Surface Water Management Section input to Rat-Marsh Rivers Watershed characterization report

Surface water management in the Rat and Marsh Rivers Watershed tends to consist largely of natural waterways, retention, and agricultural drainage in the area of land that contributes water to the Rat River, Marsh River and the tributaries of these two rivers. The Watershed is comprised of two major drainage systems run by the Upper and Lower Rat River and Marsh River and their many tributaries.

The overall landscape is flat and contains few bogs and marshes. The major issues in this watershed associated with the surface water are flooding, drainage, bank sliding, and retention. Ice jamming in some waterways aggravates the flooding of the farmlands. Erosion and riverbank stabilization are not a significant concern in this watershed. Caliento Bog, Carrick Bog, Rat River Swamp are the major natural wetlands in this watershed and these are considered as natural water retention areas. Due to the existence of small numbers of water bodies and retention areas and also due to the flat topography, flooding and drainage are the significant concerns in this watershed. Consequently, the 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 particular prior to a description of the surface water management.

AGRICULTURAL DRAINAGE: GENERAL DESCRIPTION

Need for Drainage:

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's from periodic heavy summer rainstorms. If excess summer rainwater's pond 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 2/3's 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's 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 has a ridge and swale or similar nature, 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 could sustain no 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 1st order being the smallest and 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 order 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; the benefits are the reduction in the damages to the adjacent crops. These damages occur due to excess summer rainwaters ponding on the cropland, and the damages are reduced when excess summer rainwaters are removed more quickly by larger drains which have larger water-carrying capacities. However, even in areas with larger drains, damages to the agricultural cropland from summer flooding still occur periodically. In a wet cycle, those damages will occur more often. In an exceptionally wet, rainy year like 2009, damages 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 hays and forages. As well, many special, high-value crops are more quickly damaged by excess rainwater's 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's percolate downward quite slowly where there are dense soils. Therefore, areas with dense clay soils require larger drains, because so little of the rainwaters percolate 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 Cook's 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 (PR's) and Provincial Trunk Highways (PTH's), 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 1980's and early 1990's, when the authority for these drains had been transferred to the four conservation districts. Currently, the Province is in the process of evaluating whether the jurisdiction and responsibility for these drains go back to the Province.

Drainage Licensing**:**

All work on 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 impacts of drainage works on downstream landowners or jurisdictions, and any negative environmental impacts.

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 drain's 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 for 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 channel's 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.

MAJOR SURFACE WATER ISSUES IN THE WATERSHED

The Rat-Marsh watershed consists of three sub-watersheds (WS) and their designated numbers are 3, 4 and 5. 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 Rat-Marsh Rivers Watershed

Sub-watershed #	Waterway	Infrastructures/Projects/Retentions/Forests
WS 3	Rat River, Sand River	Sandilands Provincial Forest, Rat River Swamp Project
WS 4	Rat River, Joubert Creek, Joubert Creek Extension, Mosquito Creek, St. Malo Canal, Sarto West Drain, St. Pierre Drain, Carey Drain, Otterburne East Drain, Coulee Des Nault, Charlie's Creek	St. Malo Dam and Reservoir, St. Pierre Diversion, Caliento Bog, Carrick Bog, Z Dyke
WS 5	Marsh River, Dufrost North Drain, Angle Drain, Ste. Elizabeth Drain, Arnaud Drain, Lafond Drain, Aubigny Drain	No significant structures/projects exist

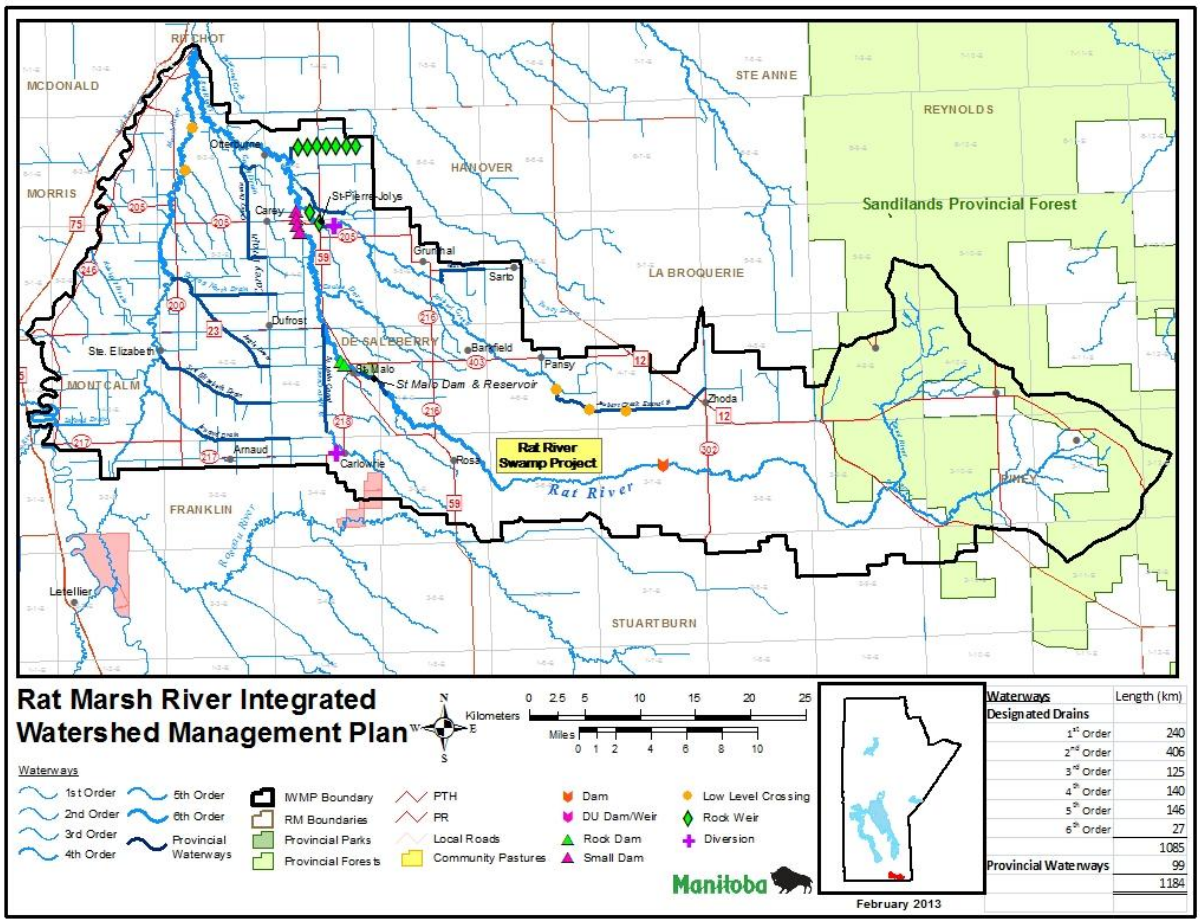

Figure 1: Watershed map

The notable water control infrastructures in this watershed are provincial waterways, large and small dams, diversions, bridges, culverts, drop culverts, low level crossing, rock weirs, etc. There are about 100 km of provincial waterway drains, as well as approximately 1,085 km of municipal drains in this watershed.

The Rat River is the main watercourse in this watershed; the Marsh River and the Joubert Creek are the two important tributaries to the Rat River. Mosquito Creek is another tributary that contributes flow to the Rat River through St. Malo Canal.

The Rat River has a length of more than 137 km from the headwaters in the Sandilands Provincial Forest, to the downstream confluence with Red River, approximately 3.2 km north of the Village of Ste. Agathe. The River flows into the present St. Malo reservoir and then proceeds westward to meet the Red River. The river flows through eight municipalities on its way from upstream to downstream. The total difference in elevation between the upstream boundary of the watershed and the downstream boundary at the confluence is 152 m, which makes the overall slope of the watershed approximately 1.11 m per kilometer.

The land that drains to the Rat River generally slopes to the west and northwest, and the slope varies considerably over the length of the watershed. The upper and lower reaches are relatively

steep and the middle 48 km reach is gradually sloped. Frequent overbank flooding has occurred over the centuries in the middle reach and has resulted in the development of permanent wetlands in the areas along Ranges 6E, 7E and 8E.

The soils throughout most of the watershed are poorly drained with the exception in the headwater areas where the soils are well drained. Long ago a portion of the flood overflows along the Rat River in Ranges 6E and 7E spilled north into the Joubert Creek. From the spillover point, it was transported downstream through Joubert Creek to re-enter the Rat River downstream of St. Pierre-Jolys.

Caliento Bog at the east of the Village of Sundown is a complex wetland area that is the source of runoff to both the adjacent Roseau River to the south and Rat River to the north. Depending on the precipitation, Caliento Bog has significant influence on the runoff water flow to the Rat River. Rat River Swamp and Carrick Bog are two other storage reservoirs in this watershed holding significant flood overflows during the spring runoff period.

The Marsh River starts near Letellier and ends to Ste. Agathe where it converged to the Rat River. The Marsh River has an average elevation of 238 m above sea level. The topography of the watershed is flat. The predominant soil type in this region is clay. Due to the flat topography and soil types, drainage is a big concern in this sub-watershed. Drainage improvements in the Marsh River area was undertaken by the province in 1980/81 in five designated drains named Angle drain, Ste. Elizabeth drain, Lafond drain, Arnaud drain, and Aubigny drain improvement projects.

Joubert Creek is located in south-east Manitoba, approximately 65 km south of Winnipeg. The Creek drains an area extending from 4-8E to 6-4E, 1.6 km west of St. Pierre, where it joins the Rat River. The Creek is approximately 32 km long. The topography of the drainage basin is level to gently rolling with some low ridges. Drainage is good and excessive on high land but large, poorly drained swamps are common.

Land use in the watershed is dominated by agriculture. 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 coincident 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, more localized flooding can also occur during the summertime due to unusual heavy summer rainstorms. In the last 15 years, various parts of southern Manitoba experienced unusual heavy rainfalls, which resulted in summer flooding. As well, flooding does occur along some of Manitoba's lakes, when inflows are high and lake levels go up and, as in the case of Lake Winnipeg & Lake Manitoba, strong northerly winds result in significant wave setup and wave uprush. Beaver dam, trees, brush and debris aggravates the flooding problems in the waterways.

The Rat River is a meandering waterway, with an expansive natural floodplain, which is subject to frequent flooding. There was a long history of flooding in the townships 3-5E, 3-6E and 3-7E by breakout of the Rat River. During 1963-2000, a number of projects were proposed by Stuartburn-Piney Agricultural Development Association (SPADA) and Ducks Unlimited (DU) in the townships 3-6E & 3-7E to address the Rat River flooding. To prevent frequent overflows containment structures (dike) and diversions were proposed by the province as well as by the RMs concerned. Dredging was done in some locations to increase the channel capacity. Rat River Swamp project was completed in 1994 by the Ducks Unlimited to address the Rat River flooding issues as well as for the development of a wetland for wildlife and waterfowl conservation in sections 20-23, 27 and 28-3-6E.

The project included inlet and outlet structures as well as a diversion to divert water from the Rat River for impoundment. Numerous rock dams were built within the Rat River channel at certain locations, especially at the downstream of St. Malo Dam for holding water. Ring dykes were also constructed to protect the private properties from flooding in some places. Joubert Creek, which is a tributary to the Rat River, has also experienced severe flooding in the past, especially between PR 216 and PTH 12. Joubert Creek had overflow issues in the Sarto area located in R.M. of Hanover.

Excess flows have historically broken out of the Rat River upstream of St. Malo in two general areas, named, eastern overflow and western overflow area. In eastern overflow area, water used to flow northwest into the Joubert Creek. Flood control was necessarily needed to prevent inundation of agricultural lands between the Rat River and Joubert Creek. In the western overflow, the water moved generally west north of Isle a Pilotte, and re-enter the Rat River via two channels known as Charlie's Creek and the Coulee Des Naults. The water flowing down Charlie's Creek had historically caused erosion and a deposition problem, as the drain was not designed to handle the excess flows. To lessen the amount of water entering Charlie's Creek and Coulee Des Naults, the RM of DeSalaberry had constructed a drain in 1999 to intercept some of the overflow water and convey it back to the Rat River upstream of St. Malo. The project was named as Rat River Overflow Diversion Project.

In 2000, Rat River overflow study was undertaken to identify various options to control flow at two locations including retention option. Five options as follows were evaluated in the study to get rid of the flooding problems due to the Rat River overflow:

Option 1: Containment of Rat River overflows east of Isle a Pilotte by dyking along the east-west road allowance just north of the Rat River.

Rat River Development Project was initially proposed by SPADA in 1971 to construct a containment structure (dyke) along the road allowance north of sections 19 to 24-3-6E to prevent the Rat River flooding.

In 1983, the province found that the solution to the flooding and drainage problem would be to prevent overflow out of the Rat River, by the construction of dykes and to improve the drain north of sections 8, 9 and 10-4-5E. In 1984, the proposal for the dyke was again raised. It was realized that construction of a seven mile long dyke (containment structure) from PR 208 (currently 302, section 24-3-7E) to Isle a Pilotte at section NE 23-3-6E would prevent Rat River flood water from flowing north to Joubert Creek. Back water flooding dams with open pipe were also considered at the same time to regulate the Rat River overflows to Joubert Creek.

Option 2: Diversion of overflows north of Isle a Pilotte to Joubert Creek that would control breakout flows by constructing an interceptor channel from high ground at Isle a Pilotte to divert flood water directly north to Joubert Creek. This would improve drainage in the area between Isle a Pilotte and Joubert Creek.

Option 3: Diversion of flows from a point NE 1-4-5E west and south to the Rat River. Designs should include a bypass or spillway for overland flows from extreme floods. This option returns Rat River break outs back to the Rat River and as such was preferable to a diversion to Joubert Creek.

Option 4: Diversion of flows from a point NE 1-4-5E along the North-South Inter-municipal boundary between 5 and 6E north to Joubert Creek.

Option 5: Upgrading of the municipal drain located in sections 8, 9, 10-4-5E.

However, no other options were materialized except Option 5 in which the municipal drain located in sections 8, 9 & 10-4-5E was upgraded to enhance proper drainage in that area.

Recent flooding issues:

Dufrost Drain is a provincial waterway, and currently the drain has flooding issues. Otterburne East Drain has overland flooding issues started two years ago. Carey Drain has overland flooding issues around PR 205 due to siltation and under capacity culverts. Survey was done to undertake clean-up works.

Drainage

Drainage of lands in Townships 3 & 4 and Ranges 4E & 5E was an issue in the past, especially in the St. Malo Wildlife management area. A number of diversions and drains were constructed to drain off the water out of this area to the Rat River.

Drainage was an issue in the past in the vicinity of section 18-6-3E along Marsh River. In 1981, RM of Morris requested the province for better drainage solutions. The province proposed three routes to drain the area. Route A involves major reconstruction of two miles of existing drain. Route B involves improvement to one mile of existing road drain, which runs east into the Marsh River. Route C runs north and west into the Red River. For Route A, two drop inlet structures were proposed at the outlet to the Red River. No construction was done.

Drainage and flooding problems along a municipal drain in section 10-4-4E, which is a tributary drain to St. Malo Canal was noticed by the RM of De Salaberry in 1990. Drainage investigations were done by the province in 1990 and two options were proposed after investigation. Option 1 includes a drain construction north of section 3-4-4E with 2 rock gradient control structures. Option 2 was construction of a drain in section 10-4-4E (Moose Creek to south) with the removal of low level crossing and replacing with 2 culverts and 1 rock gradient control structure without sheet piling. RM council agreed with the option 1 but nothing was constructed.

Ste Eligabeth Drain has capacity issues. Reconstruction of the drain from section 30-4-3E to the end is going on and also the number of pipes at the crossing was increased. During fiscal year 2011/2012, half of the work will be completed and the rest is expected to be done in 2012/2013.

Erosion

Otterburne East Drain had experienced erosion in the past because of the steep gradient (roughly 3 m/km) and for erosion control seven rock weir drop structures were constructed.

In 1992, two-gradient control structures (rock or culvert) were proposed to reduce the channel velocity on the upper Joubert Creek through sections 10 to 12-4-6E and 6-4-7E. One drop structure was constructed in section 6-4-7E but washed out later.

In 1985, river bank erosion and slope failure was noticed by the RM of Franklin in section 35-3-4E along the Mosquito Creek. A remedial measure to control erosion and bank failure was sought by the RM to the province. As of record no protective measures were taken to control this erosion and slope failure.

In 1988, a local land owner (Mr. Ed Herrmann) proposed the province for rip rap work on the eroded outside bank (west bank of the Rat River meander loop adjacent to the residence of Mr. Herrmann) of the low flow channel in the designated reservoir area of St. Malo Dam along the section 18-4-5E in the RM of De Salaberry. The bank was only 3-4 ft high. No riprap protective measure was undertaken to arrest the erosion. In 2006, a fishing dock was built in section 18-4-5E within the St. Malo designated Reservoir area by a private landowner.

To reduce erosion in Joubert Creek extension, at least one gradient control structure was proposed at section 13-4-6E by the province to RM of Hanover. But no structure was constructed.

Ford Crossing/Spillway

Joubert Creek and its extension have experienced overflow problems in the past at several spots. A rock ford crossing was constructed at section 15-4-6E to pass the Joubert Creek overflows. In 1991, a spillway (low level crossing) was installed by RM of La Broquerie in section 5-4-7E across the Joubert Creek to handle the spring flooding on Joubert Creek Extension, which is a designated provincial waterway at this location.

In 1992, a private land owner (Mr. Gordon) proposed to construct a rock/culvert ford crossing between the sections 1-4-6E and 12-4-6E to handle the Joubert Creek overflows. Accordingly the ford crossing was constructed in place.

In 1972, a low level rock ford crossing flush with the channel bottom was constructed on the Marsh River in section 17-6-3E by the RM of DeSalaberry with the permission of the province.

The Ste. Elizabeth drain is a third-order drain that outlets into the Marsh River. In 1982, RM of DeSalaberry requested the province to create a rock type ford crossing across the drain in section

20-4-3E for a farmer who works both sides of the drain. But the province was in opinion that the province cannot expend funds to create this crossing over this waterway. In a later date, the ford crossing was constructed by the RM but it is currently abandoned.

In section 32-6-3E, a spillway was constructed on the Marsh River to spill over the overflows to Rat River when required. RM of De Salaberry had constructed the spillway with the recommendation of the province.

Diversion

Existing diversion

Floods in the southern portion of the village of St. Pierre was investigated by the province in 1960 and the construction of a diversion channel from the bridge half mile east of PTH 59 to the Rat River via Joubert Creek, was recommended by the province. In 1964, the Village of St. Pierre-Jolys with the help of provincial government completed the diversion channel and diverted Joubert Creek along the south side of the village to reduce flooding in the village. The diversion (St. Pierre Diversion/Joubert Creek Diversion) was not deep enough to drain all the low spots, which resulted in water logging in summer. The diversion was constructed to prevent flooding in the village as a result of overflows from Joubert Creek when the Joubert Creek cutoff carries maximum discharge.

Proposed diversion

There were drainage and flooding issues in Rosa area between PTH 59 and the east boundary of RM of Franklin in township 3-5E. Rat River was overflowed to Roseau River in that location through various swales. A diversion was proposed by R.M. of Franklin from Rat River at section 24-3-5E to Roseau River to address the overflows of Rat River. But the proposed diversion was not constructed.

In 1972, a diversion channel of the Rat River was designed at the east of section 4-4-5E near the Golf Course in order to eliminate a twin meandering loop in the alignment of the Rat River at bridge crossing across PR 216. But this diversion was not constructed. However, in township 4 and range 5E, Cam Mart Drain diversion was constructed at least 20 years ago to drain off water to the Rat River.

There is a long history of flooding along the Rat River at section NE 21-3-8E. In 1976, water control by diverting a portion of Rat River flow through a diversion at the meander loop in section 20-3-8E was proposed by the province. But this diversion was not constructed.

In 1985, flooding and erosion problems in the vicinity of the diversion of Mosquito Creek at PR 218 were noticed by the RM of Franklin. A diversion was proposed by the RM of Franklin at the upstream of Highway Bridge on PR 218 in section 35-3-4E to get rid of the problems. The diversion was constructed in late 1990's.

During floods in the Red River, high stages at the confluence of the Red and Roseau Rivers cause an overflow in a northerly direction from the Roseau River to the Marsh River. Eventually

these overflow waters rejoin the Red River in the vicinity of Ste. Agathe. In 1969, a diversion was proposed by the province from a point near Letellier (22-2-2E) to a point just below St. Agathe (20-7-3E) following the location of Marsh River to divert a part of the flow of flood waters in the Red River into the Marsh River. Benefit-Cost study was done in 1969 by the province for the proposed diversion from Red River to Marsh River with control structures for erosion control and also with no control structures. The benefits from the two alternatives were compared. Without control structures had shown the higher B-C ratio. However, this diversion was not constructed.

Lafond drain is a third order waterway located on the east side of the Red River approximately 1.6 km north of St. Jean Baptiste. This drain discharges water into the Red River north of Ste Jean Baptiste. Lafond Drain conveys the flows of the flat areas in sections 10, 11, 14 & 15-4-2E. In 1976, drainage improvements in these sections to the Marsh River were requested by the RM of Montcalm. A diversion was proposed in sections 10 & 11-4-2E from Marsh River to Lafond Drain to get rid of the flooding and drainage problems. But the proposed diversion was not constructed. Only maintenance of the drain was done.

Retention

Existing Dam/Retention

In this watershed, retention is facilitated by few wetlands, manmade dams and Ducks Unlimited (DU) retention projects. St. Malo Dam is the only provincial dam in this watershed that retains water for water supply and recreation.

The St. Malo Dam is a rolled earth-fill structure on the Rat River. The project was constructed by the Prairie Farm Rehabilitation Administration (PFRA) at section 24-4-4E on the Rat River in 1959-60 at the request of the province. PFRA transferred the dam to the province in 1963. The dam was constructed to provide a source of municipal water supply for the Village of St. Malo and also to maintain a live stream for stock-watering and other agricultural uses downstream from the project. The dam is 457 m long having a maximum height of 12.8 m and a top width of 6.1 m. Flood flows are passed by a fixed crest overflow spillway of 30.5 m wide and 44 m long. The spillway construction was completed in early 1964. The reservoir created by the dam is about 2.4 km long with an average width of about 305 m. The storage capacity of the reservoir at full supply level is 2,160 dam^3.

A number of small rock-fill type weirs were constructed in the past at the downstream of the St. Malo Dam on the Rat River for stock-watering purposes. Between St. Malo dam and downstream of Highway 59, there are at least five dams exist in this reach of the Rat River. These man-made rock riprap dams influenced overbank flow at some locations.

In 1971, two rock-filled structures on the Joubert Creek in the vicinity of Village of St. Pierre were constructed by the Village of St. Pierre, one in the vicinity of the bridge on PTH 59 and the other one further downstream, passed the bridge on PR 205 for holding water to a certain depth in the summer months.

In 1995, one local land owner (Mr. Manchulenko) claimed that the flooding in Rat/Joubert systems was caused by four unauthorized dams built on the Rat River within a two mile reach of

the Rat River that impacted on his property on Joubert Creek, near St. Pierre. A site inspection by the province revealed that only one dam affected the Joubert Creek water levels. This dam was constructed by the Rat River Golf Course in early nineties and is located several hundred meters downstream of the Golf Course access road. However, the Rat River Golf Course had applied for a Water Rights Licence to withdraw water from the Rat River above the dam for irrigation purposes. Two dams are located in the vicinity of Golf Course and one at a point above the confluence of Joubert Creek that were constructed by the Golf Course.

Rat River Swamp Project

Poor drainage and history of flooding in township 3 and ranges 7E & 8E within the RM's of Hanover and De Salaberry were the concerns in the past. Seven miles long overflow drain constructed from PR 208 (currently 302, section NE 24-3-7E) westerly to North side of the Rat River (Ile of Pilotte at section 23-3-6E), dyked to prevent flooding to the north into the Joubert Creek system would provide a better outlet for the drainage system in 3-7E & 3-8E. SPADA desired a reservoir area in 3-6E to reduce downstream effects that caused by seven miles long channel and dyke in range 7E. In 1980, SPADA proposed a reservoir for the area surrounding Isle a Pilotte at the downstream of section 20-3-6E in order to prevent water from the Rat River flooding and farmland. In this area the river banks are very low and the overflows that caused flooding.

In 1980 and 1982, the province found that the proposed flood control project by SPADA was not feasible only for agricultural benefits. Then DU was interested in developing and managing a reservoir area in township 3 and ranges 6E &7E for waterfowl. Rat River Wetland Development Task Force was established by the province in 1986. In 1986, DU completed a feasibility study for a seven cell wetland complex with a flood storage reservoir and indicated the project be economically viable. Detailed feasibility study was completed in 1988 under the auspices of Rat River Swamp Project.

Ducks Unlimited's intention was to construct drainage systems in the upper reaches of the Rat River to direct excessive flows to a retention basin immediately south of the wooded upland area known locally as Ile of Pilotte. The retention basin was planned to hold spring flows and to develop for waterfowl production. The province, RMs, SPADA and Ducks Unlimited were the agencies involved in the proposed project.

In 1994, the Province and DU made an agreement to construct a dam for diverting and impoundment of water under the Rat River Swamp Project. The project was expected to create a 369 ha impoundment of water in sections 20-23, 27 & 28-3-6E in the LGD of Stuartburn. The project includes an inlet and outlet controlled structures to control the water level. A 7.12 km dyke construction was planned to impound water. Water control of the Rat River swamp would expect to be achieved by a supply channel and inlet structure, outflow channel and outlet structure. The project was completed in 1994 by Ducks Unlimited, known as Rat River Swamp Project near the north shore of the Rat River in the LGD of Stuartburn.

Proposed Dam/Retention

The Town of Niverville was extremely interested in the creation of a recreational area in the vicinity of the junction of Rat-Marsh Rivers. For water retention, a dam was proposed to construct for facilitating the recreational area in sections 16 & 27-7-3E. But this proposed dam was not constructed.

In 1965, RM of Richot requested the province for a feasibility investigation of a reservoir at the junction of Rat and Marsh Rivers and immediately upstream and adjacent to PR 305. A RCC spillway was also taken into account for construction as a part of the dam/reservoir. The reservoir was expected to use for stock-watering purposes for water supply to the towns of Otterburne and Ste Agathe. But the reservoir was not constructed. However, a weir was constructed by Ducks Unlimited on Tourond Creek south to highway 311 in the vicinity of Rat-Marsh junction (Tourond Creek 1 & 2 Project).

In 1990, small dams were proposed by the land owners on the Rat River in section 16-3-8E for water retention in sections 10, 15, & 16-3-8E. However, retention of any portion of the Rat River flow with small dams in the vicinity of these sections was found impractical by the provincial investigation due to steepness of the prairie gradient. Therefore, no small dams were constructed in these sections.

In 1961, PFRA investigated with a view to construct a dam on Joubert Creek in the vicinity of sections 24 & 25-5-4E. But the site was not good due to pervious stratum. Then topographic survey was done and a dam site was chosen in section 8-5-5E. In 1989, geotechnical investigation was done to confirm the site. The location was preferred by the residents at Grunthal. The main objective for this dam was storage of water for water supply to the village of Grunthal as well as for recreation. PFRA had performed an intensive investigation for a dam in that area in 1954-55 that was capable of retaining 3.66 to 5.5 m depth of water. The first request for a reservoir on Joubert Creek was made in 1953 by RM of Hanover. The stated purpose was to supply water for vegetable canning factory and irrigation. During 1960's the construction of Grunthal Dam have been stopped for the favour of St. Malo Dam. In 1989/90, RM of Hanover requested the Province to install this dam in section 8-5-5E on Joubert Creek, pointing out that the dam has the same recreational potential as the St. Malo dam. The dam design consisted of a rolled earth embankment, a reinforced concrete chute spillway (13.4m wide and 31.1m long) and a metal pipe conduit. The drainage area created by the dam was estimated to be 75 sq. kilometer. However, the dam was not even constructed until now.

In 1965, a dam on St. Elizabeth Drain in section 30-4-3E was recommended for water retention by the province. The local farmer had a license to build a dam at a farm crossing. However, the dam was not constructed.

There are two bogs, namely Caliento and Carrick Bog, located closer to the Rat River at the upstream reach and these bogs have water retention potentials. In the past control structures were proposed to develop storage reservoirs in these areas but no structures were constructed. Within the framework of the Rat River Basin Hydraulic Study 2001, an earthen dam with emergency overflow weir was proposed at section 5-3-9E to raise the water levels for creating a storage reservoir in the Caliento Bog. But nothing was constructed. However, a Z-dyke was constructed to develop storage facilities in the Caliento bog area. An earthen dam was proposed in the past at section 5-3-10E to facilitate water retention in the Carrick Bog area but also this dam was not constructed.

Ducks Unlimited Retention Projects

Ducks Unlimited has constructed about three wildlife and waterfowl conservation projects in this watershed. The projects were constructed in WS 3, 4 and 5.

DU built a single cell wetland project for wildlife in 1992 in township 3 and range 6E. The primary benefit of the project was for wildlife and the secondary benefit was flood control by limiting break-out flows to the north towards Joubert Creek.

Rat River Swamp Project was constructed in 1994 for wildlife habitat in township 3 and range 6E. The project was expected to create a 369 ha impoundment of water in sections 20-23, 27 & 28-3-6E.

The farmland north of the section 20 to 24-3-7E was flooded due to break out of the Rat River which eventually flowed north into the Joubert Creek. Feasibility study was done in 1980 to construct a diversion with north side dyked. A 21 sq. km reservoir with storage capacity of 22,000 dam^3 was designed to contain flood water. A control dam either in the form of a stop-log control or rock overflow weir with low level culvert control was designed. Because of the flat topography, extensive dyking was taken into account to contain large amount of flood water. The stop-log control dam was eventually constructed by the Ducks Unlimited in 1990's.

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 infrastructure works (rehabilitation, reconstruction, enlarging) 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 drain's 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.