MODIFIED FRENCH DRAINS

Modified French Drains (MFD) are shallow trench excavations filled with stone that are designed to intercept and temporarily store storm water runoff until it infiltrates into the soil. MFDs can provide significant reductions in storm water runoff and pollutant loads. They are particularly well suited to receive rooftop runoff, but can also be used to receive storm water runoff from other small impervious areas. In Kirkwood, only the daylighted French Drain version is permitted in residential applications. The perforated pipe is daylighted at its end to allow for overflow of larger storm events as a failsafe mechanism if infiltration is less than anticipated.

LOCATION

- MFD trenches should be located at least 5 feet from building with slab foundations and 10 feet from property lines, buildings with basements, and below-ground swimming pools. The top end of the MFD can be adjacent to the building to connect downspouts but should be directed away from the structure.
- MFDs should slope away from the structures. The slope of the MFD pipe should be between 0.5% and 6%. It can be serpentine or multi-pronged in construction if sufficient slope is available and spacing is kept at least 15 feet apart.
- To reduce the chance of clogging, MFDs should drain only impervious areas. Pretreat runoff with at least one of the leaf removal options to remove particulates and larger debris.
- MFD gravel depths should be at least 18 inches and no more than 36 inches.
- MFDs should be located in a lawn or other pervious (unpaved) area; and should be designed so that the top of the MFD is located as close as possible to the soil surface to reduce digging.

- NOTE: MFDs should **not** be located:
  (1) Beneath an impervious (paved) surface or structure;
  (2) Above an area with a water table or bedrock less than two feet below the trench bottom;
  (3) Over other utility lines; or,
  (4) Above a septic field. Always call Missouri One Call to locate utility lines before you dig.
- The downstream end of the pipe must daylight or be discharged with a pop-up emitter for overflows at least ten feet from the property line.

CONSTRUCTION

- As a rule of thumb, there should be about 23 cubic feet of stone for every 100 square feet of rooftop. The table provides MFD length requirements for different depths.
- Measurements in the table at right are based on trench width of 24 inches, however the width can be from 18 to 32 inches. Required lengths should be adjusted proportionately if other widths are used.
- The sides of the excavation should be trimmed of all large roots that will hamper the installation of the permeable drainage fabric to be placed part way down the sides and above the gravel layer on top of the MFD.
- Scarify or till the native soils along the bottom of the MFD to a depth of 3-4 inches.

Rooftop Area (square feet)	Depth of Gravel From Top of Pipe (inches)			
	18	24	30	36
	Required Linear Feet of MFD			
100	7	5	4	4
500	35	25	20	20
1000	70	55	45	35
2000	140	110	90	75
3000	210	160	130	110
4000	280	215	175	150
5000	345	270	220	185

- Fill the MFD with clean, washed ASTM No. 57 stone; embed a four (4) or six (6)-inch diameter schedule 40 PVC perforated pipe (WRAPPED WITH FILTER SOCK) in the top top of the stone such that the stone covers the top of the pipe. No. 57 stone averages ½ inch to 1-½ inches.
- The pipe should have 3/8-inch perforations, spaced 6 inches on center, and have a minimum slope of 0.5% and a maximum slope of 6%.
- The perforated pipe must daylight at the downstream end of the trench. The daylighted discharge end shall be capped with a rodent-proof screen or end with a pop-up emitter.
- An overflow, such as a vegetated filter strip area or grass channel, must be designed to safely convey stormwater runoff generated by larger storm events out of the downstream end of the MFD.
- Place permeable landscape fabric over soil/pea gravel to prevent it from migrating into the stone and clogging the pore spaces; leave a four to six-inch space above the pipe to the ground surface.
- Cover with top soil and sod or with pea gravel.
- For rooftop runoff, install one or more leaf screen options upstream from/ahead of the MFD to prevent leaves and other large debris from clogging the MFD. For driveway or parking runoff a screened inlet grate over a sump or pea gravel pit can be used to settle out material prior to entering the pipe.
- **NOTE: This method cannot be used if the results of the soil infiltration test described in Appendix A are less than 0.25 in/hr.**

VEGETATION

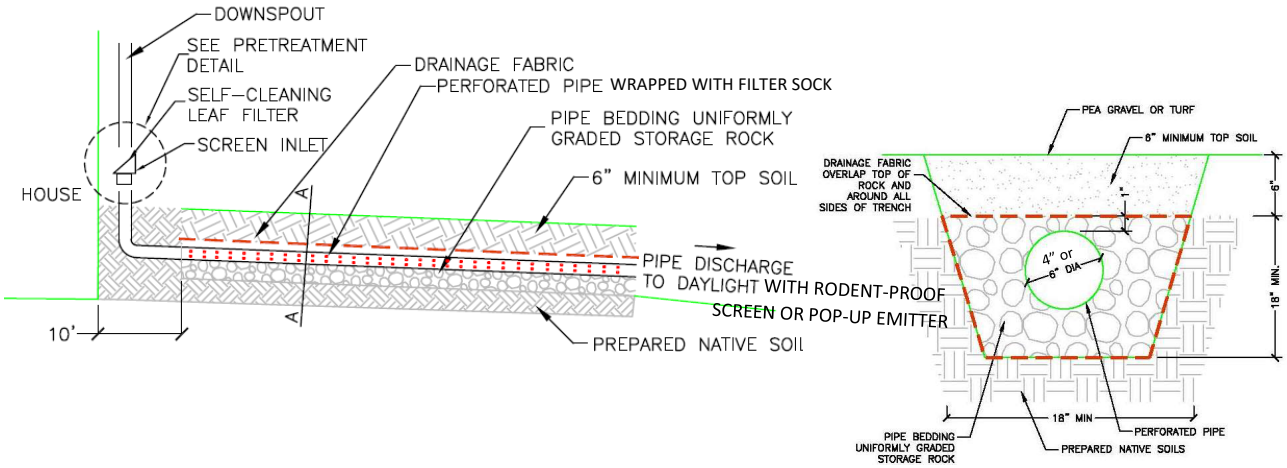
- MFDs are normally covered with topsoil and managed turf or other herbaceous vegetation.
- As an alternative, the area above the surface of a MFD may be covered with pea gravel (or larger depending on the inflow rates) to allow for incidental lateral inflow along the edge of ground level impervious surfaces.
- The downstream end of the pipe must be stabilized and can be landscaped for aesthetics.

MAINTENANCE

Annual maintenance is important for MFDs.

- Inspect gutters and downspouts removing accumulated leaves and debris, and cleaning leaf removal system(s).
- Inspect any pretreatment devices for sediment accumulation. Remove accumulated trash and debris.
- Inspect MFDs following a large rainfall event to ensure overflow is operating and flow is not causing problems.

MODIFIED FRENCH DRAINS



SECTION A-A

CONSTRUCTION STEPS:

1. Prior to submittal, perform an infiltration test according to Appendix A. **If the rate is less than 0.25 in/hr, this method cannot be used.** If the rate is more than 0.50 in/hr, the length of the ditch may be decreased 10% for every 0.50 in/hr infiltration rate increase above 0.50 in/hr.
2. Review potential MFD areas and layout. MFDs should slope between 0.5% and 6% away from structures and should not be located: (1) beneath an impervious (paved) surface or structure; (2) above an area with a water table or bedrock less than two feet below the trench bottom; (3) over other utility lines; or, (4) above a septic field. Ensure outlet daylights or is discharged with a pop-up emitter at least ten feet from property line.
3. Measure the area draining to the MFD and determine required length from the table on the next page using assumed width and gravel depth, and plan route and excavation depth.
4. Measure elevations, lay out the MFD to the required dimensions marking the route, and required excavation depths. Often a level line (torpedo level) is used.
5. Remove sod using a sod cutter if appropriate. Excavate ditch to the depth of the gravel plus six inches for topsoil/pea gravel and three additional inches to accommodate half the pipe depth. Be careful not to compact soils in the bottom. Level the bottom laterally as much as possible to maximize the infiltration area. Roughen bottom to a depth of at least three inches and trim roots.
6. Place Mirafi 140 N or approved equal drainage fabric along the bottom and sides of the trench with enough excess to extend over the top of pipe and stone. This fabric must be a needle-punched nonwoven polypropylene geotextile.
7. Place and tamp gravel in ditch to bottom of pipe elevation. Placing the 4 or 6-inch diameter Perforated Schedule 40 PVC pipe, wrapped with polyester fabric, on top of the gravel.
   INITIAL INSPECTION POINT
8. Then place and gently tamp gravel around and over the pipe until it covers the pipe by 1 inch. Lap geosynthetic over gravel a minimum of 18 inches.
9. Place 6-inches of topsoil and cap with sod or pea gravel.
10. **Pretreatment Option.** Cut and route downspouts or other rainwater delivery components, leaf screen option(s) chosen (circle selected option(s) in Pretreatment Options Detail figure in Appendix E). Strap and support as needed.
11. Create a safe overflow at least 10 feet from your property edge and ensure it is protected from erosion.
    FINAL INSPECTION POINT

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MODIFIED FRENCH DRAIN – LAYOUT SKETCH

PROVIDE PLAN AND ELEVATION VIEWS OF MFD AND HOUSE SHOWING ROOF AREA DIRECTED TO MFD AND KEY DIMENSIONS, CONNECTIONS AND OVERFLOW RELATIVE TO PROPERTY LINE.

SIZING CALCULATION:

SITE INFILTRATION RATE= _____ IN/HR

- IS BMP SUITABLE FOR SITE? □ YES □ NO
- CAN BMP SIZE BE REDUCED? □ YES □ NO

Rooftop Area (square feet)	Depth of Gravel From 1-inch above Top of Pipe (inches)			
	18	24	30	36
	Required Linear Feet of MFD			
100	7	5	4	4
500	35	25	20	20
1000	70	55	45	35
2000	140	110	90	75
3000	210	160	130	110
4000	280	215	175	150
5000	345	270	220	185

MEASURE CONTRIBUTING ROOFTOP (DRAINAGE) AREA AND READ AREA FOR GIVEN 18-36 INCH DEPTH of #57 GRAVEL.

CONTRIBUTING DRAINAGE AREA= _____ SQ FT

DEPTH OF GRAVEL= _____ INCHES

WIDTH OF TRENCH= _____ INCHES (18 INCHES, MINIMUM)

LENGTH OF MFD= _____ FT

MAINTENANCE:

1. INSPECT GUTTERS AND DOWNSPOUTS, REMOVE ACCUMULATED LEAVES AND DEBRIS, CLEAN LEAF REMOVAL SYSTEM(S).
2. IF APPLICABLE, INSPECT PRETREATMENT DEVICES FOR SEDIMENT ACCUMULATION. REMOVE ACCUMULATED TRASH AND DEBRIS.
3. INSPECT MFD FOLLOWING A LARGE RAINFALL EVENT TO ENSURE OVERFLOW IS OPERATING AND FLOW IS NOT CAUSING PROBLEMS.

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