

Roseau River HEC-1 Hydrologic Model

prepared for the:

ROSEAU RIVER WATERSHED DISTRICT

P.O. Box 26

Roseau, MN 56751-0026

and the:

U.S. ARMY CORPS OF ENGINEERS

St. Paul District

July 18, 2001

prepared by:

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(Under contract with: Short, Elliot, Hendrickson, Inc.)

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Introduction

This hydrologic model of the Roseau River Basin was developed for the Roseau River Watershed District for planning purposes, including evaluation of proposed flood control strategies. The model covers the drainage area of the Roseau River to the point where it crosses the International Border and enters Canada near Caribou, Minnesota. The modeled basin includes 1,009 square miles of drainage area in Minnesota and 423 square miles of drainage area in Manitoba.

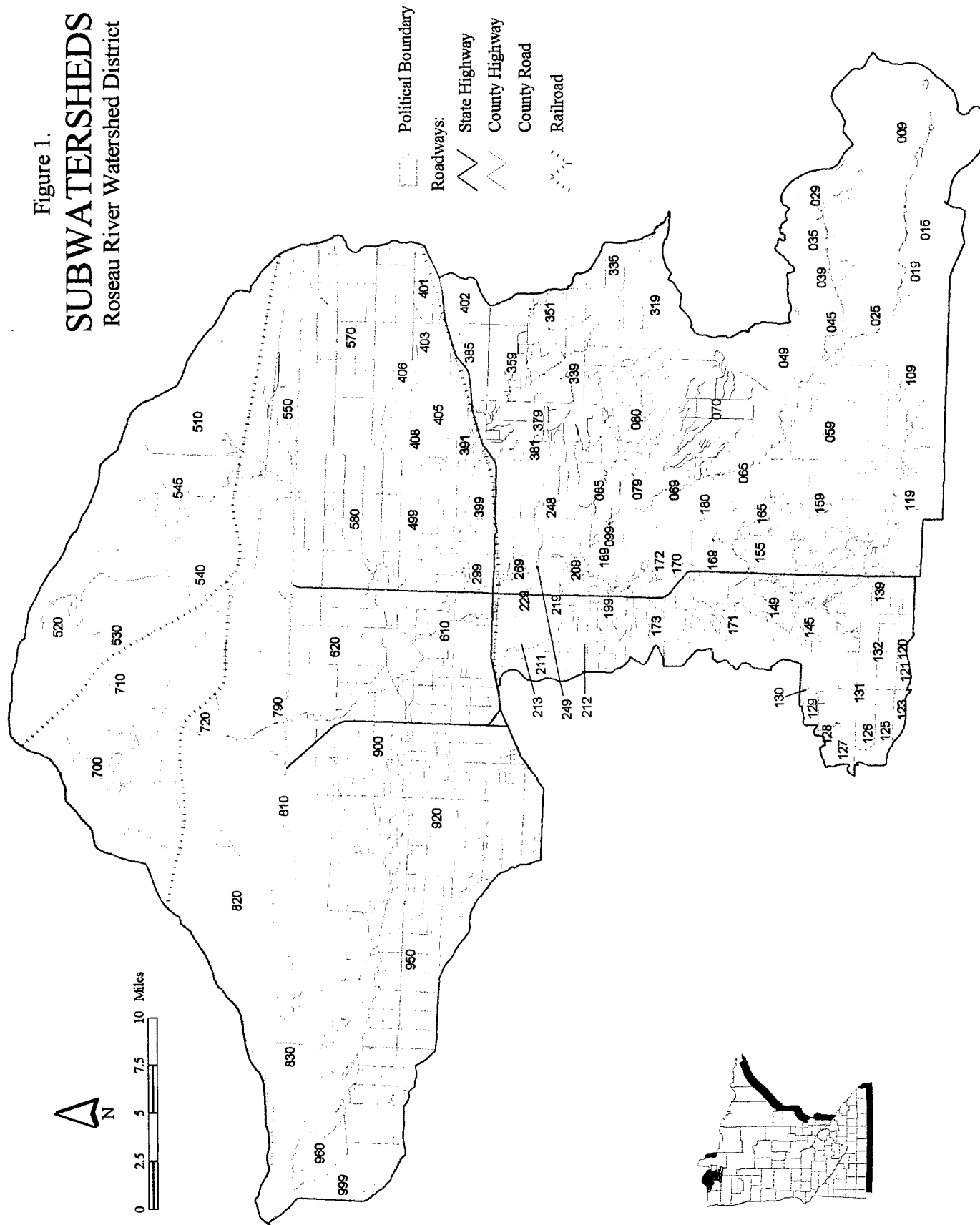
The Minnesota portion of the model was developed as part of the Roseau River Watershed District "Overall Plan" revision process as required by the 1998 Red River Basin Mediation Agreement. The Manitoba portion of the model was developed by a Section 22 Study under the U.S. Army Corps of Engineers. The modeling effort of both sides of the border was done concurrently in order to develop a seamless model. This report covers the entire model.

There are significant differences in the type and extent of data available in Manitoba and Minnesota. In general, the Manitoba data has been transformed to provide the necessary modeling parameters in a format consistent with the way data is presented in Minnesota.

Although the model is fully functional at this time, it is anticipated that refinements will continue to be made as the planning and implementation process evolves. Potential users should ensure that they have the latest, or most appropriate, version of the model.

Watershed

The modeled watershed is the upper portion of the Roseau River Basin as outlined on the map shown in Figure 1. The Roseau River is a major tributary of the Red River of the North. It joins the Red River in Canada near Letellier, Manitoba about 91.5 miles downstream from the modeled area. The drainage area of the Roseau River at its mouth is 2,057 square miles. The modeled portion is 1,432.2 square miles. It consists primarily of cropland, grassland, woodland, and wetlands.



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The Minnesota portion of the drainage area is within the geomorphic areas of the Agassiz Lacustrine Plain. Included are the Inter-Beach area, Beltrami Island area, and Agassiz Peatlands (Minnesota Soil Atlas Miscellaneous Report 173-1980). The Inter-Beach area consists of a linear network of beach ridges and low, poorly drained areas. About half the soils are sandy, 10% are organic, and the rest are loamy. The Beltrami Island area consists of a nearly level to slightly depressional lake plain. Most of the soils are loamy and poorly drained. This region also includes some shallow sands over loamy till, areas of clayey soils, and areas of organic soils. Agassiz Peatlands are a low, very poorly drained lake plain. About 75% consists of organic soils generally from 7 to 8 feet deep. The mineral soils are pre-dominantly sandy and poorly drained.

The Manitoba portion of the Roseau River Watershed tributary to Caribou, Minnesota has been subdivided into Lowland Till Plain, Sandilands Upland, Pine Creek Lowland, and Sprague Creek Lowland (Joint Studies for Co-ordinated Water Use and Control in the Roseau River Basin, International Roseau River Engineering Board Report to the International Joint Commission, September, 1975, Appendix A Water Resources).

Sandilands Upland consists primarily of thick sand deposits, overlain along the lower edges by till or lacustrine clays.

Pinecreek Lowlands are mainly peats and lacustrine clays.

Sprague Creek Lowland occupies the eastern portion of the watershed in Manitoba. It is a broad flat area with appreciable local relief developed on glacial till with extensive areas of peat, thick lacustrine clays, and isolated patches of sand.

The portion of the Lowland Till Plain that contributes to the Caribou drainage area is primarily the Menisino Swamp. The swamp is primarily sedge but areas of treed swamp occur at the higher elevations. This area drains into the Roseau River Wildlife Management Area in Minnesota.

Rainfall

Meteorological data used in this model for hypothetical rainstorm events is based on information developed by the (National Weather Service as presented in Technical Papers #40 and 49).

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These papers include maps showing expected amounts of point precipitation for storms with durations of 30 minutes to 10 days. The magnitude of storms range from 1 year to 100 years and also include an estimate of the Probable Maximum Precipitation (PMP).

Point Rainfall-Duration-Frequency curves were developed from the meteorological data. They are shown graphically in Figure 2. The curves are based on data at the City of Roseau, which is near the geographic center of the modeled watershed. The rainfall intensity tends to increase from northwest to southeast. Therefore, when analyzing individual sub-watershed strategies, it may be advisable to adjust the rainfall amounts.

Area reduction factors are applied by the hydrologic model to reduce the point precipitation to the amount which would be expected to fall over the entire 1,432 square mile watershed area. Smaller storm areas should be used where appropriate to evaluate strategies at a sub-basin level.

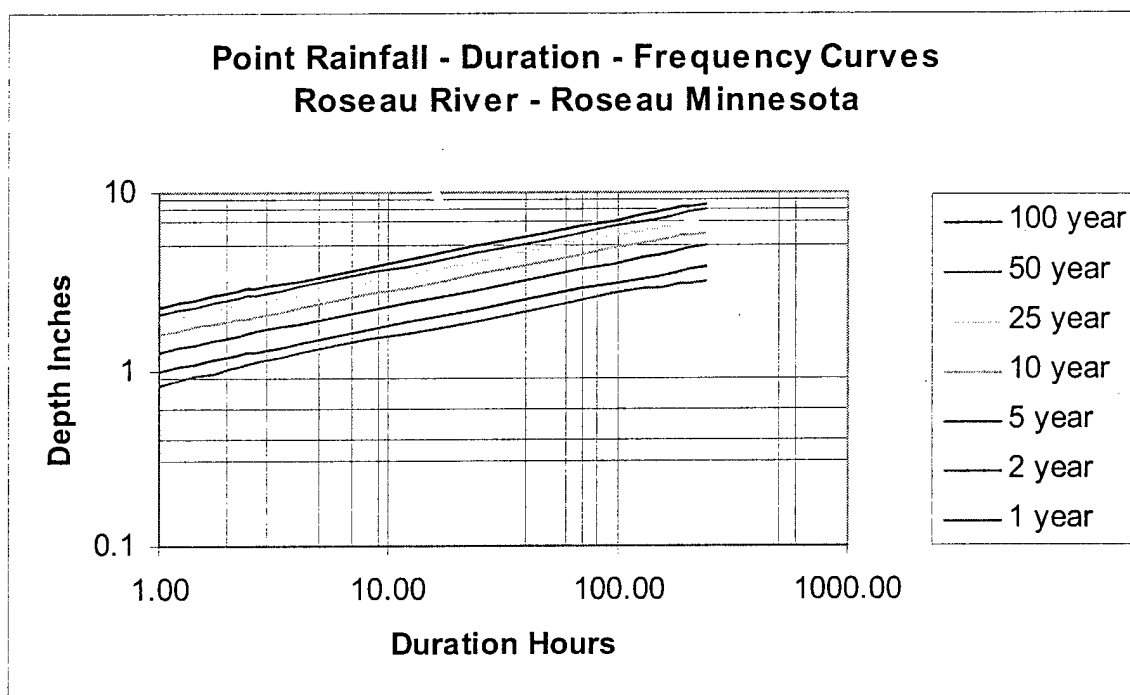
The hypothetical summer storm events that have been analyzed are of 10 days total duration. The precipitation pattern within the 10 days was determined by nesting the shorter duration amounts. In other words, the Maximum precipitation rate of the 6 hour storm is within the 1 day storm which is within the 10 day storm.

Summer Runoff (Rainfall Events)

The amount of runoff generated by rainfall was estimated using the Hydrologic Curve Number (CN) method developed by the Soil Conservation Service (SCS). The curve number takes into account the soil type, topography, land cover, and cultural practices of the watershed, and relates precipitation to runoff. The runoff curve numbers were adjusted for use with 10 day duration storms as recommended by the SCS National Engineering Handbook.

SCS curve numbers were developed using Geographic Information System (GIS) based analysis. So far as known, the best available GIS data has been used. The level of detail of the available data varies considerably.

Figure 2



Roseau River HEC-1 Hydrologic Model (July 18, 2001)

The required data layers to determine the curve numbers are land cover and hydrologic soil group. A composite map of the hydrologic soil groups is shown in Figure 3. A composite map of the land use data is shown in Figure 4 and a composite map of hydrologic curve numbers is shown in Figure 5.

The hydrologic soil groups are based on expected rates of infiltration. They are A, B, C, and D, varying from most to least permeable. For some soil types, two classes are given, depending on whether or not the soil has been drained. These were reclassified by processing the data within the GIS system using the assumption that all lands shown as agricultural had been drained.

The land cover data used for Minnesota was developed in the early 1990's by the International Coalition (TIC) and by the Minnesota Department of Natural Resources (MNDNR). The TIC data, which covers most of the basin, was developed from 1990 vintage aerial photography. The land cover for the forested, southeastern portion of the basin, was developed from satellite imagery from 1995-1996 by the Manitoba Remote Sensing Center. MNDNR further reclassified the forested area data set into fewer categories.

The land cover data used for the Manitoba portion was provided by Environment, Manitoba.

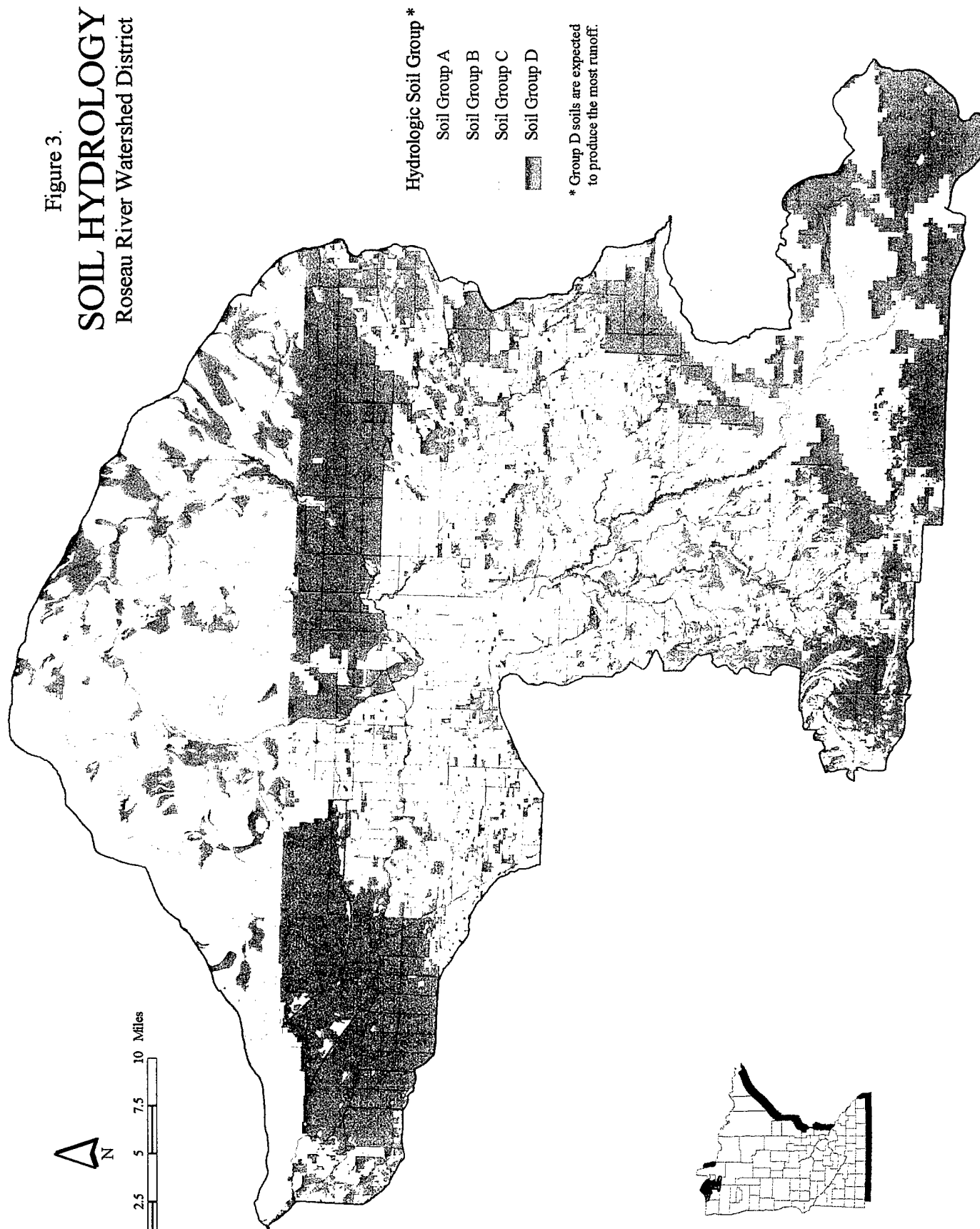
Most of the soils information in Minnesota was from the Minnesota Land Management Information System (MLMIS) 100 meter, generalized soil data. A detailed soil survey of Roseau County has been done by Natural Resource and Conservation Service (NRCS). However, only pre-release detailed soil survey data is currently available from NRCS. Some of the soil survey sheets have been digitized by JOR for the Watershed District. The digitized detailed soils information was used where available.

The GIS soils data for the Canadian portion of the basin was from data developed by the Canadian Department of Agriculture. They do not classify soils into hydrologic groups. The SCS Hydrologic Soils Group was developed based on infiltration rates for each soils class. This was done using criteria described in the (United States Department of Agriculture, Soil Survey Manual, Soil Survey Division Staff, Agriculture Handbook No. 18, Issued October 1993).

Figure 3.

SOIL HYDROLOGY

Roseau River Watershed District



Hydrologic Soil Group *

Soil Group A

Soil Group B

Soil Group C

Soil Group D

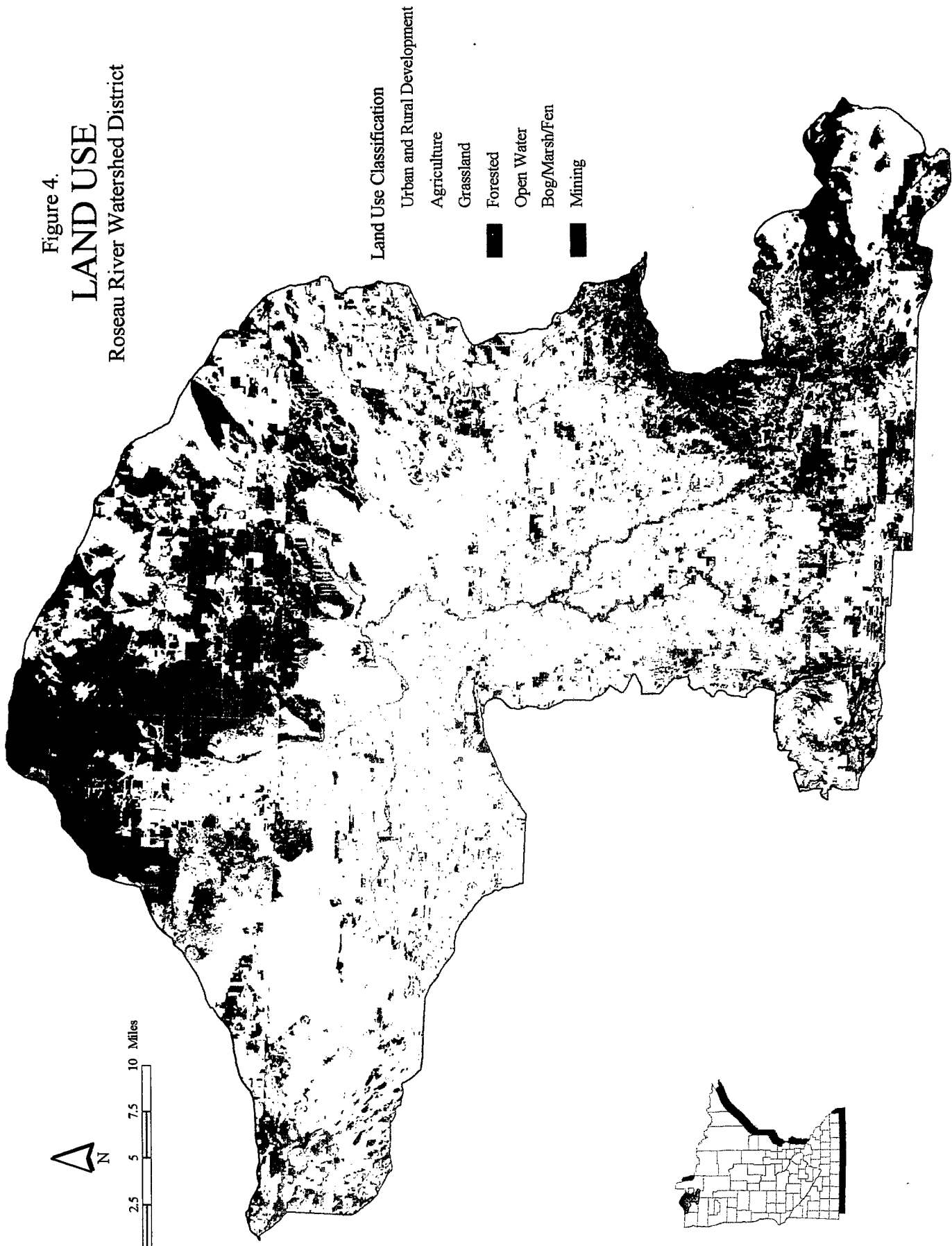
* Group D soils are expected to produce the most runoff.

Source: Soils data was derived through compilation of data from Minnesota Land Management Information System (MLMIS), from the Natural Resource and Conservation Service (NRCS), and the Canadian Department of Agriculture.

Figure 4.

LAND USE

Roseau River Watershed District



Land Use Classification

Urban and Rural Development

Agriculture

Grassland

Forested

Open Water

Bog/Marsh/Fen

Mining

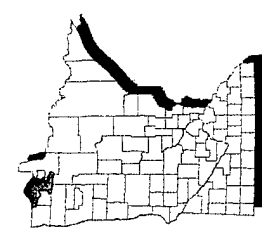
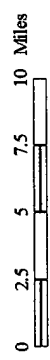
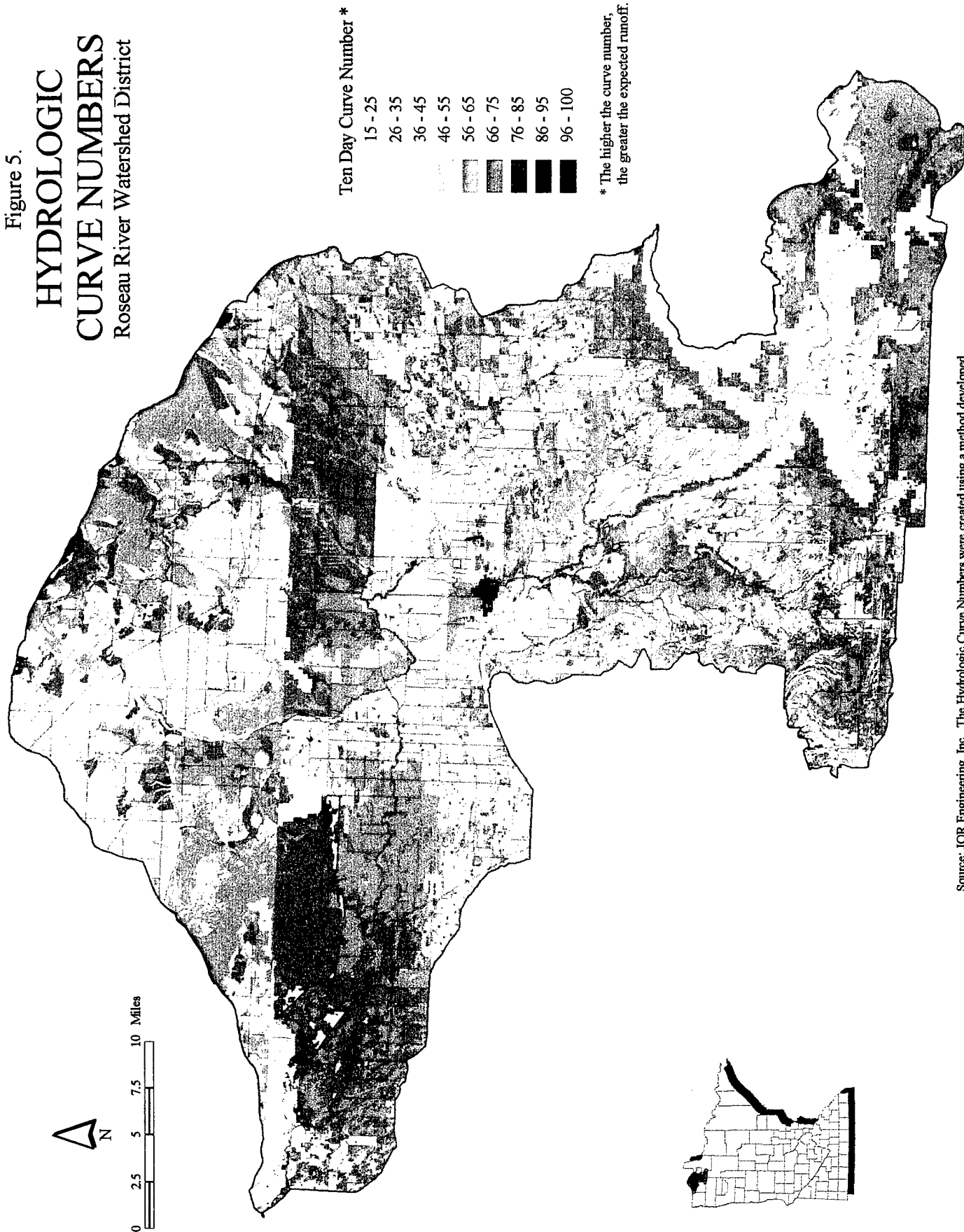


Figure 5. HYDROLOGIC CURVE NUMBERS Roseau River Watershed District



Source: JOR Engineering, Inc. The Hydrologic Curve Numbers were created using a method developed by the Soil Conservation Service. The data used to create this dataset was a land-use file (MNDNR, TIC, and Environment, Manitoba), as well as a soils base (MLMIS and NRCS).

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Antecedent Moisture Condition II (normal) was assumed to exist prior to all hypothetical storm events. This is generally considered applicable for moisture conditions when storms would occur in Minnesota. (The Minnesota Hydrology Guide (MHG) Table 3-1) provides a table for conversion to AMC III for pre-storm conditions.

Spring Runoff (Snowmelt Events)

Spring snowmelt runoff events are also modeled. The amount of 10 day runoff was based on a map in Figure 1-12 of the Minnesota Hydrology Guide which displays expected 10 day runoff amounts for 100 year recurrence events. The estimates were developed from records which include both rainfall and snowmelt runoff estimates. Since most major floods occur in the spring as a result of a combination of rainfall and snowmelt, this data reasonably represents the spring runoff condition. However, in a strict statistical sense, this flood could occur at any time during the year. Factors are also given to estimate runoff amounts for the 50, 25, and 10 year recurrence events. The amount of runoff estimated for each 10 day runoff event in the Roseau area is listed in Table 1. This amount of runoff was used over the entire modeled basin; however, the runoff amount tends to increase from west to east. For individual project assessment, area specific runoff data should be used.

Table 1
Runoff Estimated for 10-day Event

Year	Runoff (Inches)
10	4.03
25	4.88
50	5.49
100	6.1

The 10 day runoff amounts were distributed in time using the SCS procedure described in (NEH, Chapter 21.10) with the following equation:

$$Q_{(\text{max 24 hour})} = .3 * Q_{(10 \text{ Day})}$$

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This relation means that 30% of the runoff, for the 10 day period, occurs within a 24 hour period. We consider this distribution representative of a typical snowmelt with rainfall event in Northwestern Minnesota. The runoff was distributed equally over the watershed area. Total runoff is simulated in the model by using a SCS curve number of 100 which represents an impervious condition and inputting the runoff amount as precipitation. The assumption that runoff is equally distributed implies that soil infiltration rates are equal. This tends to be true due to the frozen condition of the soil. However, as actual spring flow data is collected, the model can be calibrated to reflect observed differences in spring infiltration rates due to soil type, land cover, or other factors.

Hydrograph Development

For the purpose of hydrograph development at a sub-basin level, the watershed was divided into 97 sub-watersheds. The subwatersheds were shown on the map in Figure 1. Runoff within each sub-watershed is determined, as discussed above, by the SCS curve number method. The curve number determined for each sub-watershed is shown in Table 2. The weighted average 24 hour curve number for the entire drainage area was determined to be 72. This converts to a 10 day curve number of 55 (SCS NEH-4, Table 21.2)

The Clark Unit hydrograph method was used in the model to transform runoff excess to outflow from each sub-watershed. This method requires determination of two runoff parameters related to, time of concentration and storage. The time of concentration was calculated for each sub-watershed. Time of concentration is the travel time required for runoff to flow from the most hydrologically distant point of the sub-watershed to the outlet. The storage coefficients were preliminarily estimated using regional curves developed by the (Red Lake Watershed District, Charles Anderson, P.E.). This uses the relationship: $R=K*T_c$ where R is the storage parameter, K is a drainage/slope coefficient, and T_c is the time of concentration. The Clark Method utilizes time-area curve of the basin for runoff transformation. Synthetic time-area curves were used based on the sub-watershed shape, IE: fan, rectangular, or diamond shape, as presented in the (October 6-9, 1981 workshop on Hydrologic Analysis of Floods, US Army Corps of Engineers in Madison Wisconsin). Sub-watershed hydrologic parameters used in the model are summarized in Table 2.

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Table 2
Subwatershed Parameters

Name	Code	DA (Sq Mi)	24-Hour CN	10-Day CN	Tc (Hours)	R (Hours)
Roseau River Flowage	RNF9	40.81	75	58	35.53	82.78
Dam 3	RNF15	13.69	68	50	25.65	51.30
Dam 4	RNF19	5.80	73	56	14.88	29.76
RR to Hanson Creek	RNF25	12.52	62	43	18.80	37.60
Dam 1	RNF29	12.73	75	58	34.28	79.87
Dam 2	RNF35	4.90	65	46	22.66	52.80
Winner Dam	RNF39	13.36	65	46	40.79	95.04
Hanson Creek to RR	RNF45	5.59	57	38	16.96	33.92
Hayes Lake	RNF49	18.29	64	45	60.89	121.78
Beaver	RNF59	15.71	66	47	43.26	64.89
Pencer East	RNF65	12.79	67	49	15.54	12.43
RR to Severson Creek	RNF69	2.29	72	54	7.24	7.24
Severson Creek	RNF70	22.25	68	50	17.30	17.30
RR to Bear Creek	RNF79	7.52	70	52	13.14	13.14
Comstocks	RNF80	20.66	72	55	16.80	14.11
Bear Creek	RNF85	5.27	72	54	11.08	8.64
Gage 2	RNF99	2.18	74	57	3.96	2.65
North Branch		216.09	69	51		
Skime	RNF109	28.21	72	55	67.63	157.58
SB to Mickinock Creek	RNF119	24.20	73	56	25.87	51.74
Palmville Sub RNF3	RNF120	1.27	76	60	7.06	14.12
Palmville Sub RNF4b	RNF121	0.95	78	63	9.62	19.24
Palmville Sub RNF4a	RNF123	2.32	78	62	6.98	13.96
Palmville Sub RNF5	RNF125	4.44	72	54	15.40	30.80
Palmville Sub RNF6	RNF126	1.25	74	57	11.52	17.28
Palmville Sub RNF7	RNF127	2.93	67	48	16.27	16.27
Palmville Sub RNF8	RNF128	1.22	66	47	6.25	9.38

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Name	Code	DA (Sq Mi)	24-Hour CN	10-Day CN	Tc (Hours)	R (Hours)
Palmville Sub RNF9	RNF129	2.90	66	47	7.84	11.76
Palmville Sub RNF10	RNF130	1.29	64	45	5.11	11.91
Palmville wildlife pool	RNF131	7.65	78	62	13.89	32.36
Palmville flood pool	RNF132	0.89	78	62	7.85	18.29
Oseland	RNF139	23.74	73	56	21.3	31.95
Mickinock Creek	RNF145	8.37	72	54	18.97	18.97
Wannaska	RNF149	14.00	72	54	19.28	19.28
SB to Paulson Creek	RNF155	4.45	71	53	6.05	4.05
Gage 43	RNF159	20.07	72	55	20.56	27.76
Paulson Creek	RNF165	3.47	71	53	10.25	10.25
Pencer West	RNF169	6.56	77	61	14.79	14.79
SB to Unamed Creek 1	RNF170	1.65	77	61	6.34	6.34
Unamed Creek 1	RNF171	13.67	72	54	19.15	19.15
SB to Unamed Creek 2	RNF172	5.04	76	60	16.23	16.23
Unamed Creek 2	RNF173	16.03	71	53	16.17	16.17
Gage 3	RNF180	11.52	72	54	18.81	18.81
Sucker Creek	RNF189	0.69	72	55	7.44	4.98
Gage 1	RNF199	9.25	74	57	11.09	11.09
South Branch		218.03	73	55		
Gage 50	RNF209	3.24	72	55	8.83	8.83
Stafford 1	RNF211	11.25	70	52	16.80	11.25
Stafford 2	RNF212	1.45	71	53	2.49	1.67
Stafford 3	RNF213	0.70	66	47	5.56	3.73
County Ditch 8	RNF219	6.26	71	53	17.92	17.92
RR to Cow Creek	RNF229	4.83	71	53	12.04	12.04
Gage 44	RNF248	16.90	72	55	15.15	15.15
Cow Creek	RNF249	0.31	75	58	1.76	1.76
Center Street	RNF269	5.07	76	60	10.04	10.04
Roseau River at Center Street		484.13	71	53		
Gage 15	RNF299	5.51	76	60	9.18	9.18
County Road 2	RNF319	19.38	74	57	17.12	16.95

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Name	Code	DA (Sq Mi)	24-Hour CN	10-Day CN	Tc (Hours)	R (Hours)
Upper Summer Road	RNF335	10.04	69	51	19.28	19.28
Summer Road	RNF339	10.50	67	49	17.20	17.20
Upper SE Hwy11	RNF351	4.32	72	55	12.99	12.99
Gage 12	RNF359	12.44	68	50	13.97	14.39
MN Highway 11	RNF379	20.97	72	54	37.80	56.70
Hay Creek Det 1	RNF381	4.14	72	54	20.23	20.23
Norland CD 18	RNF385	8.39	72	55	29.83	59.66
Hay Creek Pool 1	RNF391	2.21	72	55	3.60	3.60
Lower Hay Creek	RNF399	19.76	71	53	24.80	31.00
Hay Creek		112.15	71	53		
Norland sub RNF20	RNF401	2.85	74	57	6.27	9.41
Norland sub RNF30	RNF402	6.43	72	54	39.75	79.50
Norland sub RNF40	RNF403	5.66	67	49	13.51	13.51
Norland sub RNF60	RNF405	7.08	72	55	11.04	11.04
Norland sub RNF65	RNF406	1.71	65	46	5.00	5.85
Norland sub RNF70	RNF408	7.65	67	48	12.55	18.83
MN Highway 310	RNF499	19.26	67	49	18.59	32.35
Roseau River @ MN 310		652.43	71	53		
Mud Creek near Sprague, MB	RNF510	32.18	75	59	71.13	106.70
East Fork Sprague Creek	RNF520	22.42	68	51	43.20	64.80
West Fork Sprague Creek	RNF530	20.42	64	45	48.32	72.48
Sprague Creek at Vassar Road	RNF540	47.64	69	51	43.35	65.03
Sprague Creek near Sprague, MB	RNF545	21.93	74	57	35.70	53.55
Sprague Creek at USGS gage	RNF550	39.01	72	55	52.83	35.40
Lat 2 JD 61	RNF570	54.33	76	60	39.24	58.86
Lower Sprague Creek	RNF580	47.32	78	62	29.00	43.50
Sprague Creek		285.25	73	56		
South Roseau Lake	RNF610	40.91	71	53	10.48	7.02
North Roseau Lake	RNF620	46.20	72	55	40.11	40.11
West Pine Creek	RNF700	33.76	62	43	56.23	37.67
East Pine Creek	RNF710	9.55	60	41	20.36	13.63

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Name	Code	DA (Sq Mi)	24-Hour CN	10-Day CN	Tc (Hours)	R (Hours)
Pine Creek to Diversion	RNF720	16.68	67	49	7.58	5.08
Pine Creek at Gage 19	RNF790	20.29	73	56	17.76	17.76
Pine Creek		80.28	66	47		
Roseau River at Ross		1105.07	71	54		
RRWMA Pool 1	RNF810	24.88	75	58	13.30	13.30
RRWMA Pool 2	RNF820	89.71	75	58	51.00	76.50
RRWMA Pool 3	RNF830	23.73	70	52	12.50	12.50
Lins Bridge	RNF900	41.99	72	54	14.73	9.87
RR to Big Swamp	RNF920	24.09	75	59	32.83	32.83
Big Swamp	RNF950	88.82	78	63	32.48	48.72
Caribou	RNF960	24.04	71	53	24.04	33.80
Roseau River to Int'l Border	RNF999	9.56	70	52	13.78	13.78
Roseau River at Int'l Border		1431.89	72	55		

Reach Routing

Roseau River HEC-1 Hydrologic Model (July 18, 2001)

The channel reaches were modeled using the Modified Puls routing method. This method requires the input of an eight point cross section, Mannings (n value) for channel and overbank flow, reach length, slope, and the number of routing steps.

The channel cross section, reach length, and slope were derived from (USGS 7.5 minute topographic maps). Cross section data from the stream gaging program the District operates were also used. The number of routing steps is a calibration parameter for storage routing, it was set to reflect average flows as measured in the Districts stream gaging program. As actual storm events are studied this number should be varied to produce a more accurate hydrograph.

Calibration

Model calibration was done on two rainfall events, the first occurring in May of 1996 and the later occurring in October of 2000. The results of this calibration is shown in Figures 6-12. The gage on Sprague Creek was not in operation for the 1996 flood.

The initial runs of these floods produced higher peaks and shorter durations than the gaged data. The total volume of the events were about equal so calibration was done by adjusting storage upstream of the gaging site. As more gaging data becomes available on the tributaries, this storage can be distributed better.

Results and Conclusions

The model can be used to evaluate the relative change to the flood hydrograph with and without projects which are being considered in the basin. The ability to evaluate relative difference (as apposed to predicting absolute values) is the strength of the hydrologic modeling process.

Tables 3, 4, and 5 show a summary of model predicted peak flows at various points in the basin. These predicted peak flows are considered reasonable. However, care should be taken in using model predicted peak flows for project design purposes. Modeling is only one of the methods normally used for project design.

Figure 6

Roseau River HEC-1 Hydrologic Model (July 18, 2001)

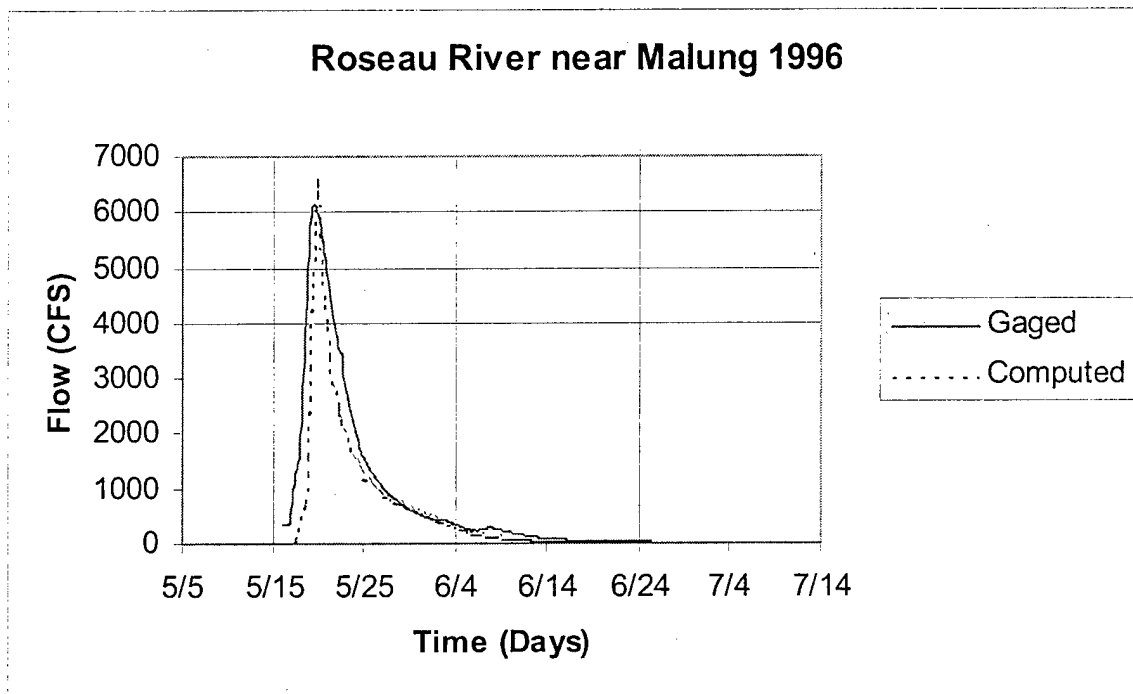
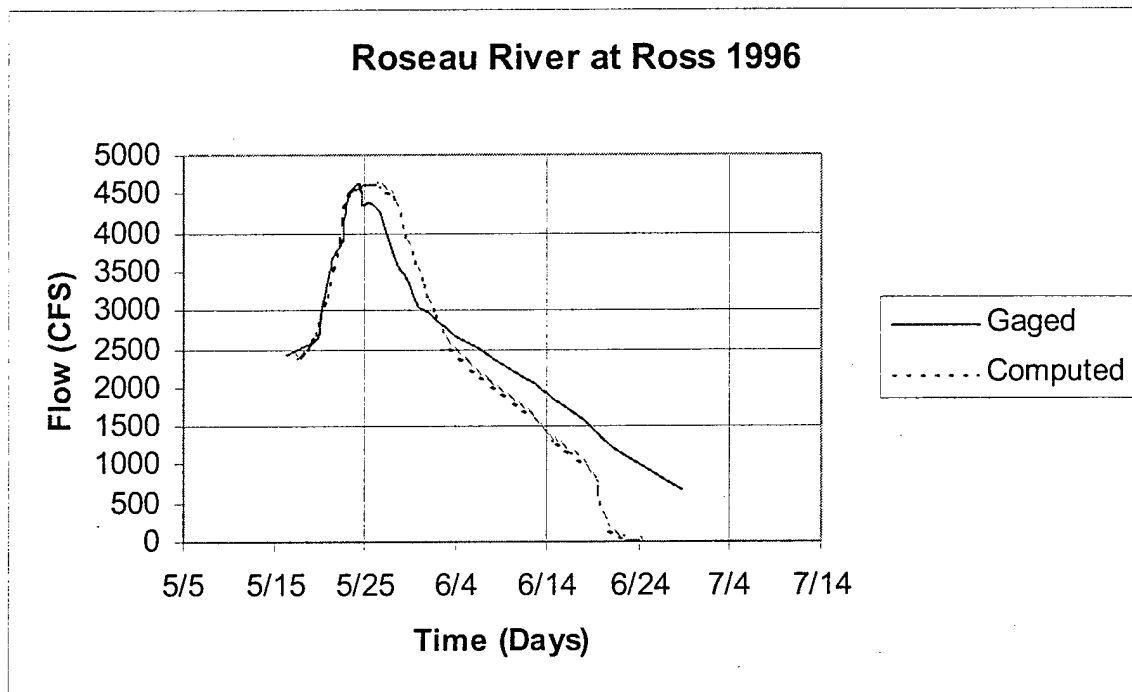


Figure 7



Roseau River HEC-1 Hydrologic Model (July 18, 2001)

Figure 8

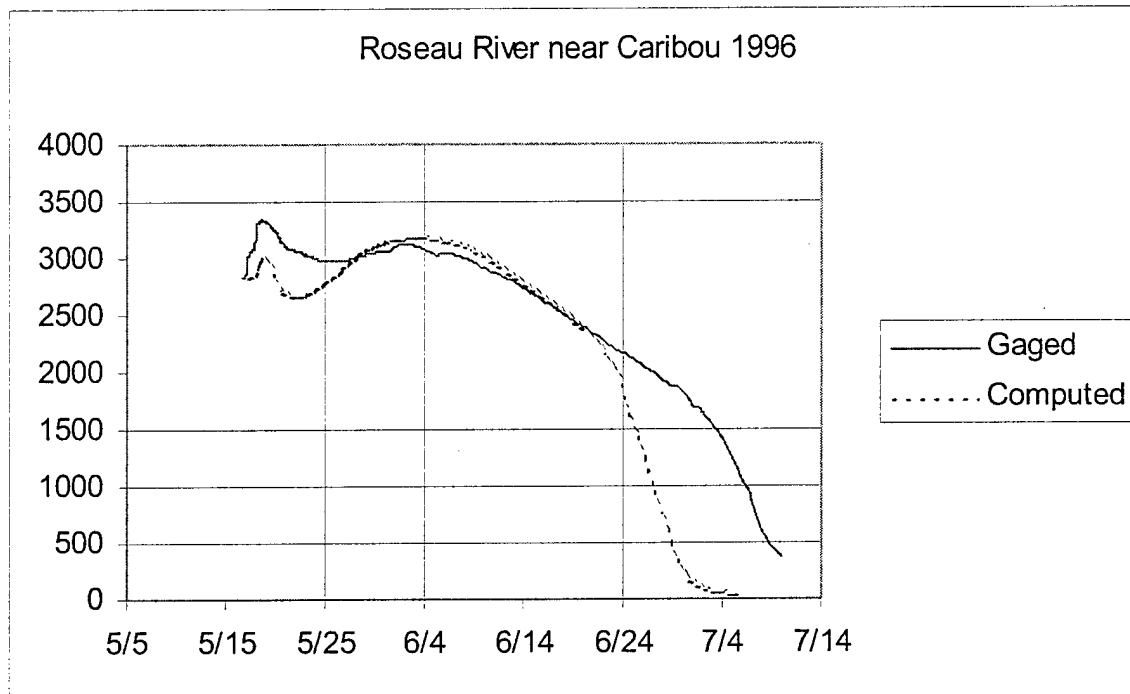


Figure 9

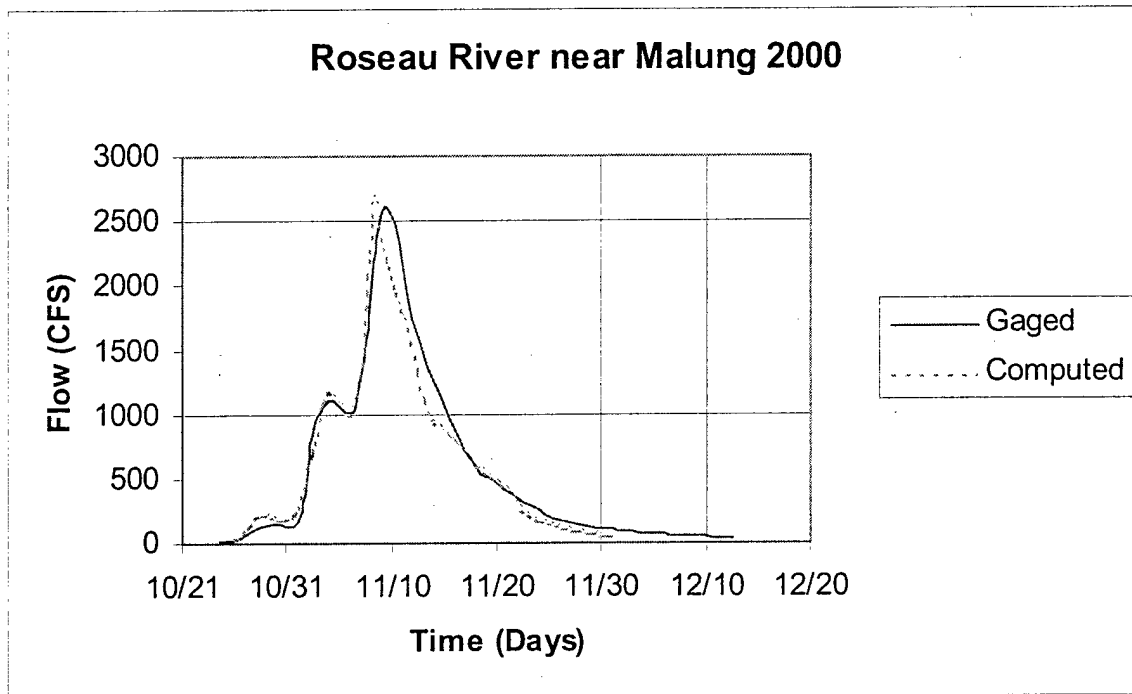


Figure 10

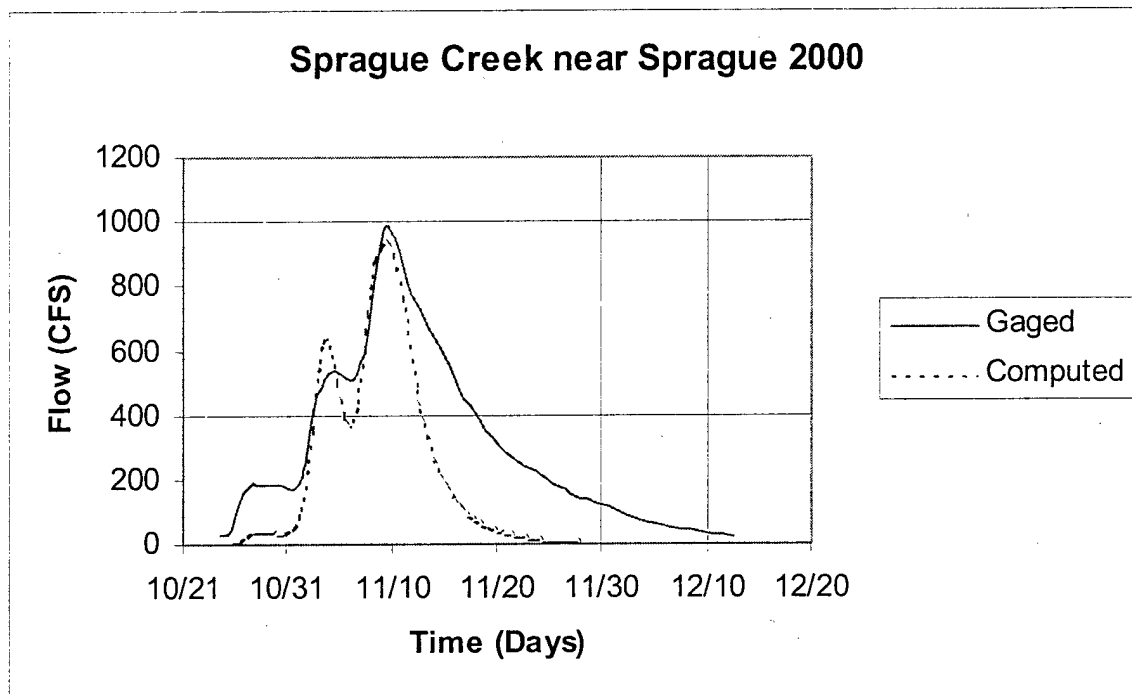


Figure 11

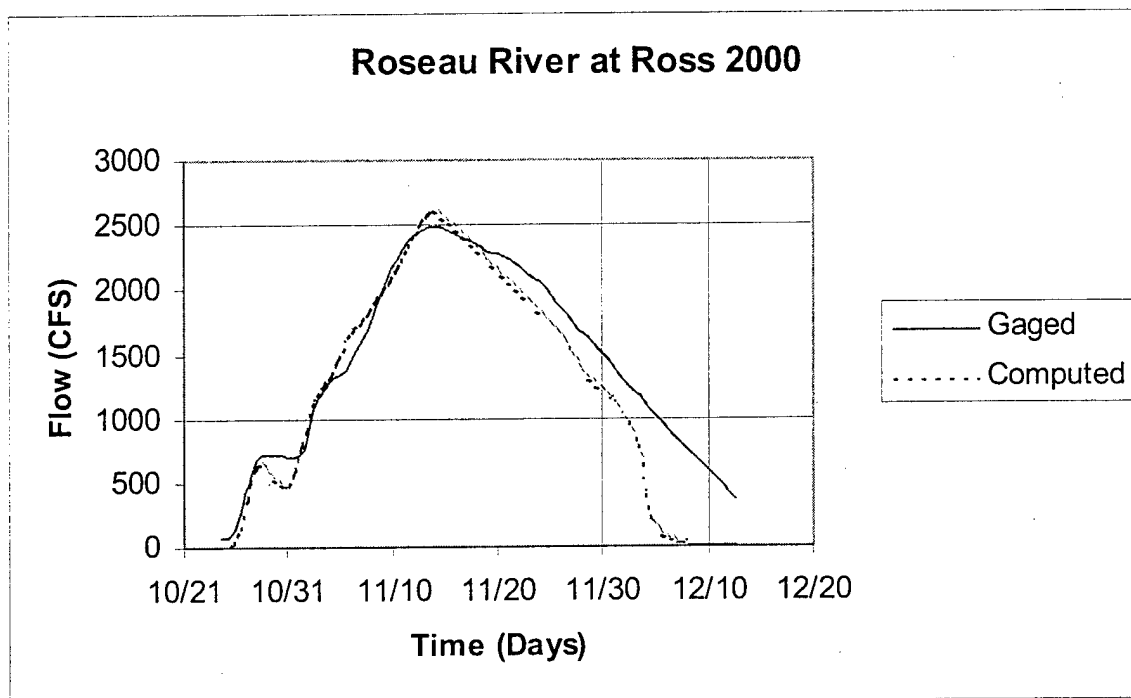
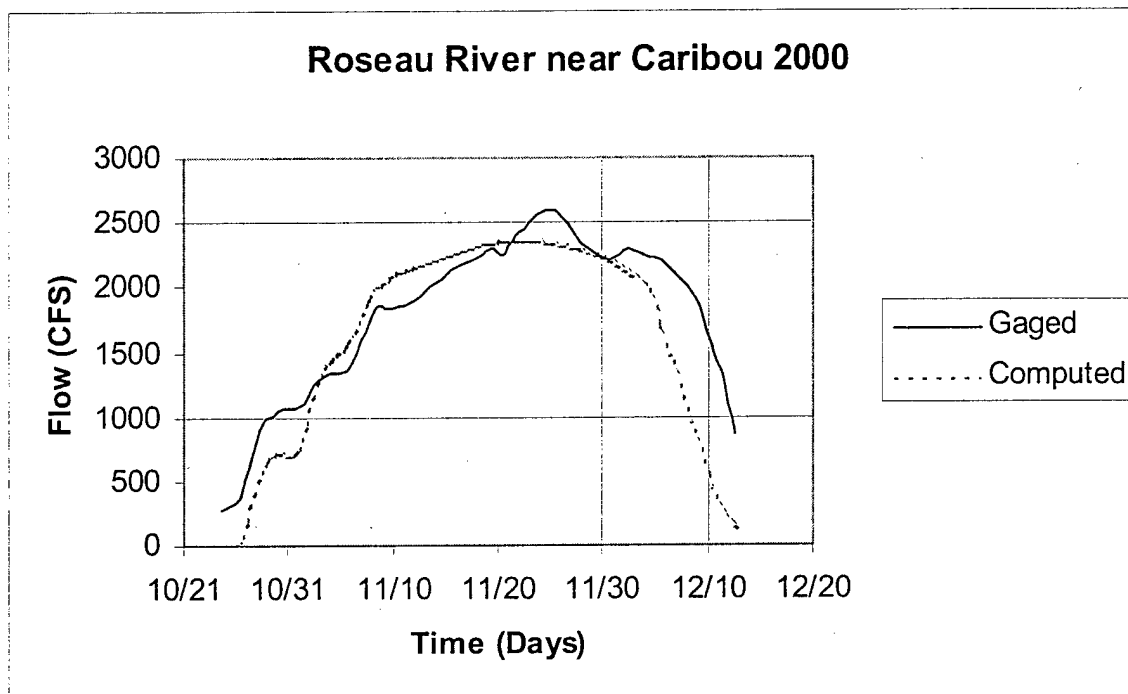


Figure 12



Roseau River HEC-1 Hydrologic Model (July 18, 2001)

Table 3
Summary of Synthetic Summer Flood Flows

Location	Stream Gage ID	Model Id	Drainage Area	1 yr (cfs)	2 yr (cfs)	5 yr (cfs)	10 yr (cfs)
North Branch near Malung	2	adh99	216.09	63	82	295	499
South Fork at Wannaska	36	adh149	125.63	144	170	560	1,027
South Fork near Malung	1	adh199	218.03	148	187	440	973
Roseau River near Malung	50	adh209	437.36	198	258	729	1,411
Roseau River at Roseau	30	adh269	484.13	214	283	793	1,533
Hay Creek at Summer Road	11	adh339	45.43	51	61	245	482
Hay Creek at MN Hwy 11	13	adh379	83.16	83	100	397	779
Hay Creek at Mouth		adh399	112.15	110	133	524	821
Roseau River at CR 28	15	adh400	601.79	275	362	1,067	2,159
Roseau River at MN Hwy 310	16	adh499	652.43	296	390	1,224	2,280
Sprague Creek at USGS Gage	57	adh550	183.60	135	160	554	984
Sprague Creek		adh580	285.25	294	338	961	1,673
Pine Creek at Diversion	606	adh720	59.99	12	16	130	345
Pine Creek Diversion	606	rtv720		12	16	130	303
Pine Creek at CR 118	19	adh790	80.28	39	47	171	324
Roseau River at Ross	20	rsv699	1,105.07	646	755	1,365	1,968
Overflow to Two Rivers	40	rtv920		0	0	0	4
Roseau River near Caribou		adh960	1,422.33	732	839	1,448	2,008
Roseau River at Int'l Border		adh999	1,432.89	733	839	1,448	2,008

Roseau River HEC-1 Hydrologic Model (July 18, 2001)

Table 4
Summary of Synthetic Summer Flood Flows

Location	Stream Gage ID	Model Id	Drainage Area	25 yr (cfs)	50 yr (cfs)	100 yr (cfs)
North Branch near Malung	2	adh99	216.09	999	1,617	2,052
South Fork at Wannaska	36	adh149	125.63	1,621	2,088	2,500
South Fork near Malung	1	adh199	218.03	2,321	3,568	4,302
Roseau River near Malung	50	adh209	437.36	2,781	4,106	5,230
Roseau River at Roseau	30	adh269	484.13	3,184	4,725	5,840
Hay Creek at Summer Road	11	adh339	45.43	770	1,007	1,209
Hay Creek at MN Hwy 11	13	adh379	83.16	1,185	1,518	1,805
Hay Creek at Mouth		adh399	112.15	1,247	1,610	1,944
Roseau River at CR 28	15	adh400	601.79	4,053	5,340	6,600
Roseau River at MN Hwy 310	16	adh499	652.43	3,781	5,082	6,113
Sprague Creek at USGS Gage	57	adh550	183.60	1,427	1,847	2,164
Sprague Creek		adh580	285.25	2,462	3,164	3,727
Pine Creek at Diversion	606	adh720	59.99	629	878	1,100
Pine Creek Diversion	606	rtv720		493	658	784
Pine Creek at CR 118	19	adh790	80.28	557	755	923
Roseau River at Ross	20	rsv699	1,105.07	2,698	3,772	4,514
Overflow to Two Rivers	40	rtv920		186	380	557
Roseau River near Caribou		adh960	1,422.33	2,342	2,697	3,008
Roseau River at Int'l Border		adh999	1,432.89	2,342	2,697	3,007

Roseau River HEC-1 Hydrologic Model (July 18, 2001)

Table 5
Summary of Synthetic Spring Flood Flows

Location	Stream Gage ID	Model Id	Drainage Area	10 yr (cfs)	25 yr (cfs)	50 yr (cfs)	100 yr (cfs)
North Branch near Malung	2	adh99	216.09	3,168	3,880	4,365	4,845
South Fork at Wannaska	36	adh149	125.63	2,237	2,721	3,066	3,416
South Fork near Malung	1	adh199	218.03	3,969	4,673	5,224	5,802
Roseau River near Malung	50	adh209	437.36	7,164	8,484	9,485	10,433
Roseau River at Roseau	30	adh269	484.13	8,100	9,587	10,465	11,572
Hay Creek at Summer Road	11	adh339	45.43	928	1,119	1,257	1,396
Hay Creek at MN Hwy 11	13	adh379	83.16	1,622	1,954	2,195	2,440
Hay Creek at Mouth		adh399	112.15	1,902	2,337	2,639	2,954
Roseau River at CR 28	15	adh400	601.79	8,534	10,039	11,171	12,267
Roseau River at MN Hwy 310	16	adh499	652.43	8,038	9,819	10,996	12,142
Sprague Creek at USGS Gage	57	adh550	183.60	2,489	3,020	3,434	3,829
Sprague Creek		adh580	285.25	3,852	4,708	5,337	5,966
Pine Creek at Diversion	606	adh720	59.99	1,127	1,470	1,654	1,838
Pine Creek Diversion	606	rtv720		796	850	850	850
Pine Creek at CR 118	19	adh790	80.28	792	1,182	1,432	1,684
Roseau River at Ross	20	rsv699	1,105.07	5,136	6,741	8,160	9,798
Overflow to Two Rivers	40	rtv920		1,334	1,793	2,235	2,740
Roseau River near Caribou		adh960	1,422.33	3,449	3,687	3,915	4,175
Roseau River at Int'l Border		adh999	1,432.89	3,449	3,687	3,915	4,175

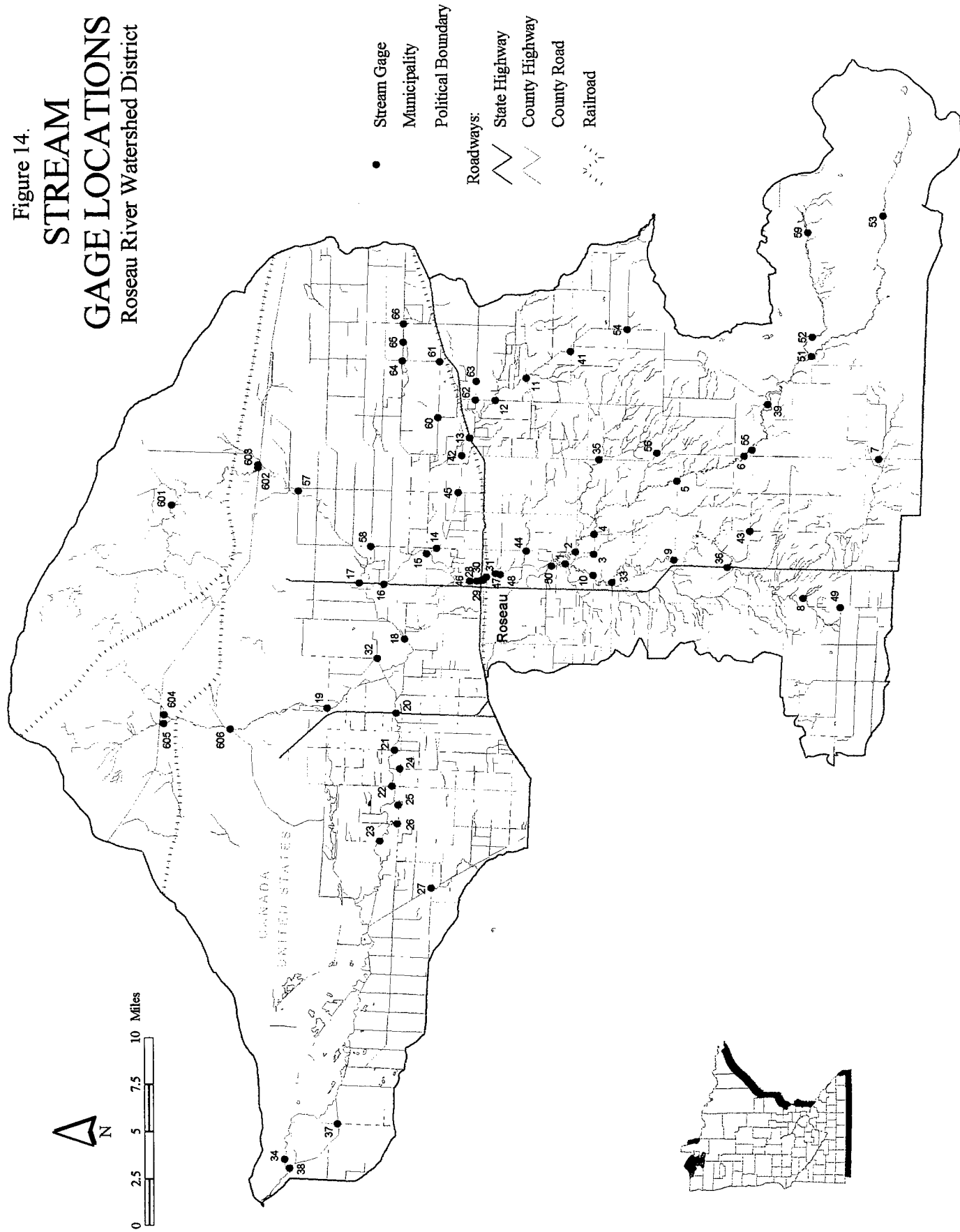
Future Model Improvements

The model has had limited calibration to actual storm events due to the limited extent of actual gaging data available, particularly in Manitoba. We have established a network of stream gaging sites within the watershed. The location of these sites are shown in Figure 14. We recommend that as additional data from these sites becomes available, further calibration of the model should be performed.

The modeling capabilities of the program are somewhat limited in their ability to model the sloped storage that occurs in the Old Roseau Lake Bed and the Big Swamp areas. Within the current model, this is done by an approximation of level pool storage. Ideally, these areas would be analyzed using a dynamic routing model such as Unet.

As the planning process evolves, it is anticipated that the model will need to be further refined to analyze specific flood damage reduction strategies in specific areas.

Figure 14.
**STREAM
 GAGE LOCATIONS**
 Roseau River Watershed District



Roseau River HEC-1 Hydrologic Model (July 18, 2001)

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- Joint Studies for Co-ordinated Water Use and Control in the Roseau River Basin, International Roseau River Engineering Board Report to the International Joint Commission, September, 1975, Appendix A Water Resources
- National Weather Service, Technical Papers #40 and 49
- Soil Conservation Service, National Engineering Handbook (NEH)
- United States Department of Agriculture, Soil Survey Manual, Soil Survey Division Staff, Agriculture Handbook No. 18, Issued October 1993
- The Minnesota Hydrology Guide (MHG)
- Red Lake Watershed District, Charles Anderson, P.E.
- Hydrologic Analysis of Floods, Workshop - U.S. Army Corps of Engineers, October 6-9, 1981 Madison, Wisconsin
- USGS 7.5 Minute Topographic Maps

APPENDIX A

Basin Schematic

SCHEMATIC DIAGRAM OF STREAM NETWORK

INPUT		
LINE	(V) ROUTING	(--->) DIVERSION OR PUMP FLOW
NO.	(.) CONNECTOR	(<---) RETURN OF DIVERTED OR PUMPED FLOW

6	RNF9	
	V	
	V	
32	RSV9	
	V	
	V	
40	RCH9	
	.	
47	.	RNF15
	.	.
	.	.
54	ADH15.....	
	V	
	V	
57	RCH15	
	.	
	.	
64	.	RNF19
	.	.
	.	.
71	ADH19.....	
	V	
	V	
74	RCH19a	
	V	
	V	
81	RC19b	
	.	
	.	
88	.	RNF25
	.	.
	.	.
95	ADH25.....	
	.	
	.	
99	.	RNF29
	.	V
	.	V
106	.	RSV29
	.	V
	.	V
114	.	RCH29
	.	.
	.	.
121	.	RNF35
	.	.
	.	.
128	ADH35.....	
	V	
	V	
131	RCH35	
	.	
	.	
138	.	RNF39
	.	.
	.	.
145	ADH39.....	
	V	
	V	
148	RSV39	
	V	
	V	
156	RCH39	
	.	
	.	
163	.	RNF45
	.	.
	.	.
170	ADH45.....	
	.	
	.	
174	ADH46.....	
	V	

	V	
177	RCH46	
	.	
184	.	RNF49
	.	
191	ADH49.....	
	V	
	V	
194	RSV49	
	V	
	V	
205	RCH49	
	.	
212	.	RNF59
	.	
219	ADH59.....	
	V	
	V	
222	RCH59	
	.	
229	.	RNF65
	.	
236	ADH65.....	
	V	
	V	
239	RCH65	
	.	
246	.	RNF69
	.	
253	ADH69.....	
	.	
256	.	RNF070
	.	
263	ADH70.....	
	V	
	V	
266	RCH070	
	.	
273	.	RNF079
	.	
280	ADH79.....	
	.	
283	.	RNF80
	.	V
	.	V
290	.	RCH80
	.	
297	.	RNF85
	.	
304	.	ADH85.....
	.	
308	ADH86.....	
	V	
	V	
311	RCH86	
	.	
318	.	RNF99

325	ADH99.....			
	V			
	V			
328	RSV99			
	V			
	V			
333	RCH99			
340		RNF109		
		V		
		V		
347		RCH109		
		V		
		V		
354		RCH110		
361			RNF119	
368		ADH119.....		
372			RNF120	
			V	
			V	
380			RCH120	
386				RNF121
				V
				V
393				RCH121
399				
				RNF123
406				ADH123.....
				V
				V
409				RCH123
415				ADH124.....
418				
				RNF125
				V
				V
425				RCH125
431				
				RNF126
				V
				V
438				RCH126
444				
				RNF127
				V
				V
451				RCH127
457				
				RNF128
				V
				V
464				RCH128

602	.	.	.	RNF165
609	.	.	ADH165.....	.
613	.	ADH166.....	.	.
	.	V	.	.
	.	V	.	.
616	.	RCH166	.	.
623	.	.	RNF169	.
630	.	ADH169.....	.	.
	.	V	.	.
	.	V	.	.
633	.	RCH169	.	.
640	.	.	RNF170	.
647	.	ADH170.....	.	.
651	.	.	RNF171	.
658	.	ADH171.....	.	.
	.	V	.	.
	.	V	.	.
661	.	RCH171	.	.
668	.	.	RNF172	.
675	.	ADH172.....	.	.
679	.	.	RNF173	.
686	.	ADH173.....	.	.
	.	V	.	.
	.	V	.	.
689	.	RCH173	.	.
696	.	.	RNF199	.
703	.	ADH198.....	.	.
706	.	.	RNF180	.
	.	.	V	.
	.	.	V	.
713	.	.	RCH180	.
720	.	.	.	RNF189
727	.	.	ADH189.....	.
731	.	ADH199.....	.	.
	.	V	.	.
	.	V	.	.

734	.	RSV199	
	.	V	
	.	V	
739	.	RCH199	
	.	.	
746	ADH200.....	.	
	.	V	
	.	V	
749	RCH200	.	
	.	.	
756	.	RNF209	
	.	.	
763	ADH209.....	.	
	.	V	
	.	V	
766	RCH209	.	
	.	.	
773	.	RNF211	
	.	.	
780	.	.	RNF212
	.	.	.
787	.	.	RNF213
	.	.	.
794	ADH211.....	.	
	.	V	
	.	V	
797	RCH211	.	
	.	.	
804	.	.	RNF219
	.	.	.
811	ADH220.....	.	
	.	.	
815	ADH221.....	.	
	.	V	
	.	V	
818	RCH221	.	
	.	.	
825	.	RNF229	
	.	.	
832	ADH229.....	.	
	.	.	
836	.	RNF248	
	.	V	
	.	V	
843	.	RCH248	
	.	.	
850	.	.	RNF249
	.	.	.
857	ADH249.....	.	
	.	.	
861	ADH260.....	.	
	.	V	
	.	V	
864	RCH260	.	
	.	.	
871	.	RNF269	
	.	.	

878	ADH269.....		
	V		
	V		
881	RCH269		
	.		
888		RNF299	
	.		
895	ADH299.....		
	.		
898		RNF319	
	.	V	
	.	V	
905		RCH319	
	.		
912			RNF335
	.		
921			-----> OUT335
919		DVT335	
	.	V	
	.	V	
924		RCH335	
	.		
931	ADH336.....		
	V		
	V		
934	RCH336		
	.		
941		RNF339	
	.		
948	ADH339.....		
	V		
	V		
951	RCH339		
	.		
958		RNF351	
	.		
967			-----> OUT335
965		RTV335	
	.	V	
	.	V	
968		RCH350	
	.		
973	ADH351.....		
	.		
978			-----> OUT351
976		DVT351	
	.	V	
	.	V	
981		RCH351	
	.		
988	ADH352.....		
	V		
	V		
991	RCH352		
	.		
998		RNF359	
	.		
1005	ADH359.....		

		V	
		V	
1008		RCH359	
1017			<----- OUT351
1015		RTV351	
		V	
		V	
1018		RCH352	
1023		ADH360.....	
		V	
		V	
1026		RCH360	
1033		RNF379	
1040		ADH379.....	
		V	
		V	
1043		RCH379	
1050		RNF381	
1057		ADH381.....	
		V	
		V	
1060		RCH381	
1067		RNF385	
		V	
		V	
1075		RCH385	
1082			RNF391
1089		ADH391.....	
		V	
		V	
1092		RCH391	
1101			-----> OUT391
1099		DVT391	
		V	
		V	
1104		RCH392	
1111		ADH395.....	
		V	
		V	
1114		RCH395	
1121		RNF399	
1128		ADH399.....	
1132	ADH400.....		
		V	
		V	
1136	RSV400		

1144	.	.	<-----	OUT391
1142	.	RTV391		
	.	V		
	.	V		
1145	.	RC391b		
	.	.		
1150	ADH401	.....		
	.	V		
	.	V		
1154	RC391m			
	.	.		
1160	.	RNF401		
	.	V		
	.	V		
1168	.	RCH401		
	.	.		
1175	.	.	RNF402	
	.	.	.	
1183	.	ADH402	.....	
	.	.		
1188	.	.	----->	OUT402
1186	.	DVT402		
	.	V		
	.	V		
1191	.	RCH402		
	.	.		
1198	.	.	RNF403	
	.	.	.	
1206	.	ADH403	.....	
	.	V		
	.	V		
1209	.	RCH403		
	.	.		
1216	.	.	RNF405	
	.	.	.	
1224	.	ADH405	.....	
	.	.		
1228	.	.	RNF406	
	.	.	.	
1236	.	ADH406	.....	
	.	.		
1240	.	.	RNF408	
	.	.	.	
1248	.	ADH408	.....	
	.	.		
1253	.	.	----->	OUT410
1251	.	DVT408		
	.	V		
	.	V		
1256	.	RCH420		
	.	.		
1263	ADH421	.....		
	.	V		
	.	V		
1266	RCH421			
	.	.		

1274	.	.	----- OUT410
1272	.	RTV430	
	.	V	
	.	V	
1275	.	RCH430	
	.	.	
1280	ADH430	.....	
	.	.	
1283	.	RNF499	
	.	.	
1290	ADH499	.....	
	.	.	
1294	.	RNF520	
	.	.	
1301	.	.	RNF530
	.	.	
1308	.	ADH530	.....
	.	V	
	.	V	
1311	.	RCH530	
	.	.	
1318	.	.	RNF540
	.	.	
1325	.	ADH540	.....
	.	V	
	.	V	
1328	.	RCH540	
	.	.	
1335	.	.	RNF545
	.	.	
1342	.	ADH545	.....
	.	.	
1346	.	.	RNF510
	.	.	
1353	.	ADH546	.....
	.	V	
	.	V	
1356	.	RCH546	
	.	.	
1363	.	.	RNF550
	.	.	
1370	.	ADH550	.....
	.	V	
	.	V	
1374	.	RCH550	
	.	.	
1381	.	.	RNF570
	.	.	
1390	.	.	----- OUT402
1388	.	.	RTV402
	.	.	V
	.	.	V
1391	.	.	RCH571
	.	.	
1396	.	ADH574	.....
	.	V	
	.	V	

1399	.	.	RCH574
	.	.	.
1406	.	ADH575.....	.
	.	V	.
	.	V	.
1409	.	RCH575	.
	.	.	.
1416	.	.	RNF580
	.	.	.
1423	.	ADH580.....	.
	.	.	.
1427	ADH456.....	.	.
	V	.	.
	V	.	.
1431	RCH456	.	.
	.	.	.
1438	.	RNF610	.
	.	.	.
1445	.	.	RNF620
	.	.	.
1452	ADH620.....	.	.
	.	.	.
1456	.	RNF700	.
	.	V	.
	.	V	.
1463	.	RCH700	.
	.	.	.
1470	.	.	RNF710
	.	.	V
	.	.	V
1477	.	.	RCH710
	.	.	.
1484	.	ADH710.....	.
	.	V	.
	.	V	.
1488	.	RCH711	.
	.	.	.
1495	.	.	RNF720
	.	.	.
1502	.	ADH720.....	.
	.	.	.
1508	.	.	-----> OUT720
1506	.	DVT720	.
	.	V	.
	.	V	.
1511	.	RCH720	.
	.	.	.
1518	.	.	RNF790
	.	.	.
1525	.	ADH790.....	.
	.	.	.
1529	ADH699.....	.	.
	V	.	.
	V	.	.
1532	RSV699	.	.
	V	.	.
	V	.	.
1542	RCH699	.	.

1549	.	RNF900	
	.		
1556	ADH900.....		
	V		
	V		
1559	RCH900		
	.		
1566	.	RNF920	
	.		
1573	ADH920.....		
	V		
	V		
1576	RCH920		
	.		
1583	.	RNF810	
	.		
1592	.		----- OUT720
1590	.	RTV720	
	.	V	
	.	V	
1593	.	RC720a	
	.		
1598	ADH810.....		
	V		
	V		
1601	RSV810		
	.		
1608	.	RNF820	
	.		
1615	ADH820.....		
	V		
	V		
1618	RSV820		
	.		
1627	.		----- OUT820
1625	DVT820		
	V		
	V		
1630	RCH821		
	V		
	V		
1637	RCH822		
	.		
1644	ADH930.....		
	V		
	V		
1647	RCH930		
	.		
1654	.	RNF830	
	.		
1663	.		----- OUT820
1661	.	RTV820	
	.		
1664	ADH830.....		
	V		
	V		
1667	RSV830		
	V		
	V		

1674	.	RCH831	
	.	V	
	.	V	
1681	.	RCH832	
	.		
1688	ADH940.....		
	V		
	V		
1691	RCH940		
	.		
1698	.	RNF950	
	.		
1705	ADH950.....		
	V		
	V		
1708	RSV950		
	.		
1716	----->	OUT920	
1714	DVT950		
	V		
	V		
1719	RCH950		
	.		
1726	.	RNF960	
	.		
1733	ADH960.....		
	V		
	V		
1736	RCH960		
	.		
1743	.	RNF999	
	.		
1750	ADH999.....		
	.		
1756	.	<-----	OUT920
1754	.	RTV920	

Appendix B

HEC-1 Input
Spring Runoff Events

ID Roseau River Watershed District
 ID Developed by JOR Engineering, Inc. Crookston, MN
 ID 10 Day Spring Event 6/11/01 Michael Bakken
 *DIAGRAM
 IT 480 1JAN94 0 150
 IO 0
 KK RNF9
 KM Local Drainage to Roseau River Flowage
 KO 0 0 0 0 22
 BA 40.81
 IN 144.
 KM 100 year
 PB 6.1
 KM 50 year
 PB 5.49
 KM 25 year
 PB 4.88
 KM 10 year
 PB 4.03
 PC 0. 0.00527 0.01059 0.01596 0.02139 0.02687 0.03241 0.03801 0.04368 0.04941
 PC0.0552 0.06108 0.06702 0.07304 0.07914 0.08532 0.09158 0.09793 0.10438 0.11092
 PC0.1175 0.12432 0.13119 0.13818 0.14529 0.15253 0.15991 0.16744 0.17513 0.183
 PC0.191 0.1993 0.20776 0.21645 0.22539 0.23460 0.24412 0.25397 0.2642 0.27485
 PC0.2859 0.29769 0.31004 0.32318 0.33728 0.35261 0.36957 0.38885 0.41184 0.44238
 PC0.5323 0.57169 0.59764 0.61852 0.63652 0.6526 0.66728 0.68088 0.69361 0.70562
 PC0.717 0.72792 0.73836 0.7484 0.75808 0.76744 0.77651 0.78532 0.79389 0.80224
 PC0.8103 0.81834 0.82612 0.83373 0.84119 0.8485 0.85568 0.86273 0.86965 0.87646
 PC0.8831 0.88975 0.89624 0.90264 0.90895 0.91517 0.92131 0.92737 0.93335 0.93925
 PC0.945 0.95084 0.95654 0.96217 0.96774 0.97325 0.97871 0.98411 0.98947 0.99474
 LS 0 100 0
 UC 35.53 82.78
 * fan
 UA 0 0.05 0.15 0.35 0.65 1
 KK RSV9
 KM Roseau River Flowage Impoundment
 KM Outlet and Storage curves developed by Dan Thul (MNDNR 1981)
 KO 0 0 0 0 22
 RS 1 STOR 240 0
 * rsv9stor
 SV 240 310 400 500 643 940 1092 1245 1550
 * rsv9flow
 SQ 0 52 155 288 435 800 1225 1913 3663
 * Rsv9elev
 SE 1230 1230.5 1231 1231.5 1232 1233 1233.5 1234 1235
 KK RCH9
 KM North Branch Downstream of Roseau River Flowage
 KO 0 0 0 0 22
 RS 1 FLOW 0 0
 RC 0.125 0.035 0.125 11200 0.0004 0
 * rch9
 RX 0 700 750 756 780 786 900 2800
 RY 1230 1225 1224 1218 1218 1224 1225 1230
 KK RNF15
 KM local drainage to DNR dam 3 Non-functional
 KO 0 0 0 0 22
 BA 13.69
 LS 0 100 0
 UC 25.65 51.3
 * diamond
 UA 0 0.09 0.34 0.64 0.9 1
 KK ADH15
 KO 0 0 0 0 22
 HC 2
 KK RCH15
 KM North Branch Downstream of DNR dam 3

KO	0	0	0	0	22			
RS	2	FLOW	0	0				
RC	0.125	0.035	0.125	12800	0.0004	0		
* rch15								
RX	0	820	1000	1006	1030	1036	1400	2500
RY	1225	1220	1219	1213	1213	1219	1220	1225
KK RNF19								
KM	Local Drainage to DNR dam 4 Non-functional							
KO	0	0	0	0	22			
BA	5.8							
LS	0	100	0					
UC	14.88	29.76						
* diamond								
UA	0	0.09	0.34	0.64	0.9	1		
KK ADH19								
KO	0	0	0	0	22			
HC	2							
KKRCH19a								
KM	North Branch downstream of DNR dam 4							
KO	0	0	0	0	22			
RS	1	FLOW	0	0				
RC	0.125	0.035	0.125	9400	0.0011	0		
* rch19a								
RX	0	510	690	696	720	726	990	1690
RY	1225	1220	1209	1203	1203	1209	1220	1225
KK RC19b								
KM	North Branch downstream of DNR dam 4							
KO	0	0	0	0	22			
RS	2	FLOW	0	0				
RC	0.125	0.035	0.125	26000	0.0012	0		
* rch19b								
RX	0	200	280	286	318	324	390	450
RY	1210	1200	1195	1188.5	1188.5	1195	1200	1210
KK RNF25								
KM	Local drainage to North Branch at Hanson Creek							
KO	0	0	0	0	22			
BA	12.52							
LS	0	100	0					
UC	18.8	37.6						
* rectangle								
UA	0	0.2	0.4	0.6	0.8	1		
KK ADH25								
KM	North Branch Upstream of Hanson Creek							
KO	0	0	0	0	22			
HC	2							
KK RNF29								
KM	DNR dam 1 on Hanson Creek							
KO	0	0	0	0	22			
BA	12.73							
LS	0	100	0					
UC	34.28	79.87						
* fan								
UA	0	0.05	0.15	0.35	0.65	1		
KK RSV29								
KM	DNR dam 1 on Hanson Creek							
KM	Outlet and Storage curves developed by Dan Thul (MNDNR 1981)							
KO	0	0	0	0	22			
RS	1	STOR	320	0				
* rsv29stor								
SV	320	370	450	650	670	810	960	1360
* rsv29flow								
SQ	0	57.5	166	319	558	934	1310	4235
* rsv29elev								
SE	1219	1219.5	1220	1220.5	1221	1221.5	1222	1223
KK RCH29								

KM Hanson Creek downstream of DNR dam 1									
KO	0	0	0	0	22				
RS	2	FLOW	0	0					
RC	0.125	0.035	0.125	6000	0.0009	0			
* rch29									
RX	0	400	800	803	818	821	1100	1480	
RY	1220	1215	1214	1211	1211	1214	1215	1220	
KK RNF35									
KM Non-functional DNR dam 2 on Hanson Creek									
KO	0	0	0	0	22				
BA	4.9								
LS	0	100	0						
UC	22.66	52.8							
* diamond									
UA	0	0.09	0.34	0.64	0.9	1			
KK ADH35									
KO	0	0	0	0	22				
HC	2								
KK RCH35									
KM Hanson Creek from DNR dam 2 to Winner Dam									
KO	0	0	0	0	22				
RS	5	FLOW	0	0					
RC	0.125	0.035	0.125	17000	0.0006	0			
* rch35									
RX	0	110	310	316	336	342	600	1000	
RY	1210	1205	1204	1198	1198	1204	1205	1210	
KK RNF39									
KM Local drainage to Winner Dam									
KO	0	0	0	0	22				
BA	13.36								
LS	0	100	0						
UC	40.79	95.04							
* diamond									
UA	0	0.09	0.34	0.64	0.9	1			
KK ADH39									
KO	0	0	0	0	22				
HC	2								
KK RSV39									
KM Winner Dam impoundment on Hanson Creek									
KM Outlet and Storage curves developed by Dan Thul (MNDNR 1981)									
KO	0	0	0	0	22				
RS	1	STOR	5	0					
* rsv39stor									
SV	5	21	30	65	120	220	370	470	580
* rsv39flow									
SQ	0	6	32	75	170	320	560	920	1500
* rsv39elev									
SE1201.5	1202	1203	1204	1205	1206	1207	1207.5	1208	
KK RCH39									
KM Hanson Creek Winner dam to North Branch									
KO	0	0	0	0	22				
RS	1	FLOW	0	0					
RC	0.125	0.035	0.125	20500	0.0013	0			
* rch39									
RX	0	700	990	996	1036	1042	1290	1680	
RY	1205	1200	1194	1182	1182	1194	1200	1205	
KK RNF45									
KM Local drainage to outlet of Hanson Creek									
KO	0	0	0	0	22				
BA	5.59								
LS	0	100	0						
UC	16.96	33.92							
* rectangle									
UA	0	0.2	0.4	0.6	0.8	1			
KK ADH45									

KM	Hanson Creek outflow									
KO	0	0	0	0	22					
HC	2									
KK ADH46										
KO	0	0	0	0	22					
HC	2									
KK RCH46										
KM	North Branch from Hanson Creek to Hayes Lake									
KO	0	0	0	0	22					
RS	1	FLOW	0	0						
RC	0.125	0.035	0.125	11000	0.0007	0				
* rch46										
RX	0	200	350	358	390	398	460	990		
RY	1190	1175	1169	1161	1161	1169	1175	1190		
KK RNF49										
KM	Local drainage to Hayes Lake									
KO	0	0	0	0	22					
BA	18.29									
LS	0	100	0							
UC	60.89	121.78								
* diamond										
UA	0	0.09	0.34	0.64	0.9	1				
KK ADH49										
KO	0	0	0	0	22					
HC	2									
KK RSV49										
KM	Hayes Lake Dam									
KM	Outlet and Storage curves developed by Dan Thul (MNDNR 1981)									
KO	0	0	0	0	22					
RS	1	STOR	1640	0						
* rsv49stor										
SV	0	180	595	1290	1640	1680	1750	1840	2050	2270
SV	2510	2760	3000	3070	3180	3250				
* rsv49flow										
SQ	0	0	0	0	0	19	72	213	640	1235
SQ	2000	2950	4060	4610	5140	8150				
* rsv49elev										
SE	1150	1155	1160	1165	1167	1167.2	1167.5	1168	1169	1170
SE	1171	1172	1173	1173.4	1173.7	1174				
KK RCH49										
KM	North Branch Hayes Lake to Beaver									
KO	0	0	0	0	22					
RS	1	FLOW	0	0						
RC	0.125	0.035	0.125	28200	0.001	0				
* rch49										
RX	0	90	160	168	228	236	690	800		
RY	1150	1135	1130	1122	1122	1130	1135	1150		
KK RNF59										
KM	Local Drainage to Beaver									
KO	0	0	0	0	22					
BA	15.71									
LS	0	100	0							
UC	43.26	64.89								
* fan										
UA	0	0.05	0.15	0.35	0.65	1				
KK ADH59										
KO	0	0	0	0	22					
HC	2									
KK RCH59										
KM	North Branch to Pencer									
KO	0	0	0	0	22					
RS	2	FLOW	0	0						
RC	0.125	0.035	0.125	38000	0.0009	0				
* rch59										
RX	0	110	1000	1008	1068	1072	1690	1770		

	RY 1125	1120	1115	1107	1107	1115	1120	1125
KK RNF65								
KM	Local drainage to Pencer East							
KO	0	0	0	0	22			
BA	12.79							
LS	0	100	0					
UC	15.54	12.43						
* fan								
UA	0	0.05	0.15	0.35	0.65	1		
KK ADH65								
KO	0	0	0	0	22			
HC	2							
KK RCH65								
KM	North Branch to Severson Creek							
KO	0	0	0	0	22			
RS	1	FLOW	0	0				
RC	0.125	0.035	0.125	25509	0.0008	0		
* rch65								
RX	0	80	250	270	330	350	1580	1680
RY	1095	1090	1085	1075	1075	1085	1090	1095
KK RNF69								
KM	Local drainage to North Branch at Severson Creek							
KO	0	0	0	0	22			
BA	2.29							
LS	0	100	0					
UC	7.24	7.24						
* rectangle								
UA	0	0.2	0.4	0.6	0.8	1		
KK ADH69								
KO	0	0	0	0	22			
HC	2							
KKRNF070								
KM	Severson Creek							
KO	0	0	0	0	22			
BA	22.25							
LS	0	100	0					
UC	17.3	17.3						
* fan								
UA	0	0.05	0.15	0.35	0.65	1		
KK ADH70								
KO	0	0	0	0	22			
HC	2							
KKRCH070								
KM	North Branch to Bear Creek							
KO	0	0	0	0	22			
RS	1	FLOW	0	0				
RC	0.125	0.035	0.125	29973	0.0008	0		
* rch70								
RX	0	80	250	270	330	350	1580	1680
RY	1085	1080	1075	1065	1065	1075	1080	1085
KKRNF079								
KM	Local drainage North Branch at Bear Creek							
KO	0	0	0	0	22			
BA	7.52							
LS	0	100	0					
UC	13.14	13.14						
* rectangle								
UA	0	0.2	0.4	0.6	0.8	1		
KK ADH79								
KO	0	0	0	0	22			
HC	2							
KK RNF80								
KM	Local Drainage Comstocks Bear Creek at Roseau CSAH 9							
KO	0	0	0	0	22			
BA	20.66							

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LS      0      100      0
UC 16.8  14.11
* fan
UA      0      0.05      0.15      0.35      0.65      1
KK RCH80
KM      Bear Creek Comstock to North Branch
KO      0      0      0      0      22
RS      3      FLOW      0      0
RC 0.125  0.035      0.125  28200  0.0008      0
* rch80
RX      0      180      400      406      456      462      640      820
RY 1080  1075      1070      1064      1064      1070      1075      1080
KK RNF85
KM      Local drainage Bear Creek at outlet
KO      0      0      0      0      22
BA 5.27
LS      0      100      0
UC 11.08  8.64
* rectangle
UA      0      0.2      0.4      0.6      0.8      1
KK ADH85
KM      Bear Creek at North Branch
KO      0      0      0      0      22
HC      2
KK ADH86
KO      0      0      0      0      22
HC      2
KK RCH86
KM      North Branch from Bear Creek to Malung
KO      0      0      0      0      22
RS      1      FLOW      0      0
RC 0.125  0.035      0.125  20800  0.0006      0
* rch86
RX      0      260      350      354      411      415      490      710
RY 1070  1055      1054      1050      1050      1054      1055      1070
KK RNF99
KM      Local Drainage to Gage 2
KO      0      0      0      0      22
BA 2.18
LS      0      100      0
UC 3.96  2.65
* diamond
UA      0      0.09      0.34      0.64      0.9      1
KK ADH99
KO      0      0      0      0      22
HC      2
KKRSV99
KM temporary calibration reservoir
RS      1      STOR      0
* rsv99stor
SV      0      800      1200      4800      6500      7000      7300      7400      7800      8000
* rsv99flow
SQ      0      100      200      500      1000      1500      2500      3000      5000      15000
KK RCH99  CNAME      G2
KM      North Branch gage 2 to South Branch
KO      0      0      0      0      22
RS      1      FLOW      0      0
RC 0.125  0.035      0.125  17800  0.0004      0
* rch99
RX      0      110      180      186      246      252      260      810
RY 1055  1050      1044      1038      1038      1044      1050      1055
KKRNF109
KM      Local drainage South Branch at Skime
KO      0      0      0      0      22
BA 28.21

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LS      0      100      0
UC 67.63 157.58
* fan
UA      0      0.05      0.15      0.35      0.65      1
KKRCH109
KM      South Branch Skime to Casperson
KO      0      0      0      0      22
RS      2      FLOW      0      0
RC 0.125 0.035 0.125 34800 0.0007      0
* rch109
RX      0      1400      1620      1624      1664      1668      2150      3220
RY 1175 1170 1165 1161 1161 1165 1170 1175
KKRCH110
KM      South Branch Casperson to Mickinock Creek
KO      0      0      0      0      22
RS      3      FLOW      0      0
RC 0.125 0.035 0.125 35000 0.0012      0
* rch110
RX      0      280      300      305      345      349      400      540
RY 1135 1130 1125 1120 1120 1125 1130 1135
KKRNF119
KM      Local drainage to South Branch at Mickinock Creek
KO      0      0      0      0      22
BA 24.2
LS      0      100      0
UC 25.87 51.74
* rectangle
UA      0      0.2      0.4      0.6      0.8      1
KKADH119
KM      Combined flow South Branch upstream of Mickinock Creek
KO      0      0      0      0      22
HC      2
KKRNF120
KM      Palmville sub RNF3
KM      Palmville sub refers to areas developed for the Palmville Flood Control P
KO      0      0      0      0      22
BA 1.27
LS      0      100      0
UC 7.06 14.12
* fan
UA      0      0.05      0.15      0.35      65      1
KKRCH120
KO      0      0      0      0      22
RS      1      FLOW      0      0
RC 0.15 0.15 0.15 5500 0.0018      0
* rch120
RX      0      10      20      500      800      1300      1310      1320
RY 1170 1169 1168.5 1168 1168 1168.5 1169 1170
KKRNF121
KM      Palmville sub RNF4b
KO      0      0      0      0      22
BA 0.95
LS      0      100      0
UC 9.62 19.24
* fan
UA      0      0.05      0.15      0.35      0.65      1
KKRCH121
KO      0      0      0      0      22
RS      1      FLOW      0      0
RC 0.15 0.15 0.15 5500 0.0009      0
* rch121
RX      0      10      20      500      800      1300      1310      1320
RY 1172 1171 1170.5 1170 1170 1170.5 1171 1172
KKRNF123
KM      Palmville sub RNF4a

```

KO	0	0	0	22				
BA	2.32							
LS	0	100	0					
UC	6.98	13.96						
* fan								
UA	0	0.05	0.15	0.35	0.65	1		
KKRCH123								
KO	0	0	0	0	22			
HC	2							
KKRCH123								
KO	0	0	0	0	22			
RS	1	FLOW	0	0				
RC	0.15	0.15	0.15	2500	0.004	0		
* rch120								
RX	0	10	20	500	800	1300	1310	1320
RY	1170	1169	1168.5	1168	1168	1168.5	1169	1170
KKADH124								
KO	0	0	0	0	22			
HC	2							
KKRNF125								
KM	Palmville sub RNF5							
KO	0	0	0	0	22			
BA	4.44							
LS	0	100	0					
UC	15.4	30.8						
* fan								
UA	0	0.05	0.15	0.35	0.65	1		
KKRCH125								
KO	0	0	0	0	22			
RS	1	FLOW	0	0				
RC	0.15	0.15	0.15	1500	0.0033	0		
* rch120								
RX	0	10	20	500	800	1300	1310	1320
RY	1170	1169	1168.5	1168	1168	1168.5	1169	1170
KKRNF126								
KM	Palmville sub RNF6							
KO	0	0	0	0	22			
BA	1.25							
LS	0	100	0					
UC	11.52	17.28						
* fan								
UA	0	0.05	0.15	0.35	0.65	1		
KKRCH126								
KO	0	0	0	0	22			
RS	1	FLOW	0	0				
RC	0.15	0.15	0.15	8000	0.0006	0		
* rch120								
RX	0	10	20	500	800	1300	1310	1320
RY	1170	1169	1168.5	1168	1168	1168.5	1169	1170
KKRNF127								
KM	Palmville sub RNF7							
KO	0	0	0	0	22			
BA	2.93							
LS	0	100	0					
UC	16.27	16.27						
* diamond								
UA	0	0.09	0.34	0.64	0.9	1		
KKRCH127								
KO	0	0	0	0	22			
RS	1	FLOW	0	0				
RC	0.15	0.15	0.15	9000	0.0006	0		
* rch120								
RX	0	10	20	500	800	1300	1310	1320
RY	1170	1169	1168.5	1168	1168	1168.5	1169	1170
KKRNF128								

KM	Palmville sub RNF8							
KO	0	0	0	0	22			
BA	1.22							
LS	0	100	0					
UC	6.25	9.38						
* fan								
UA	0	0.05	0.15	0.35	0.65	1		
KKRCH128								
KO	0	0	0	0	22			
RS	1	FLOW	0	0				
RC	0.15	0.15	0.15	6000	0.0008	0		
* rch120								
RX	0	10	20	500	800	1300	1310	1320
RY	1170	1169	1168.5	1168	1168	1168.5	1169	1170
KKRNF129								
KM	Palmville sub RNF9							
KO	0	0	0	0	22			
BA	2.9							
LS	0	100	0					
UC	7.84	11.76						
* fan								
UA	0	0.05	0.15	0.35	0.65	1		
KKRNF130								
KM	Palmville sub RNF10							
KO	0	0	0	0	22			
BA	1.29							
LS	0	100	0					
UC	5.11	11.91						
* fan								
UA	0	0.05	0.15	0.35	0.65	1		
KKADH130								
KO	0	0	0	0	22			
HC	7							
KKRNF131								
KM	Palmville wildlife pool							
KO	0	0	0	0	22			
BA	7.65							
LS	0	100	0					
UC	13.89	32.36						
* fan								
UA	0	0.05	0.15	0.35	0.65	1		
KKADH131								
KO	0	0	0	0	22			
HC	2							
KKRNF132								
KM	Palmville Flood Pool							
KO	0	0	0	0	22			
BA	0.89							
LS	0	100	0					
UC	7.85	18.29						
* diamond								
UA	0	0.09	0.34	0.64	0.9	1		
KKADH132								
KO	0	0	0	0	22			
HC	2							
KKRCH132								
KO	0	0	0	0	22			
RS	1	FLOW	0	0				
RC	0.15	0.05	0.15	10560	0.0005	0		
* rch132								
RX	0	4	6	16	24	34	1320	1325
RY	1153	1151	1149	1144	1144	1149	1150	1152
KKRCH133								
KO	0	0	0	0	22			
RS	1	FLOW	0	0				

RC	0.15	0.05	0.15	9200	0.0016	0		
* rch133								
RX	0	4	6	22	30	46	1320	1325
RY	1148	1146	1144	1136	1136	1144	1144	1146
KKRNF139								
KM	Local drainage to Oseland Gage							
KO	0	0	0	0	22			
BA	23.74							
LS	0	100	0					
UC	21.3	31.95						
* fan								
UA	0	0.05	0.15	0.35	0.65	1		
KKADH139								
KO	0	0	0	0	22			
HC	2							
KKRCH139								
KO	0	0	0	0	22			
RS	1	FLOW	0	0				
RC	0.125	0.05	0.125	14800	0.0006	0		
* rch139								
RX	0	140	200	204	224	228	305	350
RY	1127	1120	1119	1115	1115	1119	1120	1127
KKRNF145								
KM	Local drainage to Mickinock Creek at Outlet							
KO	0	0	0	0	22			
BA	8.37							
LS	0	100	0					
UC	18.97	18.97						
* fan								
UA	0	0.05	0.15	0.35	0.65	1		
KKADH145								
KM	Mickinock Creek							
KO	0	0	0	0	22			
HC	2							
KKADH146								
KO	0	0	0	0	22			
HC	2							
KKRCH146								
KM	South Branch Mickinock Creek to Wannaska							
KO	0	0	0	0	22			
RS	1	FLOW	0	0				
RC	0.125	0.035	0.125	26600	0.0009	0		
* rch146								
RX	0	90	120	127	167	174	305	390
RY	1110	1105	1100	1093	1093	1100	1105	1110
KKRNF149								
KM	Local drainage South Branch at Wannaska							
KO	0	0	0	0	22			
BA	14							
LS	0	100	0					
UC	19.28	19.28						
* fan								
UA	0	0.05	0.15	0.35	0.65	1		
KKADH149								
KO	0	0	0	0	22			
HC	2							
KKRCH149								
KM	South Branch Wannaska to Paulson Creek							
KO	0	0	0	0	22			
RS	1	FLOW	0	0				
RC	0.125	0.035	0.125	15200	0.0004	0		
* rch149								
RX	0	175	300	306	346	352	775	800
RY	1100	1095	1090	1084	1084	1090	1095	1100
KKRNF155								

KM Local drainage South Branch at Paulson Creek

KO 0 0 0 0 22
 BA 4.45
 LS 0 100 0
 UC 6.05 4.05
 * fan
 UA 0 0.05 0.15 0.35 0.65 1
 KKADH155
 KO 0 0 0 0 22
 HC 2
 KKRNF159

KM Local drainage gage 43 Roseau CD 21 at CSAH4

KO 0 0 0 0 22
 BA 20.07
 LS 0 100 0
 UC 20.56 27.76
 * fan

UA 0 0.05 0.15 0.35 0.65 1
 KKRCH159
 KO 0 0 0 0 22
 RS 1 FLOW 0 0
 RC 0.125 0.05 0.125 8500 0.0005 0
 * rch159

RX 0 7.5 15 30 38 53 1373 2700
 RY 1125 1122.5 1120 1115 1115 1120 1122.5 1125

KKRCH160
 KO 0 0 0 0 22
 RS 1 FLOW 0 0
 RC 0.125 0.05 0.125 4400 0.0036 0
 * rch160

RX 0 150 180 185 195 200 300 400
 RY 1115 1100 1095 1090 1090 1095 1100 1115

KKRNF165

KM Local Drainage Paulson Creek at Outlet

KO 0 0 0 0 22
 BA 3.47
 LS 0 100 0
 UC 10.25 10.25
 * fan
 UA 0 0.05 0.15 0.35 0.65 1

KKADH165

KM Combined outflow Paulson Creek

KO 0 0 0 0 22
 HC 2
 KKADH166
 KO 0 0 0 0 22
 HC 2
 KKRCH166

KM South Branch Paulson Creek to Pencer West

KO 0 0 0 0 22
 RS 2 FLOW 0 0
 RC 0.125 0.035 0.125 29800 0.0004 0
 * rch166

RX 0 160 500 520 580 600 650 700
 RY 1090 1080 1080 1070 1070 1080 1085 1090

KKRNF169

KM Local Drainage to Pencer West

KO 0 0 0 0 22
 BA 6.56
 LS 0 100 0
 UC 14.79 14.79
 * fan
 UA 0 0.05 0.15 0.35 0.65 1
 KKADH169
 KO 0 0 0 0 22

HC 2
 KKRCH169
 KM South Branch Pencer West to Unamed Creek 1
 KO 0 0 0 0 22
 RS 1 FLOW 0 0
 RC 0.125 0.035 0.125 17000 0.0005 0
 * rch169
 RX 0 90 690 712 752 774 800 850
 RY 1075 1070 1065 1054 1054 1065 1070 1075
 KKRNF170
 KM Local draiange South Branch at Unamed Creek 1
 KO 0 0 0 0 22
 BA 1.65
 LS 0 100 0
 UC 6.34 6.34
 * general
 UA 0 0.13 0.36 0.67 0.89 1
 KKADH170
 KM South Branch upstream Unamed Creek 1
 KO 0 0 0 0 22
 HC 2
 KKRNF171
 KM Local Drainage Unamed Creek 1
 KO 0 0 0 0 22
 BA 13.67
 LS 0 100 0
 UC 19.15 19.15
 * fan
 UA 0 0.05 0.15 0.35 0.65 1
 KKADH171
 KO 0 0 0 0 22
 HC 2
 KKRCH171
 KM South Branch Unamed Creek 1 to Unamed Creek 2
 KO 0 0 0 0 22
 RS 3 FLOW 0 0
 RC 0.125 0.035 0.125 34400 0.0005 0
 * rch171
 RX 0 90 690 712 752 774 800 850
 RY 1070 1065 1060 1049 1049 1060 1065 1070
 KKRNF172
 KM Local drainage South Branch at Unamed Creek 2
 KO 0 0 0 0 22
 BA 5.04
 LS 0 100 0
 UC 16.23 16.23
 * diamond
 UA 0 0.09 0.34 0.64 0.9 1
 KKADH172
 KM South Branch upstream Unamed Creek 2
 KO 0 0 0 0 22
 HC 2
 KKRNF173
 KM Local drainage Unamed Creek 2
 KO 0 0 0 0 22
 BA 16.03
 LS 0 100 0
 UC 16.17 16.17
 * fan
 UA 0 0.05 0.15 0.35 0.65 1
 KKADH173
 KO 0 0 0 0 22
 HC 2
 KKRCH173
 KM South Branch Unamed Creek 2 to Gage 1

KO	0	0	0	0	22					
RS	3	FLOW	0	0						
RC	0.125	0.035	0.125	27000	0.0005	0				
* rch173										
RX	0	90	690	712	752	774	800	850		
RY	1065	1060	1055	1044	1044	1055	1060	1065		
KKRNF199										
KM Local drainage to Gage 1										
KO	0	0	0	0	22					
BA	9.25									
LS	0	100	0							
UC	11.09	11.09								
* fan										
UA	0	0.05	0.15	0.35	0.65	1				
KKADH198										
KO	0	0	0	0	22					
HC	2									
KKRNF180										
KM Local drainage gage 3 Sec 18/19 T161N R39W										
KO	0	0	0	0	22					
BA	11.52									
LS	0	100	0							
UC	18.81	18.81								
* fan										
UA	0	0.05	0.15	0.35	0.65	1				
KKRCH180										
KM Sucker Creek Gage 1 to Outlet										
KO	0	0	0	0	22					
RS	1	FLOW	0	0						
RC	0.125	0.05	0.125	9000	0.0023	0				
* rch180										
RX	0	90	100	125	130	155	180	240		
RY	1060	1050	1044	1041	1041	1044	1050	1060		
KKRNF189										
KM Local drainage outlet Sucker Creek										
KO	0	0	0	0	22					
BA	0.69									
LS	0	100	0							
UC	7.44	4.98								
* rectangle										
UA	0	0.2	0.4	0.6	0.8	1				
KKADH189										
KM Sucker Creek Outflow										
KO	0	0	0	0	22					
HC	2									
KKADH199										
KO	0	0	0	0	22					
HC	2									
KKRSV199										
KM temporary calibration reservoir										
RS	1	STOR	0							
* rsv199stor										
SV	0	800	1200	4800	6500	7000	7300	7400	7800	8000
* rsv199flow										
SQ	0	100	200	500	1000	1500	2500	3000	5000	15000
KKRCH199										
KM South Branch to North Branch										
KO	0	0	0	0	22					
RS	1	FLOW	0	0						
RC	0.125	0.035	0.125	6000	0.0005	0				
* rch199										
RX	0	90	100	106	146	152	290	1200		
RY	1055	1040	1039	1033	1033	1039	1050	1055		
KKADH200										
KO	0	0	0	0	22					

HC 2
 KKRCH200
 KM Roseau River to USGS Gage near Malung
 KO 0 0 0 0 22
 RS 1 FLOW 0 0
 RC 0.125 0.035 0.125 2400 0.0003 0
 * rch200
 RX 0 400 435 443 493 501 600 1600
 RY 1055 1045 1040 1034 1034 1040 1050 1055
 KKRNF209
 KM Local drainage to USGS Gage near Malung Gage 50
 KO 0 0 0 0 22
 BA 3.24
 LS 0 100 0
 UC 8.83 8.83
 * fan
 UA 0 0.05 0.15 0.35 0.65 1
 KKADH209
 KO 0 0 0 0 22
 HC 2
 KKRCH209
 KM Roseau River gage 50 to CD 8
 KO 0 0 0 0 22
 RS 1 FLOW 0 0
 RC 0.125 0.035 0.125 1000 0.0003 0
 * rch200
 RX 0 400 435 443 493 501 600 1600
 RY 1055 1045 1040 1034 1034 1040 1050 1055
 KKRNF211
 KM Local Drainage to Stafford area 1
 KO 0 0 0 0 22
 BA 11.25
 LS 0 100 0
 UC 16.8 11.25
 * fan
 UA 0 0.05 0.15 0.35 0.65 1
 KKRNF212
 KM Local drainage to Stafford area 2
 KO 0 0 0 0 22
 BA 1.45
 LS 0 100 0
 UC 2.49 1.67
 * fan
 UA 0 0.05 0.15 0.35 0.65 1
 KKRNF213
 KM Local drainage to Stafford area 3
 KO 0 0 0 0 22
 BA 0.7
 LS 0 100 0
 UC 5.56 3.73
 * fan
 UA 0 0.05 0.15 0.35 0.65 1
 KKADH211
 KO 0 0 0 0 22
 HC 3
 KKRCH211
 KM Roseau County Ditch 8 Stafford project to Outlet
 KO 0 0 0 0 22
 RS 1 FLOW 0 0
 RC 0.125 0.05 0.125 17120 0.0005 0
 * rch211
 RX 0 10 16 31 37 52 1372 2640
 RY1058.2 1058 1056 1051 1051 1056 1056.2 1056.5
 KKRNF219
 KM Local Drainage Outlet RCD 8

KO	0	0	0	0	22			
BA	6.26							
LS	0	100	0					
UC	17.92	17.92						
* fan								
UA	0	0.05	0.15	0.35	0.65	1		
KKADH220								
KM Roseau County ditch 8 outflow								
KO	0	0	0	0	22			
HC	2							
KKADH221								
KO	0	0	0	0	22			
HC	2							
KKRCH221								
KM Roseau River RCD 8 to Cow Creek								
KO	0	0	0	0	22			
RS	1	FLOW	0	0				
RC	0.125	0.035	0.125	8800	0.0003	0		
* rch221								
RX	0	3600	3800	3812	3862	3874	4024	7624
RY	1055	1050	1035	1029	1029	1035	1050	1055
KKRNF229								
KM Local drainage Roseau River at Cow Creek								
KO	0	0	0	0	22			
BA	4.83							
LS	0	100	0					
UC	12.04	12.04						
* fan								
UA	0	0.05	0.15	0.35	0.65	1		
KKADH229								
KM Roseau River upstream Cow Creek								
KO	0	0	0	0	22			
HC	2							
KKRNF248								
KM Local drainage Cow Creek Gage 44 Sec 31/32 T162N R39W								
KO	0	0	0	0	22			
BA	16.9							
LS	0	100	0					
UC	15.15	15.15						
* fan								
UA	0	0.05	0.15	0.35	0.65	1		
KKRCH248								
KM Cow Creek Gage 44 to Outlet								
KO	0	0	0	0	22			
RS	1	FLOW	0	0				
RC	0.125	0.05	0.125	4800	0.0023	0		
* rch248								
RX	0	170	190	194	204	208	290	380
RY	1050	1045	1044	1040	1040	1044	1045	1050
KKRNF249								
KM Local drainage outlet Cow Creek								
KO	0	0	0	0	22			
BA	0.31							
LS	0	100	0					
UC	1.76	1.76						
* rectangle								
UA	0	0.2	0.4	0.6	0.8	1		
KKADH249								
KM Cow Creek Outflow								
KO	0	0	0	0	22			
HC	2							
KKADH260								
KO	0	0	0	0	22			
HC	2							
KKRCH260								

KM Roseau River Cow Creek to Center Street
KO 0 0 0 0 22
RS 1 FLOW 0 0
RC 0.125 0.035 0.125 11800 0.0003 0
* rch221
RX 0 3600 3800 3812 3862 3874 4024 7624
RY 1055 1050 1035 1029 1029 1035 1050 1055
KKRNF269
KM Local drainage Roseau River at Center Street
KO 0 0 0 0 22
BA 5.07
LS 0 100 0
UC 10.04 10.04
* fan
UA 0 0.05 0.15 0.35 0.65 1
KKADH269
KO 0 0 0 0 22
HC 2
KKRCH269
KM Roseau River Center Street to Gage 15
KO 0 0 0 0 22
RS 2 FLOW 0 0
RC 0.125 0.035 0.125 23500 0.0003 0
* rch269
RX 11097 13712 20000 20035 20106 20131 20219 23721
RY1043.9 1038.4 1041.3 1024.7 1024.7 1036.8 1035.1 1043.6
KKRNF299
KM Local drainage Roseau River Gage 15
KO 0 0 0 0 22
BA 5.51
LS 0 100 0
UC 9.18 9.18
* diamond
UA 0 0.09 0.34 0.64 0.9 1
KKADH299
KO 0 0 0 0 22
HC 2
KKRNF319
KM Local Drainage Hay Creek at County Road 2 Sec 1/12 T161N R37W
KO 0 0 0 0 22
BA 19.38
LS 0 100 0
UC 17.12 16.95
* fan
UA 0 0.05 0.15 0.35 0.65 1
KKRCH319
KM Hay Creek County Road 2 to Branch CD 9
KO 0 0 0 0 22
RS 1 FLOW 0 0
RC 0.125 0.05 0.125 7200 0.0017 0
* rch319
RX 0 1130 1270 1282 1300 1312 1400 1650
RY 1110 1105 1095 1089 1089 1095 1105 1110
KKRNF335
KM Upper Summer Road RCD 9 drainage
KO 0 0 0 0 22
BA 10.04
LS 0 100 0
UC 19.28 19.28
* fan
UA 0 0.05 0.15 0.35 0.65 1
KKDVT335
KM Split flow west to Summer Road
DTOUT335 0 0
* din335

DI	0	50	100	200	300	500	750	1000
* dout335								
DQ	0	33	67	133	200	333	500	670
KKRCH335								
KM Branch of RCD 9 west to Hay Creek								
KO	0	0	0	0	22			
RS	1	FLOW	0	0				
RC	0.125	0.05	0.125	8810	0.0005	0		
* rch335								
RX	0	800	1700	1708	1712	1720	1722	1724
RY	1110	1107	1105	1101	1101	1105	1106	1107
KKADH336								
KO	0	0	0	0	22			
HC	2							
KKRCH336								
KM Hay Creek branch RCD9 to Summer Road								
KO	0	0	0	0	22			
RS	1	FLOW	0	0				
RC	0.125	0.05	0.125	7800	0.0017	0		
* rch336								
RX	0	1130	1270	1282	1300	1312	1400	1650
RY	1105	1100	1090	1084	1084	1090	1100	1105
KKRNF339								
KM Local Drainage Hay Creek at Summer Road								
KO	0	0	0	0	22			
BA	10.5							
LS	0	100	0					
UC	17.2	17.2						
* fan								
UA	0	0.05	0.15	0.35	0.65	1		
KKADH339								
KO	0	0	0	0	22			
HC	2							
KKRCH339								
KM Hay Creek Summer Road to Branch of RCD 9								
KO	0	0	0	0	22			
RS	1	FLOW	0	0				
RC	0.125	0.05	0.125	4400	0.001	0		
* rch339								
RX	0	100	3550	3562	3580	3592	4000	4800
RY	1080	1078	1075	1069	1069	1075	1078	1080
KKRNF351								
KM Local drainage Upper Hwy 11								
KO	0	0	0	0	22			
BA	4.32							
LS	0	100	0					
UC	12.99	12.99						
* fan								
UA	0	0.05	0.15	0.35	0.65	1		
KKRTV335								
KM Split flow from Upper Summer Road North								
DROUT335								
KKRCH350								
RS	2	FLOW	0	0				
RC	0.125	0.05	0.125	10560	0.0014	0		
* rch350								
RX	0	2	4	12	16	24	1320	2640
RY	1107	1106	1105	1101	1101	1105	1105.5	1107
KKADH351								
KO	0	0	0	0	22			
HC	2							
KKDVT351								
KM Split flow to Roseau County Road 11								
DTOUT351								
* din351								

DI	0.	100.	200.	400.	600.	800.	1000.	2000.
* dout351								
DQ	0.	50.	100.	200.	300.	400.	500.	1000.
KKRCH351								
KM	Branch RCD 9 to Hay Creek							
KO	0	0	0	0	22			
RS	3	FLOW	0	0				
RC	0.125	0.05	0.125	16600	0.0007	0		
* rch351								
RX	0	750	1320	1328	1332	1340	1342	1344
RY	1090	1089	1088	1084	1084	1088	1090	1092
KKADH352								
KO	0	0	0	0	22			
HC	2							
KKRCH352								
KM	Hay Creek branch of RCD9 to Gage 12							
KO	0	0	0	0	22			
RS	1	FLOW	0	0				
RC	0.125	0.05	0.125	7400	0.0014	0		
* rch352								
RX	0	100	3550	3562	3580	3592	4000	4800
RY	1075	1073	1070	1064	1064	1070	1073	1075
KKRNF359								
KM	Local drainage Hay Creek at Gage 12							
KO	0	0	0	0	22			
BA	12.44							
LS	0	100	0					
UC	13.97	14.39						
* diamond								
UA	0	0.09	0.34	0.64	0.9	1		
KKADH359								
KO	0	0	0	0	22			
HC	2							
KKRCH359								
KM	Hay Creek Gage 12 to Branch RCD 9							
KO	0	0	0	0	22			
RS	1	FLOW	0	0				
RC	0.125	0.05	0.125	9220	0.0009	0		
* rch359								
RX	0	250	550	562	580	592	700	1000
RY	1070	1068	1065	1059	1059	1065	1068	1070
KKRTV351								
KM	Upper Hwy 11 split flow							
DROUT351								
KKRCH352								
RS	4	FLOW	0	0				
RC	0.125	0.05	0.125	37920	0.0007	0		
* rch352								
RX	0	2	4	12	16	24	500	1000
RY	1076	1075	1074	1070	1070	1074	1074	1075
KKADH360								
KO	0	0	0	0	22			
HC	2							
KKRCH360								
KM	Hay Creek Branch RCD9 to MN HWY 11							
KO	0	0	0	0	22			
RS	1	FLOW	0	0				
RC	0.125	0.05	0.125	4980	0.0009	0		
* rch360								
RX	0	250	550	562	580	592	700	1000
RY	1060	1058	1055	1049	1049	1055	1058	1060
KKRNF379								
KM	Local Drainage MN Hwy 11							
KO	0	0	0	0	22			
BA	20.97							

LS 0 100 0
 UC 37.8 56.7
 * fan
 UA 0 0.05 0.15 0.35 0.65 1
 KKADH379
 KO 0 0 0 0 22
 HC 2
 KKRCH379
 KM Hay Creek MN Hwy 11 to Hay Creek Proj Det 1
 KO 0 0 0 0 22
 RS 1 FLOW 0 0
 RC 0.125 0.035 0.125 5680 0.0004 0
 * rch379
 RX 0 1000 2300 2312 2328 2340 4000 5000
 RY 1060 1058 1058 1050 1050 1058 1058 1060
 KKRNF381
 KM Hay Creek Proj Det 1
 KO 0 0 0 0 22
 BA 4.14
 LS 0 100 0
 UC 20.23 20.23
 * fan
 UA 0 0.05 0.15 0.35 0.65 1
 KKADH381
 KO 0 0 0 0 22
 HC 2
 KKRCH381
 KM Hay Creek Det 1 to Roseau County Ditch 18
 KO 0 0 0 0 22
 RS 1 FLOW 0 0
 RC 0.125 0.035 0.125 10820 0.0004 0
 * rch381
 RX 0 1000 2300 2312 2328 2340 4000 5000
 RY 1055 1053 1053 1045 1045 1053 1053 1055
 KKRNF385
 KM Norland sub RNF50 Roseau County Ditch 18 Sec 4/5 T162N R38W
 KO 0 0 0 0 22
 BA 8.39
 LS 0 100 0
 UC 29.83 59.66
 * rnf385
 UA 0 0.1 0.24 0.46 0.65 0.75 0.83 0.89 0.94 0.98
 UA 1
 KKRCH385
 KM RCD 18 to Hay Creek
 KO 0 0 0 0 22
 RS 1 FLOW 0 0
 RC 0.08 0.05 0.08 17690 0.001 0
 * rch385
 RX 0 5 10 45 53 57 100 250
 RY1067.4 1067.4 1067.4 1056.14 1056.14 1064.7 1064.7 1064.7
 KKRNF391
 KM Hay Creek Project Pool #1
 KO 0 0 0 0 22
 BA 2.21
 LS 0 100 0
 UC 3.6 3.6
 * fan
 UA 0 0.05 0.15 0.35 0.65 1
 KKADH391
 KO 0 0 0 0 22
 HC 2
 KKRCH391 CNAME 391
 KM RCD 18 Pool#1 to NW Sec 2 T162N R39W
 KO 0 0 0 0 22

RS	1	FLOW	0	0					
RC	0.08	0.05	0.08	5280	0.0003	0			
* rch391									
RX	0	5	10	24	30	44	5000	5250	
RY	1053	1052	1049	1042	1042	1049	1049.5	1050	
KKDVT391									
KM Split flow RCD 18									
DTOUT391									
* in391									
DI	0.	300.	600.	900.	1200.	2100.			
* out391									
DQ	0.	200.	400.	600.	800.	1400.			
KKRCH392									
KM RCD 18 NW Sec 2 T162N R39W									
KO	0	0	0	0	22				
RS	1	FLOW	0	0					
RC	0.08	0.05	0.08	8300	0.0003	0			
* rch392									
RX	0	5	10	24	30	44	5000	5250	
RY	1052	1051	1048	1041	1041	1048	1048.5	1049	
KKADH395									
KO	0	0	0	0	22				
HC	2								
KKRCH395									
KM Hay Creek RCD 18 to Outlet									
KO	0	0	0	0	22				
RS	1	FLOW	0	0					
RC	0.125	0.035	0.125	12900	0.0004	0			
* rch395									
RX	0	1000	2300	2312	2328	2340	4000	5000	
RY	1050	1048	1048	1040	1040	1048	1048	1050	
KKRNF399									
KM Local drainage to Lower Hay Creek									
KO	0	0	0	0	22				
BA 19.76									
LS	0	100	0						
UC	24.8	31							
* fan									
UA	0	0.05	0.15	0.35	0.65	1			
KKADH399									
KM Hay Creek at Outlet									
KO	0	0	0	0	22				
HC	2								
KKADH400									
KM Roseau River at Gage 15 Sec 6/31 T162-163N R39W County Road 28									
KO	0	0	0	0	22				
HC	2.								
KKRSV400									
KM Storage behind CR 28									
KO	0	0	0	0	22				
RS	1	FLOW	0						
* rsv400stor									
SV	0	147	247	847	2587	4517	7282	10872	15272 20471
* rsv400flow									
SQ	0	720	800	2190	4110	5200	6120	8450	10000 11690
KKRTV391									
KM Overflow RCD 18									
DROUT391									
KKRC391b									
RS	1	FLOW	0	0					
RC	0.08	0.05	0.08	17000	0.0006	0			
* rc391b									
RX	0	2	4	14	18	28	1300	2600	
RY	1057	1056	1055	1050	1050	1055	1055.5	1057	
KKADH401									

KM Roseau River at Sout side Sec 31 T163N R39W at lateral JD61
 KO 0 0 0 0 22
 HC 2
 KKRC391m
 KM Roseau River Gage 15 to Lat 3 Judicial 61
 KO 0 0 0 0 22
 RS 1 STOR 0 0
 * stor391m
 SV 0 90 132 228 606 2187 2916 3579 4242 5460
 * flow391m
 SQ 0 500 1000 2000 3000 5000 6000 7000 8000 10000
 KKRNF401
 KM Norland sub RNF20 Sec 28/29 T163N R37W
 KO 0 0 0 0 22
 BA 2.85
 LS 0 100 0
 UC 6.27 9.41
 * rnf401
 UA 0 0 0.01 0.03 0.09 0.19 0.29 0.51 0.78 0.95
 UA 1
 KKRCH401
 KM Lat 3 JD61
 KO 0 0 0 22
 RS 1 FLOW 0 0
 RC 0.08 0.05 0.08 5120 0.006 0
 * rch401
 RX 0 5 10 19 27 36 143 243
 RY1079.1 1079 1078 1075 1075 1078 1079 1079.1
 KKRNF402
 KM Norland Sub RNF30
 KO 0 0 0 22
 BA 6.43
 LS 0 100 0
 UC 39.75 79.5
 * rnf402
 UA 0 0.19 0.33 0.56 0.79 0.87 0.92 0.93 0.95 0.99
 UA 1
 KKADH402
 KO 0 0 0 22
 HC 2
 KKDVT402
 KM 50-50 split west and north
 DTOUT402
 * in402
 DI 0. 10. 20. 30. 40. 50. 100. 200. 500. 1000.
 * out402
 DQ 0. 5. 10. 15. 20. 25. 50. 100. 250. 500.
 KKRCH402
 KM Lat 3 JD61
 KO 0 0 0 22
 RS 1 FLOW 0 0
 RC 0.08 0.05 0.08 10320 0.006 0
 * rch402
 RX 0 5 10 22 30 42 47 252
 RY1075.1 1075 1074 1070 1070 1074 1075 1075.1
 KKRNF403
 KM Norland Sub RNF40
 KO 0 0 0 22
 BA 5.66
 LS 0 100 0
 UC 13.51 13.51
 * rnf40
 UA 0 0.1 0.29 0.5 0.62 0.74 0.8 0.86 0.91 0.95
 UA 1
 KKADH403

KO	0	0	0	0	22					
HC	2									
KKRCH403										
KM	Lat 3 JD 61									
KO	0	0	0	0	22					
RS	1	FLOW	0	0						
RC	0.08	0.05	0.08	9650	0.006	0				
* rch403										
RX	0	5	10	22	30	42	47	252		
RY1070.1	1070	1069	1065	1065	1069	1070	1070.1			
KKRNF405										
KM	Norland sub RNF60									
KO	0	0	0	0	22					
BA	7.08									
LS	0	100	0							
UC	11.04	11.04								
* rnf405										
UA	0	0.08	0.18	0.31	0.51	0.65	0.82	0.9	0.97	0.99
UA	1									
KKADH405										
KM	Sec 21/22 T163N R38W									
KO	0	0	0	0	22					
HC	2									
KKRNF406										
KM	Norland sub RNF65									
KO	0	0	0	0	22					
BA	1.71									
LS	0	100	0							
UC	5	5.85								
* rnf406										
UA	0	0.13	0.25	0.34	0.45	0.57	0.7	0.8	0.89	0.97
UA	1									
KKADH406										
KM	Sec 21/22 T163N R38W									
KO	0	0	0	0	22					
HC	2									
KKRNF408										
KM	Norland Pool area RNF70									
KO	0	0	0	0	22					
BA	7.65									
LS	0	100	0							
UC	12.55	18.83								
* rnf408										
UA	0	0.02	0.08	0.15	0.26	0.41	0.61	0.75	0.87	0.93
UA	1									
KKADH408										
KO	0	0	0	0	22					
HC	2									
KKDVT408										
KM Split Norland flows into BR 5 Lat 3 and Lat 3 flows										
DTOUT410										
* in410										
DI	0.	35.	99.	239.	443.	696.	1065.	1515.	2032.	
* out410										
DQ	0.	11.	33.	80.	148.	232.	355.	505.	677.	
KKRCH420										
KM	Lat 3 JD 61									
KO	0	0	0	0	22					
RS	2	FLOW	0	0						
RC	0.125	0.05	0.125	24200	0.0006	0				
* rch420										
RX	0	6	8	18	24	34	1320	1325		
RY	1054	1051	1050	1045	1045	1050	1050	1054		
KKADH421										
KO	0	0	0	0	22					

HC 2
 KKRCH421
 KM Roseau River Lat 3 JD 61 to Hwy 310
 KO 0 0 0 0 22
 RS 1 STOR 0 0
 * stor421
 SV 0 312 459 792 2106 7611 10140 12450 14757 18993
 * flow421
 SQ 0 561 1000 2000 3000 5000 6000 7000 8000 10000
 KKRTV430
 KM Br 5 Lat 3 JD61
 DROUT410
 KKRCH430
 RS 4 FLOW 0 0
 RC 0.125 0.05 0.125 44000 0.0004 0
 * out410
 RX 0 6 8 18 24 34 1320 1325
 RY 1054 1051 1050 1045 1045 1050 1050 1054
 KKADH430
 KO 0 0 0 0 22
 HC 2
 KKRNF499
 KM Local drainage Roseau River at MN Hwy 310
 KO 0 0 0 0 22
 BA 19.26
 LS 0 100 0
 UC 18.59 32.35
 * fan
 UA 0 0.05 0.15 0.35 0.65 1
 KKADH499
 KM Roseau River at MN Hwy 310
 KO 0 0 0 0 22
 HC 2
 KKRNF520
 KM East Fork of Sprague Creek
 KO 0 0 0 0 22
 BA 22.42
 LS 0 100 0
 UC 43.2 64.8
 * fan
 UA 0 0.05 0.15 0.35 0.65 1
 KKRNF530
 KM West Fork of Sprague Creek
 KO 0 0 0 0 22
 BA 20.42
 LS 0 100 0
 UC 48.32 72.48
 * fan
 UA 0 0.05 0.15 0.35 0.65 1
 KKADH530
 KO 0 0 0 0 22
 HC 2
 KKRCH530
 KM Sprague Creek forks to Vasser Road
 KO 0 0 0 0 22
 RS 6 FLOW 0 0
 RC 0.125 0.04 0.125 40765 0.0006 0
 * rch530
 RX 0 10 510 516 534 540 1040 1050
 RY 1080 1075 1073 1067 1067 1073 1075 1080
 KKRNF540
 KM Local drainage to Sprague Creek at Vassar Road
 KO 0 0 0 0 22
 BA 47.64
 LS 0 100 0

UC	43.35	65.03						
* fan								
UA	0	0.05	0.15	0.35	0.65	1		
KKADH540								
KO	0	0	0	0	22			
HC	2							
KKRCH540								
KM	Sprague Creek Vassar Road to Mud Creek							
KO	0	0	0	0	22			
RS	5	FLOW	0	0				
RC	0.125	0.04	0.125	56058	0.0005	0		
* rch540								
RX	0	10	510	516	534	540	1040	1050
RY	1075	1070	1068	1062	1062	1068	1070	1075
KKRNF545								
KM	Local drainage Sprague Creek at Sprague Manitoba							
KO	0	0	0	0	22			
BA	21.93							
LS	0	100	0					
UC	35.7	53.55						
* fan								
UA	0	0.05	0.15	0.35	0.65	1		
KKADH545								
KM	Sprague Creek at Sprague							
KO	0	0	0	0	22			
HC	2							
KKRNF510								
KM	Local Drainage to Mud Creek							
KO	0	0	0	0	22			
BA	32.18							
LS	0	100	0					
UC	71.13	106.7						
* fan								
UA	0	0.05	0.15	0.35	0.65	1		
KKADH546								
KO	0	0	0	0	22			
HC	2							
KKRCH546								
KM	Sprague Creek Sprague to USGS Gage							
KO	0	0	0	0	22			
RS	2	FLOW	0	0				
RC	0.125	0.04	0.125	17973	0.0009	0		
* rch546								
RX	0	10	510	516	534	540	1040	1050
RY	1065	10602	1057	1051	1051	1057	1060	1065
KKRNF550								
KM	Local drainage Sprague Creek at USGS Gage							
KO	0	0	0	0	22			
BA	39.01							
LS	0	100	0					
UC	52.83	35.4						
* fan								
UA	0	0.05	0.15	0.35	0.65	1		
KKADH550								
KM	Sprague Creek at USGS gaging station							
KO	0	0	0	0	22			
HC	2							
KKRCH550								
KM	Sprague Creek USGS Gage to Lat 2 JD 61							
KO	0	0	0	0	22			
RS	3	FLOW	0	0				
RC	0.125	0.04	0.125	32800	0.0006	0		
* rch550								
RX	0	50	1850	1856	1874	1880	2980	3030
RY	1050	1047	1045	1039	1039	1045	1047	1050

KKRNF570
 KM Local Drainage to Upper Lat 2 JD 61
 KO 0 0 0 0 22
 BA 54.33
 LS 0 100 0
 UC 39.24 58.86
 * fan
 UA 0 0.05 0.15 0.35 0.65 1
 KKRTV402
 KM Split flow out of RNF402
 DROUT402
 KKRCH571
 RS 1 FLOW 0 0
 RC 0.08 0.05 0.08 10420 0.0006 0
 * rch571
 RX 0 2 4 10 24 30 1300 2600
 RY 1081 1080 1079 1076 1076 1079 1079.5 1080
 KKADH574
 KO 0 0 0 0 22
 HC 2
 KKRCH574
 KM Lat 2 JD 61
 KO 0 0 0 0 22
 RS 4 FLOW 0 0
 RC 0.125 0.05 0.125 31460 0.0005 0
 * rch574
 RX 0 1 5 9 17 21 2621 2655
 RY 1047 1046 1042 1038 1038 1042 1043 1045
 KKADH575
 KO 0 0 0 0 22
 HC 2
 KKRCH575
 KM Sprague Creek Br2 JD 61 to Outlet
 KO 0 0 0 0 22
 RS 1 FLOW 0 0
 RC 0.125 0.04 0.125 9000 0.0005 0
 * rch575
 RX 0 15 1515 1521 1541 1547 2547 2555
 RY 1036 1033 1032 1026 1026 1032 1033 1035
 KKRNF580
 KM Local drainage to Sprague Creek at Outlet
 KO 0 0 0 0 22
 BA 47.32
 LS 0 100 0
 UC 29 43.5
 * rectangle
 UA 0 0.2 0.4 0.6 0.8 1
 KKADH580
 KM Sprague Creek at Outlet
 KO 0 0 0 0 22
 HC 2
 KKADH456
 KM Combined flows Roseau River and Sprague Creek
 KO 0 0 0 0 22
 HC 2
 KKRCH456
 KM Roseau Rive Sprague Creek to Roseau Lake Bed
 KO 0 0 0 0 22
 RS 3 FLOW 0 0
 RC 0.125 0.035 0.125 27200 0.0002 0
 * rch456
 RX 0 1320 2640 2665 2718 2743 4063 5390
 RY 1035 1034.25 1034 1021.5 1021.5 1034 1034.25 1035
 KKRNF610
 KM South Roseau Lake Bottom

KO	0	0	0	0	22			
BA	40.91							
LS	0	100	0					
UC	10.48	7.02						
* rectangle								
UA	0	0.2	0.4	0.6	0.8	1		
KKRNF620								
KM	North Roseau Lake Bottom							
KO	0	0	0	0	22			
BA	46.2							
LS	0	100	0					
UC	40.11	40.11						
* fan								
UA	0	0.05	0.15	0.35	0.65	1		
KKADH620								
KM	Roseau River at Lake Bed							
KO	0	0	0	0	22			
HC	3							
KKRNF700								
KM	Local Drainage West Pine Creek							
KO	0	0	0	0	22			
BA	33.76							
LS	0	100	0					
UC	56.23	37.67						
* fan								
UA	0	0.05	0.15	0.35	0.65	1		
KKRCH700								
KM	West Pine Creek Manitoba Hwy 12 to East Pine Creek							
KO	0	0	0	0	22			
RS	1	FLOW	0	0				
RC	0.125	0.05	0.125	1672	0.0014	0		
* rch700								
RX	0	750	1500	1510	1518	1528	2278	3000
RY	1100	1095	1090	1086	1086	1090	1091	1095
KKRNF710								
KM	Local drainage East Pine Creek							
KO	0	0	0	0	22			
BA	9.55							
LS	0	100	0					
UC	20.36	13.63						
* fan								
UA	0	0.05	0.15	0.35	0.65	1		
KKRCH710								
KM	East Pine Creek Manitoba Hwy 12 to West Pine Creek							
KO	0	0	0	0	22			
RS	1	FLOW	0	0				
RC	0.125	0.05	0.125	2048	0.0014	0		
* rch710								
RX	0	750	1500	1510	1516	1526	2276	3000
RY	1095	1091	1090	1086	1086	1090	1095	1100
KKADH710								
KM	Pine Creek near Hwy 12							
KO	0	0	0	0	22			
HC	2							
KKRCH711								
KM	East and West Pine Creek to Diversion							
KO	0	0	0	0	22			
RS	1.	FLOW	0					
RC	0.125	0.05	0.125	19288	0.0014			
* rch711								
RX	0	750	3000	3010	3016	3026	5250	6000
RY	1095	1090	1085	1081	1081	1085	1090	1095
KKRNF720								
KM	Local drainage Pine Creek at Diversion							
KO	0	0	0	0	22			

BA	16.68								
LS	0	100	0						
UC	7.58	5.08							
* fan									
UA	0	0.05	0.15	0.35	0.65	1			
KKADH720									
KM Pine Creek Upstream of Diversion									
KO	0	0	0	0	22				
HC	2.								
KKDVT720									
KM Pine Creek Diversion									
DTOUT720									
* in720									
DI	0.	220.	300.	500.	1000.	1250.	1500.	2000.	
* out720									
DQ	0.	220.	273.	407.	740.	850.	850.	850.	
KKRCH720									
KM Pine Creek Diversion to Roseau County Road 118									
KO	0	0	0	0	22				
RS	3	FLOW	0	0					
RC	0.125	0.04	0.125	37815	0.001	0			
* rch720									
RX	0	600	1180	1184	1192	1196	1700	2410	
RY	1050	1047	1045	10417	1041	1045	1047	1050	
KKRNF790									
KM Local Drainage at RCR 118									
KO	0	0	0	0	22				
BA	20.29								
LS	0	100	0						
UC	17.76	17.76							
* rectangle									
UA	0	0.2	0.4	0.6	0.8	1			
KKADH790									
KM Pine Creek at Lake Bottom									
KO	0	0	0	0	22				
HC	2								
KKADH699									
KO	0	0	0	0	22				
HC	2								
KKRSV699									
KM Roseau Lake Bottom									
KO	0	0	0	0	22				
RS	1	FLOW	2430	0					
* stor699									
SV	0	500	1100	3000	5580	12970	17860	28000	40000
SV	60590	74010	84505	144375	179500	203000			52260
* flow699									
SQ	0	250	732	954	1136	1372	1638	1924	2222
SQ	3084	3868	4494	5200	7500	10000			2574
* elev699									
SE1017.1	1024.8	1026	1027	1028	1029	1030	1031	1032	1033
SE 1034	1035	1035.5	1036	1037	1038				
KKRCH699									
KM Roseau River Ross to Lins Bridge									
KO	0	0	0	0	22				
RS	2	FLOW	0	0					
RC	0.125	0.035	0.125	24390	0.0005	0			
* rch699									
RX	0	9	3200	3232	3299	3331	5271	5280	
RY	1035	1032	1030	1014	1014	1030	1032	1035	
KKRNF900									
KM Local drainage at Lins Bridge									
KO	0	0	0	0	22				
BA	41.99								
LS	0	100	0						

UC 14.73 9.87
 * rectangle
 UA 0 0.2 0.4 0.6 0.8 1
 KKADH900
 KO 0 0 0 0 22
 HC 2
 KKRCH900
 KM Roseau River Lins Bridge to Big Swamp
 KO 0 0 0 0 22
 RS 2 FLOW 0 0
 RC 0.125 0.035 0.125 24390 0.0004 0
 * rch900
 RX 0 25 35 67 134 166 2806 5280
 RY 1035 1030 1028 1012 1012 1028 1030 1032
 KKRNF920
 KM Local drainage upstream of Big Swamp
 KO 0 0 0 0 22
 BA 24.09
 LS 0 100 0
 UC 32.83 32.83
 * rectangle
 UA 0 0.2 0.4 0.6 0.8 1
 KKADH920
 KO 0 0 0 0 22
 HC 2
 KKRCH920
 KM Roseau River to Roseau River Wildlife Management Pool 2 Outlet
 KO 0 0 0 0 22
 RS 52 FLOW 0 0
 RC 0.125 0.035 0.125 13000 0.0004 0
 * rch920
 RX 0 2640 5280 5296 5363 5380 8020 10659
 RY 1025 1024.5 1024 1018 1018 1024 1024.5 1025
 KKRNF810 RRWMA Pool 1
 KM Local Drainage to RRWMA Pool 1
 KO 0 0 0 0 22
 BA 24.88
 LS 0 100 0
 UC 13.3 13.3
 * rectangle
 UA 0 0.2 0.4 0.6 0.8 1
 KKRTV720
 KM Pine Creek Diversion
 DROUT720
 KKRC720a
 RS 3 FLOW 0 0
 RC 0.05 0.05 0.05 41517 0.0001 0
 * rc720a
 RX 0 10 28 42 52 66 84 94
 RY 1068 1063 1063 1056 1056 1063 1063 1068
 KKADH810
 KO 0 0 0 0 22
 HC 2
 KKRSV810
 KM RRWMA Pool 1
 KO 0 0 0 0 22
 RS 1 STOR 2415 0
 * stor810
 SV 2415 2477 3968 4899 4215 4575 5115 5475 6415 6735
 * flow810
 SQ 0 8.4 33 235 460 820 1390 1960 3035 4735
 * elev810
 SE 1035 1035.2 1035.5 1035.8 1036 1036.2 1036.5 1036.7 1037 1037.4
 KKRNF820
 KM Local drainage RRWMA Pool 2

[illegible]

KO	0	0	0	0	22				
HC	2								
KKRSV830									
KM	RRWMA Pool 3								
KO	0	0	0	0	22				
RS	1	STOR	2700	0					
* stor830									
SV	2700	3400	4500	5800	6750	7750	9700	12900	16650
* flow830									
SQ	0	8.4	33	185	355	620	1040	1925	2980
* elev830									
SE	1024	1024.2	1024.5	1024.8	1025	1025.2	1025.5	1026	1026.5
KKRCH831									
KM	Outlet Channel Pool3								
KO	0	0	0	0	22				
RS	1	FLOW	0	0					
RC	0.125	0.05	0.125	2920	0.0001	0			
* rch831									
RX	0	700	1400	1410	1420	1430	2100	3000	
RY	1023	1022	1021	1016	1016	1021	1022	1023	
KKRCH832									
KM	Old Roseau River Channel								
KO	0	0	0	0	22				
RS	1	FLOW	0	0					
RC	0.125	0.05	0.125	1150	0.0001	0			
* rch832									
RX	0	700	1400	1412	1512	1514	2100	3000	
RY	1023	1022	1021	1015	1015	1021	1022	1023	
KKADH940									
KO	0	0	0	0	22				
HC	2								
KKRCH940									
KM	Roseau River pool 3 to end of Big Swamp								
KO	0	0	0	0	22				
RS	1	FLOW	0	0					
RC	0.125	0.035	0.125	34000	0.0004	0			
* rch940									
RX	0	2640	5280	5296	5363	5380	8020	10659	
RY	1019	1018.5	1018	1012	1012	1018	1018.5	1019	
KKRNF950									
KM	Local drainage Big Swamp								
KO	0	0	0	0	22				
BA	88.82								
LS	0	100	0						
UC	32.48	48.72							
* rectangle									
UA	0	0.2	0.4	0.6	0.8	1			
KKADH950									
KO	0	0	0	0	22				
HC	2								
KKRSV950									
KM	Big Swamp Storage								
KO	0	0	0	0	22				
RS	1	STOR	0	0					
* stor950									
SV	0	2000	6000	13000	21000	29000	37000	45000	53000
* flow950									
SQ	0	700	1300	1900	2300	2600	2900	3200	3500
KKDVT950									
KM	Flow transfer to Two Rivers								
DTOUT920									
* in920									
DI	0.	2000.	3513.	3699.	4403.				
* out920									
DQ	0.	0.	533.	619.	1083.				

KKRCH950

KM Roseau River Big Swamp to USGS Gaging Station

KO 0 0 0 0 22

RS 3 FLOW 0 0

RC 0.125 0.035 0.125 32900 0.0002 0

* rch950

RX 0 1600 2200 2220 2275 2295 2900 3250

RY 1020 1018 1015 1005 1005 1015 1018 1020

KKRNF960

KM Local drainage to USGS Gage near Caribou

KO 0 0 0 0 22

BA 24.04

LS 0 100 0

UC 24.04 33.8

* rectangle

UA 0 0.2 0.4 0.6 0.8 1

KKADH960

KO 0 0 0 0 22

HC 2

KKRCH960

KM Roseau River Caribou to International Border

KO 0 0 0 0 22

RS 1 FLOW 0 0

RC 0.125 0.035 0.125 12200 .0003 0

* rch960

RX 0 1600 2200 2220 2275 2295 2900 3250

RY 1015 1013 1010 1000 1000 1010 1013 1015

KKRNF999

KM Local Drainage Roseau River at Border

KO 0 0 0 0 22

BA 9.56

LS 0 100 0

UC 13.78 13.78

* rectangle

UA 0 0.2 0.4 0.6 0.8 1

KKADH999

KM Roseau River at International Border

KO 0 0 0 0 22

HC 2

KKRTV920

KM Diverted flow to Two Rivers

DROUT920

ZZ

Appendix C

HEC-1 Input

Summer Rainfall Events

ID Roseau River Watershed District
 ID Developed by JOR Engineering, Inc. Crookston, MN
 ID 10 Day Summer Event 6/11/01 Michael Bakken
 *DIAGRAM
 IT 480 1JAN94 0 150
 IO 0
 JD 1432
 PH 1 2.25 2.71 3.00 3.55 4.23 5.00
 PH 5.85 7.00 7.99 8.70
 PH 2 2.09 2.50 2.76 3.25 3.85 4.59
 PH 5.40 6.49 7.40 8.00
 PH 4 1.89 2.24 2.49 2.93 3.45 4.10
 PH 4.85 5.79 6.55 7.10
 PH 10 1.59 1.88 2.09 2.48 2.92 3.45
 PH 4.08 4.90 5.55 6.00
 PH 20 1.28 1.52 1.70 2.00 2.39 2.82
 PH 3.35 4.00 4.59 5.00
 PH 50 0.99 1.19 1.31 1.58 1.86 2.20
 PH 2.61 3.09 3.52 3.83
 PH 99 0.82 1.01 1.16 1.37 1.61 1.91
 PH 2.27 2.69 3.02 3.17
 KK RNF9
 KM Local Drainage to Roseau River Flowage
 KO 0 0 0 0 22
 BA 40.81
 LS 0 58 0
 UC 35.53 82.78
 * fan
 UA 0 0.05 0.15 0.35 0.65 1
 KK RSV9
 KM Roseau River Flowage Impoundment
 KM Outlet and Storage curves developed by Dan Thul (MNDNR 1981)
 KO 0 0 0 0 22
 RS 1 STOR 240 0
 * rsv9stor
 SV 240 310 400 500 643 940 1092 1245 1550
 * rsv9flow
 SQ 0 52 155 288 435 800 1225 1913 3663
 * Rsv9elev
 SE 1230 1230.5 1231 1231.5 1232 1233 1233.5 1234 1235
 KK RCH9
 KM North Branch Downstream of Roseau River Flowage
 KO 0 0 0 0 22
 RS 1 FLOW 0 0
 RC 0.125 0.035 0.125 11200 0.0004 0
 * rch9
 RX 0 700 750 756 780 786 900 2800
 RY 1230 1225 1224 1218 1218 1224 1225 1230
 KK RNF15
 KM local drainage to DNR dam 3 Non-functional
 KO 0 0 0 0 22
 BA 13.69
 LS 0 50 0
 UC 25.65 51.3
 * diamond
 UA 0 0.09 0.34 0.64 0.9 1
 KK ADH15
 KO 0 0 0 0 22
 HC 2
 KK RCH15
 KM North Branch Downstream of DNR dam 3
 KO 0 0 0 0 22
 RS 2 FLOW 0 0
 RC 0.125 0.035 0.125 12800 0.0004 0
 * rch15

RX	0	820	1000	1006	1030	1036	1400	2500
RY	1225	1220	1219	1213	1213	1219	1220	1225
KK RNF19								
KM Local Drainage to DNR dam 4 Non-functional								
KO	0	0	0	0	22			
BA	5.8							
LS	0	56	0					
UC	14.88	29.76						
* diamond								
UA	0	0.09	0.34	0.64	0.9	1		
KK ADH19								
KO	0	0	0	0	22			
HC	2							
KKRCH19a								
KM North Branch downstream of DNR dam 4								
KO	0	0	0	0	22			
RS	1	FLOW	0	0				
RC	0.125	0.035	0.125	9400	0.0011	0		
* rch19a								
RX	0	510	690	696	720	726	990	1690
RY	1225	1220	1209	1203	1203	1209	1220	1225
KK RC19b								
KM North Branch downstream of DNR dam 4								
KO	0	0	0	0	22			
RS	2	FLOW	0	0				
RC	0.125	0.035	0.125	26000	0.0012	0		
* rch19b								
RX	0	200	280	286	318	324	390	450
RY	1210	1200	1195	1188.5	1188.5	1195	1200	1210
KK RNF25								
KM Local drainage to North Branch at Hanson Creek								
KO	0	0	0	0	22			
BA	12.52							
LS	0	43	0					
UC	18.8	37.6						
* rectangle								
UA	0	0.2	0.4	0.6	0.8	1		
KK ADH25								
KM North Branch Upstream of Hanson Creek								
KO	0	0	0	0	22			
HC	2							
KK RNF29								
KM DNR dam 1 on Hanson Creek								
KO	0	0	0	0	22			
BA	12.73							
LS	0	58	0					
UC	34.28	79.87						
* fan								
UA	0	0.05	0.15	0.35	0.65	1		
KK RSV29								
KM DNR dam 1 on Hanson Creek								
KM Outlet and Storage curves developed by Dan Thul (MNDNR 1981)								
KO	0	0	0	0	22			
RS	1	STOR	320	0				
* rsv29stor								
SV	320	370	450	650	670	810	960	1360
* rsv29flow								
SQ	0	57.5	166	319	558	934	1310	4235
* rsv29elev								
SE	1219	1219.5	1220	1220.5	1221	1221.5	1222	1223
KK RCH29								
KM Hanson Creek downstream of DNR dam 1								
KO	0	0	0	0	22			
RS	2	FLOW	0	0				
RC	0.125	0.035	0.125	6000	0.0009	0		

```

* rch29
RX      0      400      800      803      818      821      1100      1480
RY 1220      1215      1214      1211      1211      1214      1215      1220
KK RNF35
KM      Non-functional DNR dam 2 on Hanson Creek
KO      0      0      0      0      22
BA      4.9
LS      0      46      0
UC 22.66      52.8
* diamond
UA      0      0.09      0.34      0.64      0.9      1
KK ADH35
KO      0      0      0      0      22
HC      2
KK RCH35
KM      Hanson Creek from DNR dam 2 to Winner Dam
KO      0      0      0      0      22
RS      5      FLOW      0      0
RC 0.125      0.035      0.125      17000      0.0006      0
* rch35
RX      0      110      310      316      336      342      600      1000
RY 1210      1205      1204      1198      1198      1204      1205      1210
KK RNF39
KM      Local drainage to Winner Dam
KO      0      0      0      0      22
BA 13.36
LS      0      46      0
UC 40.79      95.04
* diamond
UA      0      0.09      0.34      0.64      0.9      1
KK ADH39
KO      0      0      0      0      22
HC      2
KK RSV39
KM      Winner Dam impoundment on Hanson Creek
KM      Outlet and Storage curves developed by Dan Thul (MNDNR 1981)
KO      0      0      0      0      22
RS      1      STOR      5      0
* rsv39stor
SV      5      21      30      65      120      220      370      470      580
* rsv39flow
SQ      0      6      32      75      170      320      560      920      1500
* rsv39elev
SE1201.5      1202      1203      1204      1205      1206      1207      1207.5      1208
KK RCH39
KM      Hanson Creek Winner dam to North Branch
KO      0      0      0      0      22
RS      1      FLOW      0      0
RC 0.125      0.035      0.125      20500      0.0013      0
* rch39
RX      0      700      990      996      1036      1042      1290      1680
RY 1205      1200      1194      1182      1182      1194      1200      1205
KK RNF45
KM      Local drainage to outlet of Hanson Creek
KO      0      0      0      0      22
BA      5.59
LS      0      38      0
UC 16.96      33.92
* rectangle
UA      0      0.2      0.4      0.6      0.8      1
KK ADH45
KM      Hanson Creek outflow
KO      0      0      0      0      22
HC      2
KK ADH46

```

KO	0	0	0	0	22				
HC	2								
KK RCH46									
KM	North Branch from Hanson Creek to Hayes Lake								
KO	0	0	0	0	22				
RS	1	FLOW	0	0					
RC	0.125	0.035	0.125	11000	0.0007	0			
* rch46									
RX	0	200	350	358	390	398	460	990	
RY	1190	1175	1169	1161	1161	1169	1175	1190	
KK RNF49									
KM	Local drainage to Hayes Lake								
KO	0	0	0	0	22				
BA	18.29								
LS	0	45	0						
UC	60.89	121.78							
* diamond									
UA	0	0.09	0.34	0.64	0.9	1			
KK ADH49									
KO	0	0	0	0	22				
HC	2								
KK RSV49									
KM	Hayes Lake Dam								
KM	Outlet and Storage curves developed by Dan Thul (MNDNR 1981)								
KO	0	0	0	0	22				
RS	1	STOR	1640	0					
* rsv49stor									
SV	0	180	595	1290	1640	1680	1750	1840	2050
SV	2510	2760	3000	3070	3180	3250			2270
* rsv49flow									
SQ	0	0	0	0	0	19	72	213	640
SQ	2000	2950	4060	4610	5140	8150			1235
* rsv49elev									
SE	1150	1155	1160	1165	1167	1167.2	1167.5	1168	1169
SE	1171	1172	1173	1173.4	1173.7	1174			1170
KK RCH49									
KM	North Branch Hayes Lake to Beaver								
KO	0	0	0	0	22				
RS	1	FLOW	0	0					
RC	0.125	0.035	0.125	28200	0.001	0			
* rch49									
RX	0	90	160	168	228	236	690	800	
RY	1150	1135	1130	1122	1122	1130	1135	1150	
KK RNF59									
KM	Local Drainage to Beaver								
KO	0	0	0	0	22				
BA	15.71								
LS	0	47	0						
UC	43.26	64.89							
* fan									
UA	0	0.05	0.15	0.35	0.65	1			
KK ADH59									
KO	0	0	0	0	22				
HC	2								
KK RCH59									
KM	North Branch to Pencer								
KO	0	0	0	0	22				
RS	2	FLOW	0	0					
RC	0.125	0.035	0.125	38000	0.0009	0			
* rch59									
RX	0	110	1000	1008	1068	1072	1690	1770	
RY	1125	1120	1115	1107	1107	1115	1120	1125	
KK RNF65									
KM	Local drainage to Pencer East								
KO	0	0	0	0	22				

BA 12.79
 LS 0 49 0
 UC 15.54 12.43
 * fan
 UA 0 0.05 0.15 0.35 0.65 1
 KK ADH65
 KO 0 0 0 0 22
 HC 2
 KK RCH65
 KM North Branch to Severson Creek
 KO 0 0 0 0 22
 RS 1 FLOW 0 0
 RC 0.125 0.035 0.125 25509 0.0008 0
 * rch65
 RX 0 80 250 270 330 350 1580 1680
 RY 1095 1090 1085 1075 1075 1085 1090 1095
 KK RNF69
 KM Local drainage to North Branch at Severson Creek
 KO 0 0 0 0 22
 BA 2.29
 LS 0 54 0
 UC 7.24 7.24
 * rectangle
 UA 0 0.2 0.4 0.6 0.8 1
 KK ADH69
 KO 0 0 0 0 22
 HC 2.
 KKRNF070
 KM Severson Creek
 KO 0 0 0 0 22
 BA 22.25
 LS 0 50 0
 UC 17.3 17.3
 * fan
 UA 0 0.05 0.15 0.35 0.65 1
 KK ADH70
 KO 0 0 0 0 22
 HC 2
 KKRCH070
 KM North Branch to Bear Creek
 KO 0 0 0 0 22
 RS 1 FLOW 0 0
 RC 0.125 0.035 0.125 29973 0.0008 0
 * rch70
 RX 0 80 250 270 330 350 1580 1680
 RY 1085 1080 1075 1065 1065 1075 1080 1085
 KKRNF079
 KM Local drainage North Branch at Bear Creek
 KO 0 0 0 0 22
 BA 7.52
 LS 0 52 0
 UC 13.14 13.14
 * rectangle
 UA 0 0.2 0.4 0.6 0.8 1
 KK ADH79
 KO 0 0 0 0 22
 HC 2
 KK RNF80
 KM Local Drainage Comstocks Bear Creek at Roseau CSAH 9
 KO 0 0 0 0 22
 BA 20.66
 LS 0 55 0
 UC 16.8 14.11
 * fan
 UA 0 0.05 0.15 0.35 0.65 1

```

KK RCH80
KM   Bear Creek Comstock to North Branch
KO   0      0      0      0      22
RS   3      FLOW      0      0
RC 0.125  0.035  0.125  28200  0.0008      0
*   rch80
RX   0      180      400      406      456      462      640      820
RY 1080    1075    1070    1064    1064    1070    1075    1080
KK RNF85
KM   Local drainage Bear Creek at outlet
KO   0      0      0      0      22
BA 5.27
LS   0      54      0
UC 11.08   8.64
*   rectangle
UA   0      0.2      0.4      0.6      0.8      1
KK ADH85
KM   Bear Creek at North Branch
KO   0      0      0      0      22
HC   2
KK ADH86
KO   0      0      0      0      22
HC   2
KK RCH86
KM   North Branch from Bear Creek to Malung
KO   0      0      0      0      22
RS   1      FLOW      0      0
RC 0.125  0.035  0.125  20800  0.0006      0
*   rch86
RX   0      260      350      354      411      415      490      710
RY 1070    1055    1054    1050    1050    1054    1055    1070
KK RNF99
KM   Local Drainage to Gage 2
KO   0      0      0      0      22
BA 2.18
LS   0      57      0
UC 3.96   2.65
*   diamond
UA   0      0.09     0.34     0.64     0.9      1
KK ADH99
KO   0      0      0      0      22
HC   2
KKRSV99
KM   temporary calibration reservoir
RS   1      STOR      0
*   rsv99stor
SV   0      800      1200      4800      6500      7000      7300      7400      7800      8000
*   rsv99flow
SQ   0      100      200      500      1000      1500      2500      3000      5000      15000
KK RCH99  CNAME      G2
KM   North Branch gage 2 to South Branch
KO   0      0      0      0      22
RS   1      FLOW      0      0
RC 0.125  0.035  0.125  17800  0.0004      0
*   rch99
RX   0      110      180      186      246      252      260      810
RY 1055    1050    1044    1038    1038    1044    1050    1055
KKRNF109
KM   Local drainage South Branch at Skime
KO   0      0      0      0      22
BA 28.21
LS   0      55      0
UC 67.63  157.58
*   fan
UA   0      0.05     0.15     0.35     0.65     1

```

KKRCH109

KM South Branch Skime to Casperson

KO 0 0 0 0 22

RS 2 FLOW 0 0

RC 0.125 0.035 0.125 34800 0.0007 0

* rch109

RX 0 1400 1620 1624 1664 1668 2150 3220

RY 1175 1170 1165 1161 1161 1165 1170 1175

KKRCH110

KM South Branch Casperson to Mickinock Creek

KO 0 0 0 0 22

RS 3 FLOW 0 0

RC 0.125 0.035 0.125 35000 0.0012 0

* rch110

RX 0 280 300 305 345 349 400 540

RY 1135 1130 1125 1120 1120 1125 1130 1135

KKRNF119

KM Local drainage to South Branch at Mickinock Creek

KO 0 0 0 0 22

BA 24.2

LS 0 56 0

UC 25.87 51.74

* rectangle

UA 0 0.2 0.4 0.6 0.8 1

KKADH119

KM Combined flow South Branch upstream of Mickinock Creek

KO 0 0 0 0 22

HC 2

KKRNF120

KM Palmville sub RNF3

KM Palmville sub refers to areas developed for the Palmville Flood Control P

KO 0 0 0 0 22

BA 1.27

LS 0 60 0

UC 7.06 14.12

* fan

UA 0 0.05 0.15 0.35 65 1

KKRCH120

KO 0 0 0 0 22

RS 1 FLOW 0 0

RC 0.15 0.15 0.15 5500 0.0018 0

* rch120

RX 0 10 20 500 800 1300 1310 1320

RY 1170 1169 1168.5 1168 1168 1168.5 1169 1170

KKRNF121

KM Palmville sub RNF4b

KO 0 0 0 0 22

BA 0.95

LS 0 63 0

UC 9.62 19.24

* fan

UA 0 0.05 0.15 0.35 0.65 1

KKRCH121

KO 0 0 0 0 22

RS 1 FLOW 0 0

RC 0.15 0.15 0.15 5500 0.0009 0

* rch121

RX 0 10 20 500 800 1300 1310 1320

RY 1172 1171 1170.5 1170 1170 1170.5 1171 1172

KKRNF123

KM Palmville sub RNF4a

KO 0 0 0 0 22

BA 2.32

LS 0 62 0

UC 6.98 13.96

* fan								
UA	0	0.05	0.15	0.35	0.65	1		
KKADH123								
KO	0	0	0	0	22			
HC	2							
KKRCH123								
KO	0	0	0	0	22			
RS	1	FLOW	0	0				
RC	0.15	0.15	0.15	2500	0.004	0		
* rch120								
RX	0	10	20	500	800	1300	1310	1320
RY	1170	1169	1168.5	1168	1168	1168.5	1169	1170
KKADH124								
KO	0	0	0	0	22			
HC	2							
KKRNF125								
KM	Palmville sub RNF5							
KO	0	0	0	0	22			
BA	4.44							
LS	0	54	0					
UC	15.4	30.8						
* fan								
UA	0	0.05	0.15	0.35	0.65	1		
KKRCH125								
KO	0	0	0	0	22			
RS	1	FLOW	0	0				
RC	0.15	0.15	0.15	1500	0.0033	0		
* rch120								
RX	0	10	20	500	800	1300	1310	1320
RY	1170	1169	1168.5	1168	1168	1168.5	1169	1170
KKRNF126								
KM	Palmville sub RNF6							
KO	0	0	0	0	22			
BA	1.25							
LS	0	57	0					
UC	11.52	17.28						
* fan								
UA	0	0.05	0.15	0.35	0.65	1		
KKRCH126								
KO	0	0	0	0	22			
RS	1	FLOW	0	0				
RC	0.15	0.15	0.15	8000	0.0006	0		
* rch120								
RX	0	10	20	500	800	1300	1310	1320
RY	1170	1169	1168.5	1168	1168	1168.5	1169	1170
KKRNF127								
KM	Palmville sub RNF7							
KO	0	0	0	0	22			
BA	2.93							
LS	0	48	0					
UC	16.27	16.27						
* diamond								
UA	0	0.09	0.34	0.64	0.9	1		
KKRCH127								
KO	0	0	0	0	22			
RS	1	FLOW	0	0				
RC	0.15	0.15	0.15	9000	0.0006	0		
* rch120								
RX	0	10	20	500	800	1300	1310	1320
RY	1170	1169	1168.5	1168	1168	1168.5	1169	1170
KKRNF128								
KM	Palmville sub RNF8							
KO	0	0	0	0	22			
BA	1.22							
LS	0	47	0					

UC	6.25	9.38						
* fan								
UA	0	0.05	0.15	0.35	0.65	1		
KKRCH128								
KO	0	0	0	0	22			
RS	1	FLOW	0	0				
RC	0.15	0.15	0.15	6000	0.0008	0		
* rch120								
RX	0	10	20	500	800	1300	1310	1320
RY	1170	1169	1168.5	1168	1168	1168.5	1169	1170
KKRNF129								
KM	Palmville sub RNF9							
KO	0	0	0	0	22			
BA	2.9							
LS	0	47	0					
UC	7.84	11.76						
* fan								
UA	0	0.05	0.15	0.35	0.65	1		
KKRNF130								
KM	Palmville sub RNF10							
KO	0	0	0	0	22			
BA	1.29							
LS	0	45	0					
UC	5.11	11.91						
* fan								
UA	0	0.05	0.15	0.35	0.65	1		
KKADH130								
KO	0	0	0	0	22			
HC	7							
KKRNF131								
KM	Palmville wildlife pool							
KO	0	0	0	0	22			
BA	7.65							
LS	0	62	0					
UC	13.89	32.36						
* fan								
UA	0	0.05	0.15	0.35	0.65	1		
KKADH131								
KO	0	0	0	0	22			
HC	2							
KKRNF132								
KM	Palmville Flood Pool							
KO	0	0	0	0	22			
BA	0.89							
LS	0	62	0					
UC	7.85	18.29						
* diamond								
UA	0	0.09	0.34	0.64	0.9	1		
KKADH132								
KO	0	0	0	0	22			
HC	2							
KKRCH132								
KO	0	0	0	0	22			
RS	1	FLOW	0	0				
RC	0.15	0.05	0.15	10560	0.0005	0		
* rch132								
RX	0	4	6	16	24	34	1320	1325
RY	1153	1151	1149	1144	1144	1149	1150	1152
KKRCH133								
KO	0	0	0	0	22			
RS	1	FLOW	0	0				
RC	0.15	0.05	0.15	9200	0.0016	0		
* rch133								
RX	0	4	6	22	30	46	1320	1325
RY	1148	1146	1144	1136	1136	1144	1144	1146

KKRNF139

KM Local drainage to Oseland Gage

KO 0 0 0 0 22

BA 23.74

LS 0 56 0

UC 21.3 31.95

* fan

UA 0 0.05 0.15 0.35 0.65 1

KKADH139

KO 0 0 0 0 22

HC 2

KKRCH139

KO 0 0 0 0 22

RS 1 FLOW 0 0

RC 0.125 0.05 0.125 14800 0.0006 0

* rch139

RX 0 140 200 204 224 228 305 350

RY 1127 1120 1119 1115 1115 1119 1120 1127

KKRNF145

KM Local drainage to Mickinock Creek at Outlet

KO 0 0 0 0 22

BA 8.37

LS 0 54 0

UC 18.97 18.97

* fan

UA 0 0.05 0.15 0.35 0.65 1

KKADH145

KM Mickinock Creek

KO 0 0 0 0 22

HC 2

KKADH146

KO 0 0 0 0 22

HC 2

KKRCH146

KM South Branch Mickinock Creek to Wannaska

KO 0 0 0 0 22

RS 1 FLOW 0 0

RC 0.125 0.035 0.125 26600 0.0009 0

* rch146

RX 0 90 120 127 167 174 305 390

RY 1110 1105 1100 1093 1093 1100 1105 1110

KKRNF149

KM Local drainage South Branch at Wannaska

KO 0 0 0 0 22

BA 14

LS 0 54 0

UC 19.28 19.28

* fan

UA 0 0.05 0.15 0.35 0.65 1

KKADH149

KO 0 0 0 0 22

HC 2

KKRCH149

KM South Branch Wannaska to Paulson Creek

KO 0 0 0 0 22

RS 1 FLOW 0 0

RC 0.125 0.035 0.125 15200 0.0004 0

* rch149

RX 0 175 300 306 346 352 775 800

RY 1100 1095 1090 1084 1084 1090 1095 1100

KKRNF155

KM Local drainage South Branch at Paulson Creek

KO 0 0 0 0 22

BA 4.45

LS 0 53 0

UC	6.05	4.05						
* fan								
UA	0	0.05	0.15	0.35	0.65	1		
KKADH155								
KO	0	0	0	0	22			
HC	2							
KKRNF159								
KM	Local drainage gage 43 Roseau CD 21 at CSAH4							
KO	0	0	0	0	22			
BA	20.07							
LS	0	55	0					
UC	20.56	27.76						
* fan								
UA	0	0.05	0.15	0.35	0.65	1		
KKRCH159								
KO	0	0	0	0	22			
RS	1	FLOW	0	0				
RC	0.125	0.05	0.125	8500	0.0005	0		
* rch159								
RX	0	7.5	15	30	38	53	1373	2700
RY	1125	1122.5	1120	1115	1115	1120	1122.5	1125
KKRCH160								
KO	0	0	0	0	22			
RS	1	FLOW	0	0				
RC	0.125	0.05	0.125	4400	0.0036	0		
* rch160								
RX	0	150	180	185	195	200	300	400
RY	1115	1100	1095	1090	1090	1095	1100	1115
KKRNF165								
KM	Local Drainage Paulson Creek at Outlet							
KO	0	0	0	0	22			
BA	3.47							
LS	0	53	0					
UC	10.25	10.25						
* fan								
UA	0	0.05	0.15	0.35	0.65	1		
KKADH165								
KM	Combined outflow Paulson Creek							
KO	0	0	0	0	22			
HC	2							
KKADH166								
KO	0	0	0	0	22			
HC	2							
KKRCH166								
KM	South Branch Paulson Creek to Pencer West							
KO	0	0	0	0	22			
RS	2	FLOW	0	0				
RC	0.125	0.035	0.125	29800	0.0004	0		
* rch166								
RX	0	160	500	520	580	600	650	700
RY	1090	1080	1080	1070	1070	1080	1085	1090
KKRNF169								
KM	Local Drainage to Pencer West							
KO	0	0	0	0	22			
BA	6.56							
LS	0	61	0					
UC	14.79	14.79						
* fan								
UA	0	0.05	0.15	0.35	0.65	1		
KKADH169								
KO	0	0	0	0	22			
HC	2							
KKRCH169								
KM	South Branch Pencer West to Unamed Creek 1							
KO	0	0	0	0	22			

RS	1	FLOW	0	0				
RC	0.125	0.035	0.125	17000	0.0005	0		
* rch169								
RX	0	90	690	712	752	774	800	850
RY	1075	1070	1065	1054	1054	1065	1070	1075
KKRNF170								
KM	Local draiange South Branch at Unamed Creek 1							
KO	0	0	0	0	22			
BA	1.65							
LS	0	61	0					
UC	6.34	6.34						
* general								
UA	0	0.13	0.36	0.67	0.89	1		
KKADH170								
KM	South Branch upstream Unamed Creek 1							
KO	0	0	0	0	22			
HC	2							
KKRNF171								
KM	Local Drainage Unamed Creek 1							
KO	0	0	0	0	22			
BA	13.67							
LS	0	54	0					
UC	19.15	19.15						
* fan								
UA	0	0.05	0.15	0.35	0.65	1		
KKADH171								
KO	0	0	0	0	22			
HC	2							
KKRCH171								
KM	South Branch Unamed Creek 1 to Unamed Creek 2							
KO	0	0	0	0	22			
RS	3	FLOW	0	0				
RC	0.125	0.035	0.125	34400	0.0005	0		
* rch171								
RX	0	90	690	712	752	774	800	850
RY	1070	1065	1060	1049	1049	1060	1065	1070
KKRNF172								
KM	Local drainage South Branch at Unamed Creek 2							
KO	0	0	0	0	22			
BA	5.04							
LS	0	60	0					
UC	16.23	16.23						
* diamond								
UA	0	0.09	0.34	0.64	0.9	1		
KKADH172								
KM	South Branch upstream Unamed Creek 2							
KO	0	0	0	0	22			
HC	2							
KKRNF173								
KM	Local drainage Unamed Creek 2							
KO	0	0	0	0	22			
BA	16.03							
LS	0	53	0					
UC	16.17	16.17						
* fan								
UA	0	0.05	0.15	0.35	0.65	1		
KKADH173								
KO	0	0	0	0	22			
HC	2							
KKRCH173								
KM	South Branch Unamed Creek 2 to Gage 1							
KO	0	0	0	0	22			
RS	3	FLOW	0	0				
RC	0.125	0.035	0.125	27000	0.0005	0		
* rch173								

RX	0	90	690	712	752	774	800	850
RY	1065	1060	1055	1044	1044	1055	1060	1065
KKRNF199								
KM	Local drainage to Gage 1							
KO	0	0	0	0	22			
BA	9.25							
LS	0	57	0					
UC	11.09	11.09						
* fan								
UA	0	0.05	0.15	0.35	0.65	1		
KKADH198								
KO	0	0	0	0	22			
HC	2							
KKRNF180								
KM	Local drainage gage 3 Sec 18/19 T161N R39W							
KO	0	0	0	0	22			
BA	11.52							
LS	0	54	0					
UC	18.81	18.81						
* fan								
UA	0	0.05	0.15	0.35	0.65	1		
KKRCH180								
KM	Sucker Creek Gage 1 to Outlet							
KO	0	0	0	0	22			
RS	1	FLOW	0	0				
RC	0.125	0.05	0.125	9000	0.0023	0		
* rch180								
RX	0	90	100	125	130	155	180	240
RY	1060	1050	1044	1041	1041	1044	1050	1060
KKRNF189								
KM	Local drainage outlet Sucker Creek							
KO	0	0	0	0	22			
BA	0.69							
LS	0	55	0					
UC	7.44	4.98						
* rectangle								
UA	0	0.2	0.4	0.6	0.8	1		
KKADH189								
KM	Sucker Creek Outflow							
KO	0	0	0	0	22			
HC	2							
KKADH199								
KO	0	0	0	0	22			
HC	2							
KKRSV199								
KM	temporary calibration reservoir							
RS	1	STOR	0					
* rsv199stor								
SV	0	800	1200	4800	6500	7000	7300	7400
							7800	8000
* rsv199flow								
SQ	0	100	200	500	1000	1500	2500	3000
							5000	15000
KKRCH199								
KM	South Branch to North Branch							
KO	0	0	0	0	22			
RS	1	FLOW	0	0				
RC	0.125	0.035	0.125	6000	0.0005	0		
* rch199								
RX	0	90	100	106	146	152	290	1200
RY	1055	1040	1039	1033	1033	1039	1050	1055
KKADH200								
KO	0	0	0	0	22			
HC	2							
KKRCH200								
KM	Roseau River to USGS Gage near Malung							
KO	0	0	0	0	22			

RS	1	FLOW	0	0				
RC	0.125	0.035	0.125	2400	0.0003	0		
* rch200								
RX	0	400	435	443	493	501	600	1600
RY	1055	1045	1040	1034	1034	1040	1050	1055
KKRNF209								
KM	Local drainage to USGS Gage near Malung Gage 50							
KO	0	0	0	0	22			
BA	3.24							
LS	0	55	0					
UC	8.83	8.83						
* fan								
UA	0	0.05	0.15	0.35	0.65	1		
KKADH209								
KO	0	0	0	0	22			
HC	2							
KKRCH209								
KM	Roseau River gage 50 to CD 8							
KO	0	0	0	0	22			
RS	1	FLOW	0	0				
RC	0.125	0.035	0.125	1000	0.0003	0		
* rch200								
RX	0	400	435	443	493	501	600	1600
RY	1055	1045	1040	1034	1034	1040	1050	1055
KKRNF211								
KM	Local Drainage to Stafford area 1							
KO	0	0	0	0	22			
BA	11.25							
LS	0	52	0					
UC	16.8	11.25						
* fan								
UA	0	0.05	0.15	0.35	0.65	1		
KKRNF212								
KM	Local drainage to Stafford area 2							
KO	0	0	0	0	22			
BA	1.45							
LS	0	53	0					
UC	2.49	1.67						
* fan								
UA	0	0.05	0.15	0.35	0.65	1		
KKRNF213								
KM	Local drainage to Stafford area 3							
KO	0	0	0	0	22			
BA	0.7							
LS	0	47	0					
UC	5.56	3.73						
* fan								
UA	0	0.05	0.15	0.35	0.65	1		
KKADH211								
KO	0	0	0	0	22			
HC	3							
KKRCH211								
KM	Roseau County Ditch 8 Stafford project to Outlet							
KO	0	0	0	0	22			
RS	1	FLOW	0	0				
RC	0.125	0.05	0.125	17120	0.0005	0		
* rch211								
RX	0	10	16	31	37	52	1372	2640
RY	1058.2	1058	1056	1051	1051	1056	1056.2	1056.5
KKRNF219								
KM	Local Drainage Outlet RCD 8							
KO	0	0	0	0	22			
BA	6.26							
LS	0	53	0					
UC	17.92	17.92						

* fan

UA 0 0.05 0.15 0.35 0.65 1

KKADH220

KM Roseau County ditch 8 outflow

KO 0 0 0 0 22

HC 2

KKADH221

KO 0 0 0 0 22

HC 2

KKRCH221

KM Roseau River RCD 8 to Cow Creek

KO 0 0 0 0 22

RS 1 FLOW 0 0

RC 0.125 0.035 0.125 8800 0.0003 0

* rch221

RX 0 3600 3800 3812 3862 3874 4024 7624

RY 1055 1050 1035 1029 1029 1035 1050 1055

KKRNF229

KM Local drainage Roseau River at Cow Creek

KO 0 0 0 0 22

BA 4.83

LS 0 53 0

UC 12.04 12.04

* fan

UA 0 0.05 0.15 0.35 0.65 1

KKADH229

KM Roseau River upstream Cow Creek

KO 0 0 0 0 22

HC 2

KKRNF248

KM Local drainage Cow Creek Gage 44 Sec 31/32 T162N R39W

KO 0 0 0 0 22

BA 16.9

LS 0 55 0

UC 15.15 15.15

* fan

UA 0 0.05 0.15 0.35 0.65 1

KKRCH248

KM Cow Creek Gage 44 to Outlet

KO 0 0 0 0 22

RS 1 FLOW 0 0

RC 0.125 0.05 0.125 4800 0.0023 0

* rch248

RX 0 170 190 194 204 208 290 380

RY 1050 1045 1044 1040 1040 1044 1045 1050

KKRNF249

KM Local drainage outlet Cow Creek

KO 0 0 0 0 22

BA 0.31

LS 0 58 0

UC 1.76 1.76

* rectangle

UA 0 0.2 0.4 0.6 0.8 1

KKADH249

KM Cow Creek Outflow

KO 0 0 0 0 22

HC 2

KKADH260

KO 0 0 0 0 22

HC 2

KKRCH260

KM Roseau River Cow Creek to Center Street

KO 0 0 0 0 22

RS 1 FLOW 0 0

RC 0.125 0.035 0.125 11800 0.0003 0

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* rch221
RX      0      3600      3800      3812      3862      3874      4024      7624
RY 1055      1050      1035      1029      1029      1035      1050      1055
KKRNF269
KM      Local drainage Roseau River at Center Street
KO      0          0          0          0          22
BA 5.07
LS      0          60          0
UC 10.04      10.04
* fan
UA      0      0.05      0.15      0.35      0.65          1
KKADH269
KO      0          0          0          0          22
HC      2
KKRCH269
KM      Roseau River Center Street to Gage 15
KO      0          0          0          0          22
RS      2      FLOW          0          0
RC 0.125      0.035      0.125      23500      0.0003          0
* rch269
RX 11097      13712      20000      20035      20106      20131      20219      23721
RY1043.9      1038.4      1041.3      1024.7      1024.7      1036.8      1035.1      1043.6
KKRNF299
KM      Local drainage Roseau River Gage 15
KO      0          0          0          0          22
BA 5.51
LS      0          60          0
UC 9.18      9.18
* diamond
UA      0      0.09      0.34      0.64      0.9          1
KKADH299
KO      0          0          0          0          22
HC      2
KKRNF319
KM      Local Drainage Hay Creek at County Road 2 Sec 1/12 T161N R37W
KO      0          0          0          0          22
BA 19.38
LS      0          57          0
UC 17.12      16.95
* fan
UA      0      0.05      0.15      0.35      0.65          1
KKRCH319
KM      Hay Creek County Road 2 to Branch CD 9
KO      0          0          0          0          22
RS      1      FLOW          0          0
RC 0.125      0.05      0.125      7200      0.0017          0
* rch319
RX      0      1130      1270      1282      1300      1312      1400      1650
RY 1110      1105      1095      1089      1089      1095      1105      1110
KKRNF335
KM      Upper Summer Road RCD 9 drainage
KO      0          0          0          0          22
BA 10.04
LS      0          51          0
UC 19.28      19.28
* fan
UA      0      0.05      0.15      0.35      0.65          1
KKDVT335
KM      Split flow west to Summer Road
DTOUT335      0          0
* din335
DI      0          50          100          200          300          500          750          1000
* dout335
DQ      0          33          67          133          200          333          500          670
KKRCH335

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KM Branch of RCD 9 west to Hay Creek								
KO	0	0	0	0	22			
RS	1	FLOW	0	0				
RC	0.125	0.05	0.125	8810	0.0005	0		
* rch335								
RX	0	800	1700	1708	1712	1720	1722	1724
RY	1110	1107	1105	1101	1101	1105	1106	1107
KKADH336								
KO	0	0	0	0	22			
HC	2							
KKRCH336								
KM Hay Creek branch RCD9 to Summer Road								
KO	0	0	0	0	22			
RS	1	FLOW	0	0				
RC	0.125	0.05	0.125	7800	0.0017	0		
* rch336								
RX	0	1130	1270	1282	1300	1312	1400	1650
RY	1105	1100	1090	1084	1084	1090	1100	1105
KKRNF339								
KM Local Drainage Hay Creek at Summer Road								
KO	0	0	0	0	22			
BA	10.5							
LS	0	49	0					
UC	17.2	17.2						
* fan								
UA	0	0.05	0.15	0.35	0.65	1		
KKADH339								
KO	0	0	0	0	22			
HC	2							
KKRCH339								
KM Hay Creek Summer Road to Branch of RCD 9								
KO	0	0	0	0	22			
RS	1	FLOW	0	0				
RC	0.125	0.05	0.125	4400	0.001	0		
* rch339								
RX	0	100	3550	3562	3580	3592	4000	4800
RY	1080	1078	1075	1069	1069	1075	1078	1080
KKRNF351								
KM Local drainage Upper Hwy 11								
KO	0	0	0	0	22			
BA	4.32							
LS	0	55	0					
UC	12.99	12.99						
* fan								
UA	0	0.05	0.15	0.35	0.65	1		
KKRTV335								
KM Split flow from Upper Summer Road North								
DROUT335								
KKRCH350 CNAME								
RS	2	FLOW	0	0				
RC	0.125	0.05	0.125	10560	0.0014	0		
* rch350								
RX	0	2	4	12	16	24	1320	2640
RY	1107	1106	1105	1101	1101	1105	1105.5	1107
KKADH351								
KO	0	0	0	0	22			
HC	2							
KKDVT351								
KM Split flow to Roseau County Road 11								
DTOUT351								
* din351								
DI	0.	100.	200.	400.	600.	800.	1000.	2000.
* dout351								
DQ	0.	50.	100.	200.	300.	400.	500.	1000.
KKRCH351								

KM Branch RCD 9 to Hay Creek								
KO	0	0	0	0	22			
RS	3	FLOW	0	0				
RC	0.125	0.05	0.125	16600	0.0007	0		
* rch351								
RX	0	750	1320	1328	1332	1340	1342	1344
RY	1090	1089	1088	1084	1084	1088	1090	1092
KKADH352								
KO	0	0	0	0	22			
HC	2							
KKRCH352								
KM Hay Creek branch of RCD9 to Gage 12								
KO	0	0	0	0	22			
RS	1	FLOW	0	0				
RC	0.125	0.05	0.125	7400	0.0014	0		
* rch352								
RX	0	100	3550	3562	3580	3592	4000	4800
RY	1075	1073	1070	1064	1064	1070	1073	1075
KKRNF359								
KM Local drainage Hay Creek at Gage 12								
KO	0	0	0	0	22			
BA	12.44							
LS	0	50	0					
UC	13.97	14.39						
* diamond								
UA	0	0.09	0.34	0.64	0.9	1		
KKADH359								
KO	0	0	0	0	22			
HC	2							
KKRCH359								
KM Hay Creek Gage 12 to Branch RCD 9								
KO	0	0	0	0	22			
RS	1	FLOW	0	0				
RC	0.125	0.05	0.125	9220	0.0009	0		
* rch359								
RX	0	250	550	562	580	592	700	1000
RY	1070	1068	1065	1059	1059	1065	1068	1070
KKRTV351								
KM Upper Hwy 11 split flow								
DROUT351								
KKRCH352								
RS	4	FLOW	0	0				
RC	0.125	0.05	0.125	37920	0.0007	0		
* rch352								
RX	0	2	4	12	16	24	500	1000
RY	1076	1075	1074	1070	1070	1074	1074	1075
KKADH360								
KO	0	0	0	0	22			
HC	2							
KKRCH360								
KM Hay Creek Branch RCD9 to MN HWY 11								
KO	0	0	0	0	22			
RS	1	FLOW	0	0				
RC	0.125	0.05	0.125	4980	0.0009	0		
* rch360								
RX	0	250	550	562	580	592	700	1000
RY	1060	1058	1055	1049	1049	1055	1058	1060
KKRNF379								
KM Local Drainage MN Hwy 11								
KO	0	0	0	0	22			
BA	20.97							
LS	0	54	0					
UC	37.8	56.7						
* fan								
UA	0	0.05	0.15	0.35	0.65	1		

KKADH379
 KO 0 0 0 0 22
 HC 2
 KKRCH379
 KM Hay Creek MN Hwy 11 to Hay Creek Proj Det 1
 KO 0 0 0 0 22
 RS 1 FLOW 0 0
 RC 0.125 0.035 0.125 5680 0.0004 0
 * rch379
 RX 0 1000 2300 2312 2328 2340 4000 5000
 RY 1060 1058 1058 1050 1050 1058 1058 1060
 KKRNF381
 KM Hay Creek Proj Det 1
 KO 0 0 0 0 22
 BA 4.14
 LS 0 54 0
 UC 20.23 20.23
 * fan
 UA 0 0.05 0.15 0.35 0.65 1
 KKADH381
 KO 0 0 0 0 22
 HC 2
 KKRCH381
 KM Hay Creek Det 1 to Roseau County Ditch 18
 KO 0 0 0 0 22
 RS 1 FLOW 0 0
 RC 0.125 0.035 0.125 10820 0.0004 0
 * rch381
 RX 0 1000 2300 2312 2328 2340 4000 5000
 RY 1055 1053 1053 1045 1045 1053 1053 1055
 KKRNF385
 KM Norland sub RNF50 Roseau County Ditch 18 Sec 4/5 T162N R38W
 KO 0 0 0 0 22
 BA 8.39
 LS 0 55 0
 UC 29.83 59.66
 * rnf385
 UA 0 0.1 0.24 0.46 0.65 0.75 0.83 0.89 0.94 0.98
 UA 1
 KKRCH385
 KM RCD 18 to Hay Creek
 KO 0 0 0 0 22
 RS 1 FLOW 0 0
 RC 0.08 0.05 0.08 17690 0.001 0
 * rch385
 RX 0 5 10 45 53 57 100 250
 RY1067.4 1067.4 1067.4 1056.14 1056.14 1064.7 1064.7 1064.7
 KKRNF391
 KM Hay Creek Project Pool #1
 KO 0 0 0 0 22
 BA 2.21
 LS 0 55 0
 UC 3.6 3.6
 * fan
 UA 0 0.05 0.15 0.35 0.65 1
 KKADH391
 KO 0 0 0 0 22
 HC 2
 KKRCH391 CNAME 391
 KM RCD 18 Pool#1 to NW Sec 2 T162N R39W
 KO 0 0 0 0 22
 RS 1 FLOW 0 0
 RC 0.08 0.05 0.08 5280 0.0003 0
 * rch391
 RX 0 5 10 24 30 44 5000 5250

RY	1053	1052	1049	1042	1042	1049	1049.5	1050
KKDVT391								
KM Split flow RCD 18								
DTOUT391								
* in391								
DI	0.	300.	600.	900.	1200.	2100.		
* out391								
DQ	0.	200.	400.	600.	800.	1400.		
KKRCH392								
KM RCD 18 NW Sec 2 T162N R39W								
KO	0	0	0	0	22			
RS	1	FLOW	0	0				
RC	0.08	0.05	0.08	8300	0.0003	0		
* rch392								
RX	0	5	10	24	30	44	5000	5250
RY	1052	1051	1048	1041	1041	1048	1048.5	1049
KKADH395								
KO	0	0	0	0	22			
HC	2							
KKRCH395								
KM Hay Creek RCD 18 to Outlet								
KO	0	0	0	0	22			
RS	1	FLOW	0	0				
RC	0.125	0.035	0.125	12900	0.0004	0		
* rch395								
RX	0	1000	2300	2312	2328	2340	4000	5000
RY	1050	1048	1048	1040	1040	1048	1048	1050
KKRNF399								
KM Local drainage to Lower Hay Creek								
KO	0	0	0	0	22			
BA	19.76							
LS	0	53	0					
UC	24.8	31						
* fan								
UA	0	0.05	0.15	0.35	0.65	1		
KKADH399								
KM Hay Creek at Outlet								
KO	0	0	0	0	22			
HC	2							
KKADH400								
KM Roseau River at Gage 15 Sec 6/31 T162-163N R39W County Road 28								
KO	0	0	0	0	22			
HC	2.							
KKRSV400								
KM Storage behind CR 28								
KO	0	0	0	0	22			
RS	1	FLOW	0					
* rsv400stor								
SV	0	147	247	847	2587	4517	7282	10872 15272 20471
* rsv400flow								
SQ	0	720	800	2190	4110	5200	6120	8450 10000 11690
KKRTV391								
KM Overflow RCD 18								
DROUT391								
KKRC391b								
RS	1	FLOW	0	0				
RC	0.08	0.05	0.08	17000	0.0006	0		
* rc391b								
RX	0	2	4	14	18	28	1300	2600
RY	1057	1056	1055	1050	1050	1055	1055.5	1057
KKADH401								
KM Roseau River at Sout side Sec 31 T163N R39W at lateral JD61								
KO	0	0	0	0	22			
HC	2							
KKRC391m								

KM Roseau River Gage 15 to Lat 3 Judicial 61
 KO 0 0 0 0 22
 RS 1 STOR 0 0
 * stor391m
 SV 0 90 132 228 606 2187 2916 3579 4242 5460
 * flow391m
 SQ 0 500 1000 2000 3000 5000 6000 7000 8000 10000
 KKRNF401
 KM Norland sub RNF20 Sec 28/29 T163N R37W
 KO 0 0 0 0 22
 BA 2.85
 LS 0 57 0
 UC 6.27 9.41
 * rnf401
 UA 0 0 0.01 0.03 0.09 0.19 0.29 0.51 0.78 0.95
 UA 1
 KKRCH401
 KM Lat 3 JD61
 KO 0 0 0 0 22
 RS 1 FLOW 0 0
 RC 0.08 0.05 0.08 5120 0.006 0
 * rch401
 RX 0 5 10 19 27 36 143 243
 RY1079.1 1079 1078 1075 1075 1078 1079 1079.1
 KKRNF402
 KM Norland Sub RNF30
 KO 0 0 0 0 22
 BA 6.43
 LS 0 54 0
 UC 39.75 79.5
 * rnf402
 UA 0 0.19 0.33 0.56 0.79 0.87 0.92 0.93 0.95 0.99
 UA 1
 KKADH402
 KO 0 0 0 0 22
 HC 2
 KKDVT402
 KM 50-50 split west and north
 DTOUT402
 * in402
 DI 0. 10. 20. 30. 40. 50. 100. 200. 500. 1000.
 * out402
 DQ 0. 5. 10. 15. 20. 25. 50. 100. 250. 500.
 KKRCH402
 KM Lat 3 JD61
 KO 0 0 0 0 22
 RS 1 FLOW 0 0
 RC 0.08 0.05 0.08 10320 0.006 0
 * rch402
 RX 0 5 10 22 30 42 47 252
 RY1075.1 1075 1074 1070 1070 1074 1075 1075.1
 KKRNF403
 KM Norland Sub RNF40
 KO 0 0 0 0 22
 BA 5.66
 LS 0 49 0
 UC 13.51 13.51
 * rnf40
 UA 0 0.1 0.29 0.5 0.62 0.74 0.8 0.86 0.91 0.95
 UA 1
 KKADH403
 KO 0 0 0 0 22
 HC 2
 KKRCH403
 KM Lat 3 JD 61

KO	0	0	0	0	22					
RS	1	FLOW	0	0						
RC	0.08	0.05	0.08	9650	0.006	0				
* rch403										
RX	0	5	10	22	30	42	47	252		
RY1070.1	1070	1069	1065	1065	1069	1070	1070.1			
KKRNF405										
KM Norland sub RNF60										
KO	0	0	0	0	22					
BA	7.08									
LS	0	55	0							
UC	11.04	11.04								
* rnf405										
UA	0	0.08	0.18	0.31	0.51	0.65	0.82	0.9	0.97	0.99
UA	1									
KKADH405										
KM Sec 21/22 T163N R38W										
KO	0	0	0	0	22					
HC	2									
KKRNF406										
KM Norland sub RNF65										
KO	0	0	0	0	22					
BA	1.71									
LS	0	46	0							
UC	5	5.85								
* rnf406										
UA	0	0.13	0.25	0.34	0.45	0.57	0.7	0.8	0.89	0.97
UA	1									
KKADH406										
KM Sec 21/22 T163N R38W										
KO	0	0	0	0	22					
HC	2									
KKRNF408										
KM Norland Pool area RNF70										
KO	0	0	0	0	22					
BA	7.65									
LS	0	48	0							
UC	12.55	18.83								
* rnf408										
UA	0	0.02	0.08	0.15	0.26	0.41	0.61	0.75	0.87	0.93
UA	1									
KKADH408										
KO	0	0	0	0	22					
HC	2									
KKDVT408										
KM Split Norland flows into BR 5 Lat 3 and Lat 3 flows										
DTOUT410										
* in410										
DI	0.	35.	99.	239.	443.	696.	1065.	1515.	2032.	
* out410										
DQ	0.	11.	33.	80.	148.	232.	355.	505.	677.	
KKRCH420										
KM Lat 3 JD 61										
KO	0	0	0	0	22					
RS	2	FLOW	0	0						
RC	0.125	0.05	0.125	24200	0.0006	0				
* rch420										
RX	0	6	8	18	24	34	1320	1325		
RY	1054	1051	1050	1045	1045	1050	1050	1054		
KKADH421										
KO	0	0	0	0	22					
HC	2									
KKRCH421										
KM Roseau River Lat 3 JD 61 to Hwy 310										
KO	0	0	0	0	22					

RS	1	STOR	0	0						
* stor421										
SV	0	312	459	792	2106	7611	10140	12450	14757	18993
* flow421										
SQ	0	561	1000	2000	3000	5000	6000	7000	8000	10000
KKRTV430										
KM Br 5 Lat 3 JD61										
DROUT410										
KKRCH430										
RS	4	FLOW	0	0						
RC	0.125	0.05	0.125	44000	0.0004	0				
* out410										
RX	0	6	8	18	24	34	1320	1325		
RY	1054	1051	1050	1045	1045	1050	1050	1054		
KKADH430										
KO	0	0	0	0	22					
HC	2									
KKRNF499										
KM Local drainage Roseau River at MN Hwy 310										
KO	0	0	0	0	22					
BA 19.26										
LS	0	49	0							
UC	18.59	32.35								
* fan										
UA	0	0.05	0.15	0.35	0.65	1				
KKADH499										
KM Roseau River at MN Hwy 310										
KO	0	0	0	0	22					
HC	2									
KKRNF520										
KM East Fork of Sprague Creek										
KO	0	0	0	0	22					
BA 22.42										
LS	0	51	0							
UC	43.2	64.8								
* fan										
UA	0	0.05	0.15	0.35	0.65	1				
KKRNF530										
KM West Fork of Sprague Creek										
KO	0	0	0	0	22					
BA 20.42										
LS	0	45	0							
UC	48.32	72.48								
* fan										
UA	0	0.05	0.15	0.35	0.65	1				
KKADH530										
KO	0	0	0	0	22					
HC	2									
KKRCH530										
KM Sprague Creek forks to Vasser Road										
KO	0	0	0	0	22					
RS	6	FLOW	0	0						
RC	0.125	0.04	0.125	40765	0.0006	0				
* rch530										
RX	0	10	510	516	534	540	1040	1050		
RY	1080	1075	1073	1067	1067	1073	1075	1080		
KKRNF540										
KM Local drainage to Sprague Creek at Vassar Road										
KO	0	0	0	0	22					
BA 47.64										
LS	0	51	0							
UC	43.35	65.03								
* fan										
UA	0	0.05	0.15	0.35	0.65	1				
KKADH540										

KO	0	0	0	0	22			
HC	2							
KKRCH540								
KM	Sprague Creek Vassar Road to Mud Creek							
KO	0	0	0	0	22			
RS	5	FLOW	0	0				
RC	0.125	0.04	0.125	56058	0.0005	0		
* rch540								
RX	0	10	510	516	534	540	1040	1050
RY	1075	1070	1068	1062	1062	1068	1070	1075
KKRNF545								
KM	Local drainage Sprague Creek at Sprague Manitoba							
KO	0	0	0	0	22			
BA	21.93							
LS	0	57	0					
UC	35.7	53.55						
* fan								
UA	0	0.05	0.15	0.35	0.65	1		
KKADH545								
KM	Sprague Creek at Sprague							
KO	0	0	0	0	22			
HC	2							
KKRNF510								
KM	Local Drainage to Mud Creek							
KO	0	0	0	0	22			
BA	32.18							
LS	0	59	0					
UC	71.13	106.7						
* fan								
UA	0	0.05	0.15	0.35	0.65	1		
KKADH546								
KO	0	0	0	0	22			
HC	2							
KKRCH546								
KM	Sprague Creek Sprague to USGS Gage							
KO	0	0	0	0	22			
RS	2	FLOW	0	0				
RC	0.125	0.04	0.125	17973	0.0009	0		
* rch546								
RX	0	10	510	516	534	540	1040	1050
RY	1065	10602	1057	1051	1051	1057	1060	1065
KKRNF550								
KM	Local drainage Sprague Creek at USGS Gage							
KO	0	0	0	0	22			
BA	39.01							
LS	0	55	0					
UC	52.83	35.4						
* fan								
UA	0	0.05	0.15	0.35	0.65	1		
KKADH550								
KM	Sprague Creek at USGS gaging station							
KO	0	0	0	0	22			
HC	2							
KKRCH550								
KM	Sprague Creek USGS Gage to Lat 2 JD 61							
KO	0	0	0	0	22			
RS	3	FLOW	0	0				
RC	0.125	0.04	0.125	32800	0.0006	0		
* rch550								
RX	0	50	1850	1856	1874	1880	2980	3030
RY	1050	1047	1045	1039	1039	1045	1047	1050
KKRNF570								
KM	Local Drainage to Upper Lat 2 JD 61							
KO	0	0	0	0	22			
BA	54.33							

LS 0 60 0
 UC 39.24 58.86
 * fan
 UA 0 0.05 0.15 0.35 0.65 1
 KKRTV402
 KM Split flow out of RNF402
 DROUT402
 KKRCH571
 RS 1 FLOW 0 0
 RC 0.08 0.05 0.08 10420 0.0006 0
 * rch571
 RX 0 2 4 10 24 30 1300 2600
 RY 1081 1080 1079 1076 1076 1079 1079.5 1080
 KKADH574
 KO 0 0 0 0 22
 HC 2
 KKRCH574
 KM Lat 2 JD 61
 KO 0 0 0 0 22
 RS 4 FLOW 0 0
 RC 0.125 0.05 0.125 31460 0.0005 0
 * rch574
 RX 0 1 5 9 17 21 2621 2655
 RY 1047 1046 1042 1038 1038 1042 1043 1045
 KKADH575
 KO 0 0 0 0 22
 HC 2
 KKRCH575
 KM Sprague Creek Br2 JD 61 to Outlet
 KO 0 0 0 0 22
 RS 1 FLOW 0 0
 RC 0.125 0.04 0.125 9000 0.0005 0
 * rch575
 RX 0 15 1515 1521 1541 1547 2547 2555
 RY 1036 1033 1032 1026 1026 1032 1033 1035
 KKRNF580
 KM Local drainage to Sprague Creek at Outlet
 KO 0 0 0 0 22
 BA 47.32
 LS 0 62 0
 UC 29 43.5
 * rectangle
 UA 0 0.2 0.4 0.6 0.8 1
 KKADH580
 KM Sprague Creek at Outlet
 KO 0 0 0 0 22
 HC 2
 KKADH456
 KM Combined flows Roseau River and Sprague Creek
 KO 0 0 0 0 22
 HC 2
 KKRCH456
 KM Roseau Rive Sprague Creek to Roseau Lake Bed
 KO 0 0 0 0 22
 RS 3 FLOW 0 0
 RC 0.125 0.035 0.125 27200 0.0002 0
 * rch456
 RX 0 1320 2640 2665 2718 2743 4063 5390
 RY 1035 1034.25 1034 1021.5 1021.5 1034 1034.25 1035
 KKRNF610
 KM South Roseau Lake Bottom
 KO 0 0 0 0 22
 BA 40.91
 LS 0 53 0
 UC 10.48 7.02

* rectangle

UA 0 0.2 0.4 0.6 0.8 1

KKRNF620

KM North Roseau Lake Bottom

KO 0 0 0 0 22

BA 46.2

LS 0 55 0

UC 40.11 40.11

* fan

UA 0 0.05 0.15 0.35 0.65 1

KKADH620

KM Roseau River at Lake Bed

KO 0 0 0 0 22

HC 3

KKRNF700

KM Local Drainage West Pine Creek

KO 0 0 0 0 22

BA 33.76

LS 0 43 0

UC 56.23 37.67

* fan

UA 0 0.05 0.15 0.35 0.65 1

KKRCH700

KM West Pine Creek Manitoba Hwy 12 to East Pine Creek

KO 0 0 0 0 22

RS 1 FLOW 0 0

RC 0.125 0.05 0.125 1672 0.0014 0

* rch700

RX 0 750 1500 1510 1518 1528 2278 3000

RY 1100 1095 1090 1086 1086 1090 1091 1095

KKRNF710

KM Local drainage East Pine Creek

KO 0 0 0 0 22

BA 9.55

LS 0 41 0

UC 20.36 13.63

* fan

UA 0 0.05 0.15 0.35 0.65 1

KKRCH710

KM East Pine Creek Manitoba Hwy 12 to West Pine Creek

KO 0 0 0 0 22

RS 1 FLOW 0 0

RC 0.125 0.05 0.125 2048 0.0014 0

* rch710

RX 0 750 1500 1510 1516 1526 2276 3000

RY 1095 1091 1090 1086 1086 1090 1095 1100

KKADH710

KM Pine Creek near Hwy 12

KO 0 0 0 0 22

HC 2

KKRCH711

KM East and West Pine Creek to Diversion

KO 0 0 0 0 22

RS 1 FLOW 0

RC 0.125 0.05 0.125 19288 0.0014

* rch711

RX 0 750 3000 3010 3016 3026 5250 6000

RY 1095 1090 1085 1081 1081 1085 1090 1095

KKRNF720

KM Local drainage Pine Creek at Diversion

KO 0 0 0 0 22

BA 16.68

LS 0 49 0

UC 7.58 5.08

* fan

UA	0	0.05	0.15	0.35	0.65	1				
KKADH720										
KM Pine Creek Upstream of Diversion										
KO	0	0	0	0	22					
HC	2.									
KKDVT720										
KM Pine Creek Diversion										
DTOUT720										
* in720										
DI	0.	220.	300.	500.	1000.	1250.	1500.	2000.		
* out720										
DQ	0.	220.	273.	407.	740.	850.	850.	850.		
KKRCH720										
KM Pine Creek Diversion to Roseau County Road 118										
KO	0	0	0	0	22					
RS	3	FLOW	0	0						
RC	0.125	0.04	0.125	37815	0.001	0				
* rch720										
RX	0	600	1180	1184	1192	1196	1700	2410		
RY	1050	1047	1045	10417	1041	1045	1047	1050		
KKRNF790										
KM Local Drainage at RCR 118										
KO	0	0	0	0	22					
BA	20.29									
LS	0	56	0							
UC	17.76	17.76								
* rectangle										
UA	0	0.2	0.4	0.6	0.8	1				
KKADH790										
KM Pine Creek at Lake Bottom										
KO	0	0	0	0	22					
HC	2									
KKADH699										
KO	0	0	0	0	22					
HC	2									
KKRSV699										
KM Roseau Lake Bottom										
KO	0	0	0	0	22					
RS	1	FLOW	0	0						
* stor699										
SV	0	500	1100	3000	5580	12970	17860	28000	40000	52260
SV	60590	74010	84505	144375	179500	203000				
* flow699										
SQ	0	250	732	954	1136	1372	1638	1924	2222	2574
SQ	3084	3868	4494	5200	7500	10000				
* elev699										
SE1017.1	1024.8	1026	1027	1028	1029	1030	1031	1032	1033	
SE	1034	1035	1035.5	1036	1037	1038				
KKRCH699										
KM Roseau River Ross to Lins Bridge										
KO	0	0	0	0	22					
RS	2	FLOW	0	0						
RC	0.125	0.035	0.125	24390	0.0005	0				
* rch699										
RX	0	9	3200	3232	3299	3331	5271	5280		
RY	1035	1032	1030	1014	1014	1030	1032	1035		
KKRNF900										
KM Local drainage at Lins Bridge										
KO	0	0	0	0	22					
BA	41.99									
LS	0	54	0							
UC	14.73	9.87								
* rectangle										
UA	0	0.2	0.4	0.6	0.8	1				
KKADH900										

KO	0	0	0	0	22			
HC	2							
KKRCH900								
KM	Roseau River Lins Bridge to Big Swamp							
KO	0	0	0	0	22			
RS	2	FLOW	0	0				
RC	0.125	0.035	0.125	24390	0.0004	0		
* rch900								
RX	0	25	35	67	134	166	2806	5280
RY	1035	1030	1028	1012	1012	1028	1030	1032
KKRNF920								
KM	Local drainage upstream of Big Swamp							
KO	0	0	0	0	22			
BA	24.09							
LS	0	59	0					
UC	32.83	32.83						
* rectangle								
UA	0	0.2	0.4	0.6	0.8	1		
KKADH920								
KO	0	0	0	0	22			
HC	2							
KKRCH920								
KM	Roseau River to Roseau River Wildlife Management Pool 2 Outlet							
KO	0	0	0	0	22			
RS	52	FLOW	0	0				
RC	0.125	0.035	0.125	13000	0.0004	0		
* rch920								
RX	0	2640	5280	5296	5363	5380	8020	10659
RY	1025	1024.5	1024	1018	1018	1024	1024.5	1025
KKRNF810 RRWMA Pool 1								
KM	Local Drainage to RRWMA Pool 1							
KO	0	0	0	0	22			
BA	24.88							
LS	0	58	0					
UC	13.3	13.3						
* rectangle								
UA	0	0.2	0.4	0.6	0.8	1		
KKRTV720								
KM	Pine Creek Diversion							
DROUT720								
KKRC720a								
RS	3	FLOW	0	0				
RC	0.05	0.05	0.05	41517	0.0001	0		
* rc720a								
RX	0	10	28	42	52	66	84	94
RY	1068	1063	1063	1056	1056	1063	1063	1068
KKADH810								
KO	0	0	0	0	22			
HC	2							
KKRSV810								
KM	RRWMA Pool 1							
KO	0	0	0	0	22			
RS	1	STOR	2415	0				
* stor810								
SV	2415	2477	3968	4899	4215	4575	5115	5475
* flow810								
SQ	0	8.4	33	235	460	820	1390	1960
* elev810								
SE	1035	1035.2	1035.5	1035.8	1036	1036.2	1036.5	1036.7
KKRNF820								
KM	Local drainage RRWMA Pool 2							
KO	0	0	0	0	22			
BA	89.71							
LS	0	58	0					
UC	51	76.5						

* fan										
UA	0	0.05	0.15	0.35	0.65	1				
KKADH820										
KO	0	0	0	0	22					
HC	2									
KKRSV820										
KM	RRWMA Pool 2									
KO	0	0	0	0	22					
RS	1	STOR	4450	0						
* stor820										
SV	4450	5400	6800	8400	9500	10800	12800	14300	16540	19550
* flow810										
SQ	0	8.4	33	235	460	820	1390	1960	3035	4735
* elev820										
SE	1029	1029.2	1029.5	1029.8	1030	1030.2	1030.5	1030.7	1031	1031.4
KKDVT820										
KM Main outlet Roseau River, Emergency Spillway and Secondary Outlet										
DTOUT820										
* in820										
DI	0.	8.4	33.	235.	460.	820.	1390.	1960.	3035.	4735.
* out820										
DQ	0.	0.	0.	170.	370.	700.	1225.	1645.	2345.	3325.
KKRCH821										
KM	Roseau County Ditch 17									
KO	0	0	0	0	22					
RS	1	FLOW	0	0						
RC	0.125	0.035	0.125	3900	0.0001	0				
* rch821										
RX	0	1050	2100	2108	2116	2124	2128	2134		
RY	1025	1022	1020	1016	1016	1020	1022	1025		
KKRCH822										
KM	Old Roseau River Channel									
KO	0	0	0	0	22					
RS	1	FLOW	0	0						
RC	0.125	0.035	0.125	8800	0.0001	0				
* rch822										
RX	0	500	1400	1408	1548	1556	2500	4000		
RY	1024	1022	1020	1016	1016	1020	1022	1024		
KKADH930										
KO	0	0	0	0	22					
HC	2									
KKRCH930										
KM	Roseau River Pool 2 outlet to Pool 3 outlet									
KO	0	0	0	0	22					
RS	2	FLOW	0	0						
RC	0.125	0.035	0.125	15200	0.0004	0				
* rch930										
RX	0	2640	5280	5296	5363	5380	8020	10659		
RY	1020	1019.5	1019	1013	1013	1019	1019.5	1020		
KKRNF830										
KM	Local drainage RRWMA Pool 3									
KO	0	0	0	0	22					
BA	23.73									
LS	0	52	0							
UC	12.5	12.5								
* fan										
UA	0	0.05	0.15	0.35	0.65	1				
KKRTV820										
KM	Pool 2 outflow to Pool3									
DROUT820										
KKADH830										
KO	0	0	0	0	22					
HC	2									
KKRSV830										
KM	RRWMA Pool 3									

KO	0	0	0	0	22				
RS	1	STOR	2700	0					
* stor830									
SV	2700	3400	4500	5800	6750	7750	9700	12900	16650
* flow830									
SQ	0	8.4	33	185	355	620	1040	1925	2980
* elev830									
SE	1024	1024.2	1024.5	1024.8	1025	1025.2	1025.5	1026	1026.5
KKRCH831									
KM Outlet Channel Pool3									
KO	0	0	0	0	22				
RS	1	FLOW	0	0					
RC	0.125	0.05	0.125	2920	0.0001	0			
* rch831									
RX	0	700	1400	1410	1420	1430	2100	3000	
RY	1023	1022	1021	1016	1016	1021	1022	1023	
KKRCH832									
KM Old Roseau River Channel									
KO	0	0	0	0	22				
RS	1	FLOW	0	0					
RC	0.125	0.05	0.125	1150	0.0001	0			
* rch832									
RX	0	700	1400	1412	1512	1514	2100	3000	
RY	1023	1022	1021	1015	1015	1021	1022	1023	
KKADH940									
KO	0	0	0	0	22				
HC	2								
KKRCH940									
KM Roseau River pool 3 to end of Big Swamp									
KO	0	0	0	0	22				
RS	1	FLOW	0	0					
RC	0.125	0.035	0.125	34000	0.0004	0			
* rch940									
RX	0	2640	5280	5296	5363	5380	8020	10659	
RY	1019	1018.5	1018	1012	1012	1018	1018.5	1019	
KKRNF950									
KM Local drainage Big Swamp									
KO	0	0	0	0	22				
BA	88.82								
LS	0	63	0						
UC	32.48	48.72							
* rectangle									
UA	0	0.2	0.4	0.6	0.8	1			
KKADH950									
KO	0	0	0	0	22				
HC	2								
KKRSV950									
KM Big Swamp Storage									
KO	0	0	0	0	22				
RS	1	STOR	0	0					
* stor950									
SV	0	2000	6000	13000	21000	29000	37000	45000	53000
* flow950									
SQ	0	700	1300	1900	2300	2600	2900	3200	3500
KKDVT950									
KM Flow transfer to Two Rivers									
DTOUT920									
* in920									
DI	0.	2000.	3513.	3699.	4403.				
* out920									
DQ	0.	0.	533.	619.	1083.				
KKRCH950									
KM Roseau River Big Swamp to USGS Gaging Station									
KO	0	0	0	0	22				
RS	3	FLOW	0	0					

RC	0.125	0.035	0.125	32900	0.0002	0		
* rch950								
RX	0	1600	2200	2220	2275	2295	2900	3250
RY	1020	1018	1015	1005	1005	1015	1018	1020
KKRNF960								
KM Local drainage to USGS Gage near Caribou								
KO	0	0	0	0	22			
BA	24.04							
LS	0	53	0					
UC	24.04	33.8						
* rectangle								
UA	0	0.2	0.4	0.6	0.8	1		
KKADH960								
KO	0	0	0	0	22			
HC	2							
KKRCH960								
KM Roseau River Caribou to International Border								
KO	0	0	0	0	22			
RS	1	FLOW	0	0				
RC	0.125	0.035	0.125	12200	.0003	0		
* rch960								
RX	0	1600	2200	2220	2275	2295	2900	3250
RY	1015	1013	1010	1000	1000	1010	1013	1015
KKRNF999								
KM Local Drainage Roseau River at Border								
KO	0	0	0	0	22			
BA	9.56							
LS	0	52	0					
UC	13.78	13.78						
* rectangle								
UA	0	0.2	0.4	0.6	0.8	1		
KKADH999								
KM Roseau River at International Border								
KO	0	0	0	0	22			
HC	2							
KKRTV920								
KM Diverted flow to Two Rivers								
DROUT920								
ZZ								