2017 DEQ-8

MONTANA STANDARDS FOR SUBDIVISION STORM WATER DRAINAGE

Major Changes

- New Rules
- Updated Circular
- New Spreadsheets

New Rules – ARM 17.36.310

- "Exempt Plan" moved from rule to circular and named the "Simplified Plan"
- PE Design required for:
  - Six or more lots
  - Lot proposed for use other than a single living unit with > 25% impervious area
- Maintenance plans required for all designs
- Exemption for lots located within a 1st or 2nd class municipality or an MS4 (form available here: link)
- Renewal for PE designs if rules and circulars haven't changed

Updated Circular

- Improved Layout
  - Table of Contents (interactive)
  - List of Tables and Figures
  - Bookmarked PDF for easier navigation
  - Available here: link

Updated Circular

Chapter 1

- Applicability
- Definitions

Chapter 2

- All applications must include a report – §2.2
- All applications must include plans – §2.3
- Construction documents may be required for complex designs – §2.4
- All plans – standard or simplified – must have an O&M plan – §2.5
- Deviation procedures – §2.6

Updated Circular

Chapter 3 – Design Criteria

- Simplified Plan – §3.2
  - Slope < 3%
  - Impervious area ≤ 25%
  - No change in historic runoff
  - No flow between lots
  - Design storm = 100-year
- Standard Plan – §3.3
  - Post-development flow cannot exceed pre-development flow for the 2-year storm
  - Cannot overtop roads or driveways for the 10-year storm
  - Cannot flood homes or drainfields for the 100-year storm

Updated Circular

Chapter 3 – Design Criteria

- Initial Storm Water Facility – §3.4
  - Must be sized to infiltrate, evapotranspire, and/or capture for reuse the post-development runoff generated from the first 0.5 inches of rainfall on impervious areas.
- $V = \frac{(0.5 * A_{imp})}{12 \frac{inches}{ft}}$
  - V = minimum volume (ft^3)
  - A_{imp} = total impervious area (ft^2)
- Pre- and Post Development Conditions – §3.5
- Clarifies
  - when the entire pre-development condition should be considered unimproved.
  - the procedure for rewrites.
  - situation where post-development impervious area is unknown.

Updated Circular

Chapter 3 – Design Criteria

- Rainfall Intensity – §3.6
- Derived from the 24-hour storm duration:
  - Hydrometeorological Design Studies Center's Precipitation Frequency Data Server (NOAA Atlas 2), B.
  - Data for select sites in Appendix A.
  - IDF curve at the time of concentration; or
  - Other sources approved by the reviewing authority.
- Acceptable Methods– §3.7
  - Variety of methods in Appendix B
  - "Other methods may be used upon approval by the reviewing authority."

Updated Circular

Chapter 3 – Design Criteria

- Storm Water Volume – §3.8
  - Pre- and Post-development conditions.
  - Simplified Plan – based on the 100-year storm event.
  - Standard Plan – based on the 2-year storm event.
- Peak Flow – §3.9
  - Simplified Plan – may not alter historic runoff patterns outside the boundaries of the lot.
  - Standard Plan
    - Onsite Drainage Basin
      - Pre-Development Peak Flow for the 2-year storm event
      - Post-Development Peak Flow for 2-year, 10-year, and 100 year storm event
    - Offsite Drainage
      - Peak Flow for the 2-year, 10-year, and 100-year storm event

Updated Circular

Chapter 4 – Conveyance Structures

- Clarifies that impacts from sediment deposition and erosion must be addressed.
- Conveyance structures must be designed to convey post-development peak flow
  - Cannot overtopping roadways or driveways during a 10-year storm event
  - Cannot flood buildings or drain fields during a 100-year storm event.
- Describes three common types of conveyance structures:
  - Open Channels
  - Storm Sewers
  - Culverts
- Includes design criteria for each.

Updated Circular

Chapter 5 – Retention & Detention Facilities

- Retention facilities:
  - Must be sized for the difference between the pre- and post-development runoff volumes,
    - No consideration for infiltration
    - No designed outlet
    - Must include the volume of the initial storm water facility.
  - Side slopes must be no steeper than 3 to 1 and must be stabilized.
  - Should not hold runoff for > 72 hours.
- Detention facilities:
  - May not be used in simplified plans.
    - Must capture runoff and release at a flow rate ≤ the 2-year pre-development peak flow rate
    - Must include minimum volume requirement for an Initial Storm Water Facility as either infiltration or retention.
  - Should not hold runoff for > 72 hours.
  - Engineered outlet must be designed to reduce erosive velocities.

Updated Circular

Chapter 6 – Infiltration Facilities

- Infiltration facilities:
  - Must include minimum volume requirement for an Initial Storm Water Facility as either infiltration or retention.
  - Must be sized in accordance with Appendix C (infiltration rates and testing procedure).
  - Should be sized to drain in 48 hours.
- Lawns and landscaping areas proposed as infiltration facilities must be sized using the appropriate runoff coefficient, curve number, or other factor consistent with the proposed land use and as designated by the selected design method in accordance with Appendix B.

Updated Circular

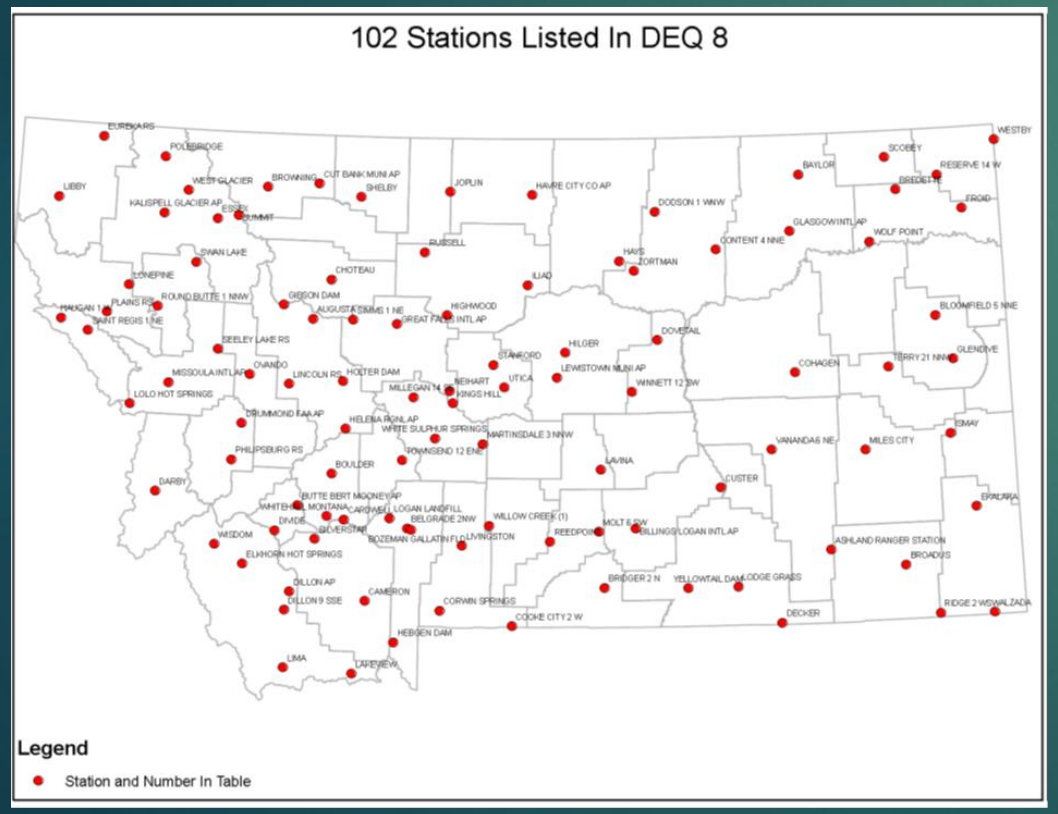
Chapter 7 – Pre-Treatment Facilities

- "Only those facilities described in this Chapter may be used as pre-treatment facilities."

- Describes designs for
  - Vegetative filter strips
  - Vegetated swales
  - Screens
  - Oil/water separators
  - Proprietary spinners/swirl chambers/centrifuges
  - Drain inlet inserts

Updated Circular

Appendix A – Rainfall Data



- Various stations across the state:
  - 2-year 24-hour
  - 10-year 24-hour
  - 100-year 24-hour

Updated Circular

Appendix B - Acceptable Hydrologic Models & T_c

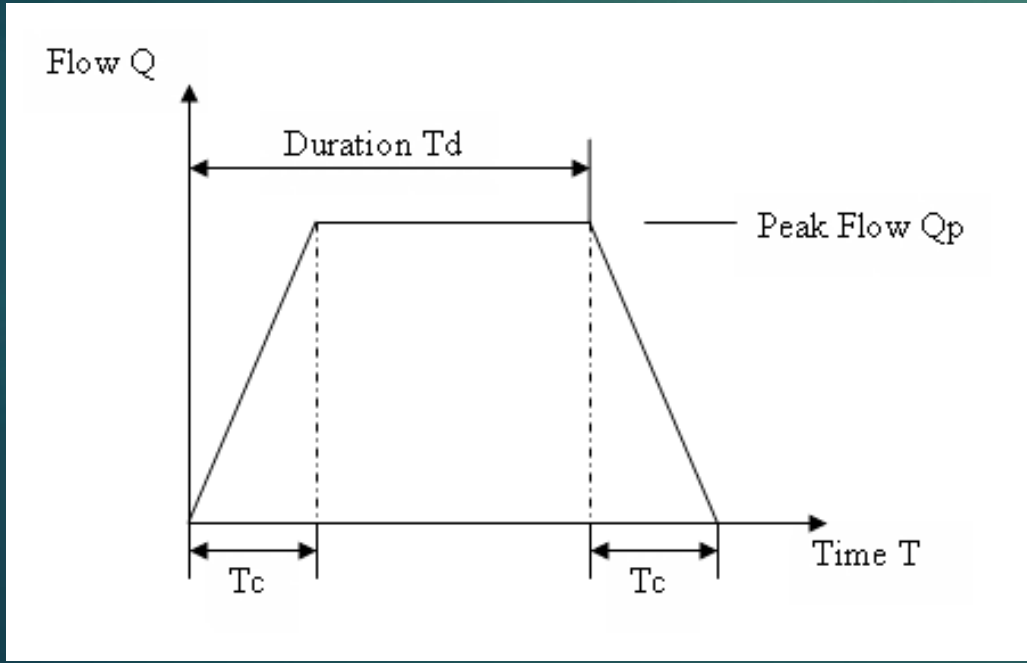
- Appendix B.1 – Methods
  - Rational Method
  - TR-55
  - Storage-Indication Routing
- Changes to Rational Coefficients
  - paved or other hard surface areas — 0.90
  - gravel areas — 0.80
  - undeveloped areas — 0.20
  - lawns or other landscaped areas — 0.10

- Intensity (i) must be determined using:
  - Tabulated rainfall data in Appendix A.
  - Location specific Intensity-Duration-Frequency (IDF) curve
    - time period = T_c
    - minimum T_c is 5 minutes.
    - For multiple sub-drainage areas, the longest T_c must be selected.
    - IDF curves for selected areas are available from the Department.

Updated Circular

Appendix B - Acceptable Hydrologic Models & T_c

- Modified Rational Method



- $V = T_D * Q$
  - V = Volume (ft^3)
  - T_d = Storm Duration (min. of 3600 seconds)
  - Q = Peak flow rate (cfs)

Updated Circular

Appendix B - Acceptable Hydrologic Models & T_c

- Appendix B.2 – Time of Concentration (T_c)
- Includes equations
  - Sheet Flow
  - Shallow Flow
- Longest T_c must be selected if there are multiple drainage areas.
- Appendix B.3 – Computer Models
  - Hydraflow extensions for AutoCad, HEC-1, WINTR-55, WINTR-20, and SWMM
- When using computer models:
  - Minimum T_c = 5 minutes
  - i determined using an IDF curve for time = T_c
  - For multiple sub-drainage areas, the longest T_c must be selected
  - Provide computations and assumptions
  - Graphic inflow-outflow hydrographs
  - Provide schematic (node) diagrams

Updated Circular

Appendix C - Infiltration

- Appendix C.1 – Design Infiltration Rate

Table 2. Infiltration Rates

Texture	Infiltration rate (inches per hour)
Gravel, gravelly sand, or very coarse sand (c)	2.6
Loamy sand, coarse sand (d)	1.05
Medium sand, sandy loam	0.9
Fine sandy loam, loam	0.7
Very fine sand, sandy clay loam, silt loam	0.7
Clay loam, silty clay loam	0.07
Sandy clay	0.07
Clays, silts, silty clays (e)	0.0

- Appendix C.2 – Encased Falling Head Test
  - Includes instructions on the procedure

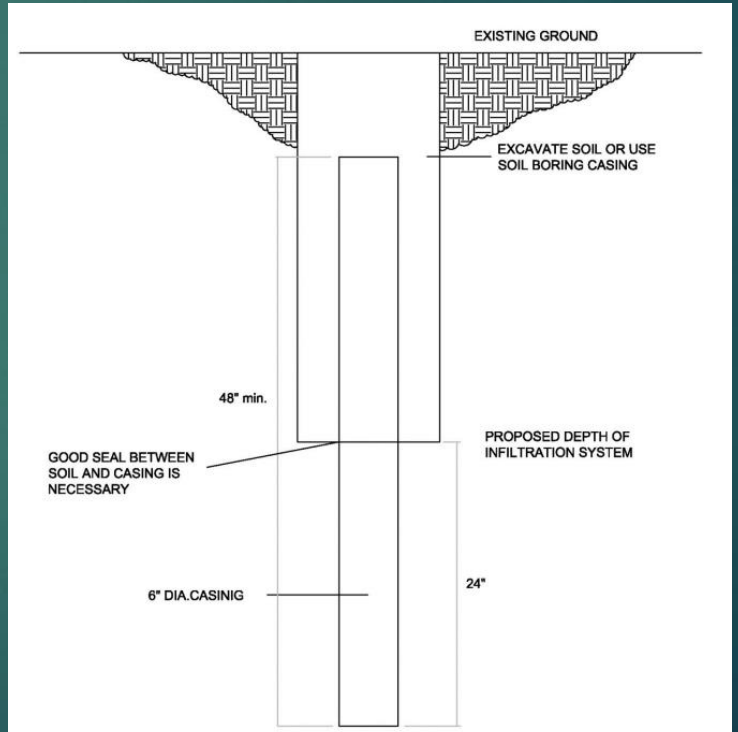


Figure 2. Encased Falling Head Schematic

Updated Circular

Appendix D – Detention Outlet Structure Equations

- D.1 – Circular Orifices
- D.2 – Weirs

Appendix E – Conveyance Structure Equations

- E.1 – Chezy-Manning Formula
- E.2 – Curb and Gutter
- E.3 – Storm Sewer Velocities (table)

Appendices H – M Examples

- Initial Storm Water Facility
- Simplified Plan
- Standard Plan – Retention Facility
- Standard Plan – Infiltration Facility
- Standard Plan – Detention Facility
- Standard Plan – Conveyance Facility

Updated Circular

Appendix N

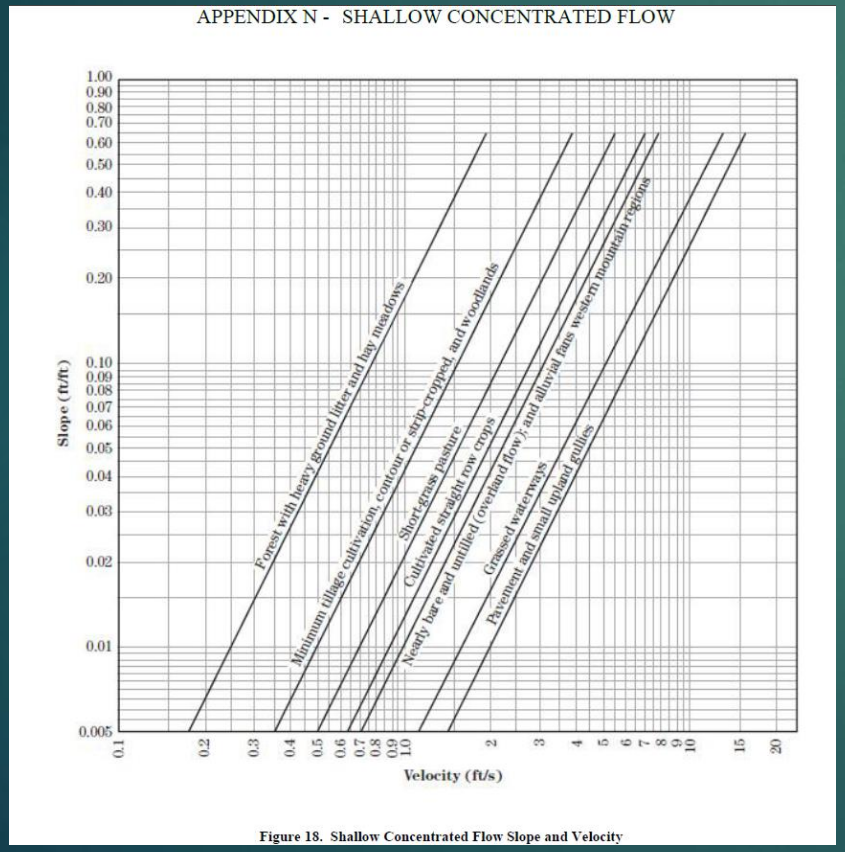


Figure 18. Shallow Concentrated Flow Slope and Velocity

Appendix O

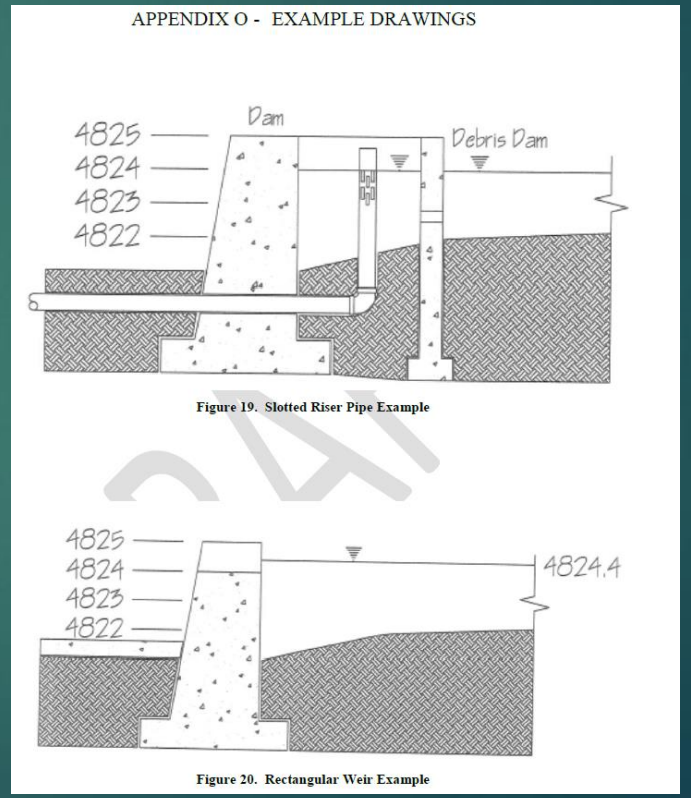


Figure 19. Slotted Riser Pipe Example

Figure 20. Rectangular Weir Example

Spreadsheets

APPENDIX F - SPREADSHEET – SIMPLIFIED PLAN

Appendix F: Simplified Storm Drainage Plan

DEQ Montana Department of Environmental Quality

Sudivision Name			
EQ#			
County			
Location			
Lot/Area No.			
Max. Slope on Lot		%	OK
Impervious Surfaces		%	OK
Will Alter Off-site Pass-Through?			STOP, Sumbit a DEQ-8 Plan
100-year, 24-hour, i		inches	
Total Area/Lot Size		acres =	0 ft^2

Rational Method Co-Efficients (C)	
0.9	Paved/hard surfaces
0.8	Gravel surfaces
0.1	Lawn/landscaping
0.2	Unimproved areas

Q=C*i*A

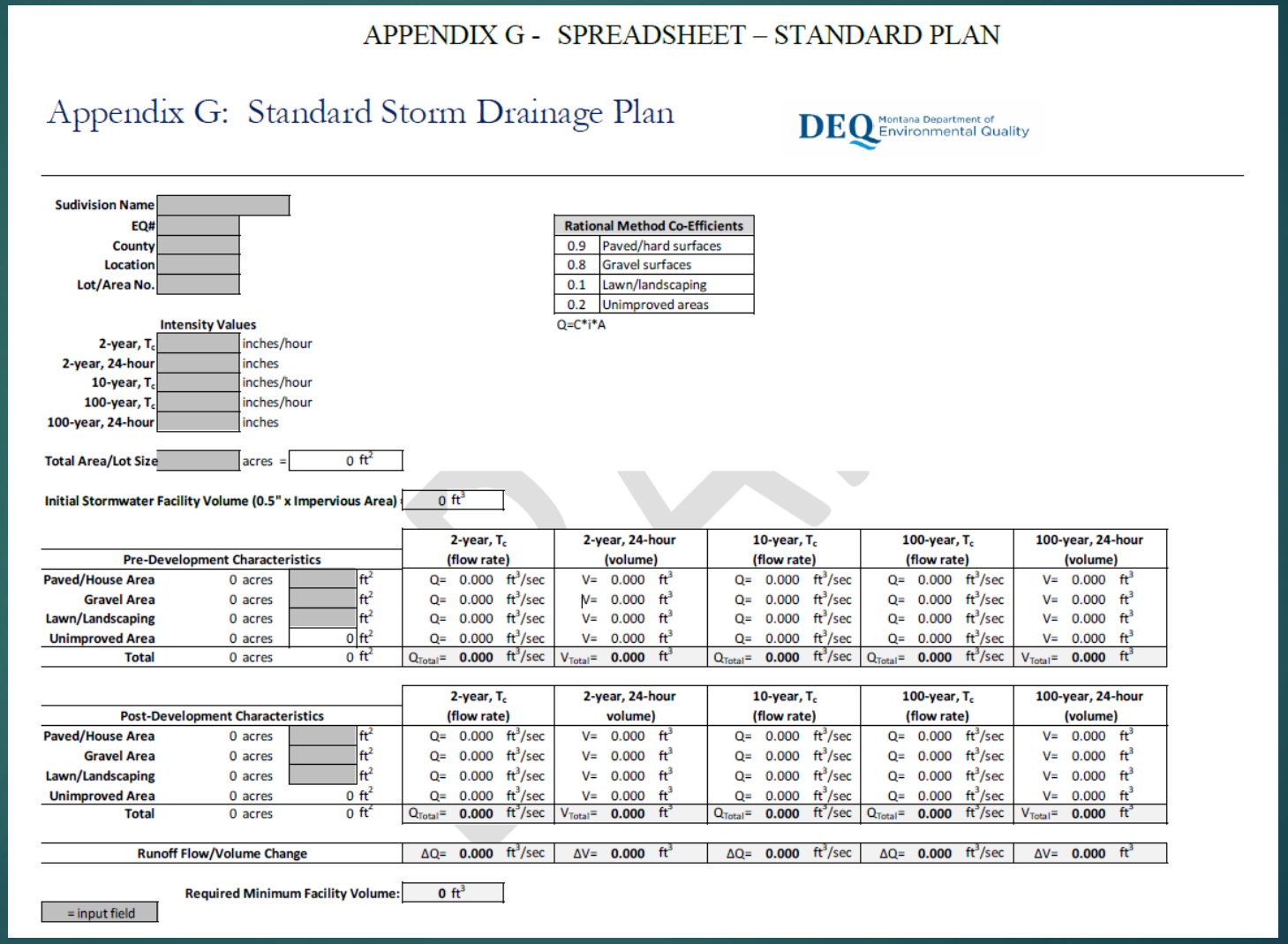
Pre-Development Characteristics			100-year, 24-hour i (volume)	
Paved/House Area	0 acres	0 ft^2	V=	0 ft^3
Gravel Area	0 acres	0 ft^2	V=	0 ft^3
Lawn/Landscaping	0 acres	0 ft^2	V=	0 ft^3
Unimproved Area	0 acres	0 ft^2	V=	0 ft^3
Total	0 acres	0 ft^2	V_{Total}=	**0.00** ft^3

Post-Development Characteristics			100-year, 24-hour i (volume)	
Paved/House Area	0 acres	0 ft^2	V=	0 ft^3
Gravel Area	0 acres	0 ft^2	V=	0 ft^3
Lawn/Landscaping	0 acres	0 ft^2	V=	0 ft^3
Unimproved Area	0 acres	0 ft^2	V=	0 ft^3
Total	0 acres	0 ft^2	V_{Total}=	**0.00** ft^3

Increase in Runoff Volume (Minimum Retention Pond Size)		
	ΔV=	**0.00** ft^3

= input field

Spreadsheets



APPENDIX G - SPREADSHEET – STANDARD PLAN

Appendix G: Standard Storm Drainage Plan

DEQ Montana Department of Environmental Quality

Sudivision Name
EQ#
County
Location
Lot/Area No.

Rational Method Co-Efficients	
0.9	Paved/hard surfaces
0.8	Gravel surfaces
0.1	Lawn/landscaping
0.2	Unimproved areas

Q=C*i*A

Intensity Values		
2-year, T_c		inches/hour
2-year, 24-hour		inches
10-year, T_c		inches/hour
100-year, T_c		inches/hour
100-year, 24-hour		inches

Total Area/Lot Size _____ acres = 0 ft^2

Initial Stormwater Facility Volume (0.5" x Impervious Area) = 0 ft^3

Pre-Development Characteristics			2-year, T_c (flow rate)	2-year, 24-hour (volume)	10-year, T_c (flow rate)	100-year, T_c (flow rate)	100-year, 24-hour (volume)
Paved/House Area	0 acres	_____ ft^2	Q= 0.000 ft^3/sec	V= 0.000 ft^3	Q= 0.000 ft^3/sec	Q= 0.000 ft^3/sec	V= 0.000 ft^3
Gravel Area	0 acres	_____ ft^2	Q= 0.000 ft^3/sec	V= 0.000 ft^3	Q= 0.000 ft^3/sec	Q= 0.000 ft^3/sec	V= 0.000 ft^3
Lawn/Landscaping	0 acres	_____ ft^2	Q= 0.000 ft^3/sec	V= 0.000 ft^3	Q= 0.000 ft^3/sec	Q= 0.000 ft^3/sec	V= 0.000 ft^3
Unimproved Area	0 acres	0 ft^2	Q= 0.000 ft^3/sec	V= 0.000 ft^3	Q= 0.000 ft^3/sec	Q= 0.000 ft^3/sec	V= 0.000 ft^3
Total	0 acres	0 ft^2	Q_{Total}= **0.000** ft^3/sec	V_{Total}= **0.000** ft^3	Q_{Total}= **0.000** ft^3/sec	Q_{Total}= **0.000** ft^3/sec	V_{Total}= **0.000** ft^3

Post-Development Characteristics			2-year, T_c (flow rate)	2-year, 24-hour volume)	10-year, T_c (flow rate)	100-year, T_c (flow rate)	100-year, 24-hour (volume)
Paved/House Area	0 acres	_____ ft^2	Q= 0.000 ft^3/sec	V= 0.000 ft^3	Q= 0.000 ft^3/sec	Q= 0.000 ft^3/sec	V= 0.000 ft^3
Gravel Area	0 acres	_____ ft^2	Q= 0.000 ft^3/sec	V= 0.000 ft^3	Q= 0.000 ft^3/sec	Q= 0.000 ft^3/sec	V= 0.000 ft^3
Lawn/Landscaping	0 acres	_____ ft^2	Q= 0.000 ft^3/sec	V= 0.000 ft^3	Q= 0.000 ft^3/sec	Q= 0.000 ft^3/sec	V= 0.000 ft^3
Unimproved Area	0 acres	0 ft^2	Q= 0.000 ft^3/sec	V= 0.000 ft^3	Q= 0.000 ft^3/sec	Q= 0.000 ft^3/sec	V= 0.000 ft^3
Total	0 acres	0 ft^2	Q_{Total}= **0.000** ft^3/sec	V_{Total}= **0.000** ft^3	Q_{Total}= **0.000** ft^3/sec	Q_{Total}= **0.000** ft^3/sec	V_{Total}= **0.000** ft^3

Runoff Flow/Volume Change	ΔQ= **0.000** ft^3/sec	ΔV= **0.000** ft^3	ΔQ= **0.000** ft^3/sec	ΔQ= **0.000** ft^3/sec	ΔV= **0.000** ft^3

Required Minimum Facility Volume: 0 ft^3

= input field