SECTION 4.0
STORM SEWER DRAINAGE SYSTEM

4.1 General

4.1.1 The requirements for storm drainage systems shall be dependent upon the type of development, the drainage area and the length of surface drainage runs.

4.1.2 The concept of stormwater management with a major and a minor system of storm drainage shall be used. The major system will accommodate a 1:100 year storm condition utilizing overland flow and/or storm water ponds. The minor storm sewer will accommodate a 1:5 year storm condition utilizing a piped system.

4.1.3 The storm sewer design is to be in accordance to the "Alberta Environmental Protection Stormwater Management Guidelines".

4.2 Design Criteria

4.2.1 Storm sewer mains, culverts and ditches for areas less than 65 hectares may be designed in accordance with the Rational Method of Storm Sewer Design and according to the formula of:

SI Units	Imperial
$Q = \frac{CiA}{360}$	Q= CiA
Q = discharge in m^3/sec	Q = discharge cfs
i = rainfall intensity in mm/hr.	i = rainfall intensity in inches/hr.
A = area in hectares	A = area in acres
C = run-off coefficient	C = run-off coefficient

A typical "Storm Sewer Design Sheet" is attached in Appendix B for these calculations.

4.2.2 The following table may be used to calculate rainfall intensity unless more up to date information is available. Environment Canada short duration intensity - duration frequency data, based on recording rain gauge data for the period 1970 - 1986 Edson airport. (Refer also to the Rainfall intensity Curves in Appendix B).

INTENSITY IN MM/HR.

RETURN PERIODS	2 YEAR	5 YEAR	10 YEAR	25 YEAR	50 YEAR EST.	100 YEAR EST.
MINUTES						
5	96	120	140	185	200	220
10	63	80	95	115	130	140
15	44	64	73	84	93	102
20	37	49	58	67	73	80
30	28	36	42	50	56	61

4.2.3 The run-off coefficients shall be calculated for each particular development with the design value to be the greater of the calculated values and the minimum values as indicated below:

		Minimum Run-off Factor
.1	Agricultural	* 0.10
.2	Parks	* 0.15
.3	Residential	* 0.40
.4	Industrial	* 0.60
.5	Commercial	* 0.70

4.2.4 A maximum inlet time of 15 minutes shall be used for residential and 10 minutes for commercial industrial.

4.2.5 Alternative computer design methods for storm sewer mains, culverts and ditches may be submitted and will be subject to the approval of the Town.

4.3 Drainage Ditches

4.3.1 Drainage ditches and culverts may be utilized to convey storm water under special controlled conditions, through or past the subdivision.

4.3.2 Ditches shall be designed to store excess run-off from a 1 in 25 year storm return period.

4.3.3 The minimum drainage ditch cross section shall be as follows:

- maximum 3:1 side slopes
- design must accommodate pipe sizing along ditch bottom

4.4 Piped Systems

4.4.1 Where a piped system is required by the Town, then the following criteria will apply.

4.4.2 Storm Sewer Mains and Leads:

.1 Pipe for storm sewer mains will be concrete pipe (sulphate resistant cement) conforming to ASTM C-14-nonreinforced concrete pipe; or ASTM C76-reinforced pipe, latest revisions thereof. HDPE pipe conforming to ASTM D3350 or latest revision will also be permitted upon the approval of the Town.

.2 PVC pipe, ASTM D3034 or F679, DR 35 will be allowed for mains and leads up to 675 mm diameter.

.3 Minimum 250 mm (10 inch) diameter for catch basin leads and 300 mm (12 inch) diameter for mains.

.4 Minimum cover to top of pipe shall be 1.5 m (5 feet).

.5 Mains shall be generally located 3.0 m off the centerline of the streets as indicated on the drawings. Where design dictates for drainage, the mains shall be placed in the center of lanes or utility lots.

4.4.3 Manholes - Refer to Section 3.3 as for Sanitary Sewers.

4.4.4 Catch Basins:

.1 Catch basins shall be provided to intercept surface run-off and minimize surface run-off along the street. The first intercepting catch basin maximum distance is to be 240 m (800 feet) with additional catch basins every 122 m (400 feet) thereafter.

.2 Catch basin grates and leads shall be sized to accommodate design flow.

.3 All catch basin leads shall discharge directly into storm sewer manholes.

.4 Catch basin barrels to be a minimum 525 mm (21 inch) diameter and of the proper diameter required to accommodate the specified frame and grate. There is to be a suitable precast top and frame to match the road and sidewalk/curb conditions. Precast barrels and bases are acceptable providing they are suitable for the conditions encountered.

.5 Catch basin leads shall have a minimum slope of 1%.

.6 Catch basins shall be located upstream of any pedestrian crossing areas and be a minimum of 1.5 m clear of driveways.

.7 Catch basin frame and covers shall be as specified on the drawings for proper curb type and inlet capacity.

4.5 Culverts

4.5.1 Type of culvert pipe material is subject to the approval of the Town.
All pipe and fittings to be galvanized, couplers to ensure water tight joints.

4.5.2 Minimum diameter of pipe shall be 300 mm.

4.5.3 The pipe shall be bedded with a minimum of 150 mm of approved granular material, with a minimum of 150 mm of cover over the top of pipe and rip-rap placed on the ends where required for erosion protection. Concrete or steel pipe sleeves shall be placed over the ends for protection (if required by the Town).

4.6 Curved Sewers

4.6.1 Curved sewers will be permitted with the following restrictions:

.1 The sewers shall be laid as a smooth curve with a radius equal to or greater than 60 m and shall not exceed the manufacturer's recommendations.

.2 Manholes shall be located at the beginning and end of the curve.

.3 Manholes shall be located at intervals not greater than 120 m along the curve.

.4 The curve shall run parallel to the curb or street center line.

.5 The minimum grade for sewers on a curve shall be 50% greater than the minimum grade required for straight runs for sewers.

.6 Length of pipe shall be such that deflections at each joint shall be less than the allowable maximum recommended by the manufacturer.

.7 In general curved sewers will be used only where savings in costs or the difficulty of avoiding other utilities necessitates same.

4.7 Materials

4.7.1 All materials shall be of the manufacturers stated in the "Approved List" in Appendix A, unless otherwise approved in writing by the Town.

4.8 Storm Outfalls

4.8.1 Outfalls shall be designed, constructed properly and located so as to not impact downstream areas, natural channels and watercourses in regards to erosion and flooding problems.

4.8.2 The proposed rate of discharge and location shall meet the approval of Alberta Environment.

4.8.3 Open bodies receiving drainage flows must be reviewed and accounted for regarding impact of high water levels and possible backflow prevention measures.

4.8.4 Exposed plastic pipe will not be permitted on inlets or outfalls.

4.9 Concrete for Manholes, Outfalls & Appurtenances

4.9.1 Refer to Section 3.5 as for Sanitary Sewers.