City of Stillwater, Part IX. Appendix C Submittal

St Croix River ORVW Restricted Discharge Water

Stillwater, MN

January 2009

Project Number: 510-08001

Bonestroo

BACKGROUND

The entire length of the St Croix River was designated as a wild and scenic river in the original Wild and Scenic Rivers Act in1968. Due to this designation, the State of Minnesota declared the entire length of the river an Outstanding Resource Value Water (ORVW) on November 5, 1984 (Minn. Rule 7050.047).

The Minnesota nondegradation rule (Minn. Rule Ch. 7050.0180) protects ORVW's from degradation by prohibiting or restricting new and expanded discharges to these waters so as to maintain their "function as exceptional recreational, cultural, aesthetic, or scientific resources", according to the provisions of the rules. These state rules were put in place in order to comply with the "antidegradation" part of the federal Clean Water Act passed in 1972.

Since 2003, most municipalities with a population between 10,000 and 100,000 have been required to secure coverage under the general permit from the Minnesota Pollution Control Agency (MPCA) that authorizes storm water discharges from their municipal storm drainage system to waters of the state under the National Pollutant Discharge Elimination System (NPDES) program. These systems are known as Municipal Separate Storm Sewer Systems or MS4's. The general permit does not authorize new and expanded discharges to ORVW's such as the St. Croix River. For ORVW's, a new discharge means one that was not in existence on the effective date the ORVW was designated, while an expanded discharge refers to any change in volume, quality, location, or other aspect of discharge such that the loading of one or more pollutants increases over the applicable values at the time the St. Croix River was designated.

Under Minn. Rule Ch. 7050.0180, subpart 6, the St Croix River is defined as a "restricted discharge" ORVW. The City's MS4 general permit does not authorize new or expanded discharges to restricted discharge waters unless the discharges are in accordance with Minnesota Rule Chapter 7050.0180,
subpart 6, 6a, and other applicable rules, and specific requirements given in the MS4 general permit.

The City's MS4 general permit gives specific requirements that the City must follow to bring discharges to the St Croix River into compliance. Stillwater is generally required to:

1. List the waters with restricted discharges to which it discharges,
2. Map with a minimum resolution of 1:24,000 the areas within Stillwater's jurisdiction that discharge to the ORVW, and provide an estimate of the percent impervious based on current and future land use plans,
3. Assess whether its Stormwater Pollution Prevention Program (SWPPP) can reasonably be altered to eliminate the new and expanded discharge, including zoning and ordinance changes and implementation of Best Management Practices (BMPs) to existing and future development areas, and
4. Submit its assessment for public comment, respond to these public comments, and submit these responses and its proposed SWPPP modifications to the MPCA.

The MPCA will consider a permittee to be in compliance with the nondegradation rules if Baseline (1985) pollutant loading levels can be achieved, either through existing facilities, programs, and policies or through proposed modifications to these. Permit language allows a range of years around the 1985 Baseline. The City of Stillwater has selected 1985 due to the available data for that year. In other words, the Baseline condition is used as the "yardstick" to measure changes in pollutant loads over time. Permittees are considered to be in compliance with the Nondegradation rules when pollutant loads calculated for 2030 conditions meet or are less than the Baseline loads,

unless mitigating environmental, economic, and social factors make additional control measures imprudent or infeasible.

LIST AND MAP

Stillwater discharges to the St. Croix River, which was designated an Outstanding Resource Value Water (ORVW) by the Minnesota Legislature in 1984. Figure 1 shows the major subwatersheds within Stillwater's municipal jurisdiction. All eight subwatersheds discharge to the St. Croix River. The subwatershed map is included as figure 1. Figure 1 also shows the jurisdictions of the three watershed management organizations within Stillwater: Browns Creek Watershed District, Carnelian Marine St. Croix Watershed District, and Middle St. Croix Watershed Management Organization.

For this Part IX. Appendix C submittal under the general NPDES permit, Stillwater prepared loading calculations for three time frames: 1985, 2007 (current), and 2030 (ultimate). To obtain consistent land use descriptions across the three timeframes, the 2030 land use categories from Stillwater's Comprehensive Plan were applied to land use coverage in 1985 and 2007. For 1985, Stillwater staff reviewed an aerial photograph and applied the 2030 land use categories to the development apparent in that photograph. The St. Croix designation as an ORVW occured in 1984. The 1985 aerial was the closest in time to this designation. For 2007 conditions Stillwater's current zoning map and an aerial photograph were used to superimpose 2030 land use categories onto current conditions. The comparative land use maps are presented as figures 2, 3, and 4.

Comparative loading calculations resulted from a GIS-based analysis of changes in land use over the three periods considered. These loading calculations considered total phosphorus (TP), total suspended solids (TSS), and runoff volume to determine whether a new and expanded discharge occurred over the 1985 to 2007 period or whether a new and expanded discharge would occur over the 2007 to 2030 period as Stillwater implemented its land use plan. This loading calculation - its methods, assumptions, and results – is presented as Appendix A to this submittal, though portions are also referenced in the assessment presented here.

As noted, all eight subwatersheds identified in figure 1 discharge to the St. Croix River. Subwatershed "Not Modeled" occurs as a small area along Stillwater's southern boundary that discharges into Oak Park Heights. The designation "Not Modeled" indicates that this area was not modeled in Stillwater's Local Surface Water Management Plan. However, the loading calculations presented in the appendix do calculate loadings from this area. The "Diversion" subwatershed had historically discharged to Browns Creek but was diverted into McKusick Lake through a 2003 project as a means of protecting the creek from expanded discharges as urbanization occurred within this subwatershed. The diversion has minimal impact on the overall discharge to the St. Croix River.

Table 1 presents land use changes within the respective land use categories for each of the three time periods. Appendix A: Loading Calculations presents more detail on these land use categories.

Table 1 – Summary of Land Use Changes for the Project Area

Land Use	Percent Impervious	Baseline Condition (Ac)	Present Condition (Ac)	Ultimate Condition (Ac)
Agriculture	0	1,058	119	0
Commercial Land & Buildings	70	183	312	147

Golf	6	286	286	286
High Density Residential	65	39	52	49
Industrial	70	44	33	119
Institutional	70	218	256	132
Low Density Residential	30	1,190	1,544	1,611
Low-Medium Density Residential	35	555	701	937
Marina	70	17	17	17
Medium Density Residential	45	4	90	115
Mixed Use	90	0	0	49
Neighborhood Commercial	70	0	6	6
Park or Open Space	6	725	735	636
Research & Development Park	70	0	9	86
Railroad Right of Way	40	27	27	0
Road Right of Way	40	699	840	839
Surface Water	NA	683	701	701
Wetland	NA	64	64	64
Total		5,795	5,795	5,795

The specific permit language requires Stillwater to provide an estimate of percent impervious based on current and future land use. The resources available to Stillwater do not allow a detailed delineation of impervious surface for current conditions. In lieu of this, Stillwater chose to associate standard percent impervious coverage to is various land use categories based on previous experience and its zoning requirements. Table 1 includes these percent impervious assumptions.

ASSESSMENT

Loading Calculations

Stillwater's loading calculations serve as background to its assessment under Part IX. Appendix C of the general NPDES MS4 permit. The intent of the loading calculations was to provide defensible, calculated values that illustrate the degree to which the City of Stillwater's stormwater management program achieves or does not achieve compliance with the nondegradation rules for the St. Croix River utilizing the process outlined in the MS4 General Permit (Part IX, Appendix C, part B). This was accomplished by first calculating the estimated pollutant loads for the land use conditions at three time periods: Baseline (1985), Present (2007), and 2030. Next, the treatment effect of storm water Best Management Practices (BMPs) was calculated to determine how the 2007 and 2030 condition's pollutant loads were reduced to meet the Baseline condition's loads.

The loading calculations consider three pollutants: total phosphorus (TP), total suspended solids (TSS), and runoff water volume. While many other pollutants exist in Stillwater's discharge and these would increase with a new and

expanded discharge to the St. Croix River, it was considered adequate to quantify loads for these three primary pollutants under the assumption that any zoning and ordinance changes or BMPs intended to bring Stillwater into compliance for the three pollutants would also bring Stillwater into compliance for new and expanded discharges for other pollutants.

The St Croix Basin Water Resources Planning Team noted in its "St Croix Basin Phosphorus-Based Water Quality Goals" report that excess phosphorus is a major concern for the water quality of the St. Croix River. Excess TP can cause eutrophication leading to excessive algal and aquatic macrophyte growth. The effects of eutrophication are well-understood. It can decrease water clarity by increasing the biomass within the water column. Eutrophication also leads to depletion of oxygen within the unmixed portion of the water stratum, such as backwaters or deep pools with a large river system such as the St Croix River. These depleted oxygen zones then negatively affect important fish habitats causing a stressor to fish populations, especially game fish. All of these effects have a negative influence on the recreational qualities of a water body.

TSS can have negative effects on water quality as well, in that increased TSS loadings can raise the turbidity in the water column. Furthermore, increases in TSS are associated with increases in other pollutants which adsorb to surfaces of the solids. These other pollutants include, but are not limited to, heavy metals, bacteria, and nutrients (e.g., phosphorus and nitrogen). Therefore, controlling TSS loading is very important to protect the quality of waters with recreational uses. By directly managing TSS loadings, other pollutants adsorbed to suspended solids surfaces will be managed, as well.

The most important pollutant to quantify and manage is runoff volume. Eliminating new and expanded discharges for runoff volume almost always means eliminating new and expanded discharges for TP, TSS and other pollutants. Furthermore, runoff volume management is the focus of the management programs of each the three watershed organizations with jurisdiction over Stillwater. Consequently, Stillwater's emphasis on runoff volume management as the centerpiece to its mitigation strategy dovetails with existing watershed rules.

The raw loadings for the three pollutants over the 5,795 acre project area are presented in table 2.

Table 2 – Summary of Raw Modeled Loadings (Project Area)

Condition	TP Load (lbs/yr)	TSS Load (lbs/yr)	Runoff Volume (ac-ft/yr)
Baseline (1985) Condition	3,385	1,155,733	2,872
Present (2007) Condition	3,674	1,269,918	3,231
Ultimate Condition	3,715	1,281,854	3,281

These raw loadings do not reflect the operation of implemented sedimentation BMPs within the project area as development occurred since 1985 nor do they reflect the operation of future sedimentation and volume management BMP's that are required by watershed rules as development proceeds from the 2007 condition to 2030 and full

build-out of Stillwater's land use plan. Obviously, without considering BMPs, pollutant loadings increase due to land use changes and the resulting increase in impervious surface.

The load calculations of appendix A consider treatment implemented with development projects from 1985 to the present. Most of this treatment occurred since the mid to late 1990's and consisted of ponding designed according NURP standards as required by Stillwater's ordinance. Lately, with the development of the NPDES construction site permit's permanent stormwater management controls, water quality ponding design has followed the requirements of that permit, as well.

Stillwater's Local Surface Water Management Plan and its various lake management plans (detailed in appendix A) provided water quality modeling that was used to determine overall water quality treatment levels within several of the subwatersheds shown in figure 1. Using this information and applying it to the calculations led to modified loads for the 2007 and 2030 conditions. The modified 2007 conditions loads primarily reflect the implementation of sedimentation and water quality ponds, though several infiltration BMPs were also constructed in more recent years. The modified 2030 loads reflect the requirements of the watersheds toward volume management, as detailed in their rules. The effectiveness of these rules is discussed below. Table 3 presents the load calculations as modified by existing and future water quality treatment.

Table 3 – Summary of Modeled Loadings with Existing & Proposed BMP's

Condition	TP Load (lbs/yr)	TSS Load (lbs/yr)	Runoff Volume (ac-ft/yr)
Baseline (1985) Condition	3,385	1,155,733	2,872
Present (2007) Condition	3,290	1,042,691	3,204
Ultimate Condition	3,197	988,023	3,111

The loading calculations indicate that new and expanded discharges for TP and TSS have not occurred for development in the 1985 to 2007 timeframe and will not occur in the 2007 to 2030 time period due to existing controls enforced by Stillwater and the Watersheds. However, runoff volume has increased in the 1985 to 2007 timeframe by 332 acre-feet (3,204 ac-ft – 2,872 ac-ft). However, existing Watershed controls preclude future increases of runoff volume in the 2007 to 2030 time period as indicated in the slight reduction in runoff volume calculated for the 2007 to 2030 period.

Existing Standards Review

The applicable standards for the Browns Creek Watershed District (BCWD) and Carnelian Marine St. Croix Watershed District (CMSCWD), as detailed in their rules, require that new development not increase runoff volume over "presettlement" conditions for the 2-year rainfall event. Table 4 provides evidence that this new development standard precludes future volume increases for Hydrologic Soil Group B soils which predominate in Stillwater.

Table 4 – Efficacy of BCWD and CMSCWD Development Controls

Condition	Curve Number	Runoff Depth (inches)			Difference in 2-year Runoff = Infiltration Standard (inches)	Adjusted Runoff Depth Based on Watershed Rules - Compared to Existing Agricultural Condition (inches)		
		2-yr, 2.8-inch rainfall	10-yr, 4.2-inch rainfall	100-yr, 5.9-inch rainfall		2-yr, 2.8-inch rainfall	10-yr, 4.2-inch rainfall	100-yr, 5.9-inch rainfall
Presettlement	57	0.19	0.70	1.61	--	--	--	--
Agricultural = Existing	70	0.60	1.46	2.72	--	0.60	1.46	2.72
Residential Development	75	0.83	1.74	3.19	0.64	0.19	1.10	2.55
Commercial Development	92	1.98	3.31	4.97	1.79	0.19	1.52	3.18

The intent of the table above is not to definitively interpret watershed rules but rather show, in a rudimentary manner,that the table 3 loading calculations accurately reflect that runoff volume will not increase in the 2007 to 2030 time period. As evidenced from table 4, existing BCWD and CMSCWD rules reduce runoff volume from developed residential land use when compared with the existing agricultural condition. For commercial development, a slight increase in runoff volume occurs for the 10-year event when compared to agricultural conditions and a larger increase, though still modest, occurs for the 100-year event. By definition, however, these rules reduce runoff volume to presettlement conditions for the 2-year event for both commercial and residential development.

Most pollutant loadings occur in smaller storms or in the first flush from larger storms and, regardless the projected future development, runoff volume will be reduced for small rainfall events (up to the 2-year rainfall event). The BCWD and CMSCWD infiltration, or volume management, standards applied to new development would thus appear to be adequate to preclude new and expanded discharges of runoff volume from Stillwater as it implements its 2030 land use plan – particularly since the majority of future development envisioned by the 2030 land use plan would be residential development, as evidenced in table 1.

The Middle St. Croix Watershed Management Organization requires runoff volume management from development projects as well. The MSCWMO rules require ½-inch infiltration off all new impervious surfaces and ¼-inch infiltration off all disturbed pervious surfaces. This standard holds the line on runoff volume for residential development but not for commercial development as shown in table 5.

Table 5 – Efficacy of MSCWMO Development Controls

Condition	Curve Number	Runoff Depth (inches)			Infiltration Design Standard (inches)	Adjusted Runoff Depth Based on Watershed Rules - Compared to Existing Agricultural Condition (inches)		
		2-yr, 2.8-inch rainfall	10-yr, 4.2-inch rainfall	100-yr, 5.9-inch rainfall		2-yr, 2.8-inch rainfall	10-yr, 4.2-inch rainfall	100-yr, 5.9-inch rainfall
Agricultural = Existing	70	0.60	1.46	2.72	--	0.60	1.46	2.72
Residential Development	75	0.83	1.74	3.19	0.34	0.49	1.40	2.85
Commercial Development	92	1.98	3.31	4.97	0.43	1.55	2.88	4.54

Residential @ 35% Impervious: (0.35 x 0.50") + (0.65 x 0.25") = 0.34"

Commercial @ 70% Impervious: (0.70 x 0.50") + (0.30 x 0.25") = 0.43"

Stillwater has essentially reached full development within its MSCWMO areas and its 2030 Land Use Plan indicates that no new development will occur within this watershed, so there will be little opportunity to implement MSCWMO rules on new development. However, some redevelopment is likely in MSCWMO areas so it is useful to consider whether their rules preclude runoff volume increases from redevelopment. For redevelopment, the MSCWMO rules apply only to areas of new construction, where soils are compacted, where runoff characteristics are changed or vegetation is removed. In cases where the redeveloping property is not highly impervious it is conceivable that this redevelopment standard would allow an increase in runoff volume. BCWD and CMSCWD rules also require that new impervious surfaces in redevelopment projects provide the full measure of treatment summarized in table 4, so redevelopment within these watersheds will occur in a manner that does not increase runoff volume.

Summary and Proposed SWPPP Modifications

Existing Watershed rules and City ordinance are sufficient to maintain current total phosphorus and total suspended solids loadings to the St. Croix River. An analysis of loading for the 1985 to 2007 period shows that no new and expanded discharge has occurred for these two pollutants. Consequently, the focus of Stillwater's mitigation strategy will be runoff volume.

Within Browns Creek and Carnelian Marine St. Croix Watershed District areas, future development standards within watershed rules are sufficient to prevent new and expanded discharges for water volume. However, runoff volume in the period from 1985 to 2007 has increased by a calculated 332 acre-feet and there is some concern that development and redevelopment within Middle St. Croix Watershed District might lead to increases in runoff volume under that watershed's current rules. Therefore, Stillwater's mitigation strategy for its water volume discharge consists of two components:

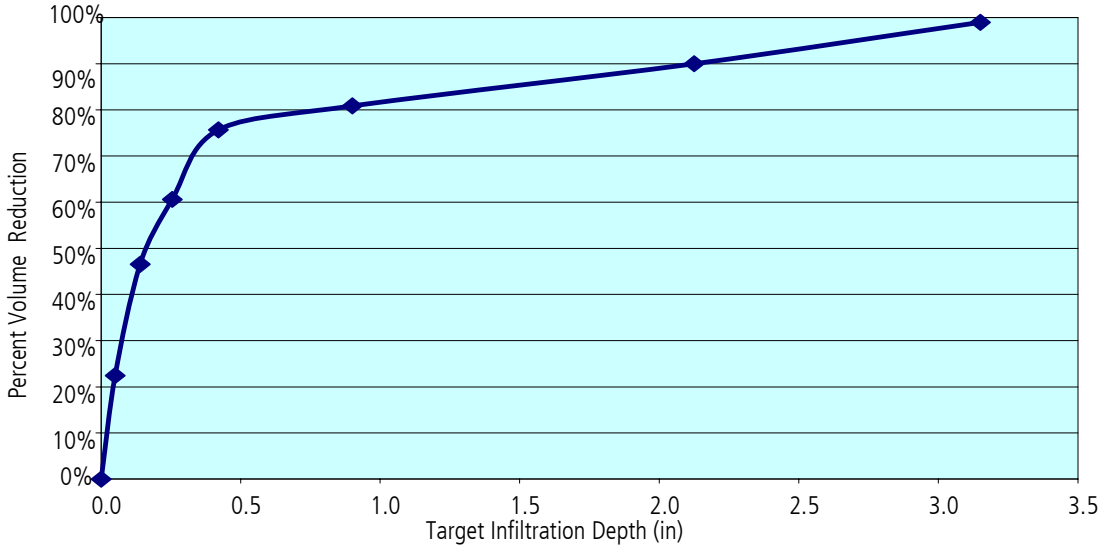
1. Systematically removing 332 acre-feet of volume from its discharge through implementing BMPs to existing areas.
2. Applying nondegradation criteria to development and redevelopment within the MSCWMO areas if and when they redevelop.

Put in perspective the 332 acre-feet of runoff volume represents the annual discharge from 133 acres of impervious surface. This is obtained as follows:

Area of Impervious x Impervious Runoff Coefficient x 33.1 inches annual rainfall = 332 acre-feet x 12 acre-inches per acre-foot

Stillwater's goal is to retrofit volume reduction to existing impervious surfaces. However, the economics of volume management suggest that 75% volume reduction should be the target for each acre of impervious surface. Chart 1 supports this premise.

Chart 1 – Target Infiltration Depth versus Percentage Reduction in Runoff Volume



Infiltrating one-half-inch off impervious surface reduces runoff volume by approximately 80%. To obtain a 90% reduction, the target infiltration depth would have to increase to over two inches off impervious surface. In general, the cost of an infiltration BMP is proportional to the target infiltration depth indicating that the marginal cost of going from 75% reduction to 90% reduction is more than double the initial cost in going from 0% to 75%. The best use of Stillwater's finite resources is to pursue 75% volume reduction through retrofitting one-half-inch of volume abstraction to each impervious acre. Consequently, the 133 acres of impervious surface to which volume abstraction would be retrofit would grow to 133 acres / 0.75 or 177 acres of impervious surface.

Stillwater's proposed mitigation strategy, or SWPPP modification, is to systematically retrofit volume management of one-half-inch off impervious surface for 177 acres of impervious surface through the following:

1. BMPs retrofit to right-of-way and other connected areas as part of Stillwater's street reconstruction program.
2. Identification of large existing impervious areas and partnering with property owners and watershed organizations to retrofit volume abstraction to these areas where no such BMPs currently exist.
3. BMPs retrofit to existing City properties as improvements are made to existing parking lots and other impervious surfaces.

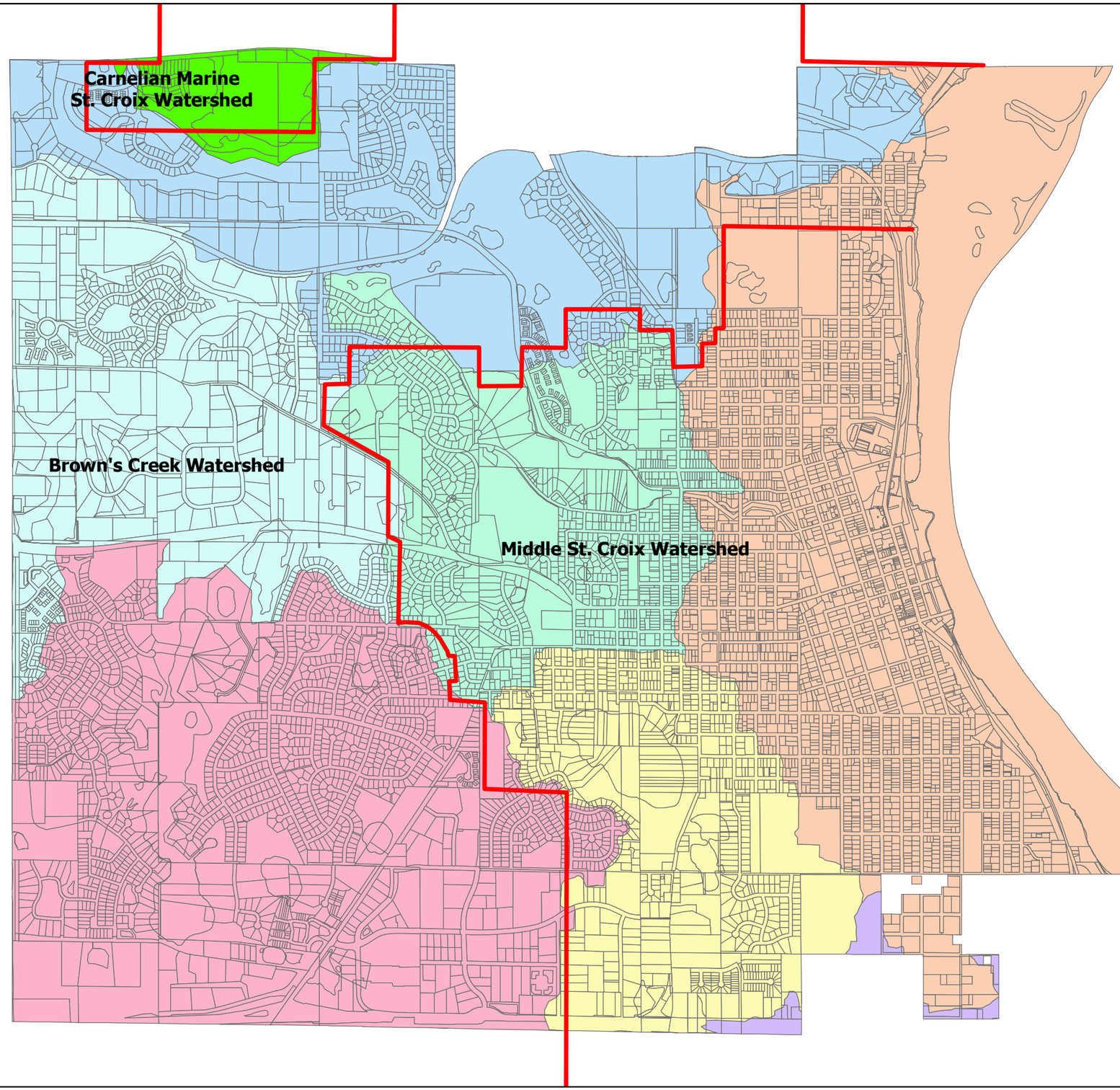
Stillwater's near term activities in regard to this mitigation strategy include designing volume management retrofits into its 2009 projects and identifying the large impervious areas that constitute potential future projects. Prospective volume load reductions from the 2009 projects and identification of the large impervious areas for future projects will occur in Stillwater's 2009 annual report, as required by its coverage under the general NPDES MS4 permit.

In regard to any redevelopment or development activities that occur within Stillwater, the City contends that it has the authority to prohibit new and expanded discharges to the St. Croix River without any modification to its current ordinance or any modification to current watershed rules. The NPDES MS4 permit does not authorize new and expanded discharges to the St. Croix River and thus provides the authority to require runoff volume management BMPs of any development or redevelopment so that, at a minimum, existing runoff volume is maintained. In reality, as discussed above, existing watershed rules will most often be adequate for this purpose. However, there may be cases where the particulars of a new development or redevelopment activity lead to increased runoff volume even when watershed rules are applied. In these cases Stillwater will, through its development review process, pursue one of two mitigation strategies:

1. Require the development to meet existing runoff volume under the statutory authority that precludes new and expanded discharges to the St. Croix River, to the extent that meeting existing runoff volume is prudent and feasible or
2. To the extent that maintaining existing runoff volume is not prudent and feasible (after current watershed rules are met), requiring that the development or redevelopment provide cash in lieu of on-site BMPs to allow the City to mitigate the new and expanded discharge in some other fashion or location.

ASSESSMENT SUBMITTAL

Stillwater submitted its proposed SWPPP modifications to public comment on date. The following are the comments received and Stillwater's official response to these.



Stillwater
THE BIRTHPLACE OF MINNESOTA

St. Croix River ORVW
Restricted Discharge Water

Figure 1

Watershed Boundaries & Subbasins

January 2009

N

Legend

WMOs_local

Drainage Boundary

- Browns Cr
- Lily
- Long
- McKusick
- Not Modeled
- StCroix
- Twin
- Diversion

1,800 900 0 1,800 Feet

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Figure 2

1985 Land Use

January 2009

N

Legend

Expansion Boundaries

- 1985
- 2030
- 2008

1985 Land Use

- AGRICULTURE
- COMM LAND & BLDGS
- GOLF
- HDR
- INDUSTRIAL
- INSTITUTIONAL
- LDR
- LMDR
- MARINA
- MDR
- PARK OR OPEN SPACE
- RAILROAD
- ROAD
- SURFACE WATER
- WETLAND

1,800 900 0 1,800 Feet

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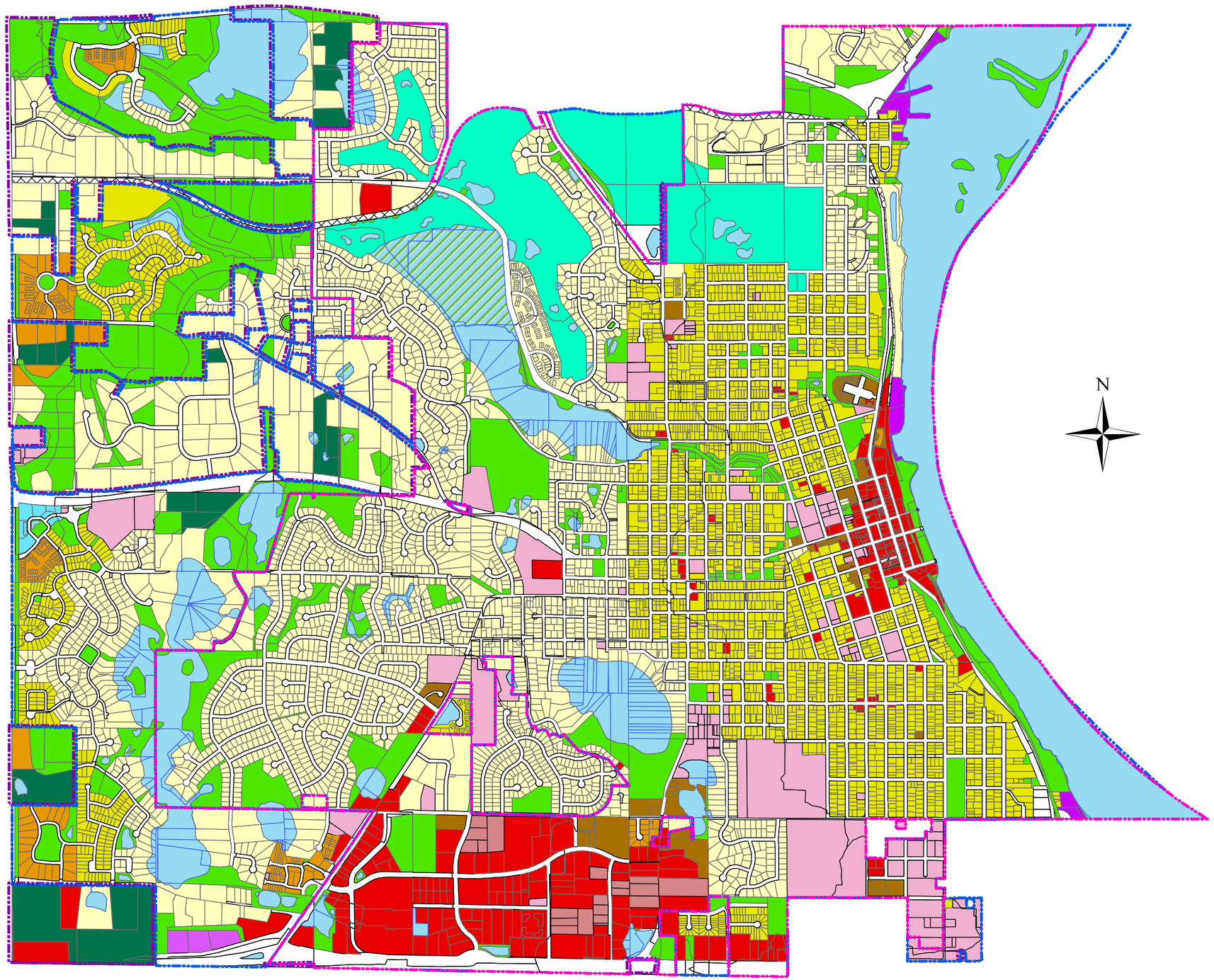
St. Croix River ORVW
Restricted Discharge Water

Figure 3

2008 Land Use

January 2009



Legend

Expansion Boundaries
- 1985
- 2030
- 2008

2007 Land Use
- AGRICULTURE
- COMM LAND & BLDGS
- GOLF
- HDR
- INDUSTRIAL
- INSTITUTIONAL
- LDR
- LMDR
- MARINA
- MDR
- NEIGHBORHOOD COMM
- PARK OR OPEN SPACE
- R & D PARK
- RAILROAD
- ROAD
- SURFACE WATER
- WETLAND

1,800 900 0 1,800 Feet

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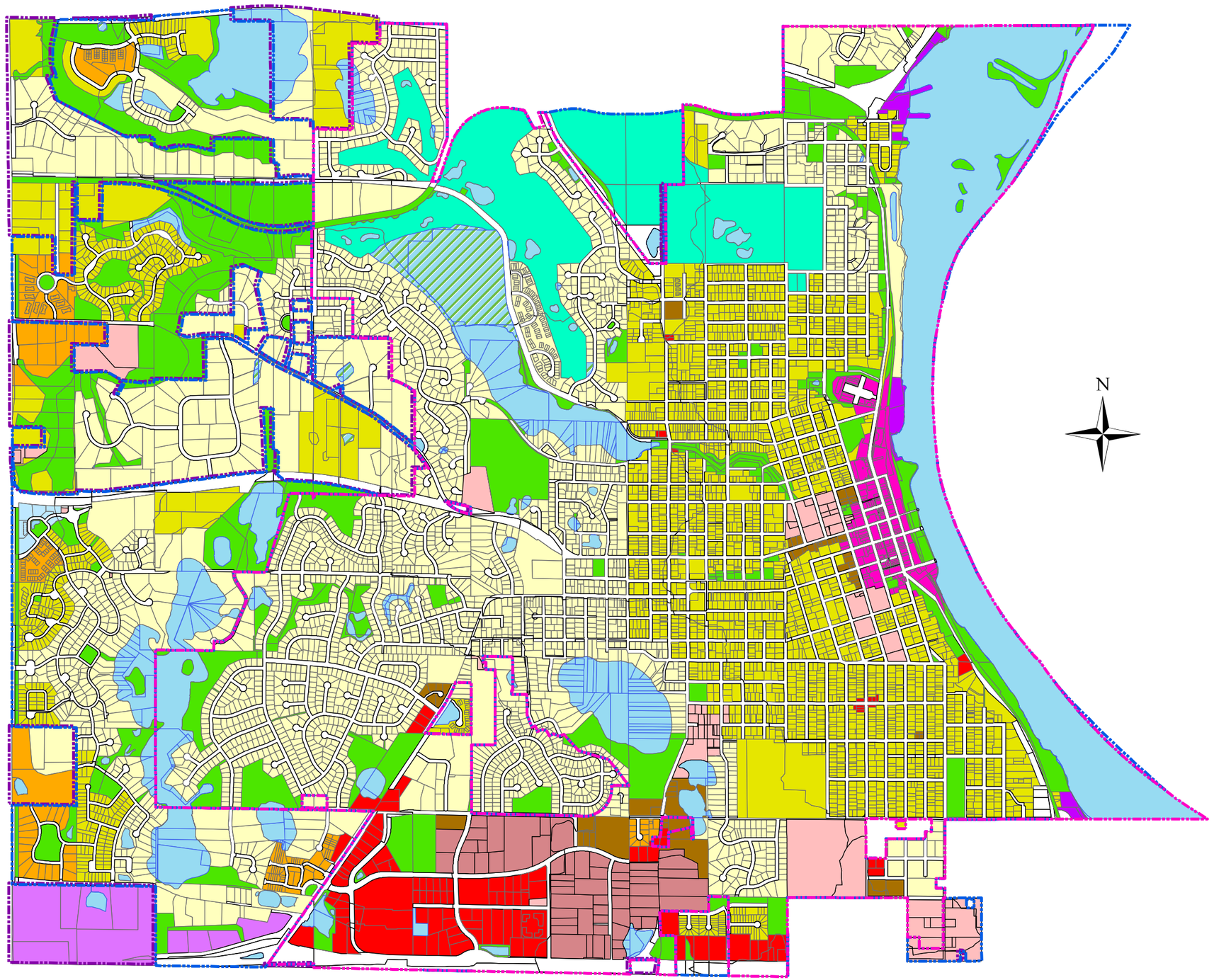

Stillwater
THE BIRTHPLACE OF MINNESOTA

St. Croix River ORVW
Restricted Discharge Water

Figure 4

2030 Land Use

January 2009

Legend

Expansion Boundaries
- 1985
- 2030
- 2008

2030 Land Use
- COMM LAND & BLDGS
- GOLF
- HDR
- INDUSTRIAL
- INSTITUTIONAL
- LDR
- LMDR
- MARINA
- MDR
- MIXED USE
- NEIGHBORHOOD COMM
- PARK OR OPEN SPACE
- R & D PARK
- ROAD
- SURFACE WATER
- WETLAND

1,800 900 0 1,800 Feet

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