Cooks-Devils Creek Watershed characterization report

Surface water management in the Cooks-Devils Creek Watershed tends to consist largely of natural waterways, retention, and agricultural drainage in the area of land that contributes water to the Cooks Creek and Devils Creek and their tributaries. This watershed is comprised of two major drainage systems, Cooks Creek and Devils Creek and their contributing tributaries.

The overall landscape in this watershed is a combination of high, low and flat lands and contains a number of lakes and marshes. The major surface water issues in this watershed are flooding, drainage, bank sliding, and retention. Ice jamming in some waterways aggravates the flooding of farmlands. Erosion and riverbank stabilization are a significant concern in this watershed. Lakes in Watershed 13 and Netley River Marsh are the major natural wetlands in this watershed and considered to be natural water retention areas. Due to the highland and lowland topography, flooding and drainage are significant concerns in this watershed. Consequently, surface water management has become a great challenge in this watershed.

As agricultural drainage is a significant surface water management feature in portions of the watershed, this will be described in detail prior to a historical review of the surface water management in the watershed.

AGRICULTURAL DRAINAGE: GENERAL DESCRIPTION

<u>Need for Drainage:</u>

Agricultural cereal and specialty crops such as wheat, canola, peas and sunflowers can be successfully grown only in the parts of Manitoba where the climate and soil conditions are favourable, and where there is adequate drainage to remove the excess rainwater from periodic heavy summer rainstorms. If excess summer rainwater pools on the cropland for too long, the agricultural plants are deprived of oxygen and are damaged or destroyed. The climate is favourable and the soils are of sufficient fertility in large portions of southern Manitoba, in what is generally called “agro-Manitoba”. These portions include much of western and southern Manitoba, and the southern two-thirds of the Interlake region. However, only a part of agro-Manitoba has natural features which result in the removal of summer rainwaters in a timely manner. In much of agro-Manitoba, the natural draining away of excess summer rainwater is slow or virtually non-existent. In many of these areas, the soils are relatively dense, so there is limited percolation of excess rainwater downward into the soil column. As well, the topography might be quite flat, or might have geological features like a ridge and swale, so the only significant natural drainage that occurs is on the relatively small areas along ridges, or near the natural streams. For these reasons, thousands of miles of artificial drains have been constructed in these areas over the last 150 years, in order to augment the limited natural drainage that occurs. Of the 4.7 million hectares of cropland in Manitoba, 1 million hectares cannot sustain crop production without artificial drainage, and an additional 1.2 million hectares of crop land benefits to varying degrees from that artificial drainage. This artificial drainage, by reducing damages to croplands, has the added benefit of reducing the payments made by Federal-Provincial crop insurance programs.

The artificial drains also have a number of secondary benefits. In the spring time, the drains help drain away snowmelt runoff, thereby reducing the risk of flooding to some rural residences and communities. As well, the length of time that the snowmelt runoff ponds against the embankments of municipal or provincial roads is greatly reduced, thereby minimizing the damage to these embankments. These same secondary benefits occur following unusually heavy summer rainstorms, where the drains are overwhelmed and significant flooding and ponding occurs on the landscape.

Waterways in Manitoba are classified from 1st order to 7th order, with the 1st order being the smallest and the 7th order being the largest. Municipalities, towns and villages typically maintain all 1st, 2nd, and some 3rd order artificial drains, whereas the Province of Manitoba typically manages and maintains most of the 3rd and higher order artificial drains.

Drainage Standard:

When Provincial waterway drains are enlarged, the principal issue to resolve is the size that the drain should be enlarged to; the methodology or formula used for determining that size is commonly called the design standard. This same issue arises in some rehabilitation (also called reconstruction) projects, when the land use in the area serviced by the drain has changed since the drain was originally constructed, or since the last time the drain was rehabilitated. In such situations, the guiding principle is to have an economically sound balance between the cost of the enlargement and the benefits of that enlargement; here, the benefits are the reduction in the damages to the adjacent crops. These damages occur due to excess summer rainwater ponding on the cropland, and the damages are reduced when excess summer rainwater is removed more quickly by larger drains which have increased water-carrying capacities. However, even in areas with larger drains, damage to the agricultural cropland from summer flooding still occurs periodically. In a wet cycle, that damage will occur more often. In exceptionally wet, rainy years like 2009 and 2010, damage will be widespread and extensive; the drainage system is not designed to protect against such wet summers and to convey unusual flood events.

A number of factors come into play in the determination of the cost-benefit balance. One factor is related to crop type. The benefits are larger for higher-value crops like peas, sunflowers and sugar beets, as compared to lower value crops like hay and forage. As well, many special, high-value crops are more quickly damaged by excess rainwater ponding on the cropland; so, to be viable, they must be drained by a drainage network with a higher water-carrying capacity. Cereal crops are less quickly damaged, and forage crops even less quickly. Another factor is related to soil type. Excess summer rainwater percolates downward quite slowly where there are dense soils. Therefore, areas with dense clay soils require larger drains, because so little of the rainwater percolates downwards. A third factor is related to topography. Areas that are especially flat require larger drains because the velocity of the water within the drains in flat areas is quite low. In steeper areas, the velocity is higher, and so smaller drains can convey the same amount of water.

Responsibility for Drainage**:**

Responsibility for agricultural drains is split among farmers, municipal governments, four conservation districts (i.e. Whitemud, Turtle River, Alonsa, and Cooks Creek), and the Provincial Government. In all cases, responsibility for the drains includes responsibility for the bridge or culvert road crossings on the drains. The exception to this is crossings for Provincial Roads (PRs) and Provincial Trunk Highways (PTHs), which are the responsibility of Manitoba Infrastructure and Transportation (MIT). Agricultural producers are responsible for maintenance and new construction of drains located on their land; this includes funding of those works. The four conservation districts have authority over and are responsible for maintenance and new construction of off-farm drains located within their districts. Outside of these four conservation districts, municipalities have authority over the off-farm drains which feed into the larger collector drains; these municipal drains are the 1st and 2nd order drains, and some 3rd order drains. Outside of the four conservation districts, the provincial government is responsible for the network of larger drains that serve as collectors for the local governments' drains. The largest of the Provincial drains typically exit into rivers or lakes. The drains under provincial jurisdiction are formally designated as "provincial waterways". Most natural streams like the Red River and the Assiniboine River are not provincial waterways, and are also not the responsibility of the local governments. Regarding the larger drains within the four conservation districts, these drains had been provincial waterways until the late 1980s and early 1990s, when the authority for these drains was transferred to the four conservation districts. Currently, the province is in the process of evaluating whether the jurisdiction and responsibility for these drains should go back to the province.

Drainage Licensing**:**

All work on the upgrading or constructing of drains by agricultural producers and municipal governments is subject to the provisions of *The Water Rights Act*. All works under provincial jurisdiction are exempt from this Act, including all provincial waterways and all road-side ditches constructed by MIT. However, they are constructed and maintained under the intent of the Act. This Act is intended to minimize or eliminate any negative impact of drainage works on downstream landowners or jurisdictions, and any negative environmental impact.

Maintenance and Reconstruction:

In all of Manitoba, there are approximately 4,350 km (2,700 miles) of provincial waterway drains, and 650 bridge crossings and 1,500 large culvert crossings related to these drains. This infrastructure has a replacement value of well over $1 billion.

Like all physical structures, the drains and crossings that make up the provincial waterways network require periodic maintenance. Maintenance activities include things like mowing the vegetated side slopes and banks, mowing or removing larger vegetative growth in the drain bottom, removing debris and areas of silt in the drain bottom, re-shaping short reaches of slumping and sliding side slopes and banks, repairing eroded road grades at culvert crossings, repairing damaged culverts, and repairing or replacing damaged planks or other elements of bridge crossings.

Sometimes drains deteriorate to such a point that normal maintenance activities are not sufficient to restore their water-carrying capacity and proper functioning. This can happen because of the effects of things like unusually destructive summer or spring flood events. When such deterioration occurs, the drains must be reconstructed to restore their water-carrying capacity. Reconstruction activities include works such as the removal of channel-bottom silt; the removal of the soil from caved-in and sliding bank slopes, then the re-shaping of the drains side slopes; and the replacement of bridges or culverts that have badly deteriorated and cannot be repaired, or that do not meet modern load ratings or width and dimension requirements of the modern, larger and heavier farm equipment. As with maintenance works, reconstruction works on culvert and bridge crossings can be needed to address public health and safety concerns, and so may need to be undertaken irrespective of the condition of the agricultural drains that they cross.

Environmental Criteria in Drain Reconstruction:

In the reconstruction of provincial waterways, a number of environmental criteria are considered. Drain flow velocities are kept low enough to prevent erosion from occurring in the drainage channel (drop structures may be needed to effect this, and rock rip rap may be placed where velocities might still be erosive). Drain side slopes are made 1 vertical to 3 horizontal, or flatter, to reduce the chance of slumping of the drain channels sides.

Features required by the Department of Fisheries and Oceans are incorporated into the drain upgrade (e.g., larger culvert crossings, rock rip rap placed within the channel). Drains are upgraded from downstream to upstream, to ensure that downstream reaches can accommodate any increased flows due to upstream improvements.

WATERSHED CHARACTERISTICS

The Cooks-Devils Creek planning areas consist of three sub-watersheds (WS) and their designated numbers are 11, 12 and 13. The entire watershed area is shown in Figure 1. The notable water bodies and infrastructures in the sub-watersheds are listed in Table 1.

Table 1: Water bodies and Infrastructures in the Cooks-Devils Creek Watershed

Sub-watershed	Waterway (River/Creek/Drain)	Municipalities concerned/Important places (Infrastructures/Projects/Retentions/Forests)
WS 11	Dubas Creek (III), Cooks Creek (V), Satans Creek (III), Melrose Drain (III), Hezelridge Drain (III), Swede Drain (III), Cooks Creek Diversion, Edie Creek (III), Sapton Drain	Municipalities: St. Clements, Springfield, Tache, Ste. Anne Birds Hill Provincial Park
WS 12	Shkolny Creek, Carrs Creek, Gunns Creek, Bottomly Creek, Bunns Creek, Outside Drain, Springfield Road Drain, Cooks Creek Diversion	Municipalities: Springfield, St. Clements, St. Andrews. East St. Paul Red River Floodway, Birds Hill Provincial Park
WS 13	Indian Reserve Drain (III), Libau Drain, Devils Creek (V), Township Line Drain (III), Pelletier Drain (III), Van Schepdael Drain (III), Semple Drain (III), Thorarinson Drain (III), Selkirk Line Drain (III)	Municipalities: St. Clements, Brokenhead, Springfield, Libau Community Pasture

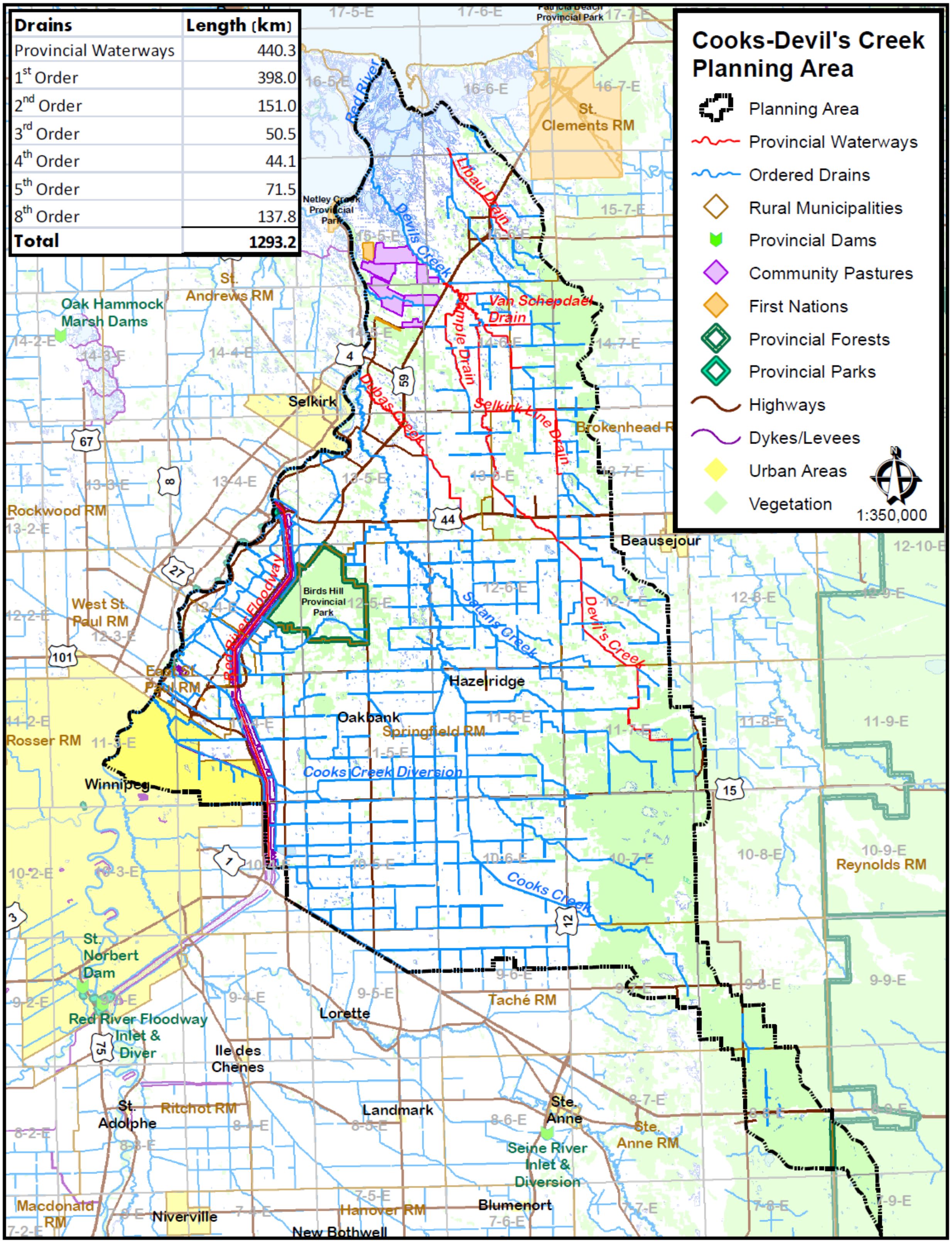

Figure 1: Watershed map

The Cooks-Devils Creek basin is nearly 1827 km^2 in size. The Cooks Creek basin has a gross drainage area of approximately 750 km^2. Cooks Creek flows in a north-westerly direction, from west of Ross, to where it joins the Red River north of Selkirk. The Devils Creek basin has a gross drainage area of approximately 557 km^2. Devils Creek flows in a north-westerly direction through the Netley-Libau Marsh where it enters the Red River at Netley Lake. The Bunns Creek basin has a gross drainage area of approximately 520 km^2 and drains in a westerly direction towards the Red River Floodway and the Red River, which flows north-easterly towards the Netley-Libau Marsh and Lake Winnipeg.

The Cooks-Devils Creek basin is generally sloped toward the north-west and flows into Lake Winnipeg Pruden Bay near the Netley Marsh via the Red River. The upper reaches of the watershed are more steeply sloped with flatter slopes in the middle and lower reaches. The middle and lower reaches of Cooks Creek have a gentle slope of 0.02 % to 0.075 % and the upper reaches are steeper with 0.1 % to 0.3 % slope. The overall gradient of Devils Creek is 0.03 % to 0.05 % slope. The Cooks-Devils Creeks watershed contains nearly 900 km of drains classified as second order and above. The watershed contains extensive areas of poorly drained land and swamps predominantly in the upper reaches of the Devils Creek watershed. The steep slopes in the upper reaches of Cooks Creek often results in high runoff peaks in the vicinity of the Cooks Creek and Swede Drain confluence causing flooding.

The Cooks-Devils Creek watershed is located in predominantly agricultural area just east of the Red River. The topography of the watershed is slightly undulating. A few low hills exist in the area adjacent to the Birds Hill Provincial Park. Drop in elevation between the headwaters area and the mouth of the Cooks Creek is about 80 m.

The basin is underlain by carbonate bedrock (limestone and dolostone). In the area north and northeast of the Birds Hill Provincial Park, buried sinkholes penetrating the carbonate rock are common. The lower part of the sinkholes are usually filled with clayey shale, sandstone, boulders, sand and silt deposited before the Ice Age and the upper part are filled with deposits of glacial origin. The carbonate rock usually contains highly permeable zones; the sandstone beds are also permeable. The materials filling the sinkholes usually are of low permeability. Till is the dominant material of surficial deposits along the eastern boundary and in the northern part. In extensive areas, the till is overlain by clay. In a few areas the surface deposits consist of silt. Fairly extensive surface sand deposits are common in the area along the eastern boundary and in the area adjacent to the Birds Hill Provincial Park. Sand and gravel deposits are found in the vicinity of East Selkirk. Swamp deposits overlie the till and other surficial deposits in the headwater areas.

There are many streams draining into the Cooks and Devils Creeks. The main tributaries of Cooks Creek are Satans Creek, Swede Drain, Hazelridge Drain and Edie Creek. The main tributaries of Devils Creek are Libau Drain, Van Schepdael Drain, Semple Drain, Selkirk Line Drain, Dubas Creek. Bunns Creek, Gunns Creek, Bottomly Creek, Carrs Creek are the tributaries to the Red River which receives flow from the Cooks Creek watershed. These streams account for approximately 90% of the total drainage area. There are about 440 km of provincial waterway drains, as well as approximately 850 km of municipal drains in this watershed.

There are numerous lakes that exist in this watershed. Significant lakes in this watershed are listed in the Table 2:

Sub-watershed Number	Lakes
11	None
12	None
13	Folster Lake, Parisian Lake, Hardman Lakes, Passwa Lake, McKay Lake, Hughes Lake, Ramsey Lake, Poplar Point Lake, Lower Devil Lake, Upper Devil Lake, Starr Lake, Boyd Lake, Oak Point Lake, Harper Lake, Netley Lake, Morrison Lake, Goldeye Lake, Cooks Lake

The soils are predominantly clay (Red River Clay and Osborne Clay) in the lacustrine plain having poor internal drainage characteristics. The terrain in the eastern headwaters area is covered with highland swamps and bogs. The Birds Hill Provincial Park is located north-west of the watershed. Water flows westward into the Cooks Creek system from the divide via Satans Creek, Hazelridge Drain and Edie Creek.

Land use in the watershed is dominated by agriculture, mainly forage and grain crops. The notable water control infrastructures in this watershed are provincial waterways, dams and reservoirs, diversions, bridges, culverts, drop structures, low level crossings, gradient control structures, etc.

MAJOR SURFACE WATER ISSUES IN THE WATERSHED

The major issues/matters related to surface water in this watershed are flooding, drainage, erosion, and water retention, which are discussed as follows.

Flooding

Flooding in southern Manitoba typically occurs from spring snowmelt runoff, which is aggravated in some locations by ice jams and coincidental heavy rainstorms. Most recently, many areas of southern Manitoba experienced flooding due to high river flows, major ice jams and ice-blocked drainage systems in the spring. In addition to spring flooding, localized flooding can also occur during the summertime due to unusually heavy summer rainstorms. In the last 15 years, various parts of southern Manitoba experienced unusually heavy rainfall, which resulted in summer flooding. As well, flooding does occur along some of Manitoba lakes when inflows are high and lake levels go up. For larer lakes, such as Lake Winnipeg and Lake Manitoba, sustained strong winds result in significant wave setup and wave up-rush. Beaver dams, trees, brush and debris aggravate the flooding problems in the waterways. Flooding occurred in many areas due to under capacity drains/waterways and also due to under capacity culverts or crossing structures. Spring flooding along Cooks Creek, in the vicinity of PTH 59 along the Red River Floodway, along Devils Creek, Hazelridge Drain, and along the other waterways has been noticed in the past.

The following paragraphs describe some localized flooding issues and the mitigation measures undertaken or considered.

Flooding occurred along Cooks Creek in the upper reaches. The Greater Winnipeg Water District (GWWD) aqueduct siphon was established in section 20-10-6E to convey Cooks Creek runoff.

In the past, a flood gate was constructed in section 13 or 24-11-5E on Swede Drain to control high stage flows in the vicinity of Cooks Creek.

Spring flooding and drainage problems along Devils Creek in sections 4, 9 & 16-14-6E were noticed. Culvert enlargement through Devils Creek east Dyke was requested in 1981 and was done later. Also reconstruction of Devils Creek in sections 21 & 28-14-6E and 4, 9, & 16-14-6E were considered. Devils Creek outlet improvements options were reviewed. Devils Creek outlet improvement works were done later. Currently there are no existing flooding issues in these sections.

Flooding problems at 11-14-6E due to outflow from the Thorarinson Drain were noticed in the past. The following three options were proposed by the province to address the flooding problems.
Option 1: Diversion through section 14-14-6E exiting through section 11.
Option 2: Relocation to the north side of the east-west road of section 11-14-6E.
Option: 3 Construction of a ring dyke. Among these three options, only option 3 was implemented to address the flooding problems.

In 1966, spring flooding was an issue along the Van Schepdael Drain, and raising a dyke on section W 23-14-6E was proposed to combat spring flooding conditions.

In 1974, spring flooding was an issue in N 11-14-6E along Thorarinson Drain. In 1980, to improve flooding and drainage problems in the Thorarinson and Van Schepdael Drains, three alternatives such as, to 1) replace the bridge with a culvert at NW 11-14-6E, 2) build culverts along W 11-14-6E, 3) build an embankment along Van Schepdael Drain were proposed. Alternatives 1 and 2 along with ring dikes were implemented later. In 1981, two options, 1) access crossings along west side of 11-14-6E through the south diversion at N 3 & 4-14-6E, and 2) the partial diversion of flow from Thorarinson Drain from NW 11-14-6E to run N of 9 & 10-14-6E to the Devils Creek channel was proposed. No diversions have been constructed. In 1981, concern about potential flooding that could occur due to the inadequacy of the multi-plate arches that replaced the two bridges at 11-14-6E on the Thorarinson Drain was raised.

In 1991, culvert problems were identified along the Libau Drain that caused flooding next to Libau Drain. No mitigation measures were implemented.

In 1979, flooding was observed along Gunns Creek and Christies Creek. In 1980s, flooding was an issue in Gunns Creek drain at St. Andrews Parish. A survey was done to assess the drain in terms of the services that it now provides for agricultural protection, as two thirds of the drainage area was removed by the intervention of the Red River Floodway.

<u>Drainage</u>

To improve drainage of lands in this watershed a number of diversions and drains were constructed to drain the water out of the waterlogged areas. Maintenance work was done on the following drains: Cooks Creek, Devils Creek, Swede Drain, Van Schepdael Drain, Libau Drain, etc. Drainage issues in particular areas of concern are described in the following paragrpaghs.

Cooks Creek experienced problems due to poor drainage in the past. In 1977, the Cooks Creek drainage system study was undertaken. Under the Cooks Creek value-added drainage study, two options were investigated, (1) channel enlargement and improved outlets that includes Cooks Creek and the Swede Drain downstream of Edie Creek, and Cooks Creek upstream of Edie Creek, (2) Diversion to the Red River Floodway. The diversion option was found to be more suitable and effective and was constructed.

Drainage improvement was done in the vicinity of the Cooks Creek Diversion in section 4-11-5E in 1977. The Cooks Creek Diversion was constructed in 1984 to divert the flow from Cooks Creeks upper reaches into the Red River Floodway during periods of high water.

Poor drainage was an issue in the Village of Dugald area in the past. To improve the drainage condition, construction of a diversion around the south side of the village was considered but found impractical at the time. Reconstruction of PTH 15 and the outlet to the Bibeau drain to the Red River Floodway were alternative measures. At a later date, the diversion around the south side of the village was constructed.

Poor drainage was an issue in the 1970s along the Devils Creek, especially in section SE 29-12-7E. The municipality established a drain through 29-12-7E in 1976; however, it faced problems with the right of way. As a result, an alternate route was sought out, but no viable alternate route was found as many ridges would have had to be cut. In 1983, an agreement was reached as to the location of the drain along 29-12-7E. Considering the constraints, the municipality instead went along E 29-12-7E to alleviate flooding problems. A ridge was cut and the road was raised. There are currently no flooding issues.

In 1977, poor drainage was an issue at Devils Creek/Pelletier Drain, and the municipality was looking to improve the drain along N Side of section 32 & 33-14-6E. Nothing was done.

In 1981, the division of flows between the Pelletier Drain and the Van Schepdael Drain was a concern. A report indicated that if it was necessary to eliminate this division of flow and then the modified Van Schepdael Drain to carry the total discharge. However, these improvement works were not undertaken.

In 1977, poor drainage along the Van Schepdael Drain at N 23-14-6E was an issue. The municipality region intended to reconstruct this reach plus downstream reaches N of 22 & 21-14-6E (the confluence of Devils Creek and the Thorarinson Drain) to the outfall into the Thorarinson Drain. Erosion, slumping, and siltation were also noticed in the past. In 1983, a potential improvement to Devils Creek in 21-14-6E was proposed. These improvement works were not undertaken

In 1986, the Village of Libau experienced poor drainage problems that caused serious ponding and flooding in the vicinity. The municipality requested for a survey in the area to come up with a solution. The survey was not undertaken.

Erosion and Erosion Control Structure

Erosion due to overland flow or overflow occurred in the past at several spots in many of the waterways in this watershed. Existing and proposed structures are listed below.

In 1970, bank erosion along Cooks Creek at St. Peters Parish (at the confluence of Red River) was observed. In 1981, erosion at 2-13-5E along the meandering section of Cooks Creek was reported.

At the junction of the Cordite drain and Springfield Road Drain, erosion occurred in the past, and riprap was placed.

An erosion problem was noticed at east of 5-11-6E on Edie Creek during 1977/78.

Existing Structures

In 1999, riverbank armoring was done along the Red River on the east bank north of Lockport to protect from erosion due to floodway flow. Rock protection was done recently by the province on the east bank north of the Lockport Control Structure, with the upgrade of the structure and the modifications to the floodway.

As a measure of erosion control on a municipal drain from Henderson Highway to the Red River, rock riprap was proposed in 1986. The drain runs east to west between River Lots 112 and 113 west of PR 204. No riprap was dumped, but the drain improvement work was done in 2012.

In 1980, a rock drop structure was designed in section 11-12-4E along the Skolony Creek Drain. The drop structure was constructed later and recently upgraded.

Proposed structure

Erosion of a drain west of PR 204 (the drain between Lots 268 and 269) in the Gunns Creek area took place in 1979. A drop inlet pipe was recommended. The river banks in this area are still very unstable.

Erosion of the Red River opposite to Selkirk Park was noticed. The river is meandering in this stretch. The province investigated this in 1981 and recommended this area for armoring. It has not been done as of yet.

Erosion of archeological sites at Lockport on the east bank of the Red River north of the Lockport control structure was noticed, which are under federal jurisdiction. Rock protection was proposed in 1987 by the province but not installed.

In 1982, slope failure along the Red River bank at Ferry Road in St. Peters Parish was noticed. Again in 1989 and 1990, continued slope failure at Ferry Road was observed due to meandering section. Reshaping/armoring was suggested as a protective measure. In 2011, further failure occurred and Disaster Financial Assistance (DFA) approved $1.9 million to the municipal Shoreline Stabilization Project. Construction of a rockfill column was initiated in 2013 and is ongoing.

In 1977, erosion that occurred at the outlet of the Melrose Drain in section 36-12-5E caused slope failure. A rock gradient control structure with rip rapping at the outlet into Cooks Creek was proposed for construction during 1978 and 1979. A site inspection confirmed that the structure was constructed.

Ford Crossing/Spillway

A concrete ford crossing was constructed on Cooks Creek at section N 20-11-6E.

In 1960, rehabilitation of various ford crossings across Cooks Creek upstream from the north boundary of 29-11-6E was undertaken.

In 1961, requests for designs of ford crossings at three locations along Cooks Creek at sections 8-11-6E, 10-10-6E, 11-10-6E were made.

In Cooks Creek upstream of Edie Creek, one low level crossing was proposed for construction across the channel between Edie Creek to the GWWD aqueduct siphon, and three low level crossings were proposed at the downstream. Some might have been constructed in the past. Currently, none exist anymore.

Existing low level crossings in the Cooks Creek watershed are shown in Figure 2.

In 1988, a low level crossing on the Red River Floodway at Dunning Road was proposed, and the preliminary design was done. The low level crossing was constructed later.

In 1982, a spillway on the Devils Creek crossing at section NE 21-13-6E was proposed. No spillway was constructed.

In section 20-12-7E, one low level crossing on Devils Creek was constructed.

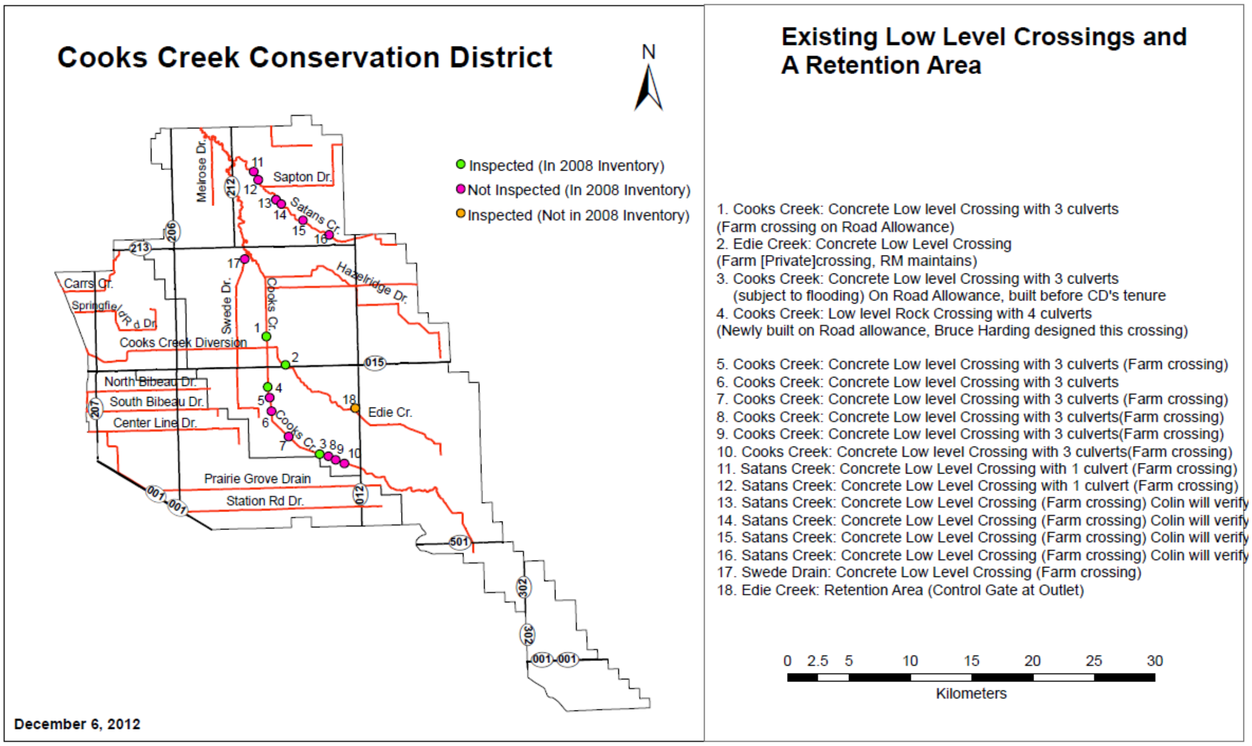

Figure 2: Existing Low Level Crossings in Cooks Creek Watershed

Diversion

Existing Diversions

The lower reaches of the Cooks Creek watershed experienced spring flooding in late 1970s. For flood mitigation and drainage improvements, a diversion was strongly proposed by the local residents in 1981 although it was an expensive option. In 1982, the Cooks Creek Diversion to the Red River Floodway in section 5-11-6E was chosen for design improvements, with a focus on splitting flow to achieve maximum flows for fish passage between Cooks Creek and the proposed diversion. The Cooks Creek Diversion was constructed in 1984 to divert the flow from Cooks Creeks upper reaches into the Red River Floodway during periods of high water. In 1988, the Cooks Creek Diversion project agreement was made.

In 1973, a diversion from Cooks Creek to the Cordite Drain (in sections 1, 2, 11, 12-11-5E) was proposed. This diversion was constructed. In 1976, some form of diversion from the Swede Drain at NE of 12-11-5E was proposed in the area approximately seven miles from the Red River Floodway to the Swede Drain and one mile north of PTH 15. This diversion was also constructed. Also, another eleven mile diversion channel at two miles south of PTH 15 connecting Edie Creek and Cooks Creek as well as the headwaters of the Swede Drain to the Red River Floodway were proposed by the municipality of Springfield to mitigate drainage problems. These diversions [South Bibeau and North Bibeau Drain] are almost done, including one drop structure.

Overflowing and flooding of land between sections 16 and 17-11-5E was experienced in the past. A diversion drain in section N17-11-5E (Springfield Rd Drain to Bunns Creek) and riprap at the entry point in Bunns Creek were proposed in 1978. The Springfield Road Drain Diversion was proposed for the east of 8 and 9-11-5E in 1989, and later the diversion was designed. A diversion of the Springfield Road Drain into the Cordite Drain outlet was proposed in 1968. All these works were anctruscted and later upgraded in 2010 by municipality of Springfield, City of Winnipeg and East St. Paul. All of the projects mentioned were completed and upgraded as of 2010.

Proposed diversion

In 1961, a diversion channel at the proposed bridge site in section 25-12-5E was proposed. Later in 1975, the Cooks Creek Diversion in sections 24-12-5E and 19-12-6E at the PR 212 location was proposed. Further in 1984, the Cooks Creek Diversion was proposed in section 18-12-6E. These were never undertaken.

Diversion of the Dubas Creek crossing PTH 59 in section 35-13-5E having length of 820 ft was proposed in 1977 by the province. This diversion was not constructed.

Retention

Existing Dam/Retention

In 1988, the Wasio dugout off the Dubas Drain in section 35-13-5E was constructed, and concrete pads on the Wasio dugout were added later.

In 1991, the design for a fixed crest sheet piling rock weir on Edie Creek at 19-10-7E was done. Later the weir was constructed. Engineering analysis is currently underway to determine whether it should remain in place or be removed.

In 2002, the engineering assessment study agreement for Salmon Lake was made. A water retention area was established. This retention area was constructed on the east side of Forestry Road at the headwater areas of Cooks Creek.

In 1997, the South Transcona storm water retention pond in section 33-10-4E was constructed by the City of Winnipeg to alleviate flooding in South Transcona west of the Red River Floodway. The other name of this retention area is Suzy Lake or the Beulers recreation area.

Three retention areas were constructed in 2013 in sections 14, 19 and 23-10-7E.

Proposed Dam/Retention

In 1953, a proposal was made to build stockwatering dams on Cooks Creek in the municipality of St. Clements. Later in 1973, a dam and a reservoir on Cooks Creek in St. Clements Parish were proposed. These have never been constructed.

For improved drainage in the Pine Ridge Golf Course, the construction of two ponds was proposed on the east side for storage. These ponds were not constructed.

In 12-12-7E and 18-12-7E, potential retention areas were proposed to hold water before flowing to Devils Creek.

Criteria to Prioritize Proposed Drainage Projects

In an attempt to make the prioritization of drain improvement and infrastructure work more explicit, transparent and open, each proposed project should be evaluated via a specific set of criteria. These criteria should be based on the needs of the residents serviced by the types of infrastructure work (rehabilitation, reconstruction, and enlargement), and the integrity of the ecosystem. Recognizing that different criteria should have more or less influence on the prioritization process, the criteria are given various point values. The higher the point value, the greater influence the specific criteria will have in determining the project priority. *These criteria are not intended to be used to prioritize routine maintenance. The intent of these criteria is for larger capital projects that are a part of a strategic multi-year plan.* The suggested prioritization criteria are as follows:

	Prioritization Criteria	Zero points for:	Maximum Points	
			Value	For:
1	Negatively impact anyone downstream, and impact is not ameliorated	If "yes", cannot proceed		
2	Significant water quality damage, which cannot be ameliorated	If "yes", cannot proceed		
3	Significant aquatic habitat damage, which cannot be ameliorated	If "yes", cannot proceed		
4	Ability to accomplish project	If "no", cannot proceed		
5	Cooperative partnership in place	No	30	Partnership
6	Identified within the SWMP	No	30	In SWMP
7	Does the drain meet the design standard for the land use, soil capability, soil type and topography in the drains catchment area?	At or above design standard	30	Much below design standard
8	Benefit/cost value (i.e., best value for money)	Small benefits &/or high costs	50	Large benefits &/or low costs
9	Extent and frequency of crop damages that have occurred on adjacent croplands	Limited, and infrequent	50	Extensive and frequent
10	Benefitting area	Very small	50	Large
11	Feedback received from local governments, affected farmers, and staff of MAFRI and Manitoba Crop Insurance about flooding problems and crop losses	Limited feedback	30	Extensive feedback and complaints
12	Water retention/holdback component	None.	30	Significant project.
13	Emergency response to natural events	No	50 or higher	Yes
14	Length of time issue has been present	Recent	10	Very old
15	Are residences, other buildings, or transportation systems flooded?	None	30	Significant no./amount
16	Part of system plan (i.e. upstream tributary drains to same standard?)	Tributaries are below standard	30	Tributaries are at design standard

17	Distance from outlet (that is, location within watershed)	Upstream end	30	Downstream end
18	Are works part of a multi-year project?	No	10	Yes
19	Useful life remaining for the culvert and bridge crossings (and other structures like weirs) on the drain	Over 10 years	10	Under 5 years
20	Project addresses environmental concerns/ issues/ problems?	No	20	Yes
21	Benefits aquatic habitat (e.g., removes barrier, or adds more productive habitat features)	No	50	Yes
22	Benefits water quality (e.g., reduces channel erosion, or traps sediments)	No	50	Yes
23	Potential for some groundwater impact?	Much impact	50	No impact

Definition of Prioritization Criteria

Distance from Outlet – The length of watercourse from the project site to the furthest downstream point within the watershed. This parameter is measured in kilometres.

Water Retention/Holdback Component – A project is ranked higher if it includes work to detain a volume of water that will be held back for a determined length of time and then released into the drain network.

Drain Standard –The appropriate design standard given the current land-use of the impacted area.

Negatively impact anyone downstream – Related to any potential damages that will occur as a result of the project. This criteria is one of the on/off 'switches', in which the project cannot proceed if the answer to the criteria is "yes" (that is, if there are downstream negative impacts that are not ameliorated).

Ability to Accomplish Project – An indication of the viability of the project in terms of taking it to completion. This criteria is one of the on/off 'switches', in which the project cannot proceed if the answer to the criteria is "no" (that is, if the project cannot be accomplished).

Cooperative Partnership in place – An assessment of whether an established and effective relationship exists between potential project partners. This parameter is measured as a yes or no.

Identified within the SWMP – An assessment of whether the project was originally identified as a key issue within the process of developing the integrated watershed management plan for the area through consultations with the public and municipalities. This parameter is measured as a yes or no.

Length of Time Issue has been Present – A measure of the number of months the problem has existed. This parameter is measured in months.

Benefit-cost value – A measure of the magnitude of the actual benefits of the project compared to the cost of the infrastructure works. For a typical agricultural drainage project, the benefit is a reduction in damages to the agricultural crops in the benefitting area, over the life of project. An accurate benefit-cost value is difficult to calculate because the agricultural benefits are difficult to estimate, as they are related to the extent and frequency of crop damages and the value of those crop damages. Where there are other benefits, like improvements to water quality or fish habitat, or a reduction in a negative impact on groundwater or a reduction in erosion, or a reduction in flood flows downstream, those benefits can also be very difficult to quantify.

For agricultural drain improvement projects, these parameters can be useful in estimating benefits-cost values.

Assessed Value – Is based on an area weighted average of the total land assessment value for the area impacted by the drainage project. An area weighted average can be useful as it will best reflect the true assessment value of the land based on the value of the majority of the land (i.e. a small parcel of very high value land will not outweigh a much larger parcel of low value land or vice-versa). This value is measured in dollars.

Area of Impact – The area upon which the project will have an influence or benefit. This value is measured in square kilometres.

Project Cost – An estimate of the total project cost. This value is measured in dollars.

Potential for Some Groundwater Impact – Groundwater located under areas of less overburden thickness is at a higher risk of contamination. Based on this knowledge a project occurring in an area of shallow overburden would receive a lower priority than a project occurring on deep overburden.

Benefits Water Quality – An assessment of the potential for the project to increase or decrease the quality of the water passing through the drain network. This parameter is measured as a range of potential impact.

Benefits Aquatic Habitat – A measure of how much a project improves the aquatic habitat of a waterway. This measure would likely be higher, depending on the quality of the watercourse and its ability to sustain a healthy fish population or provision of appropriate spawning habitat.