship for the basin.
 - c. Inflow calculations and data for all required frequencies.
 - d. Hydraulic grade line computations for pipes entering and leaving the basin for all required frequencies.

- e. Site plan with two (2) foot contours showing land to be developed and adjoining land whose topography may affect the layout or drainage of a basin site and the location of streams and other runoff channels.
 - f. Basic information regarding the receiving watercourse and affected downstream structures to a distance of two hundred (200) feet from the site. Additional analysis of the receiving stream of greater distances from the site shall be performed if required by the designated representative of Franklin County.
 - g. A summary of routing calculations for all required frequencies.
2. All computations, plans and specifications related to the implementation of this Section must be prepared and sealed by a professional engineer registered in the State of Missouri.

G. Material and Construction Standards.

1. Storm pipes shall be protected from excessive bearing pressures by placing them outside the forty-five degree (45°) influence zone of building structures unless an engineering calculation shows the pipe material or soil condition to be adequate for the subjected load.
2. Pipes on twenty percent (20%) slopes or greater shall be anchored securely with concrete anchors or equal to prevent the pipe from creeping downhill.
3. Pipes or structures constructed on fill shall be stable and protected against settlement by compacting fill material to ninety-five percent (95%) of the modified proctor maximum dry density, per the American Association of State Highway and Transportation Officials (AASHTO) T180 (ASTM D1557).
4. Pipes thirty-six (36) inches or larger may be placed on a curved alignment utilizing alignment radii established by the pipe manufacturer.
5. The receiving surface where pipes discharge shall be protected from erosion by evaluating the discharge velocity for the 10-year design storm. The use of energy-dissipating devices may be necessary to reduce the velocity to acceptable levels for the receiving surface. Grouted revetment used shall be a minimum length of ten (10) times the diameter of the discharge pipe.
6. A manhole, inlet or junction box shall be located at changes in pipe size, grade, alignment or material.
7. The angle between influent and effluent pipes shall be not less than ninety degrees (90°) and the drop between inverts shall be not less than one-tenth (0.1) foot.
8. Manhole and inlet castings located in travel ways shall be capable of withstanding traffic loads and shall be constructed flush with the finished surface.
9. All materials and appurtenances for stormwater management systems shall conform to current standards of the American Society for Testing and Materials (ASTM).

10. Manholes shall be precast or cast-in-place concrete, brick, concrete block, with concrete or brick risers and approved manhole covers.
11. A new drainage channel or pipe shall intersect an existing drainage channel at a maximum angle of sixty degrees (60°).
12. All trenches under roadway pavement shall be backfilled with Missouri Department of Transportation (MoDOT) Type I aggregate in six (6) inch layers and compacted to ninety-five percent (95%) of the modified proctor maximum dry density per AASHTO T180 (ASTM D1557).
13. All piping shall be bedded per the manufacturer's requirements.
14. Grated inlets will not be allowed without special approval by the designated representative of Franklin County.
15. All materials used in the construction of storm sewers shall be subject to inspection and approval of the County.
16. Acceptable pipe material shall be reinforced concrete pipe, corrugated metal pipe and corrugated polyethylene pipe.
 - a. Reinforced concrete pipe shall conform to the requirements of the Specifications for Reinforced Concrete Culvert, Storm Drain and Sewer Pipe, ASTM C76. Strength class or classes shall be as required per design specifications of the latest edition of the Concrete Pipe Handbook as published by the American Pipe Association.
 - b. Corrugated metal pipe shall conform to the requirements of AASHTO M36, "Standard Specification for Zinc Coated (Galvanized) Pipe" or the "Standard Specifications for AASHTO M196 Corrugated Aluminum Pipe". Structural design requirements shall be per the latest edition of the "Handbook of Steel Drainage and Highway Construction Products" as published by the American Iron and Steel Institute.
 - c. Corrugated polyethylene pipe shall conform to the requirements of AASHTO M294 "Standard Specifications for Corrugated Polyethylene Pipe". All polyethylene pipe should be installed according to ASTM D2321 "Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications".
17. Reinforced concrete pipe shall be required under road pavement.
18. A minimum pipe size of twelve (12) inches is required to prevent blockage.
19. All construction details pertaining to stormwater drainage shall be in accordance with the Metropolitan St. Louis Sewer District requirements or approved equal, unless otherwise noted herein.

Section 364: Penalties and Remedies

- A. In accordance with and by virtue of the provisions of Chapter 64.895 RSMo, any person, as defined in Article 5, who violates any of the provisions hereof shall be guilty of a misdemeanor and is subject

to prosecution in the Franklin County Municipal Court. Upon conviction of same, any said party shall be punished by virtue of Chapters 557.021, 560.016, and 560.021 RSMo regulating fines and imprisonment of anyone convicted of a Class A misdemeanor under the Franklin County Municipal Court.

- B. Any act constituting a violation of the provisions of these regulations or a failure to comply with its requirements, including violations of any conditions and safeguards established in connection with the grants of variances or conditional use permits, shall also subject the offender(s) to the penalties set forth in Subsection A.
- C. These regulations may also be enforced by any appropriate civil action, including injunctions.
- D. Each day a violation continues shall be deemed a separate offense.
- E. Any one, all, or any combination of the foregoing may be used to enforce the provisions of these regulations.