

**ENVIRONMENTAL APPROVALS BRANCH, MANITOBA CONSERVATION
CLEAN ENVIRONMENT COMMISSION PUBLIC HEARINGS
CITY OF WINNIPEG SEWAGE INVESTIGATION
JANUARY 2003**

**RECOMMENDED EFFLUENT DISCHARGE LIMITS
FOR
CITY OF WINNIPEG
SEWAGE TREATMENT PLANTS**

**BY
MIKE VAN DEN BOSCH
A/MANAGER
MUNICIPAL, INDUSTRIAL AND HAZARDOUS
WASTE APPROVALS SECTION**

Recommended Effluent Discharge Limits

Introduction

The following effluent discharge limits are proposed for the sewage treatment plants operated by the City of Winnipeg. Technology based limits such as biochemical oxygen demand, carbonaceous biochemical oxygen demand and total suspended solids would be applicable to all treatment plants. Water quality based limits such as ammonia loads would be specific to each treatment plant. The proposed limits represent a starting position and will have to be refined. A second review of river flow data, effluent discharge data, and treatment plant capacities should be undertaken before licence limits are finalized.

Biochemical Oxygen Demand (BOD₅)

The organic content of the effluent from the wastewater treatment plant, as indicated by the five day biochemical oxygen demand, should not exceed 30 milligrams per litre; where:

"five-day biochemical oxygen demand" means that part of the oxygen demand usually associated with biochemical oxidation of organic matter within 5 days at a temperature of 20°C;

Carbonaceous Biochemical Oxygen Demand (CBOD₅)

An alternative to the above limit on BOD₅ would be the following, provided that an ammonia limit is also applied:

The organic content of the effluent from the wastewater treatment plant, as indicated by the five day carbonaceous biochemical oxygen demand, should not exceed 25 milligrams per litre; where:

"five-day carbonaceous biochemical oxygen demand" means that part of the oxygen demand usually associated with biochemical oxidation of carbonaceous organic matter within 5 days at a temperature of 20°C;

Total Suspended Solids

The total suspended solids content of the effluent from the wastewater treatment plant should not exceed 30 milligrams per litre.

Fecal Coliform

The fecal coliform content of the effluent from the wastewater treatment plant, as indicated by the MPN index, should not exceed 200 per 100 millilitres of sample, as determined by the monthly geometric mean of 1 grab sample collected at equal time intervals on each of a minimum of 3 consecutive days per week, during the period between May 1 and September 30 of any year; where:

"fecal coliform" means aerobic and facultative, Gram-negative, nonspore-forming, rod-shaped bacteria capable of growth at 44.5°C, and associated with fecal matter of warm-blooded animals.

In the case of the South End Sewage Treatment Plant, limits, terms and conditions were applied to the disinfection process in response to a Notice of Alteration filed by the City of Winnipeg on July 17, 1998. These limits, terms and conditions are listed in Appendix A. These requirements will have to be taken into consideration in the preparation of a revised licence for the South End Sewage Treatment Plant.

Total Coliform

The total coliform content of the effluent, as indicated by the MPN index, should not exceed 1500 per 100 millilitres of sample, as determined by the monthly geometric mean of 1 grab sample collected at equal time intervals on each of a minimum of 3 consecutive days per week, during the period between May 1 and September 30 of any year; where:

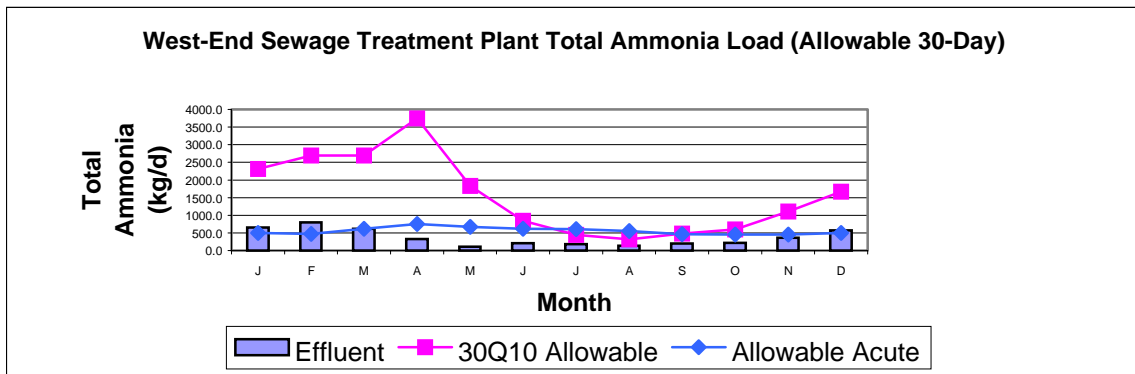
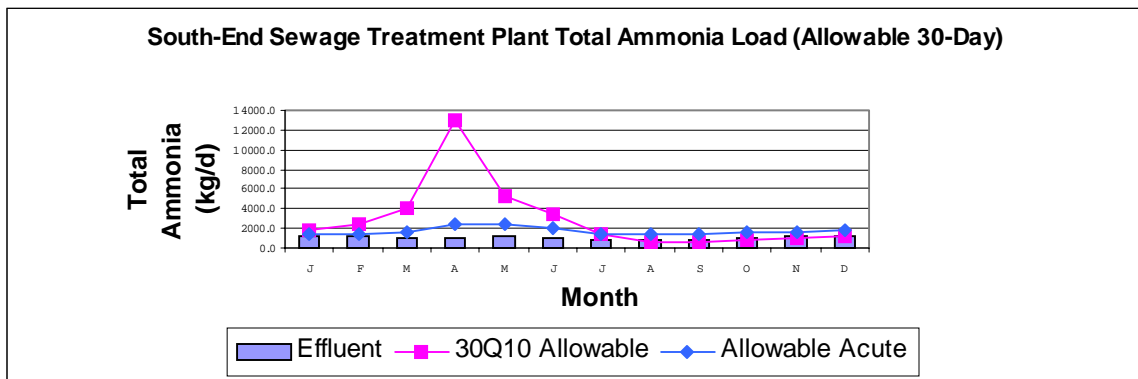
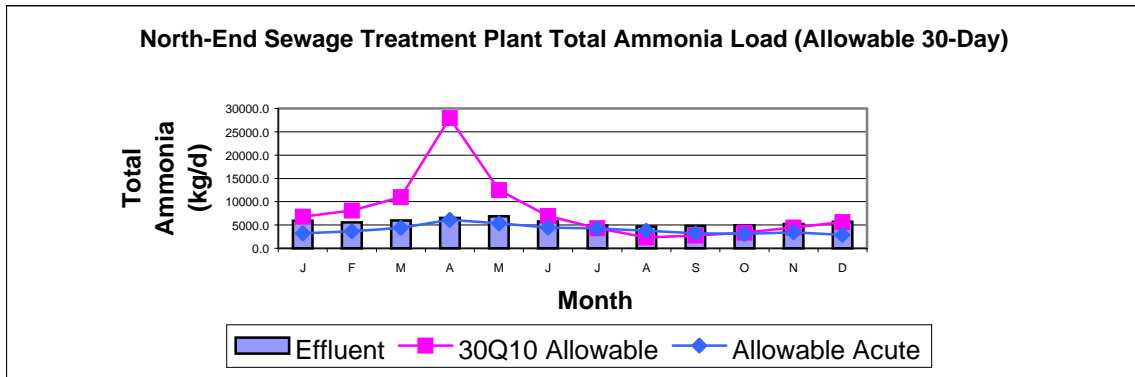
"total coliform" means a group of aerobic and facultative anaerobic, Gram-negative, nonspore-forming, rod-shaped bacteria, that ferment lactose with gas and acid formation within 48 hours at 35°C, and inhabit predominantly the intestines of man or animals, but are occasionally found elsewhere and include the sub-group of fecal coliform bacteria.

Ammonia

Monthly ammonia discharge limits have been developed on the basis of measured and adjusted water flows for the period 1913 to 2002 on the Red and Assiniboine Rivers. Allowable ammonia loads have been calculated based the criteria established in Manitoba

Water Quality Standards, Objectives and Guidelines and the use of an allocation factor of 75 percent of the assimilative capacity of the river flow. Although effluent mixing zones are permitted, conditions within the mixing zones are not to be acutely lethal to aquatic life passing through the mixing zone.

The following charts indicate the allowable ammonia loads and the current ammonia discharge from the City's three sewage treatment plants. Specific monthly ammonia limits are provided in Appendix B.



Nutrients

Manitoba Conservation is in the process of developing and implementing a comprehensive Nutrient Management Strategy including the development of water quality objectives for nitrogen and phosphorus for Lake Winnipeg. It is anticipated that such water quality objectives for nutrients in Lake Winnipeg will be developed by 2004 along with a working water quality model that will allow their implementation on a basin-wide basis. Specific limits for nitrogen and phosphorus will then be brought forward for the City of Winnipeg's discharges and will be developed in a manner that is fair and equitable with the many other contributors of nutrients to the basin.

Prepared by:

Mike Van Den Bosch, P. Eng.
A/Manager
Municipal, Industrial and Hazardous
Waste Approvals

Appendix A

The following limits, terms and conditions have been applied to the operation of South End Sewage Treatment Plant in response to a Notice of Alteration filed by the City of Winnipeg on July 17, 1998:

1. Fecal Coliform shall be used as the regulatory indicator organism for the purpose of determining compliance.
2. Dry weather flow shall be defined as the period of time the raw sewage pumping rate is less than or equal to 100 ML/d.
3. All wastewater flow up to and including 100 ML/d received at the SEWPCC, shall receive full disinfection. Dry weather flow in excess of 100 ML/d during the period May 1 to September 30 of the same year will be prevented by automatic bypass mechanism from entering the disinfection facility. The City shall be required to inform the Director, Environmental Approvals, by facsimile, of any malfunction of the automatic bypass mechanism within 24 hours of such occurrence.
4. The disinfection season shall be defined as the period between May 1 to September 30 of the same year.
5. Disinfection shall not be required when river levels exceed a geodetic elevation of 229.0 metres at the point of discharge.
6. The City shall be required to inform the Director, Environmental Approvals of any river levels in excess of the geodetic elevation of 229.0 metres within 24 hours of their occurrence, and provide the Director, Environmental Approvals with a sewage treatment and contingency action plan during the period that the river level is in excess of the geodetic elevation of 229.0 metres.
7. An end-of-pipe discharge fecal coliform limit of 200 fecal coliform per 100 millilitres of sewage shall be required during dry weather flow conditions.
8. Compliance with the fecal coliform limit shall be determined by the monthly geometric mean of a minimum of 1 grab sample collected at equal time intervals on each of a minimum of 3 consecutive days per week.

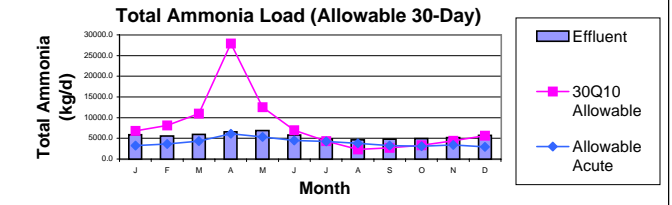
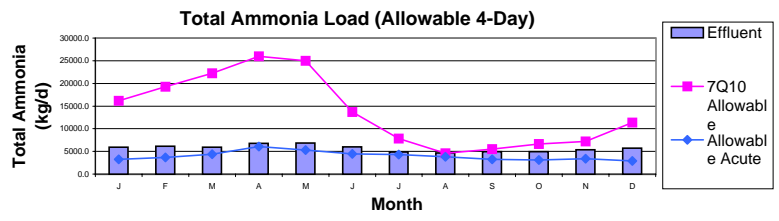
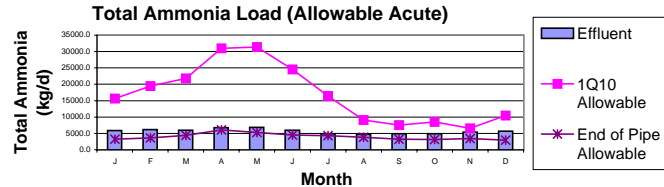
Appendix B

Monthly Allowable Loading Limits

Red River

North-End Water Pollution Control Centre

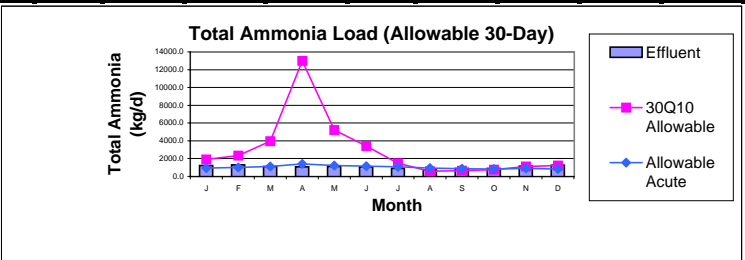
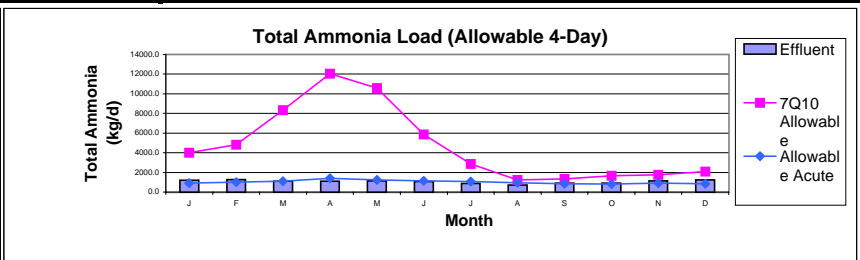
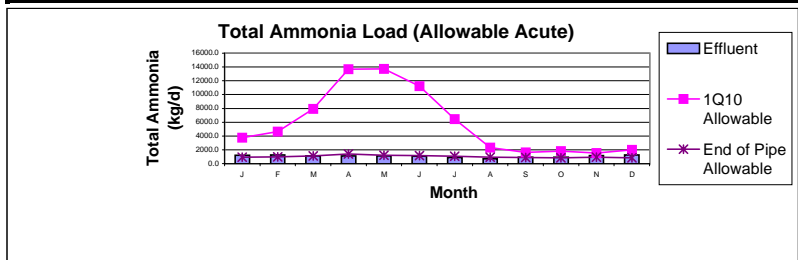
| Cool or Cold Water? | | Averaging Duration | | | | | | | Effluent | | | | | | | | | | | Allowable Effluent Load (kg/d) | | | | Allowable Effluent Concentration (mg/l) | | | | | | |
|---------------------|-----|--------------------|----------------------------|--------|------------------|--------|------------------|-----|------------------|--------------------------|--------------------------|---------------------------|-------------------|-----|--------|----------------------------------|-----------------------------------|------------------------------------|--------------------|--------------------------------|----------------------|-----------------|----------|---|----------|-------------|--------|-------|-------|-------------|
| Cool | | 30 Days | | 4 Days | | 1 Hour | | | | | | | | | | | | | | | | | | | | | | | | |
| Month | pH | Temp C | Early Life Stages ? Yes/No | Eq. | Objective (mg/l) | Eq. | Objective (mg/l) | Eq. | Objective (mg/l) | 1Q10 (m ³ /s) | 7Q10 (m ³ /s) | 30Q10 (m ³ /s) | Total Amm. (mg/l) | pH | Temp C | Max Day Flow (m ³ /s) | Max Week Flow (m ³ /s) | Max Month Flow (m ³ /s) | Max Day Total Amm. | Max Week Total Amm. | Max Month Total Amm. | Mixing Zone (%) | 1Q10 | 7Q10 | 30Q10 | End of Pipe | 1Q10 | 7Q10 | 30Q10 | End of Pipe |
| January | 7.7 | 1.7 | no | 4 | 5.552 | 5 | 13.485 | 6 | 13.485 | 15.8639 | 16.4639 | 17.7639 | 0.5 | 7.5 | 13.35 | 1.998525 | 1.998525 | 1.997691 | 34.233 | 34.233 | 34.233 | 75 | 15676.34 | 16181.18 | 6773.60 | 3231.97 | 90.79 | 93.71 | 39.24 | 18.717 |
| February | 7.6 | 1.7 | no | 4 | 6.263 | 5 | 15.657 | 6 | 16.225 | 16.0287 | 16.5287 | 18.7287 | 0.49 | 7.5 | 11.9 | 2.251136 | 2.251136 | 2.056941 | 31.45 | 31.45 | 31.45 | 75 | 19499.47 | 19290.27 | 8119.12 | 3640.48 | 100.26 | 99.18 | 45.68 | 18.717 |
| March | 7.7 | 2 | no | 4 | 5.875 | 5 | 14.687 | 6 | 14.687 | 19.9018 | 20.4018 | 27.1018 | 0.36 | 7.5 | 10.833 | 2.619062 | 2.619062 | 2.61938 | 26.3 | 26.3 | 26.3 | 75 | 21800.23 | 22264.42 | 11015.31 | 4367.13 | 96.34 | 98.39 | 48.67 | 19.299 |
| April | 8.0 | 7 | yes | 1 | 2.540 | 2 | 6.350 | 3 | 8.896 | 49.6046 | 59.8046 | 179.305 | 0.21 | 7.6 | 11.975 | 4.011126 | 4.011126 | 3.882755 | 19.5 | 19.5 | 19.5 | 75 | 31002.41 | 25997.16 | 27926.39 | 6093.78 | 89.46 | 75.01 | 83.25 | 17.584 |
| May | 8.0 | 14.8 | yes | 1 | 2.288 | 2 | 5.719 | 3 | 7.943 | 56.4895 | 63.3895 | 82.1895 | 0.08 | 7.6 | 13.673 | 3.739038 | 3.739038 | 3.739175 | 21.25 | 21.25 | 21.25 | 75 | 31349.33 | 25010.72 | 12496.56 | 5327.65 | 97.04 | 77.42 | 38.68 | 16.492 |
| June | 8.0 | 19.6 | yes | 1 | 1.754 | 2 | 4.384 | 3 | 8.408 | 41.4636 | 45.4636 | 62.6636 | 0.16 | 7.6 | 15.733 | 3.244807 | 3.244807 | 3.138599 | 21.333 | 21.333 | 21.333 | 75 | 24517.03 | 13674.41 | 6947.19 | 4474.94 | 87.45 | 48.78 | 25.62 | 15.962 |
| July | 8.0 | 22.3 | yes | 1 | 1.452 | 2 | 3.631 | 3 | 8.250 | 26.8771 | 30.0771 | 45.0771 | 0.11 | 7.6 | 18.073 | 3.102496 | 3.102496 | 3.101693 | 18.267 | 18.267 | 18.267 | 75 | 16388.67 | 7835.61 | 4310.30 | 4278.68 | 61.14 | 29.23 | 16.08 | 15.962 |
| August | 8.0 | 21.2 | yes | 1 | 1.514 | 2 | 3.786 | 3 | 7.943 | 14.056 | 15.456 | 20.956 | 0.07 | 7.6 | 19.25 | 2.743247 | 2.743247 | 2.742563 | 19.617 | 19.617 | 19.617 | 75 | 9053.75 | 4618.47 | 2319.95 | 3783.24 | 38.20 | 19.49 | 9.79 | 15.962 |
| September | 8.1 | 15.8 | yes | 1 | 1.961 | 2 | 4.901 | 3 | 7.083 | 13.2064 | 14.3064 | 19.4064 | 0.11 | 7.7 | 18.667 | 2.519368 | 2.519368 | 2.437171 | 22.667 | 22.667 | 22.667 | 75 | 7509.17 | 5508.81 | 2739.99 | 3251.24 | 34.50 | 25.31 | 13.01 | 14.936 |
| October | 8.1 | 8.9 | yes | 1 | 2.129 | 2 | 5.324 | 3 | 7.083 | 15.4597 | 16.4597 | 22.2597 | 0.11 | 7.7 | 17.35 | 2.411767 | 2.411767 | 2.411163 | 23.617 | 23.617 | 23.617 | 75 | 8461.50 | 6669.98 | 3356.46 | 3112.38 | 40.61 | 32.01 | 16.11 | 14.936 |
| November | 8.2 | 3.8 | no | 4 | 3.054 | 5 | 6.070 | 6 | 6.070 | 13.8626 | 15.6626 | 20.5626 | 0.18 | 7.6 | 15.037 | 2.389976 | 2.389976 | 2.31265 | 25.967 | 25.967 | 25.967 | 75 | 6544.54 | 7231.56 | 4439.63 | 3405.41 | 31.69 | 35.02 | 22.22 | 16.492 |
| December | 7.9 | 1.1 | no | 4 | 4.421 | 5 | 9.764 | 6 | 9.764 | 14.1784 | 15.6784 | 17.9784 | 0.22 | 7.6 | 14.15 | 1.980784 | 1.980784 | 1.981151 | 33.283 | 33.283 | 33.283 | 75 | 10439.77 | 11367.45 | 5651.46 | 2914.89 | 61.00 | 66.42 | 33.02 | 17.032 |



South-End Water Pollution Control Centre

Red River

| Cool or Cold Water? | | Cool | | Averaging Duration | | | | | | Effluent | | | | | | | | | | | | Allowable Effluent Load (kg/d) | | | | Allowable Effluent Concentration (mg/l) | | | | | | | |
|---------------------|-----|--------|---------------------------|--------------------|------------------|--------|------------------|--------|------------------|--------------------------|--------------------------|---------------------------|-------------------|-----|--------|----------------------------------|-----------------------------------|------------------------------------|--------------------|---------------------|----------------------|--------------------------------|---------------------------|----------------------------|-----------------|---|----------|----------|-------------|--------|--------|--------|-------------|
| | | | | 30 Days | | 4 Days | | 1 Hour | | 1Q10 (m ³ /s) | 7Q10 (m ³ /s) | 30Q10 (m ³ /s) | Total Amm. (mg/l) | pH | Temp C | Max Day Flow (m ³ /s) | Max Week Flow (m ³ /s) | Max Month Flow (m ³ /s) | Max Day Total Amm. | Max Week Total Amm. | Max Month Total Amm. | Max Day Amm. Load (kg/d) | Max Week Amm. Load (kg/d) | Max Month Amm. Load (kg/d) | Mixing Zone (%) | 1Q10 | 7Q10 | 30Q10 | End of Pipe | 1Q10 | 7Q10 | 30Q10 | End of Pipe |
| Month | pH | Temp C | Early Life Stages? Yes/No | Eq. | Objective (mg/l) | Eq. | Objective (mg/l) | Eq. | Objective (mg/l) | | | | | | | | | | | | | | | | | | | | | | | | |
| January | 7.9 | 2 | no | 4 | 4.361 | 5 | 9.585 | 6 | 9.585 | 5.5 | 5.9 | 6.5 | 0.33 | 7.5 | 13.35 | 0.56963 | 0.56963 | 0.569623 | 24.783 | 24.783 | 24.783 | 1219.7 | 1219.7 | 1219.7 | 75 | 3770.18 | 4010.07 | 1912.62 | 921.19 | 76.60 | 81.48 | 38.86 | 18.717 |
| February | 7.8 | 1.9 | no | 4 | 4.977 | 5 | 11.506 | 6 | 11.506 | 5.6 | 5.8 | 6.9 | 0.35 | 7.5 | 11.9 | 0.61591 | 0.61591 | 0.626295 | 23.933 | 23.933 | 23.933 | 1273.6 | 1273.6 | 1295.1 | 75 | 4660.49 | 4805.07 | 2338.26 | 996.03 | 87.58 | 90.30 | 43.21 | 18.717 |
| March | 7.9 | 2.2 | no | 4 | 4.727 | 5 | 10.703 | 6 | 10.703 | 10.8 | 11.4 | 12.8 | 0.27 | 7.5 | 10.833 | 0.663154 | 0.663154 | 0.663104 | 19.267 | 19.267 | 19.267 | 1103.9 | 1103.9 | 1103.8 | 75 | 7914.55 | 8320.17 | 3967.83 | 1105.77 | 138.13 | 145.21 | 69.26 | 19.299 |
| April | 8.1 | 7.9 | yes | 1 | 2.065 | 2 | 5.163 | 3 | 6.816 | 31.5 | 37.5 | 116.9 | 0.37 | 7.6 | 11.975 | 0.925407 | 0.925407 | 0.925439 | 13.7 | 13.7 | 13.7 | 1095.4 | 1095.4 | 1095.4 | 75 | 13702.44 | 12060.11 | 13006.85 | 1405.90 | 171.38 | 150.84 | 162.67 | 17.584 |
| May | 8.2 | 15.8 | yes | 1 | 1.704 | 2 | 4.261 | 3 | 5.954 | 35.3 | 38.4 | 50.1 | 0.14 | 7.6 | 13.673 | 0.858301 | 0.858301 | 0.858003 | 15.26 | 15.26 | 15.26 | 1131.6 | 1131.6 | 1131.2 | 75 | 13739.82 | 10570.65 | 5205.30 | 1222.97 | 185.28 | 142.54 | 70.22 | 16.492 |
| June | 8.1 | 20.6 | yes | 1 | 1.505 | 2 | 3.763 | 3 | 7.502 | 22.5 | 24.1 | 38.7 | 0.19 | 7.6 | 15.733 | 0.836318 | 0.836318 | 0.836035 | 14.95 | 14.95 | 14.95 | 1080.3 | 1080.3 | 1079.9 | 75 | 11202.83 | 5852.56 | 3407.42 | 1153.37 | 155.04 | 81.00 | 47.17 | 15.962 |
| July | 8.1 | 23.4 | yes | 1 | 1.183 | 2 | 2.957 | 3 | 6.948 | 13.6 | 14.7 | 20.9 | 0.14 | 7.6 | 18.073 | 0.770755 | 0.770755 | 0.770643 | 13.267 | 13.267 | 13.267 | 883.5 | 883.5 | 883.3 | 75 | 6462.74 | 2880.59 | 1491.21 | 1062.95 | 97.05 | 43.26 | 22.40 | 15.962 |
| August | 8.3 | 22.1 | yes | 1 | 0.998 | 2 | 2.496 | 3 | 5.096 | 6.3 | 7.1 | 9.3 | 0.13 | 7.6 | 19.25 | 0.688222 | 0.688222 | 0.688185 | 12.017 | 12.017 | 12.017 | 714.5 | 714.5 | 714.5 | 75 | 2330.57 | 1236.72 | 582.57 | 949.13 | 39.19 | 20.80 | 9.80 | 15.962 |
| September | 8.4 | 16.1 | yes | 1 | 1.267 | 2 | 3.167 | 3 | 4.278 | 5.1 | 5.9 | 7.9 | 0.12 | 7.7 | 18.667 | 0.665661 | 0.665661 | 0.665751 | 15.8 | 15.8 | 15.8 | 908.7 | 908.7 | 908.8 | 75 | 1620.18 | 1346.87 | 659.83 | 859.03 | 28.17 | 23.42 | 11.47 | 14.936 |
| October | 8.4 | 9.1 | yes | 1 | 1.312 | 2 | 3.279 | 3 | 3.959 | 6.5 | 7.3 | 8.8 | 0.13 | 7.7 | 17.35 | 0.631915 | 0.631915 | 0.631952 | 16.767 | 16.767 | 16.767 | 915.4 | 915.4 | 915.5 | 75 | 1828.72 | 1668.72 | 745.45 | 815.49 | 33.49 | 30.56 | 13.65 | 14.936 |
| November | 8.5 | 3.3 | no | 4 | 1.893 | 5 | 3.458 | 6 | 3.458 | 6.3 | 7.2 | 8.8 | 0.12 | 7.6 | 15.037 | 0.636929 | 0.636929 | 0.636697 | 20.917 | 20.917 | 20.917 | 1151.1 | 1151.1 | 1150.6 | 75 | 1553.10 | 1747.78 | 1114.94 | 907.54 | 28.22 | 31.76 | 20.27 | 16.492 |
| December | 8.3 | 1.4 | no | 4 | 2.557 | 5 | 4.902 | 6 | 4.902 | 5.7 | 6 | 7.1 | 0.17 | 7.6 | 14.15 | 0.569823 | 0.569823 | 0.569791 | 25.35 | 25.35 | 25.35 | 1248.0 | 1248.0 | 1248.0 | 75 | 1989.13 | 2081.12 | 1224.30 | 838.54 | 40.40 | 42.27 | 24.87 | 17.032 |



Assiniboine River

West-End Water Pollution Control Centre

| Month | Cool or Cold Water? | | | Averaging Duration | | | | | | Effluent | | | | | | | | | | | Allowable Effluent Load (kg/d) | | | | Allowable Effluent Concentration (mg/l) | | | | | | | | |
|-----------|---------------------|--------|----------------------------|--------------------|------------------|--------|------------------|--------|------------------|--------------------------|--------------------------|---------------------------|-------------------|-----|--------|----------------------------------|-----------------------------------|------------------------------------|--------------------|---------------------|--------------------------------|--------------------------|---------------------------|----------------------------|---|---------|---------|---------|-------------|--------|--------|--------|-------------|
| | pH | Temp C | Early Life Stages ? Yes/No | 30 Days | | 4 Days | | 1 Hour | | 1Q10 (m ³ /s) | 7Q10 (m ³ /s) | 30Q10 (m ³ /s) | Total Amm. (mg/l) | pH | Temp C | Max Day Flow (m ³ /s) | Max Week Flow (m ³ /s) | Max Month Flow (m ³ /s) | Max Day Total Amm. | Max Week Total Amm. | Max Month Total Amm. | Max Day Amm. Load (kg/d) | Max Week Amm. Load (kg/d) | Max Month Amm. Load (kg/d) | Mixing Zone (%) | 1Q10 | 7Q10 | 30Q10 | End of Pipe | 1Q10 | 7Q10 | 30Q10 | End of Pipe |
| | | | | Eq. | Objective (mg/l) | Eq. | Objective (mg/l) | Eq. | Objective (mg/l) | | | | | | | | | | | | | | | | | | | | | | | | |
| January | 7.9 | 1.6 | no | 4 | 4.604 | 5 | 10.319 | 6 | 10.319 | 7.2 | 7.4 | 7.9 | 0.32 | 7.5 | 1.6 | 0.294264 | 0.294264 | 0.294419 | 25.62 | 25.62 | 25.62 | 651.4 | 651.4 | 651.7 | 75 | 4927.37 | 5056.96 | 2310.14 | 501.16 | 193.80 | 198.90 | 90.82 | 19.712 |
| February | 7.8 | 1.8 | no | 4 | 5.104 | 5 | 11.925 | 6 | 11.925 | 7.3 | 7.5 | 8.2 | 0.31 | 7.6 | 1.8 | 0.312776 | 0.312776 | 0.325964 | 28.26 | 28.26 | 28.26 | 763.7 | 763.7 | 795.9 | 75 | 5816.55 | 5967.07 | 2690.93 | 473.30 | 215.24 | 220.81 | 95.55 | 17.514 |
| March | 7.9 | 1.7 | no | 4 | 4.665 | 5 | 10.509 | 6 | 10.509 | 5.7 | 6.3 | 9 | 0.25 | 7.5 | 1.7 | 0.338615 | 0.338615 | 0.294419 | 24.35 | 24.35 | 24.35 | 712.4 | 712.4 | 619.4 | 75 | 4096.86 | 4495.75 | 2693.75 | 613.70 | 140.03 | 153.67 | 105.90 | 20.977 |
| April | 8.2 | 7.2 | yes | 1 | 1.881 | 2 | 4.702 | 3 | 6.070 | 5.7 | 9.3 | 37 | 0.34 | 7.6 | 7.2 | 0.479191 | 0.479191 | 0.304233 | 12.45 | 12.45 | 12.45 | 515.5 | 515.5 | 327.3 | 75 | 2367.80 | 2823.35 | 3743.61 | 751.26 | 57.19 | 68.19 | 142.42 | 18.145 |
| May | 8.2 | 15.2 | yes | 1 | 1.635 | 2 | 4.088 | 3 | 5.403 | 11.3 | 13 | 18.4 | 0.13 | 7.6 | 15.2 | 0.431175 | 0.431175 | 0.294419 | 4.4333 | 4.4333 | 4.4333 | 165.2 | 165.2 | 112.8 | 75 | 4062.19 | 3486.68 | 1836.37 | 669.66 | 109.04 | 93.59 | 72.19 | 17.976 |
| June | 8.3 | 19.8 | yes | 1 | 1.102 | 2 | 2.755 | 3 | 4.807 | 9.4 | 10.4 | 13.4 | 0.16 | 7.6 | 19.8 | 0.427319 | 0.427319 | 0.304233 | 8.06 | 8.06 | 8.06 | 297.6 | 297.6 | 211.9 | 75 | 3008.36 | 1850.88 | 847.10 | 612.83 | 81.48 | 50.13 | 32.23 | 16.599 |
| July | 8.3 | 22.8 | yes | 1 | 0.879 | 2 | 2.197 | 3 | 4.624 | 5.7 | 7.4 | 8.5 | 0.12 | 7.6 | 22.8 | 0.4063 | 0.4063 | 0.294419 | 7.1833 | 7.1833 | 7.1833 | 252.2 | 252.2 | 182.7 | 75 | 1825.91 | 1073.17 | 440.34 | 603.67 | 52.01 | 30.57 | 17.31 | 17.196 |
| August | 8.4 | 21.3 | yes | 1 | 0.861 | 2 | 2.154 | 3 | 4.036 | 5.7 | 5.7 | 6.3 | 0.13 | 7.6 | 21.3 | 0.367733 | 0.367733 | 0.294419 | 5.2 | 5.2 | 5.2 | 165.2 | 165.2 | 132.3 | 75 | 1570.96 | 815.89 | 320.53 | 555.14 | 49.44 | 25.68 | 12.60 | 17.472 |
| September | 8.5 | 14.9 | yes | 1 | 1.157 | 2 | 2.892 | 3 | 3.525 | 5.7 | 5.7 | 6.7 | 0.11 | 7.6 | 14.9 | 0.340737 | 0.340737 | 0.304233 | 7.52 | 7.52 | 7.52 | 221.4 | 221.4 | 197.7 | 75 | 1365.29 | 1112.58 | 484.83 | 466.83 | 46.38 | 37.79 | 18.44 | 15.857 |
| October | 8.4 | 7.4 | yes | 1 | 1.247 | 2 | 3.118 | 3 | 3.735 | 5.7 | 6.5 | 7.7 | 0.11 | 7.6 | 7.4 | 0.327817 | 0.327817 | 0.294419 | 8.5333 | 8.5333 | 8.5333 | 241.7 | 241.7 | 217.1 | 75 | 1444.86 | 1355.14 | 599.08 | 453.58 | 51.01 | 47.85 | 23.55 | 16.014 |
| November | 8.4 | 2.8 | no | 4 | 2.059 | 5 | 3.808 | 6 | 3.808 | 5.7 | 6.6 | 8.3 | 0.1 | 7.6 | 2.8 | 0.325696 | 0.325696 | 0.304233 | 13.9 | 13.9 | 13.9 | 391.1 | 391.1 | 365.4 | 75 | 1476.84 | 1693.11 | 1107.96 | 452.13 | 52.48 | 60.17 | 42.15 | 16.067 |
| December | 8.1 | 1.1 | no | 4 | 3.251 | 5 | 6.558 | 6 | 6.558 | 6.6 | 7.1 | 8.1 | 0.23 | 7.5 | 1.1 | 0.308533 | 0.308533 | 0.294419 | 22.3 | 22.3 | 22.3 | 594.5 | 594.5 | 567.3 | 75 | 2881.28 | 3086.32 | 1668.60 | 498.95 | 108.09 | 115.78 | 65.60 | 18.717 |

