

Stormwater Management at Rural Stream Crossings

Introduction

There are more than 12,000 stream crossing structures on public roads in Alberta. Most of these structures are in rural areas, where the majority of the road drainage system consists of an open ditch network. These crossings are the points where the road drainage network connects to the natural drainage system.

Potential impacts of road operations on the natural drainage system include an increase in flow rates, a decrease in water quality, and risk of contaminated spills. Stormwater management guidelines have been published by Alberta Environment (AENV) to address these potential impacts. This best practice guideline documents the current Alberta Transportation (AT) practice for stormwater management at rural stream crossings.

Background

Rural drainage systems differ significantly from urban stormwater management systems. Some of the major differences are:

- Stormwater detention pond and outfall use are, in most cases, unwarranted at rural crossings.
- Rural drainage basins have a relatively small percent impervious drainage area due to the lack of development resulting in little impact to natural peak flow rates. Rural streams often have natural capacity to absorb additional stormwater with negligible impact to the channel.
- Rural drainage systems have minimal impact to natural drainage patterns with outfalls at most crossings.
- Rural drainage systems typically consist of open ditches (i.e. vegetated swales) that have sufficient volume to attenuate the peak flows that originate from road surfaces.
- Rural crossings are less likely to be located in close proximity to major water intakes or on streams with regulated release rates thereby greatly negating the need to provide stormwater detention facilities.
- Due to valley topography associated with many stream crossings there is often no room for stormwater detention ponds at base of valley. Additionally, any drainage infrastructure (e.g. outfalls/stormponds) placed within the stream may require extensive protection works.
- The wide geographic distribution of the road network limits the ability to efficiently operate stormwater control structures during a runoff event.

Provincial Regulatory Requirements

The AENV document “*Stormwater Management Guidelines for the Province of Alberta*” (1999) provides guidance on issues covering water quantity, water quality, and the impact of contaminated spills. Some of the water quantity objectives listed include reproducing pre-development hydrologic conditions, minimizing changes to existing topography, and preserving and utilizing the natural drainage system (section 2.5.2). It is, however, recognized that “*the imposition of rigid flow regulation policies for rural drainage based on pre-development/post-development concepts should be avoided*”, and “*In cases where high-capacity channels exist, flow regulation may be unnecessary for summer storms*” (section 2.2.3).

With respect to water quality objectives it is stated in section 6.4.3 that “In rural areas and in urban applications, grassed swales have been shown to effectively infiltrate runoff and remove pollutants”. Detailed water quality analysis at several recent road projects in semi-urban areas has shown that an open ditch drainage system is capable of exceeding the most recent sediment removal targets. Spill containment is referred to in section 6.5.8 as, “... areas of high impervious cover where there is a potential for hydrocarbon spills and polluted sediment discharges”, with examples being parking lots, industrial sites, and residential developments.

Alberta Transportation’s rural stormwater practices meet the AENV guidelines for water quantity and quality. In addition, it is extremely rare that when accidents do occur on roads and bridges that spilled goods enter receiving waterbodies. Therefore the usage of stormwater ponds is not to be considered as an effective spill containment mitigation measure. The “end of pipe” best management practices listed in section 6.5 (ponds, separators etc.) are not necessary and not compatible with the physical constraints at natural watercourse crossings.

Guidance for Stormwater Management in Rural Areas

The current AT practice for stormwater management at rural crossings includes:

- Use of open channel ditches for the drainage system
- Provision of cross-drainage and ditch drainage outfalls at all natural watercourses
- Application of erosion and sedimentation control measures, where necessary (“Design Guidelines for Erosion and Sediment Control for Highways”, 2003).
- Bridge deck drainage utilizing deck drains and longitudinal grades to avoid lane encroachment during a design storm intensity (BPG No. 11, “Bridge Deck Drainage”)
- Use of natural outfalls with ditch drainage typically directed into low lying areas adjacent to the channel

Note that AT Design Bulletin No. 16 (“Drainage Guidelines for Highways Under Provincial Jurisdiction in Urban Areas”) does not apply to rural stream crossings.

Recommendation

The current AT practice for design of stormwater management at rural stream crossings meets the applicable regulatory requirements and is compatible with the physical constraints at most natural crossings. It is recommended that this practice be formally adopted with this best practice guideline.

Contact

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