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STORM DRAINAGE DESIGN CRITERIA
CITY OF SHERIDAN, WYOMING

1. PURPOSE

The purpose of this manual is to provide the minimum standards to be used for the analysis and design of storm drainage systems for private development projects and City contracted projects within the City of Sheridan. These standards apply both to new development as well as improvements within existing developments. Design criteria and methods other than those described in these design standards shall be applied only after requesting and receiving approval from the Public Works Department.

The design criteria presented in this manual are based on national engineering practice for stormwater management, modified to suit the needs of Sheridan, Wyoming. Depending on specific site conditions, the design of storm drainage systems may need to exceed the minimum standards presented here in order to provide adequate protection from flooding. Criteria not specifically detailed herein shall be determined in accordance with sound engineering practices with the City's approval.

This manual is written for use by engineers who are familiar with generally accepted hydrologic and hydraulic design practices. A detailed presentation of hydrologic and hydraulic design methods and procedures is not included, as this information is readily available through industry-accepted publications. The "Storm Drainage Design Criteria - City of Sheridan, Wyoming" relies, in part, on methods and procedures published in the Federal Highway Administration (FHWA) Hydraulic Engineering Circular No. 22 (HEC-22), "Urban Drainage Design Manual", Publication No. FHWA-NHI-01-021, dated August 2001. References to specific sections of HEC-22 to be used for the design of storm drainage systems in the City of Sheridan are included throughout this document. HEC-22 is available as a PDF document from the FHWA Website (http://isddc.dot.gov/OLPFiles/FHWA/010593.pdf).

The guidelines in this manual will be periodically updated to reflect changes in City practices. It is the responsibility of the user to determine that they are utilizing the most current version of these standards.

Compliance with these standards does not relieve the applicant of the responsibility to use sound professional judgment. These standards are intended to assist, but not substitute for competent work by design professionals.

2. DRAINAGE REPORT SUBMITTAL REQUIREMENTS

A Preliminary Drainage Report shall be prepared by a registered Civil Engineer acting on the Owner's behalf. All drainage reports must include the design calculations necessary to support the proposal. Drainage reports shall incorporate the following in approximately this format:

- Provide a brief project summary including the location, description of the existing property and the proposed development, a discussion of surrounding developments, and the proximity to floodplains.

- Provide a detailed figure for the existing site conditions and a detailed figure for the proposed site conditions that show site boundary, topographic contours, basin/sub-basin area boundaries, drainage structures, wetlands, sensitive area buffers and setbacks, easements, etc. State on each figure the total area and the amount of pervious and impervious area in each basin/subbasin area. Show flow paths with slope, flow type, surface type, and run length.

- Describe existing conditions including structures, drainage basins, flow paths, pervious/impervious areas, slopes, vegetation/land use, soil type, runoff curve numbers (CN), time of concentration and other runoff characteristics as well as upstream offsite flow contributions, downstream offsite capacity analysis, and existing drainage problems.

- Describe proposed developed conditions including, drainage basins, flow type and flow paths, pervious/impervious areas, slopes, vegetation/land use, CNs, time of concentration and other runoff characteristics as well as upstream offsite flow routing, detention or retention storage volume, release rates, overflow route capacity, and proposed storm drainage system.

- Describe applicable State or Federal regulations, design standards, design storm frequencies, as well as hydrologic and hydraulic methods of analysis.

- State runoff control design assumptions and describe method of analysis.

- Appendix: Provide any calculations and figures necessary to support the proposed design, including basin characteristics, time of concentration, weighted Curve Numbers (CN), percent impervious area, runoff hydrograph generation, stage-discharge and stage-storage tables for detention routing, conveyance system capacity calculations, floodplain maps, applicable excerpts from previous reports, correspondence with adjacent property owners, ditch companies, utility companies, or regulatory agencies, or other information necessary to fully document the drainage plan.

Three copies of the Preliminary Drainage Report shall be submitted to the City of Sheridan for review. The City Public Works Department will return one copy with comments and suggested revisions to the applicant. The applicant shall revise the Preliminary Drainage Report and submit three copies of the Final Drainage Report along with the Storm Drainage Construction Plans and Details for final review.

3. RAINFALL

3.1. MINOR AND MAJOR DRAINAGE SYSTEMS

Every urban area has two separate and distinct drainage systems, whether or not they are actually planned or designed. One is the Minor Drainage System and the other is the Major Drainage System, which are combined to form the Total Drainage System.

The Minor Drainage System is designed to transport the runoff from storm events with recurrence intervals from 2-year to 10-year with a minimum of disruption to the urban environment. Minor storm drainage can be conveyed in the curb and gutter area of the street (subject to street classification and capacity as defined herein), a roadside ditch, by the underground storm drain, open channels, or other conveyance facilities.

The Major Drainage System is designed to convey runoff from the 100-year recurrence interval storm to minimize health and life hazards, damage to structures, and interruption to traffic and services. Major storm flows can be carried in the urban street system (within acceptable depth criteria), open channels, storm sewers, natural drainage ways, and other facilities.

Drainage planning and design shall include consideration for both the Minor and Major Drainage Systems.

3.2. DESIGN STORM FREQUENCY

The design storm frequency for the Minor Drainage System varies depending on the zoning district and land use as well as the street classification as shown in Tables 3.1 and 3.2.

Table 3.1
Design Storm Frequency by Zoning District

Zoning District/Land Use	Design Storm Frequency (Recurrence Interval, Year)	
	Minor[1]	Major
Residential	2	100
General Commercial	5	100
Industrial/Central Business	10	100
Parks, Cemeteries, Open Public Land	2	100

[1] Where multiple zoning districts or land uses apply, the greater minor design storm shall be used.

Table 3.2 Design Storm Frequency by Street Classification		
Street Classification	Design Storm Frequency (Recurrence Interval, Year)	
	Minor[1]	Major
Local	2	100
Collector	5	100
Arterial	10	100

[1] The 50-year design storm shall be used for depressed road crossings.

Where the zoning district and the street classification yield different minor storm frequencies, the greater minor design storm shall govern. Drainage systems shall also be evaluated for the Major storm to identify potential flood hazards. Drainage systems may need to be designed to convey a portion, or all, of the Major storm flows if Major storm flows cannot be safely conveyed to a suitable receiving system, or if allowable flow depths in streets cannot be maintained (see Section 5.1).

3.3. DESIGN STORM DEPTH AND INTENSITY

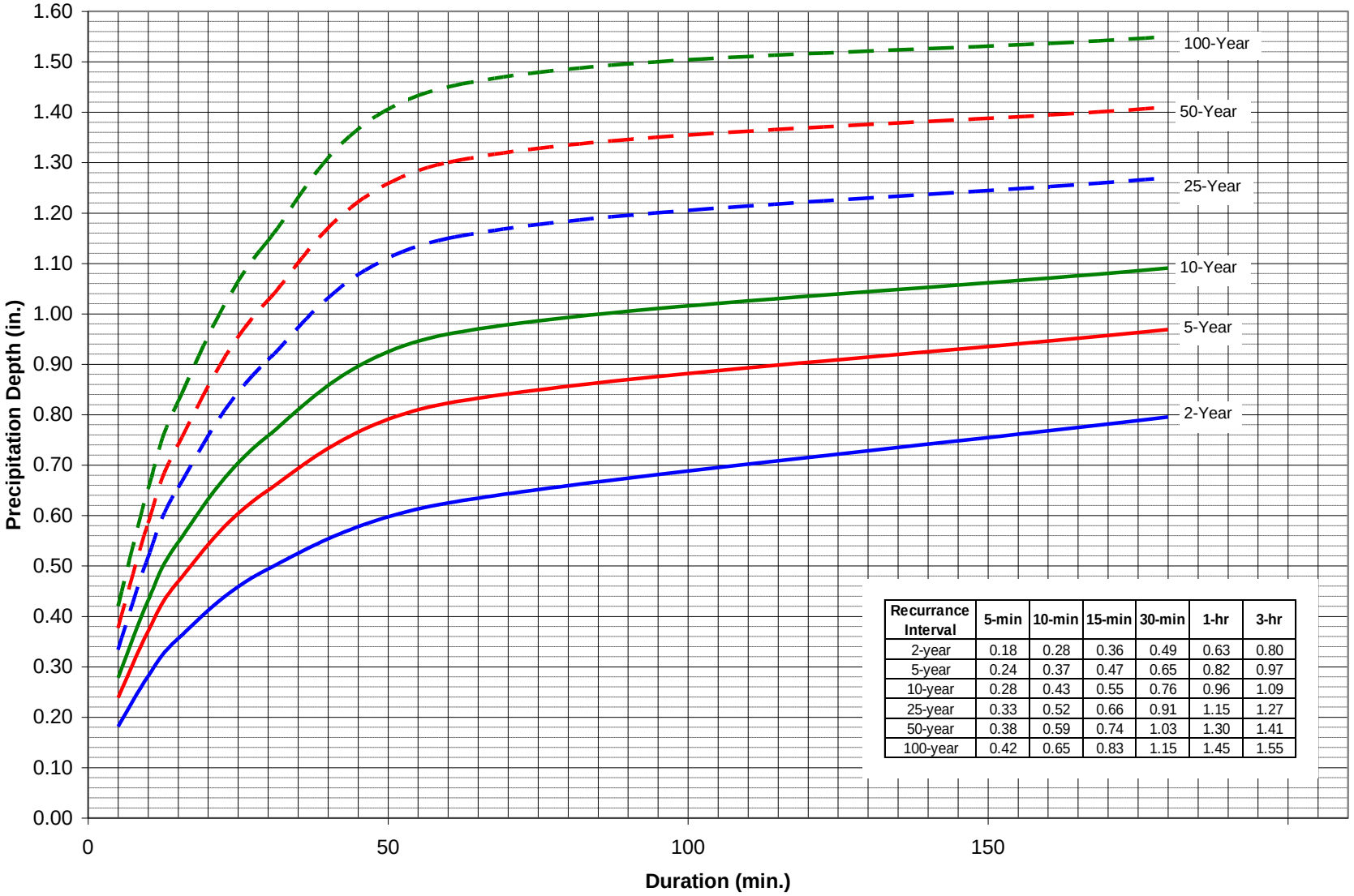
Rainfall depths and intensities for the City of Sheridan, for durations from 5 minutes up to 24 hours, and for recurrence intervals from 2-year up to 100-year are provided in Table 3.3 and Table 3.4. The rainfall depths are also shown on Figure 3.1 and Figure 3.2. This information was derived from National Climatic Data Center (NCDC) precipitation records for Sheridan Airport (NCDC Cooperative Station Number 488155) for the period of record from 1948 through 2005.

Table 3.3 Precipitation Depth – Duration Depth In Inches									
Recurrence Interval	5-min	10-min	15-min	30-min	1-hr	3-hr	6-hr	12-hr	24-hr
2-year	0.18	0.28	0.36	0.49	0.63	0.80	1.00	1.26	1.61
5-year	0.24	0.37	0.47	0.65	0.82	0.97	1.23	1.61	2.05
10-year	0.28	0.43	0.55	0.76	0.96	1.09	1.39	1.85	2.35
25-year	0.33	0.52	0.66	0.91	1.15	1.27	1.63	2.20	2.78
50-year	0.38	0.59	0.74	1.03	1.30	1.41	1.81	2.47	3.12
100-year	0.42	0.65	0.83	1.15	1.45	1.55	2.00	2.74	3.46

Table 3.4 Precipitation Intensity – Duration Intensity In Inches Per Hour									
Recurrence Interval	5-min	10-min	15-min	30-min	1-hr	3-hr	6-hr	12-hr	24-hr
2-year	2.18	1.69	1.43	0.99	0.63	0.27	0.17	0.11	0.07
5-year	2.86	2.22	1.88	1.30	0.82	0.32	0.20	0.13	0.09
10-year	3.34	2.59	2.19	1.52	0.96	0.36	0.23	0.15	0.10
25-year	4.00	3.11	2.62	1.82	1.15	0.42	0.27	0.18	0.12
50-year	4.52	3.51	2.96	2.05	1.30	0.47	0.30	0.21	0.13
100-year	5.05	3.92	3.31	2.29	1.45	0.52	0.33	0.23	0.14

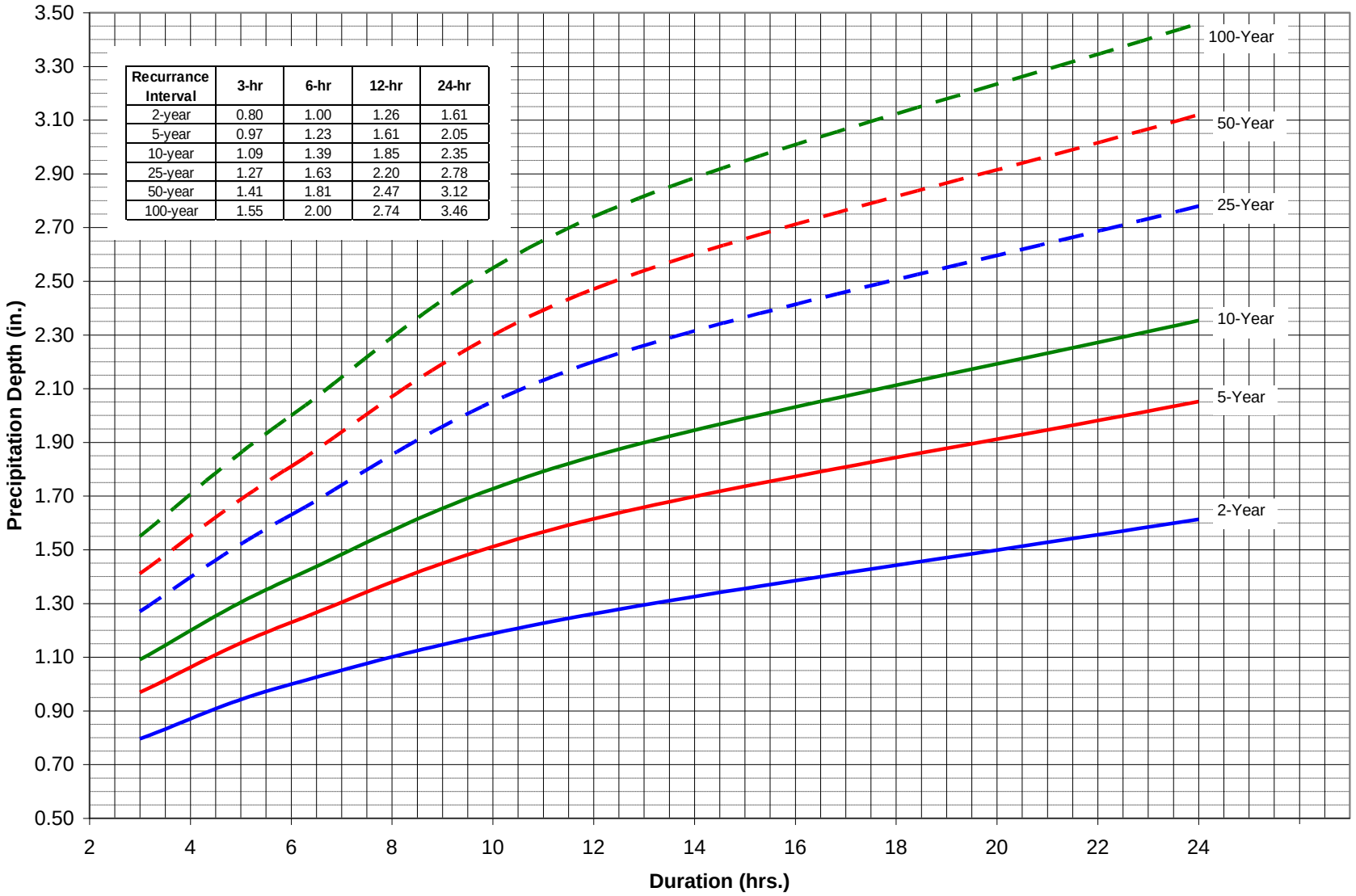
The depth versus duration information in Table 3.3 shall be used together with the SCS (NRCS) Type II rainfall distribution to develop the 24-hour storms used for runoff hydrograph analyses. The rainfall intensities listed in Table 3.4 for durations corresponding to the times of concentration shall be used in the Rational Method to determine peak runoff rates. For times of concentration other than those listed in Table 3.4, the corresponding intensity shall be derived using the rainfall depths for the specific duration as shown on Figures 3.1 and 3.2 (i.e. the 5-year, 20-minute rainfall depth is 0.54 inches which translates to an intensity of 1.62 inches per hour).

Figure 3.1
Precipitation Depth - Durations for 5-Minutes to 3-Hours



Recurrance Interval	5-min	10-min	15-min	30-min	1-hr	3-hr
2-year	0.18	0.28	0.36	0.49	0.63	0.80
5-year	0.24	0.37	0.47	0.65	0.82	0.97
10-year	0.28	0.43	0.55	0.76	0.96	1.09
25-year	0.33	0.52	0.66	0.91	1.15	1.27
50-year	0.38	0.59	0.74	1.03	1.30	1.41
100-year	0.42	0.65	0.83	1.15	1.45	1.55

Figure 3.2
Precipitation Depth - Durations for 3-Hours to 24 Hours



Recurrance Interval	3-hr	6-hr	12-hr	24-hr
2-year	0.80	1.00	1.26	1.61
5-year	0.97	1.23	1.61	2.05
10-year	1.09	1.39	1.85	2.35
25-year	1.27	1.63	2.20	2.78
50-year	1.41	1.81	2.47	3.12
100-year	1.55	2.00	2.74	3.46

4. RUNOFF

4.1. DRAINAGE BASIN AREA

The total area, including upstream offsite area, contributing to the point of interest shall be included in the delineation of drainage basins. Runoff from upstream undeveloped land, not part of the proposed project, shall be based on historic conditions assuming that detention storage will be provided if the upstream land is developed. Runoff from developed upstream land must be determined based on existing conditions or approved drainage plans.

There are several irrigation ditches within the City of Sheridan. In evaluating drainage basin boundaries, and in analyzing off-site flows, the designer needs to be careful when irrigation ditches impact the site. The drainage analysis shall include an evaluation of the capacity of the irrigation ditch for carrying stormwater runoff in addition to irrigation flows and shall also include an evaluation of potential flow contributions from irrigation deliveries or wasteway structures. Irrigation ditches should generally, not be considered to be a basin boundary since storm runoff from up-basin may overtop the ditch and flow into the development area. Irrigation ditches should only be considered drainage divides if adequate surcharge capacity is available in excess of that required to carry irrigation flows.

4.2. NRCS (SCS) HYDROGRAPH METHOD

The SCS Hydrograph Method shall be employed using the procedures detailed in Section 3.3.1 of the HEC-22 Manual.

4.2.1. Soil Types

Use site-specific soils information for the project site when available, or the Natural Resources Conservation Service (NRCS) Soil Survey of Sheridan County to identify the soils and corresponding hydrologic soil groups for drainage basins.

4.2.2. Curve Numbers

Curve numbers (CNs) to be used shall be as set forth in Table 4.1.

4.3. RATIONAL METHOD

One of the most widely used equations for the calculation of peak runoff from small basins is the Rational formula, given as follows:

$$Q = CIA$$

Where: Q = Flow in cfs,
C = a dimensionless runoff coefficient,
I = rainfall intensity in inches per hour, and
A = drainage area in acres

The Rational Method shall be employed using the procedures detailed in Section 3.2.2 of the HEC-22 Manual.

Table 4.1
Runoff Curve Numbers for Urban Areas
(Average Watershed Condition, $I_a = 0.2\ S_R$)

Land Use Description		Curve Numbers for Hydrologic Soil Group			
		A	B	C	D
Fully developed urban areas (vegetation established)					
Lawns, open spaces, parks, golf courses, cemeteries, etc.					
Good condition; grass cover on 75% or more of the area		39	61	74	80
Fair condition; grass cover on 50 to 75% of the area		49	69	79	84
Poor condition, grass cover on 50% or less of the area		68	79	86	89
Paved parking lots, roofs, driveways, etc.		98	98	98	98
Streets and roads					
Paved with curbs and storm sewers		98	98	98	98
Gravel		76	85	89	91
Dirt		72	82	87	89
Paved with open ditches		83	89	92	93
	Average % impervious				
Commercial and business areas	85	89	92	94	95
Industrial districts	72	81	88	91	93
Row houses, town houses, and residential with lot sizes 1/8 acre or less	65	77	85	90	92
Residential: average lot size	Average % impervious				
1/4 acre	38	61	75	83	87
1/3 acre	30	57	72	81	86
1/2 acre	25	54	70	80	85
1 acre	20	51	68	79	84
2 acre	12	46	65	77	82
Developing urban areas (no vegetation established)					
Newly graded area		77	86	91	94
Western desert urban areas					
Natural desert landscaping (pervious area only)		63	77	85	88
Artificial desert landscaping (impervious weed barrier, desert shrub with 25 to 55 mm [1 to2 inch] sand or gravel mulch and basin borders)		96	96	96	96
Cultivated agricultural land					
Straight row or bare soil		77	86	91	94
Conservation tillage Poor		76	85	90	93
Conservation tillage Good		74	83	88	90

4.3.1. Limitations

The Rational Method may be used with some specific limitations:

- ❖ Only for use in predicting conservative peak runoff rates to determine the required capacity for conveyance facilities.

- ❖ Drainage basin area (A) shall not exceed 100 acres.

- ❖ Not to be used for determining storage requirements for detention or retention ponds.

4.3.2. Runoff Coefficients

Runoff Coefficients to be used shall be as set forth in Table 4.2.

4.4. COMPUTER MODELS

- ❖ Acceptable storm drainage computer modeling packages are listed as follows:

  - ➢ Storm™
  - ➢ StormCAD™
  - ➢ CivilStorm™
  - ➢ EPA SWMM
  - ➢ HYDRA
  - ➢ TR-20
  - ➢ TR-55

The hydrologic results from computer models shall be verified through comparison to the results of other accepted methods including the SCS Hydrograph Method and/or the Rational Method. To the extent possible, the results shall also be verified against observed runoff during historic rainfall events in Sheridan to ensure reasonableness.

Table 4.2 Runoff Coefficients ("C") for the Rational Method	
Type of Drainage Area	Runoff Coefficient, C*
Business:	
Downtown areas	0.70 – 0.95
Neighborhood areas	0.50 – 0.70
Residential:	
Single-family areas	0.30 – 0.50
Multi-units, detached	0.40 – 0.60
Multi-units, attached	0.60 – 0.75
Suburban	0.25 – 0.40
Apartment dwelling areas	0.50 – 0.70
Industrial:	
Light areas	0.50 – 0.80
Heavy areas	0.60 – 0.90
Parks, cemeteries	0.10 – 0.25
Playgrounds	0.20 – 0.40
Railroad yard areas	0.20 – 0.40
Unimproved areas	0.10 – 0.30
Lawns:	
Sandy soil, flat, 2%	0.05 – 0.10
Sandy soil, average, 2-7%	0.10 – 0.15
Sandy soil, steep, 7%	0.15 – 0.20
Heavy soil, flat, 2%	0.13 – 0.17
Heavy soil, average 2-7%	0.18 – 0.22
Heavy soil, steep, 7%	0.25 – 0.35
Streets:	
Asphaltic	0.70 – 0.95
Concrete	0.80 – 0.95
Brick	0.70 – 0.85
Drives and walks	0.75 – 0.85
Roofs	0.75 – 0.95

*Higher values are usually appropriate for steeply sloped areas and longer return periods because infiltration and other losses have a proportionally smaller effect on runoff in these cases.

5. HYDRAULIC ANALYSIS AND DESIGN

5.1. GUTTER FLOW

Streets are an integral part of the urban drainage system and may be used for transporting a limited amount of storm runoff. The primary purpose of streets however, is for traffic and the use of streets for storm runoff must therefore be restricted. The City allows the use of streets for drainage within the limitations specified in Tables 5.1 and 5.2. Street classifications are specified on the Functional Classification Map developed by the City of Sheridan.

Table 5.1
Allowable Use Of Streets For Minor Storm Runoff

Street Classification	Maximum Street Encroachment
Local	No curb overtopping. Flow may spread to crown of street.[1]
Collectors	No curb overtopping. Flow spread must leave at least one, ten-foot lane free of water, five feet either side of the street crown.[1]
Arterials	No curb overtopping. Flow spread must leave at least two, ten-foot lanes free of water, ten feet each side of the street crown or median.[1]

[1]Where no curbing exists, encroachment shall not extend beyond property lines, except at drainage easements.

Table 5.2
Allowable Use Of Streets For Major Storm Runoff

Street Classification	Maximum Depth
Local and Collectors	The depth of water at the gutter flowline shall not exceed 18 inches. Residential dwellings and public, commercial, and industrial buildings shall not be inundated at the ground line unless flood-proofed.
Arterials	To allow for emergency vehicles, the depth of flow at the street crown shall be no more than six inches. Residential dwellings and public, commercial, and industrial buildings shall not be inundated at the ground line unless flood-proofed.

5.1.1. Hydraulics

Gutter flow encroachment and hydraulics shall be evaluated using the methods presented in Section 4.3 of the HEC-22 Manual.

5.1.2. Minimum Gutter Slope

Gutters shall be constructed at slopes no flatter than 0.4 percent.

5.1.3. Inlet Spacing and Location

The interception capacity of inlets and required spacing shall be determined in accordance with the procedures described in Sections 4.3 and 4.4 of the HEC-22 Manual. Minimum design standards for storm inlets are as follows:

- In general, inlets shall be placed at the following locations:
  - Prior to pedestrian crossings
  - at all traffic intersections
  - at low points in the gutter grade
  - where significant flows from off the right-of-way are expected
  - on horizontal curves where a change from normal crown to super-elevation may cause water to sheet-flow across the road
  - where lay-down curb (e.g., at approaches) may allow the flow to escape and cause flooding
  - where necessary to maintain gutter flow widths and depths within the allowable limits set forth in Tables 5.1 and 5.2

- Inlet types – allowed storm inlet types include grated and combination (grated with curb opening or grated with curb opening plus slotted drain) inlets. City of Sheridan standard storm drain inlets are shown in Appendix A.

- Inlets in sag locations – inlet capacity in sump locations shall reflect 50 percent plugging by debris (design capacity equals 50 percent of the theoretical capacity).

- Lateral pipe connections – no more than two inlets shall be connected by each lateral pipe entering trunk line manholes.

5.2. STORM DRAIN

5.2.1. Hydraulics

Use the methods set forth in Chapter 7 of the HEC-22 Manual for the hydraulic design of storm drains, except as modified herein.

- Freeboard Requirements

Storm drains shall be designed to operate in a non-pressurized (non-surcharged) flow condition during the Minor storm, with a maximum flow depth to diameter ratio (d/D) of 0.75.

- Manning "n" values

The Manning's "n" value used for the design of storm drains shall be as shown in Table 5.3.

Table 5.3 Manning's Coefficients (n) for Storm Drain Conduits		
Pipe Material	Roughness or Corrugation	Manning's n
Concrete Pipe	Smooth	0.011-0.013
Concrete Boxes	Smooth	0.012-0.015
Spiral Rib Metal Pipe	Smooth	0.012-0.013
Corrugated Metal Pipe, Pipe-Arch and Box	2-2/3 by 1/2 in Annular	0.022-0.027
	2-2/3 by 1/2 in Helical	0.021-0.023
	6 by 1 in Helical	0.022-0.025
	5 by 1 in	0.025-0.026
	3 by 1 in	0.027-0.028
	6 by 2 in Structural Plate	0.033-0.035
	9 by 2-1/2 in Structural Plate	0.033-0.037
Polyethylene	Smooth Corrugated	0.009-0.015 0.018-0.025
Polyvinyl chloride (PVC)	Smooth	0.009-0.011
Note: The Manning's n values in this table represent clean, new pipe material. The values at the upper end of the ranges should be used for design to represent the effects of abrasion, corrosion, deflection, and joint irregularities.		

❖ Diameter, Slope, and Velocity Limits

Minimum slopes for storm drain pipes shall be designed to maintain a full-flow velocity of at least 2.5 feet per second. Maximum full-flow velocity shall be limited to 15 feet per second in storm drain mains during the Minor storm event.

Minimum diameter for storm drain main lines, which will be part of the public storm drainage system, shall be 18 inches. Minimum diameter for lateral pipes connecting storm drain inlets to the main line shall be 12 inches. Pipe sizes shall normally increase in the downstream direction and transitions from smaller pipes to larger pipes shall occur by matching the inside top (crown) of the pipes where practicable. Where it is not possible to match crowns, the 80-percent diameter points of the pipes shall be matched.

❖ Maintenance Access

All stormwater facilities shall be accessible for operation and maintenance.
When vehicle access is necessary, for facilities constructed outside of the street section, access roads shall be provided in dedicated access easements. The minimum clear driving lane width is 12 feet. Access roads shall have a maximum grade of nine percent and shall be constructed with gravel surfacing.

Gates and/or bollards are required when necessary to restrict access to stormwater facilities. Cables and/or chains stretched across access roads are not acceptable.

5.2.2. Materials

Reinforced concrete pipe (RCP) or polyvinyl-chloride (PVC) pipe shall be used for public storm drain systems. Corrugated metal pipe (CMP) is not permitted for public storm drain construction. A minimum of Class-II RCP shall be used for storm drain main lines. RCP or PVC pipe shall be used for storm drain laterals. Pipe materials other than RCP and PVC are subject to City approval.

The minimum cover depends upon the pipe size, material type and class, and soil bedding condition, but shall not be less than 18 inches for RCP and 24 inches for PVC at any point along the pipe. Where the minimum cover criteria cannot be achieved, the designer shall provide documentation that the proposed installation can withstand the design loading condition.

Pipe wall strengths and coatings shall be suitable for the soil conditions, design depths, and trench details. Pipe strength shall be designed assuming HS-20 live load capacity unless unique conditions of the site warrant a higher load capacity (i.e., HS-25 or E-80).

A typical design strength calculation shall be submitted. Supporting documentation shall include pipe strength calculations, loading conditions, soil conditions, trench cross sections, bedding materials and any other information necessary to determine the suitability of the proposed design.

Corrosion, abrasion and other appropriate observations of field conditions shall also be considered in determining appropriate pipe materials and joint types. Corrosion resistance shall be evaluated based on minimum resistivity, pH, sulfate content and chlorine content of the soil and groundwater. Tests shall be conducted along the proposed alignment of the drainage system.

Storm drains within the City of Sheridan shall be constructed in accordance with the City of Sheridan Standard Specifications.

5.2.3. Access Manholes

❖ General

Access manholes are required when joining pipes of different sizes, at horizontal or vertical bends in the alignment, at lateral connections, and at the upstream terminus of storm drain mains. City of Sheridan standard manhole details are provided in Appendix A.

❖ Required Size

The required minimum manhole size shall be as shown in Table 5.4.

Table 5.4
Minimum Allowable Manhole Size

Storm Drain Diameter	Manhole Diameter
18" to 24" 27" to 36"	4’ 5’
42" 48" and larger	6’ Junction box or Tee Manhole

Larger manhole diameters or a junction box may be required when sewer alignments are not straight through or when lateral pipes enter the manhole. The number and size of pipes that may be connected to any one manhole is limited in order to maintain the integrity of the structure. For angled connections or those with several pipes on the same plane, a larger manhole than set forth in the Table 5.4 may be required. For structural integrity, minimum undisturbed wall (edge of pipe opening to edge of pipe opening) shall be 8 inches. For 72-inch and 96-inch diameter structures, the minimum undisturbed wall between openings is 12 inches.

❖ Required Spacing

The maximum manhole spacing along storm drains is as set forth in Table 5.5.

Table 5.5
Maximum Allowable Manhole Spacing

Storm Drain Diameter	Maximum Spacing
18” to 36”	400’
42” to 60”	500’
66” and Larger	600’

❖ Maximum manhole depth – manhole depths shall not exceed 20 feet without special safety provisions such as intermediate platforms and minimum diameter risers of 48 inches.

❖ Drop manholes – the difference between the highest pipe invert entering a manhole and the invert leaving shall not exceed 24 inches. Manholes exceeding 24 inches of fall shall be

designed as drop manholes. Drop manholes with drop heights exceeding six feet shall be designed with high strength (6,000 psi) concrete.

5.2.4. Clearance From Other Utilities

The following clearances shall be maintained between storm drains and other utilities. All clearances listed below are from edge-to-edge of each pipe.

- Horizontal clearances from storm main:

Cable TV	5 feet
Gas	5 feet
Power	5 feet
Sewer	5 feet
Telephone, Fiber Optics	5 feet
Water	10 feet

- Vertical clearances from storm main:

Cable TV	1 feet
Gas	1 feet
Power	1 feet
Sewer	1 feet
Telephone, Fiber Optics	1 feet
Water	1.5 feet

- Where storm sewer pipes cross over or below a water main, one full length of pipe shall be used, with the pipes centered for maximum joint separation.

- Water main crossings shall be designed to prevent freezing due to minimal clearance from stormwater piping.

Avoid crossing other utilities at highly acute angles. The angle measure between utilities shall be between 45 and 90 degrees.

5.2.5. Private Drainage System Connections

Private drainage systems connections to the public storm drain system shall be approved by the City of Sheridan and shall comply with the following criteria.

- Connections from stormwater outfalls from private parking lots, driveways, and roadway drainage shall be made by the following (in order of preference):

  - Connecting the conveyance pipeline to an existing manhole or catch basin; or
  - Constructing a new manhole or catch basin on the existing storm drain pipeline and connecting the conveyance pipeline to this new structure.

5.2.6. Outfalls

❖ General

Use the methods set forth in Chapter 7.1.5 of the HEC-22 Manual as modified herein.

Outfalls shall discharge no lower than the bank-full water surface elevation (2-yr storm) in open channels or streams, where practicable.

Outfalls downstream of detention facilities shall be designed to prevent backwater into those facilities.

New outfalls or modifications to existing outfalls into Goose Creek through the flood protection levies shall be in accordance with the requirements of the U.S. Army Corps of Engineers.

Contact: US Army Corps of Engineers
Ft. Peck Lake Office
Operations Division
P.O. Box 208
Fort Peck, MT 59223
406-526-3411

For guidance on preparing submittals visit the following website: https://www.nwo.usace.army.mil/html/op-e/index.html.

❖ Erosion Protection

Erosion protection shall be provided for all outfalls.

❖ Energy Dissipation

When flow velocities exceed 10 feet-per-second at the outfall point, during the Minor Storm (when the outfall conduit is running at design capacity), energy dissipation, in addition to erosion protection may be required to minimize erosion. Design energy dissipation measures in accordance with FHWA HEC-14, "Hydraulic Design of Energy Dissipaters for Culverts and Channels." This manual is available as a PDF document from the FHWA Website (http://isddc.dot.gov/OLPFiles/FHWA/010492.pdf).

❖ Maintenance Access

Provide maintenance access for inspection and debris removal.

5.3. OPEN CHANNEL CONVEYANCES

5.3.1. General

Use the methods in Chapter 5 of the HEC-22 Manual except as modified herein.

5.3.2. Clearance

Channels shall be located no closer than ten feet from any structure foundation as measured horizontally from the edge of the swale at the freeboard elevation. The maximum water surface elevation during the Major Storm event shall be no less than two feet below the finished floor elevation of adjacent residential dwellings and public, commercial, and industrial buildings.

5.3.3. Erosion Control

Channel segments which have a calculated Froude number greater than 0.95 during the Major Storm event shall be protected from erosion.

Use the criteria set forth in Section 5.2 of the HEC-22 Manual for stable channel design.

Erosion control structures, such as check drops or check dams, may be required to control flow velocities.

5.3.4. Freeboard Requirements

A minimum freeboard of one-foot from the water surface during Major Storm event to the top of bank shall be provided for open channel conveyances.

5.3.5. Low-Flow Channels

Low flow channels shall be included in the channel cross section to carry sustained low flows and frequent storm events in a confined sub-section of the larger channel.

5.3.6. Friction Factors (n)

Use Manning's roughness factors (n) set forth in Table 5-1 of the HEC-22 Manual. The design shall consider the channel roughness both immediately after construction and when vegetation is well established. Roughness factors (n), which are representative of unmaintained channel conditions, shall be used for the analysis of water surface profiles. Roughness factors (n), which are representative of maintained channel conditions, shall be used to determine velocity limitations.

5.3.7. Side Slopes

Side slopes shall be no steeper than 3:1 for grass-lined channels and 2.5:1 for riprap-lined channels.

5.3.8. Maintenance Access

Provide maintenance access for inspection, mowing operations, and debris removal by conventional equipment along the length of the conveyance channel. The type of equipment needing access is dependent on the size of the channel. Large channels will need access for dump trucks and loaders. For small ditches, foot or pick-up truck access may suffice.

5.4. BRIDGES

Hydraulic sizing for bridges shall conform to the requirements of the Wyoming Department of Transportation (WYDOT) as modified herein.

5.4.1. Freeboard Requirements

The water surface elevation during the Major Storm event shall be a least one foot below the lowest bridge girder, where practicable, to allow for the passage of floating debris.

5.4.2. Allowable Rise

The water surface elevation during the Major Storm event upstream of bridges shall not increase due to channel constrictions and hydraulic losses caused by the bridge.

5.4.3. Scour

Estimates of local and long term scour shall be calculated according to methods approved by WYDOT to determine the required abutment protection and establish the required depth of the bridge support structures.

5.4.4. State Approval

Bridge design must be submitted to WYDOT for review and approval.

5.5. CULVERTS

Culverts are used to convey irrigation ditches and natural drainage-ways under City Streets and other travel ways. Culverts shall be designed using the methods set forth in the Federal Highway Administration (FHWA) Hydraulic Design Series No. 5 (HDS-5), "Hydraulic Design of Highway Culverts", Publication No. FHWA-NHI-01-020 except as modified herein. HDS-5 is available as a PDF document from the FHWA Website (http://isddc.dot.gov/OLPFiles/FHWA/012545.pdf).

5.5.1. Street overtopping

Culverts shall be sized such that the depth of street overtopping is limited as set forth in Table 5.6.

Table 5.6
Allowable Street Overtopping Depths at Culvert Crossings

Street Classification	Minor Storm	Major Storm
Local and Collector	None	Six inches at the street crown. Residential dwellings and public, commercial, and industrial buildings shall not be inundated at the ground line unless flood-proofed.
Arterial	None	No overtopping allowed. Minimum clearance between the crown of the culvert and the energy grade line shall be 0.5 feet for basins less than two square miles, 1.0 feet for basins up to ten square miles and 2.0 feet for basins greater than ten square miles.

5.5.2. Headwater depth

The headwater (HW) depth shall be limited according to the following ratios to diameter (D):

- For drainage facilities with a cross sectional area less than or equal to 30 square feet: $HW/D \leq 1.5$
- For drainage facilities with a cross sectional area greater than 30 square feet: $HW/D \leq 1.2$

Culverts must also be sized without creating significant flow constriction, such that existing channels upstream are not overtopped during the design flow event.

5.5.3. Allowable Velocities

Culverts shall be designed to maintain a minimum velocity of 2.5 feet-per-second during the Minor Storm event to prevent sediment accumulation and shall be designed with a minimum slope of 0.5 percent where practicable.

Culverts shall be sized to limit velocities in order to minimize erosion potential during Major storm events unless adequate erosion control or energy dissipation is provided.

5.5.4. Minimum size

Culverts shall have a minimum diameter or height of 18 inches unless a smaller size is approved by the City of Sheridan.

5.5.5. Allowance for Blockage

Culverts crossing arterial streets shall be sized for Major storm events assuming 20 percent of the flow capacity is lost due to blockage. Culverts crossing local and collector streets shall be assumed to be 50 percent blocked to determine overtopping depths during Major storm events.

5.5.6. Materials

A minimum of Class-II reinforced concrete pipe (RCP) shall be used for culverts under public streets. Corrugated metal pipe (CMP) is not permitted for culverts under public streets. Pipe materials other than RCP are subject to City approval.

Culvert wall strengths and coatings shall be suitable for the soil conditions, design depths, and trench details. Culvert strength shall be designed assuming HS-20 live load capacity unless unique conditions of the crossing warrant a higher load capacity (i.e., HS-25 or E-80).

When an abrasive bed load is anticipated or when velocities exceed 10 feet per second, protective measures shall be implemented to limit pipe damage. Corrosion, abrasion and other appropriate observations of field conditions shall also be considered in determining appropriate culvert materials and joint types. Corrosion resistance shall be evaluated based on minimum resistivity, pH, sulfate content and chlorine content of the soil and groundwater.

5.5.7. End Treatments

Culverts shall be designed with appropriate end treatments at their inlets and outlets such as flared end sections, headwalls, or wingwalls to provide smooth transitions to/from the drainage channel or ditch and to conform to the embankment slopes. Erosion protection or energy dissipaters shall be provided as necessary to limit erosion due to turbulent flow and high velocities.

For exit velocities in excess of 10 feet-per-second during the Major Storm, energy dissipation, in addition to erosion protection may be required to minimize erosion. Design energy dissipation measures in accordance with FHWA HEC-14, "Hydraulic Design of Energy Dissipaters for Culverts and Channels." This manual is available as a PDF document from the FHWA Website (http://isddc.dot.gov/OLPFiles/FHWA/010492.pdf).

5.5.8. Safety Racks

Safety racks are generally needed on culverts if one cannot see clearly through the culvert, if the culvert is more than 150 feet long, if a 48 inch diameter object can not pass through or if the outlet may trap or injure a person being carried through. The open area of safety racks shall be, at least four times the open area of the culvert. Safety racks shall be constructed of smooth steel pipe, with a corrosion protection finish and capable of withstanding the full hydraulic load when completely blocked under maximum submergence. Bar clear spacing shall not exceed six inches and bars shall be generally perpendicular to flow. The longitudinal slope of the safety rack shall not exceed 3.0 H to 1.0 V. There shall be a minimum clear area under the front edge of 9 to 12

inches. Safety racks shall be attached by removable devices such as bolts or hinges to allow access for maintenance, prevent undesirable access and prevent vandalism. Safety racks shall only be installed at inlets to culverts. Safety racks at outlets to culverts can create safety issues and trap debris reducing capacity and causing maintenance problems. The rack must not cause water to rise higher than the maximum allowable flood elevation.

5.5.9. Maintenance Access

Provide maintenance access to the upstream and downstream ends of culverts for inspection and debris removal.

6. OFF-SITE DISCHARGE

Stormwater runoff from the project development shall produce no adverse impact to downstream properties. Where practicable, the site shall be designed such that runoff rates and drainage patterns following development shall be the same as those which existed prior to development. A change from unconcentrated sheet flow to concentrated flow constitutes a change in the drainage pattern.

- When the runoff rate or location of discharge from the site will be changed by a proposed development, in comparison to pre-development conditions, a downstream offsite capacity analysis shall be required.

  - A physical inspection of the existing on-site and off-site drainage system shall be performed to identify any existing or anticipated future problems. The analysis must extend from the proposed project discharge location to the point downstream where the site runoff would join the main drainage course. The makeup and general condition of the drainage system shall be investigated including collecting such information as pipe sizes, channel characteristics, drainage structures, and evidence of existing or anticipated problems.

  - At each location with an existing or anticipated drainage problem, develop runoff hydrographs or Rational Method peak flow rates for the major (100-yr) storm event for the total composite drainage area tributary to that location under existing conditions and the conditions that will exist following the proposed development. Determine the capacity of the existing drainage system and evaluate impacts of adding the peak runoff from the proposed project site to the peak runoff from the total composite drainage area tributary to these locations.

  - Solutions to Identified Drainage Problems

    - For any potential off-site problem resulting from the development or redevelopment, the Developer must demonstrate that the proposed project has been designed to mitigate the anticipated problem.
    - As an alternative, the Developer, with approval by the City, may arrange with the owners of the off-site properties to install measures which will mitigate the anticipated problem.
    - In some cases, anticipated public drainage system problems may already be scheduled for correction by the City. The Developer should contact the City Public Works Department to determine current capital improvement project schedules.

  - Provide information with the Drainage Report to document the capacity of the downstream drainage system and to illustrate that potential impacts have been adequately mitigated.

- Where the development will result in a change in the rate of runoff or location of discharge, in comparison to pre-development conditions and no downstream drainage system exists

adjacent to the property, the downstream drainage system shall be extended up to the property line and all runoff from the property shall be conveyed across the downstream properties to an approved discharge location. The Developer shall secure drainage easements from the downstream owners and record such easements prior to drainage plan approval.

- If the Developer demonstrates that easements are not reasonably obtainable as determined by the City, then all runoff shall be conveyed to an on-site retention system.

7. DETENTION AND RETENTION FACILITIES

On-site detention shall be provided for runoff control from new development, expansion, and redevelopment. Detention facilities shall be designed to limit the runoff from the site to pre-development rates for the full range of potential storms including the 2-year, 10-year, and 100-year events.

Retention facilities are used to fully retain the site runoff volume where no viable outfall exists. Retained runoff is then evacuated through infiltration and evaporation. Retention facilities shall be designed to store the post-development site runoff from the Major Storm event (100-year, 24-hour storm). The water surface in the retention facility shall return to the pre-storm level within 72-hours after cessation of the Major Storm.

Design criteria for detention and retention facilities shall be as detailed in Chapter 8 of the HEC-22 Manual as modified herein.

Detention or retention storage is not required if the total area to be developed or redeveloped results is less than 5,000 square feet of additional or new impervious area.

Street and parking overlays are considered to be routine maintenance and are not considered to be redevelopment.

The 100-year water surface elevation in the storage areas shall be at least two feet below the lowest finished floor elevation in the areas tributary to the stormwater detention or retention facility. Detention storage in parking lots shall have a maximum depth of 15 inches. Rooftop detention shall not be allowed.

7.1. GROUNDWATER

Anticipated groundwater levels must be addressed in the design to ensure that sufficient capacity will be available in the ponds for storage of stormwater runoff.

7.2. SAFETY

Fencing shall be required when vertical walls are used, when more than 25 percent of the perimeter side slopes are steeper than 3 H: 1V, or when the permanent ("dead") pool depth exceeds three feet.

7.3. MULTI-PURPOSE USE

Detention facilities designed for multi-purpose use (sport courts, neighborhood parks, play areas, picnic areas, etc.) are allowed.

Runoff from more frequent storms shall be stored separately from the multiple use areas. At a minimum, the detained volume for the 2-year, 24-hour design storm shall be used to size the separate facilities.

Multi-use amenities shall be anchored to prevent floatation. The developer shall make arrangement for maintenance of such amenities unless such responsibility is accepted by the City of Sheridan.

7.4. WATER QUALITY TREATMENT

Developers are encouraged to design detention ponds to serve the incidental benefit of water quality treatment. General guidance is provided in Section 10 of the HEC-22 Manual. The water quality design storm to be treated is 0.5 inches, which roughly equates to the 6-month, 24-hour rainfall depth for the City of Sheridan. This is commonly referred to as the first-flush runoff.

Stormwater shall be routed through a sediment forebay prior to discharging to the pond in order to facilitate removal of transported sediments and debris. If other potential pollutants such as oils, grease, or fuel (gasoline and diesel) could be present in the site runoff, it may also be necessary to provide measures to remove these contaminants.

7.5. LOW-FLOW CHANNELS

Dry detention ponds shall be constructed with Low-flow channels that have a capacity of 1 to 3 percent of the peak design storm inflow and a minimum slope of 0.5 percent. Pond bottoms shall be sloped at a 2 percent minimum grade towards the low-flow channel to facilitate drainage.

7.6. OUTLET CONTROL STRUCTURES

- General

  Use the criteria and methods set forth in Chapter 8 of the HEC-22 Manual except as modified herein.

- Orifices

  Minimum orifice diameter without screening is six inches. Screening shall be provided to prevent blockage for orifices of smaller diameter.

- Provide debris barriers or trash racks on the detention pond outlet to protect the outlet from blockage or plugging.

- Maintenance Access

  All stormwater detention system outlet control structures shall be accessible for maintenance and operation.

  Outlet control structures, which are not abutting a roadway, shall be provided with easements at least 15 feet wide to accommodate maintenance vehicles. The minimum clear driving width shall be 12 feet and the minimum turn-around radius shall be 25 feet or hammerhead.

The maximum grade of access roads shall be nine percent and gravel surfacing shall be provided.

Gates and/or removable bollards are required to restrict access, as necessary, to detention or retention facilities.

7.7. EMBANKMENTS

Embankments for detention and retention facilities shall comply with Dam Safety guidelines as published by the Wyoming State Engineers Office. The maximum embankment height is measured from the downslope toe to the crest of the embankment.

Embankments six feet and higher shall be designed and inspected by a licensed civil/geotechnical engineer with expertise in embankment design.

Permit requirements are outlined in Part I, Surface Water, of the Regulations and Instructions. Permits from the State Engineer's Office are required for any dams (including detention facilities) with a storage volume of 50 ac-ft or greater or a height of 20 feet or greater.

The Special Application filing procedures apply to flood control reservoirs and dams between 6 feet and 20 feet in height and with an inactive capacity between 20 acre-feet and 50 acre-feet if there is an 18-inch diameter, or larger, uncontrolled outlet pipe.

Dam or detention facilities are exempt from the State Engineer permitting process when they:

- Are pit-type or excavated flood control impoundments that are designed with an outlet device that will evacuate the impoundment within 24 hours.

- Have a storage capacity of 50 acre-feet or less and a height of 6 feet or less as measured from the downstream toe to the crest of the dam. Under this exemption the outlet pipe must be a minimum of 18 inches in diameter, be uncontrolled and shall totally evacuate the impoundment.

State regulations may be updated or revised periodically. It is the responsibility of the owner and the designer to comply with all State requirements for design and permitting.

7.8. OUTLET CONDUITS

The minimum diameter for outlet conduits shall be 18 inches. Anti-seep collars shall be placed on all outlet conduits through embankments.

7.9. SET BACKS

- Detention or Retention ponds shall not be located:

  - within 1: 1 plane from the pond bottom to the finished grade at an adjacent building;

- within the 1: 1 plane from the pond bottom to the property line when an easement is not provided on the adjacent property; and
- where such facilities interfere with other underground utilities,

The top of a cut embankment and the toe of a fill embankment shall be setback at least 5 feet from property lines.

7.10. EMERGENCY OVERFLOW & SPILLWAYS

Use the criteria set forth in Chapter 8.4.4.4 of the HEC-22 Manual as modified herein. All detention storage facilities shall include a provision for non-erosive control of overflows. Overflows from the Major Storm event shall be directed to a safe discharge path to protect adjacent and downstream properties from damage.

Surface detention ponds shall be provided with a minimum of two controlled overflows - the primary overflow in the control structure and the emergency overflow in the engineered embankment.

7.11. VEGETATION & LANDSCAPING

Ponds shall be landscaped to provide for slope stability, erosion control, and low maintenance. Landscape materials shall be fully compatible with use as a stormwater detention facility, including runoff treatment. Utilize plant species native to the Sheridan area to the maximum extent practicable.

Floatable or erodible material (i.e., wood chips, beauty bark, straw mulch, etc.) shall not be allowed in the pond interiors.

Vegetation on pond embankments shall be limited to shallow rooted varieties.

Points of inflow to the pond shall be armored to prevent erosion.

7.12. MAINTENANCE ACCESS

A vehicle access ramp shall be provided to the bottom of the detention or retention pond when the bottom width is 15 feet or greater and/or when the height of the interior pond embankment and/or wall is greater than four feet. The grade of the access ramp shall be no steeper than 20 percent.

Gates and/or removable bollards are required to restrict access to detention or retention facilities. Cables and chains stretched across access roads are not acceptable.

7.13. UNDERGROUND DETENTION FACILITIES

Underground detention facilities are generally not acceptable for controlling stormwater runoff. Exceptions shall be pre-approved by the City Public Works Department on a case-by-case basis.

8. INFILTRATION SYSTEMS

Infiltration Systems are generally not acceptable for disposing of stormwater runoff. Exceptions shall be pre-approved by the City Public Works Department.

If a deviation for an infiltration system is approved, the system shall meet the following minimum requirements:

- The Developer shall demonstrate that the infiltration system is the only feasible alternative available to provide drainage.

- Infiltration facilities shall not be located: 1) within 20 feet of any structure, property line, protected area or another infiltration system; or 2) within the 1: 1 plane from the bottom edge of the excavation to the finished grade at the structure foundation, whichever is greater, except as provided herein.

- Infiltration areas shall not be: 1) driven on or across by any vehicles or equipment, 2) used for material storage or stockpiles, or 3) used for vehicle or equipment parking.

- Approval of an infiltration system shall obligate the owner to repair, replace, or reconstruct the system if it fails to operate as designed. The maintenance and operation schedule for an infiltration system shall include such a provision.

- The Developer shall demonstrate through: 1) infiltration testing; 2) soil logs; and 3) a written opinion of a licensed civil/geotechnical engineer that sufficient permeable soils exist on the site for an infiltration system meeting the requirements herein to function properly with the site-specific conditions.

- Depth to seasonal high water table, bedrock, hardpan or other impermeable layer shall be no less than three feet below the bottom of the infiltration system.

- The infiltration rate shall be measured at a depth equal to the proposed bottom grade of the facility. The following safety factors shall be applied to the measured infiltration rate in arriving at the design infiltration rate, depending on the test method selected.

  - EPA Method: F.S. = 2.0

  - ASTM Method: F.S. = 1.75

- Infiltration systems shall be designed to infiltrate the 100-year, 24-hour design storm volume within 72 hours after the storm is over.

- Each infiltration facility shall be provided with emergency surface storage of at least 10 percent of the 100-year, 24-hour design storm volume, with a minimum storage depth of 0.5 feet, on the site, prior to discharging runoff to a safe overflow route. The overflow route shall have adequate capacity for the 100-year, 24-hour flow, in the event of system failure. Water

ponding in the emergency surface storage shall be used by the owner as an indication of problems with the infiltration system.

- Runoff into infiltration facilities shall be pre-treated for debris and sediment removal. Where runoff is anticipated to also contain oil, grease, or other contaminants and pollutants, it shall be treated using the appropriate BMPs set forth in the HEC-22 Manual, prior to being infiltrated.

9. PUMPING STATIONS

Pumping stations are generally not acceptable for controlling stormwater runoff. Exceptions shall be pre-approved by the City Public Works Department. Pumping stations, when allowed, shall be designed in accordance with the criteria presented in Chapter 9 of the HEC-22 Manual as modified herein.

If a deviation for a pump system is approved, the system shall meet the following minimum requirements:

- The Developer shall demonstrate that the pump system is the only feasible alternative available to provide drainage.

- Pump systems shall be owned, operated, maintained, repaired, and replaced (as needed) by property owner(s) served by such system.

- Each pump shall be capable of discharging the design flow rate for the 100-year, 24-hour design storm.

- If a stormwater detention system is not provided, the pump system shall have a storage facility (pond, tank, or vault) sized to hold 25 percent of the total volume of runoff for the developed tributary drainage area for the 2-year, 24-hour design storm.

- The pump system shall have dual, alternating pumps with emergency on-site, back-up power supply, and an external alarm system for system failure and high water level indicator.

- A safe emergency overflow route shall be provided, if possible.

- The pump system shall discharge to an elevation higher than the downstream design water surface elevation to prevent backwater/backflow conditions.

- A Maintenance and Operation Schedule shall be prepared and submitted for review.

- A note on the approved plan shall stipulate that the private property owner(s) shall be responsible for any and all claims for injuries and damage due to the operation or non-operation of the pump system.

10. EASEMENT REQUIREMENTS

Drainage facilities that are constructed to serve predominantly public property or public right-of-way shall be publicly owned and shall be dedicated to the City.

Where possible, public conveyance systems shall be constructed within the public right-of-way. When site conditions make this infeasible, public utility easements shall be provided. Private drainage facilities shall be constructed outside of the public right-of-way, on private property.

When vehicle access for maintenance is required, an access easement shall be provided. The access easement conditions shall prohibit the property owner from installing any landscaping, improvements, retaining walls, etc., which would hinder access to the drainage facility or necessitate restoration of access easement area.

10.1. EASEMENT WIDTH REQUIREMENTS

For pipes and vaults, the required utility easement width shall be: 1) the minimum value set forth below; or 2) determined by extending a line from the bottom edge of the structure or the bottom of the excavation at the outside diameter for pipes, at a 1H : 1V slope until it intercepts the finished grade, whichever is greater.

For pipes up to five feet in diameter, the minimum easement width shall be 20 feet.

For pipes five feet in diameter and greater, the minimum utility easement width shall be the outside dimension plus 15 feet, rounded to the nearest whole foot.

For open channels to be maintained by the City, the utility easement width shall include the entire width of the channel (top-of-bank to top-of-bank or width at freeboard elevation) plus a maintenance access road.

For maintenance access roads, the minimum access easement width shall be 15 feet.

Storm drainage facilities shall be located in the center of the easement.

10.2. EASEMENT DOCUMENTATION REQUIREMENTS

All easements shall be shown on the project plans and shall be designated “exclusively for storm drainage use”.

All utility easements shall be properly executed. Easement documents shall include a map, property legal description, and owners' names.

Easements shall be dedicated to, and approved by, the City prior to acceptance of a public drainage system and shall be filed along with the Plat with Sheridan County. Grantee shall be the "the City of Sheridan, a municipal corporation, its heirs, successors, or assignees."

Indemnification and hold-harmless agreements to hold the City harmless shall be included in recorded documents where maintenance access across private property and /or pumping of storm drainage is deemed necessary by the City.

Transfer of ownership for all drainage facilities appurtenant to public easements shall be given to the City with the executed real property documents that transfer property rights to the City. Grantor shall pay all title policy and recording fees necessary to transfer rights to the City.

11. FLOODPLAINS

Development activity within floodplains shall be restricted in accordance with the Sheridan County Floodplain regulations and results of the most recent Flood Insurance Study for the City of Sheridan. Stormwater runoff generated by the development during the Major Storm shall be transported to receiving channels without causing an increase in the risk of flooding in comparison to pre-development conditions.

12. EROSION AND SEDIMENT CONTROL

The objective of the Erosion and Sediment Control Standards is to minimize erosion of disturbed areas during the construction of a project. Erosion and subsequent sediment transport can have a significant impact on the water quality of receiving surface waters. Sediment loads to surface waters increase turbidity, increase water temperatures, degrade fish habitat and spawning areas, and depress dissolved oxygen concentrations. Moreover, toxic substances, trace metals and nutrients which are absorbed to soil particles can be transported into surface waters as well. The addition of these substances to surface waters degrades the existing water quality.

The Best Management Practices include the management, techniques, and methods for control of accelerated erosion and sediment damage resulting from construction activities that result in a land disturbance of greater than or equal to one acre. Reduction of pollutants in storm water discharges from construction activity disturbing less than one acre must also be addressed if that construction activity is part of a larger common plan of development that would disturb one acre or more.

12.1. PURPOSE

It is the purpose of these Standards to enact a comprehensive and coordinated erosion and sediment control program for the conservation and protection of land, water, and other resources of the City of Sheridan and thereby

- Encourage the use of land in accordance with its capabilities and treat it according to its needs;

- Prevent degradation of lands, streams, reservoirs, and lakes;

- Protect and promote the health, safety, and general welfare of the people.

12.2. EMERGENCY LAND MANAGEMENT PRACTICES

No prior notification is required for emergency land management practices necessitated by and initiated during or immediately after fire, flood, windstorm, earthquake, structural failure or other catastrophic events. Within five days after commencement of such activity, the land occupier shall notify the City Engineer of the action, with an explanation of why emergency action was necessary. Reasonable care must be taken to minimize soil disturbance and erosion during the conduct of emergency land management practices.

12.3. COMPLAINTS

Land occupiers and State and County officials responsible for the maintenance of water quality, may file a complaint against any person alleging that accelerated erosion or sediment damage has occurred or is occurring.

The complaint shall:

- include the name and address of the complainant;
- be in writing, signed, notarized, and delivered to the City Public Works Department;
- include the date and location of the alleged violation; and
- describe the source, nature and extent of the accelerated erosion or sediment damage alleged to have occurred or which is occurring.

The complaint shall become public record on file at the City Public Works Department.

The City shall, at the earliest possible date, discuss alternative solutions with the contractor or owner of the development to achieve an acceptable solution.

12.4. LIABILITY

Neither the approval of a plan or any other action of the City of Sheridan under the provisions of these Standards, shall relieve any person from the responsibility for damage to any person or property otherwise imposed by law, nor impose any liability upon the City of Sheridan for damage to any person or property.

12.5. BEST MANAGEMENT PRACTICES

Refer to the "Construction Site Best Management Practices (BMPs) Manual" by the California Department of Transportation for guidance on the selection and implementation of Erosion and Sediment Control measures. This reference provides specific guidance on accepted BMPs to reduce erosion and sediment during construction activities and is available as a PDF document through the following link:

http://www.dot.ca.gov/hq/construc/stormwater/CSBMPM_303_Final.pdf

Construction details for select Construction Site BMPs are provided in Appendix B. Additional details are available through the following link:

http://www.dot.ca.gov/hq/construc/stormwater/details.htm

12.6. MINIMUM REQUIREMENTS DURING LAND DISTURBING ACTIVITY

Land-disturbing activities shall require as a minimum that:

- Stripping of vegetation, regrading and other development activities shall be conducted in such a manner so as to minimize erosion.
- Cut and fill operations must be kept to a minimum.

- ❖ Development plans must conform to topography and soil type so as to create the lowest practical erosion potential.

- ❖ Whenever feasible, natural vegetation shall be retained, protected, and supplemented.

- ❖ The disturbed area and the duration of exposure to erosive elements shall be kept to a practicable minimum.

- ❖ Disturbed soil shall be stabilized as quickly as practicable.

- ❖ Temporary vegetation or mulching shall be employed to protect exposed critical areas during development.

- ❖ Permanent vegetation and structural erosion control measures must be installed as soon as practicable.

- ❖ To the extent necessary, sediment in run-off water must be trapped by the use of sediment basins, sediment traps, or similar measures until the disturbed area is stabilized.

- ❖ Adequate provisions must be provided to minimize damage from surface water to the cut face of excavations or the sloping surfaces of fills.

- ❖ Cuts and fills may not endanger adjoining property.

- ❖ Fills may not encroach upon natural water courses or constructed channels in a manner so as to adversely affect the conveyance capacity of the channel or other property owners.

- ❖ Construction equipment must cross flowing streams by means of bridges or culverts except when such methods are not feasible and provided, in any case, that such crossings are kept to a minimum.

- ❖ The contractor must maintain a sweeper on site during earthwork and immediately remove soil that has been tracked onto paved areas as a result of construction.

- ❖ Visible or measurable erosion which leaves the construction site shall be prohibited. Visible or measurable erosion is defined as:

    - ➢ Deposits of mud, dirt, sediment or similar material exceeding ½ cubic foot in volume in any area of 100 square feet or less on public or private streets, adjacent property, or into the storm and surface water system, either by direct deposit, dropping, discharge, or as a result of the action of erosion; or

    - ➢ Evidence of concentrated flows of water over bare soils; turbid or sediment laden flows; or evidence of on-site erosion such as rivulets on bare soil slopes, where the flow of water is not filtered or captured on the site using the techniques in the approved erosion control plan; or

- Earth slides, mud flows, earth sloughing, or other earth movement which leaves the property.

- Measured turbidity greater than 5 NTUs above background turbidity.

❖ Under no condition shall sediment be discharged to surface waters or natural wetlands. Under no condition shall the sediment be washed into the storm sewers or drainageways.

12.7. MINIMUM REQUIREMENTS OF A TEMPORARY EROSION AND SEDIMENT CONTROL PLAN

Any person planning to engage in construction activities, falling within the requirements of these criteria, shall submit an erosion and sediment control plan to the City Public Works Department for approval prior to any disturbance of land within the Sheridan City Limits. The plan shall be submitted using the form provided at the back of this section and shall include the required attachments. This form shall be expanded as necessary to fully describe all elements of the plan.

The City Public Works Department will review all plans submitted and approve any such plans that meet these standards. When the plan submitted for approval is found to be inadequate, the City will notify the person in writing of any necessary modifications, terms, and conditions as will permit approval of the plan.

The erosion and sediment control plan shall contain, as a minimum, the following information:

❖ Name, address, and telephone number of the applicant.

❖ Location of the property development.

❖ Description of land disturbing activities.

❖ A site map indicating areas of total development and all areas of soil disturbance, areas of cut and fill, drainage patterns and approximate slopes anticipated after major grading activities, areas used for the storage of soils or wastes, location of all erosion and sediment control measures or structures and areas where vegetative practice are to be implemented, the location of impervious structures (including buildings, roads, parking lots, outdoor storage areas, and etc.) after construction is completed, springs, wetlands and other surface waters, and the boundary of 100 year flood plains, if determined.

❖ The nature of fill material to be used, the existing soils located at the site, and the characteristics of such soils. Soil surveys are good sources of soil characteristics. Use site-specific soils information for the project site when available, or the Natural Resources Conservation Service (NRCS) Soil Survey of Sheridan County to identify the soils. If possible, include information on the soil series and/or mapping units found at the site.

- ❖ Estimates of the total area of the site, and all other sites if the project is a phased development, which is expected to undergo clearing, excavation, and/or grading.

- ❖ The nature of the construction activity, including a proposed time table for major activities.

- ❖ The names of the receiving water(s) and the size, type and location of each outfall and the location of any connections to public storm sewers.

The temporary erosion and sediment control plan should contain a description of best management practices (BMPs) appropriate for the site which shall be implemented to control erosion and sediment. The following minimum components shall be addressed:

- ❖ A description, including a schedule of implementation, of Temporary Soil Stabilization practices designed to preserve existing vegetation where practicable and revegetate open areas as soon as possible after grading or construction. The applicant shall consider SS-1 through SS-12 from the "Construction Site Best Management Practices (BMPs) Manual" in selecting BMPs appropriate for the site. Construction details for select temporary soil stabilization measures are provided in Appendix B.

- ❖ A description, including a schedule of implementation of Temporary Sediment Control practices which indicates how the permittee will control sediment from the construction site. The applicant shall consider SC-1 through SC-10 from the "Construction Site Best Management Practices (BMPs) Manual" in selecting BMPs appropriate for the site. Construction details for select temporary sediment control measures are provided in Appendix B. Temporary control measures shall not be removed until permanent vegetation and site stabilization has taken place.

- ❖ Graveled access entrance and exit drives and parking areas to reduce the tracking of sediment onto public or private roads may be required during wet working conditions. All unpaved roads on the site carrying more than 25 vehicle trips per day should be graveled. The applicant shall consider TC-1 through TC-3 from the "Construction Site Best Management Practices (BMPs) Manual" in selecting BMPs appropriate for the site. When trucking saturated soils from the site, loads shall be required to drain until drippage has been reduced to less than one gallon per hour before leaving the site.

Measures for controlling potential pollutants at their source shall also be addressed. The applicant shall consider NS-1 through NS-15 and WM-1 through WM-10 from the "Construction Site Best Management Practices (BMPs) Manual" in selecting BMPs appropriate for the site and the potential pollutants involved.

12.8. APPROVAL TO BEGIN WORK

The following minimum requirements must be completed prior to beginning construction:

- A copy of the approved erosion and sediment control plan must be on-site during construction. The applicant is responsible for obtaining any other required or related permits prior to beginning construction.

- The area to be cleared and graded must be approved by the City Public Works Department prior to beginning any work on the site. Clearing shall be limited to the areas within the approved disturbance limits.

- All BMPs indicated in the approved erosion and sediment control plan shall be installed as shown and in accordance with the schedule for implementation or per the direction of the City Public Works Department.

- A public information sign listing 24-hour emergency phone numbers for the City and the contractor must be posted at the project site, in full view of the public and the contractors, and it must remain posted until final sign-off by the City.

ESCP #_____

Date Received by City of Sheridan Public Works Department _____

EROSION AND SEDIMENT CONTROL PLAN

PLEASE PRINT OR TYPE

PROJECT DESCRIPTION

Owner Name:	Phone Number:
Property Location:	Address:
Legal Description:	
Purpose and types of Soil Disturbing Activities (be specific):	
Approximate acres to be disturbed:	
Sequence of Major Activities:	
1.	6.
2.	7.
3.	8.
4.	9.
5.	10.
Name of Receiving Waters: (lakes, creeks, rivers, or wetlands the site will drain into)	

Attach soils information which provides existing soils types, textures, and erodibility.
Attach site map illustrating development activities and measures to control erosion and sediment.

EROSION AND SEDIMENT CONTROLS

Provide detailed explanation of any temporary soil stabilization measures planned such as seeding, mulching, geotextiles, dikes, swales, etc…:
Provide detailed explanation of any temporary sediment control, wind erosion control and tracking control measures planned such as dikes, sediment basins, silt fences, graveled entrances/exits, etc…:
Provide detailed explanation of other Best Management Practices planned to control other potential pollutants at the source such as spill prevention and control, concrete waste management, etc…:
Duration of Activity

_____ _____

Applicant Signature **Date**

13. BIBLIOGRAPHY

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APPENDIX A
STANDARD STORM DRAINAGE DETAILS

APPENDIX B
EROSION AND SEDIMENT CONTROL BMPS