Stormwater Quality Assessment

NR216/NR151 TSS Reductions

Village of Cottage Grove, Wisconsin

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1.0 EXECUTIVE SUMMARY

This report documents the findings of a study conducted for purposes of determining the Village of Cottage Grove's compliance with Total Suspended Solids reductions in accordance with NR216.07(6)(b) and NR151.13. The standards outlined within these two chapters require that regulated communities, including the Village of Cottage Grove, achieve a 20% reduction in total suspended solids in runoff that enters waters of the state as compared to no controls by 2008, and implement programs and practices to achieve a 40% reduction in total suspended solids in runoff that enters waters of the state as compared to no controls, by March 10, 2013.

The findings of this study are taken from a detailed P8 (Ver. 3.4) water quality model of the Village. The model was used to evaluate the Village's TSS load and the TSS reduction provided by 66 existing stormwater management facilities within the Village's stormwater drainage system. Additionally, a WinSLAMM (Ver 9.4.0) model was used to evaluate the Village's current street sweeping program. This study found the following:

Village of Cottage Grove
Current Total Suspended Solids Reduction Performance

No Controls Annual Regulated Load	204.2 tons/yr
TSS Removed by Street Sweeping	8.4 tons/yr
Additional TSS Removed by Structural BMPs[1]	54.9 tons/yr
Total TSS Removed	63.3 tons/yr
TSS Reduction Rate	**31.0%**

1. TSS removal achieved by structural BMPs with no street sweeping applied is 57.8 tons/yr.

With its current management practices, the Village of Cottage Grove meets the 2008 20% TSS reduction requirement and is only 9% away from reaching the 2013 40% TSS reduction requirement.

2.0 INTRODUCTION

The Village of Cottage Grove is required to obtain a Wisconsin Pollution Discharge Elimination System (WPDES) Phase II permit to discharge stormwater runoff from the Village's Municipal Separate Storm Sewer System (MS4) and comply with the standards specified in Wisconsin rules NR151 and NR216. NR216.07(6)(b) and NR151.13(2)(b) collectively require communities to achieve a 20% reduction in total suspended solids in runoff that enters waters of the state as compared to no controls by 2008, and to achieve a 40% reduction in total suspended solids in runoff that enters waters of the state as compared to no controls, by March 10, 2013. This report documents the findings of a modeling study conducted for purposes of determining the Village of Cottage Grove's compliance with TSS reductions standards.

3.0 WATER QUALITY MODELING

The findings of this study are taken from a detailed P8 Urban Catchment Model Version 3.4 of the Village's stormwater management system. P8 is a WDNR approved model recommended for use in determining TSS removal rates from stormwater management practices for assessment of compliance with WPDES requirements (see notation NR216.07(6)(b) – "The department believes that computer modeling is the most efficient and cost effective method for calculating pollutant loads. Pollutant loading models such as SLAMM, P8 or equivalent methodology may be used to evaluate the efficiency of the design in reducing total suspended solids"). 'P8' abbreviates "Program for Predicting Polluting Particle Passage Through Pits, Puddles, and Ponds."

The P8 model predicts the generation and transport of pollutants in stormwater runoff from urban watersheds. Continuous water-balance and mass-balance calculations driven by hourly rainfall and daily air temperature time-series data are performed on the stormwater management system. P8 was initially calibrated to runoff quality and particle settling velocity using city data collected under the EPA's Nationwide Urban Runoff Program. Subsequent calibrations were developed for Wisconsin urban watersheds. Input data required by P8 for each model application describe watersheds, devices (BMPs), sediment particle classes, and water quality components.

TSS reduction achieved through street sweeping was estimated using the WinSLAMM (Ver 9.4.0) model. 'WinSLAMM' abbreviates "Source Loading and Management Model [for Windows]" Like P8, WinSLAMM is a WDNR approved model recommended for use in determining TSS removal rates from stormwater management practices. The reason WinSLAMM was used for modeling of street sweeping practices is that it is much more flexible in its application of different types (efficiencies) of street sweepers and allows the implementation of a parking ban during periods of sweeping. The street sweeping efficiency predicted by WinSLAMM was applied as a percentage reduction to the TSS loads predicted by P8 to watersheds not treated by a more efficient structural BMP (detention pond).

3.1 CLIMATIC DATA

P8 simulations are driven by hourly rainfall and mean daily air temperature. The WDNR requires the use of an 'average year's' data for rainfall and temperature in all water quality assessments. The WDNR has determined that the climate record for the Madison gauging station from March 12 through December 2, 1981 represents the best available data representing a 'typical year'. The WDNR and the P8 author have provided specific guidance in the application of this data; specifically, the model should be solved from September 1, 1980

through September 30, 1981, however, data should only be kept from October 1, 1980 on (this allows the model to normalize prior to actual simulations).

It has been determined by the USGS and WDNR that a single year's simulation does not fairly represent the impact of street sweeping. Accordingly, a second rainfall record consisting of five consecutive years' data must be used in the WinSLAMM street sweeping analysis. For Cottage Grove, the rainfall gauge was again the Madison rainfall gauge. The model was solved from 1980 to 1984 with a winter season range of December 02 to March 12.

3.2 MODEL POLLUTANT LOADINGS

Pollutant loading files required by the P8 model include a *Particle Class File*.

- The *Particle Class File* allows the P8 model to determine the weight and size distribution of particulate solids loadings in runoff. Particle classes are defined according to land use types and reflect factors controlling watershed export of TSS particles. For impervious areas the particle class relates accumulation and wash off parameters; for pervious surfaces the particle class relates fixed runoff concentrations. Particle class affects street-sweeping efficiency and effectiveness of structural management practices.

Pollutant loading files required by the WinSLAMM model include a *Pollutant Probability Distribution File, Runoff Coefficient File, Particulate Solids Concentration File, Particulate Residue Reduction File, and a Street Delivery Parameter File.*

- The *Pollutant Probability Distribution File* describes the pollutant loading from different source areas (land use types). This data is based upon actual pollutant loading collected from the study area or region.

- The *Runoff Coefficient File* describes parameters specific to different source areas (land use types) that determine the runoff volumes resulting from rainfall events of different depth.

- The *Particulate Solids Concentration File* contains parameters allowing the WinSLAMM model to determine the weight of particulate solids loadings resulting from runoff events of different volumes. The particulate solids concentration file includes data measured by the USGS from source areas including residential, commercial, and industrial rooftops; residential lawns; residential driveways; residential, commercial and industrial streets; commercial and industrial parking lots; freeways; and undeveloped areas.

- The *Particulate Residue Reduction File* describes the fraction of total particulates that remains within the drainage system after rainfall events and so do not reach the system outfall.

- The *Street Delivery Parameter File* contains data describing the fraction of total

particulates that do not reach the outfall during a rain event, for different rain depths and street textures.

3.3 MODEL PARAMETER FILES

The following model parameter files were entered into the P8 models for evaluation of the Village of Cottage Grove's stormwater management system.

Particle Class File - ***NURP50.par***

The following model parameter files were entered into the WinSLAMM model for evaluation of the Village of Cottage Grove's street sweeping practices.

Rainfall Files -	***WisReg - Madison WI 1980.RAN***
	WisReg - Madison Five Year Rainfall.RAN
Pollutant Probability Distribution File -	***WI_GEO01.ppd***
Runoff Coefficient File -	***WI_SL06 Dec06.rsv***
Particulate Solids Concentration File -	***Wi_avg01.psc***
Particulate Residue Delivery File -	***Wi_dlv01.prr***
Street Delivery File:	
Residential/Other -	***WI_Res and Other Urban Dec06.std***
Institutional/Commercial/Industrial -	***WI_Com Inst Indust Dec06.std***
Freeway -	***Freeway Dec06.std***

3.4 WATERSHEDS, LAND USES, SOURCE AREAS, AND SOIL TYPES.

Watersheds are the sources of runoff and TSS particles simulated by the programs.

For P8, the necessary input data includes drainage area, impervious fraction, depression storage, SCS Runoff Curve Number (RCN) for pervious areas, percent of impervious area served by street sweepers, and street sweeping frequency. The model simulates runoff and TSS generation from pervious and impervious surfaces; although impervious surfaces produce substantially more TSS and runoff than do pervious surfaces. Values for depression storage were set to standard default values in the model.

For WinSLAMM, the necessary input data includes *land uses* and *source areas*. WinSLAMM is capable of modeling only one watershed at a time containing up to six discrete *land uses*; residential, institutional, commercial, industrial, freeway, and other urban areas. Each land use contains specific runoff and pollutant *source areas* including roofs, paved parking/storage areas, unpaved parking/storage areas, playground, driveways, sidewalks/walks, street areas, landscaped areas (small and large), undeveloped areas, isolated/water body area, other pervious areas and impervious areas (directly connected and indirectly connected. Each source area is further categorized by *soil type*, including sand, silt, and clay soil types. It is necessary to manually enter surface area (acres) for each source area within each land use within the watershed to be evaluated.

Input data was developed for 518 watersheds using GIS data provided by the Village of Cottage Grove. Each watershed has a unique set of characteristics which translates either directly or implicitly into the input parameters for the models. These six characteristics include:

- The device to which runoff is directed in the P8 model
- The hydrologic soil group (HSG) of the underlying soil
- Whether the watershed lies within or outside the Village
- The land use within the watershed
- Whether the watershed is in a regulated or exempt area
- The acreage of the watershed

3.5 WATER QUALITY MANAGEMENT PRACTICES

Devices are structural elements of the stormwater drainage and management system that provide collection, storage, and/or treatment of stormwater. Devices include dry and wet storage basins, infiltration basins, swales, buffers, pipes, and flow splitters. All devices modeled by this study were treated as 'general' devices and were defined within the model by a user-defined rating curve that correlated water depth to volume of storage and discharge rate out of the device.

The P8 modeling for existing conditions encompassed 66 constructed stormwater storage areas within the Village's stormwater drainage system plus six natural wetland areas. Note that the natural wetland areas provided both flow and TSS reduction; however, because the natural wetland areas are not constructed management practices, and were likely located within waters-of-the-state, the TSS reductions achieved by the wetland areas were not counted.

Device geometry was taken from one of three primary sources:

- the Village-provided GIS database consisting primarily of detailed 4-foot contour interval topographic maps and spot areas of detailed 2-foot contour data.
- construction plans from various development and reconstruction projects, and
- device outlet structure information taken from field visits conducted by MSA in 2009

The full geometric configuration of all 66 devices is fully described in a HydroCAD hydrologic model of the Village's stormwater management system that was developed independently of this study and is not documented here.

WinSLAMM allows for assignation of water quality management practices for individual source areas within a land use type, land use types within a single watershed, within the drainage system serving the watershed, or at the point of discharge of the watershed. Each structural management practice must be defined according to its specific geometry, including storage volume, outlet configuration, infiltration rate, etc. Non-structural management practices such as street sweeping must be defined according to the type and frequency of activity.

The WinSLAMM modeling completed for this study included only street sweeping as a management practice. Street sweeping is a management practice applied at the *land use* level within the WinSLAMM model. Structural management practices such as ponds or other 'end-of-pipe' structural management practices were not modeled using

WinSLAMM.

4.0 APPLICATION OF WATER QUALITY MODELS

The WDNR has provided very specific guidance in the application of water quality models for the assessment of compliance with the TSS reductions required by NR151 and NR216. This guidance is documented in a June 16, 2005 memorandum from Gordon Stevenson and Eric Rortvedt, titled, "Developed Urban Areas and the 20% and 40% TSS Reductions." This memorandum is included in its entirety in the appendix of this report and documents several key issues regarding the determination of regulated *Land Uses* within the corporate limits of a regulated municipality. Several key statements from the guidance memo are reproduced below:

> *"The total suspended solids control requirements of s. NR 151.13(2)(b)1.b. and 2., Wis. Adm. Code, may be achieved on an individual municipal basis. Control does not have to apply uniformly across the municipality."*
>
> ***"Areas Required to be Included in the Calculations***
> *A municipality must include the following areas when calculating compliance with the developed urban area standard (s. NR 151.13, Wis. Adm. Code):*
> 1. *Any developed area that was not subject to the post-construction performance standards of s. NR151.12 or 151.24, Wis. Adm. Code, that went into effect October 1, 2004 and that drains to the MS4 owned or operated by the municipality.*
> 2. *…*
> 3. *Any undeveloped (in-fill) areas under 5 acres. These areas must be modeled as fully developed, with a land use similar to the properties around them.*
> 4. *…*
> 5. *…*
> 6. *…*
> 7. *…"*

The language under item #1 above refers to the need to include all land areas NOT regulated by the standards of NR151.12 or NR151.24 developed prior to October 1, 2004. While it is not specifically stated here, subsequent information made available by the WDNR has clarified this statement to also mean that all development which has occurred on or after October 1, 2004, and was regulated by NR151.12 or NR151.24 must NOT be included in the calculations.

> ***"Areas Prohibited from Inclusion in the Calculations***
> *Areas and loadings that shall not be included:*
> 1. *Lands zoned for agricultural use and operating as such.*
> 2. *Pollutant loadings from an upstream MS4*
> 3. *Any internally drained area with natural infiltration.*
> 4. *Undeveloped land parcels over 5 acres within the municipality. These areas will be subject to s. NR 151.12 or 151.24, Wis. Adm. Code, when developed"*

Item #2 above refers to pollutant loadings, and not runoff. It is necessary to account for stormwater runoff from areas outside a regulated municipality that flow into the municipality so that the effect of the hydraulic loading from these areas that passes into a management practice (detention pond, etc.)

is properly accounted for (i.e. effects on pollutant removal efficiency). Similarly, runoff, but not pollutants, from areas within the regulated municipality that are prohibited from inclusion in the calculations must be accounted for. *Note that a reader might not infer the previous requirement from reading the guidance in the June 16, 2005 memo. MSA has discussed this specific issue with the WDNR and was given this direction.*

> ***"Optional Areas to Include in the Calculations***
> *Areas a municipality may, but is not required to, include in the developed urban area load calculation:*
> 1. *Property that drains to waters of the state without passing through the permittee's MS4.*
> 2. *Any area that discharges to an adjacent municipality's MS4 without passing through the jurisdictional municipality's MS4.*
> 3. *Industrial facilities subject to a permit under subch. II of ch. NR 216, Wis. Adm. Code."*

Areas draining directly to a water of the state without passing through the Village's storm sewer system (item #1 above) were not included in the WinSLAMM modeling. Similarly, those areas draining out of Village limits without passing through part of the Village's MS4 were likewise excluded.

There are no regulated municipalities contiguous with the Village of Cottage Grove, so item #2, above, is not specifically applicable.

With regard to the language under item #3, no Industrial WPDES permitted sites existed in the Village.

4.1 MODEL STUDY LIMITS

The water quality modeling study area extends from the upstream edge of all watersheds draining into the Village, but stops at the Village limits for watersheds draining out of the Village. All of the maps included in Appendix A of this report identify the limits of the study area.

The area included in the study limits is described in the following table:

Village of Cottage Grove
Water Quality Model Study Areas

Description	Area (acres)
Study Limits	3160.0
Village Limits	2,084.9
Regulated Area	1,290.0

4.2 MODEL LAND USE

P8 requires data for impervious area as a primary input parameter. The following impervious area relationships to land use relationships were applied for this study:

- All single-family residential parcels were assigned an average impervious area based on an evaluation completed by MSA, which looked at all single family residential lots and their adjacent ROW and came up with an average lot size minus any ROW. This average lot size was assigned an impervious percent by interpolating TR-55 impervious percent lot sizes values. Single-family residential parcels were found, on average, to be 25% impervious.
- Multi-family residential parcels were assigned 55% imperviousness according to values within TR-55. All impervious is directly connected.
- Commercial non-residential parcels were assigned 85% imperviousness according to values within TR-55. All impervious is directly connected.
- Light Industrial non-residential parcels were assigned 68% imperviousness. With all impervious areas directly connected.
- Medium Industrial non-residential parcels were assigned 72% imperviousness according to values within TR-55. All impervious is directly connected.
- Institutional non-residential parcels were assigned 65% imperviousness according to values within TR-55. All impervious is directly connected.
- All roadway rights-of-way were assigned 50% imperviousness according to the area of each individual the right-of-way. All impervious area is directly connected.

WinSLAMM requires data for source areas as a primary input parameter. WinSLAMM can analyze an urban drainage area with up to six different land uses with 14 sources areas per land use. Each source area (such as turf, roofs, parking, playgrounds, streets) is further classified according to their runoff behavior (for example, whether roofs are flat or pitched, and whether they drain directly to the drainage system or drain onto sandy or clayey soils).

Since data with this level of specificity is not typically available at a municipal or watershed scale, the WinSLAMM model comes with *Standard Land Use Files* (SLU files) which describe the distribution of source areas within a particular land use type.

These files have been prepared by the authors of the WinSLAMM model based on studies of Wisconsin communities. The Standard land use files listed in the table below have been approved by the WDNR for use in Wisconsin with WinSLAMM version 9.4.0.

WDNR APPROVED SLAMM STANDARD LAND USE FILES

Land Use Class	Standard Land Use File
Residential	• Duplex • High density residential with alleys • High density residential without alleys • High rise residential • Low density residential • Medium density residential • Mobile homes • Multi-family residential • Suburban residential
Commercial	• Downtown commercial • Strip commercial • Office park
Industrial	• Light industrial • Medium industrial
Institutional	• Hospital • School • General institutional
Other Urban	• Cemetery • Airport • Open • Parks
Freeways	• Freeways

The land use classification map available from the Village had been created by MSA in 2005 and was in need of updating. To create a new up-to-date map, where each land use classification was correlated to the closest appropriate standard land use type, MSA started by assigning each parcel in Cottage Grove a land use type based on the following information: parcel 2009 tax classification, land use per previous MSA land use mapping, information from aerial photos and information from knowledgeable staff working closely with the Village of Cottage Grove. To ensure consistency when assigning an area a standard land use category, the table below was created for guidance.

Village of Cottage Grove Land Use Mapping Correlation to WinSLAMM Standard Land Uses

Village of Cottage Grove GIS Land Use	WinSLAMM Standard Land Use Type
Any commercial properties including downtown, strip malls and office Bldngs	Commercial
Parcels classified as "utilities", as well as airports. Also includes storage and distribution buildings, including warehouses and wholesalers.	Light Industrial
Manufacturing businesses such as lumber yards, auto salvage yards junk yards, grain elevators, ag coops, oil tank farms, coal and salt storage areas and areas for bulk storage of fertilizers.	Medium Industrial
Areas currently developed and dedicated as parks and/or public open space. Includes golf courses, parks, athletic fields and cemeteries.	Parks
Includes areas currently classified as forest, farmstead, ag, vacant, pasture and woods	Undeveloped
3-plexes or more	Multi-Family Residential
SFR and Duplexes	Single Family Residential
Schools, churches, etc.	Institutional
Limited access highways and the interchange areas, including and vegetated rights of ways	Freeways
Any public road and ROW other than those defined as freeway, above.	Transportation
Open Water	Water

For purposes of complying with the June 16, 2005 memorandum documenting model prohibitions the model land use map was further altered to identify 'excluded' areas. These included areas where development or redevelopment had occurred since October 2004 that was also regulated by NR151.12 or 151.24. The WDNR and Department of Commerce provided a list of all construction activities (through present day) that the WDNR had permitted under NR151.12 and NR151.24 and that the Department of Commerce permitted under Comm 21.126. Those parcels or portions of parcels, covered by these permits were coded within the model land use map as 'excluded' areas and are shown on Map 6 in Appendix A labeled 'Excluded Area Map.' Also shown on this map are all areas within the study area limits that are outside of the Village limits. These areas were coded as 'excluded' also, in compliance with the June 16, 2005 guidance document.

It is worth repeating to note that excluded land uses were included in the P8 model for purposes of properly accounting for the volume of stormwater runoff generated in these areas so that the efficiency of downstream treatment devices could be properly evaluated, but the TSS loads from excluded land uses were artificially reduced to zero in order to properly account the regulated load reduction.

4.3 SOIL CLASSIFICATIONS

One of the six watershed characteristics discussed above is the underlying soil type. WinSLAMM requires that the soil for all land uses be classified by soil texture as *sand, silt, or clay*. P8, on the other hand, requires that the soil for all land uses be classified by HSG as *Group A, Group B, Group C, or Group D*. The table below identifies the correlation of this parameter between the two models.

Correlation of Soil Texture to Hydrologic Soil Group

Soil Texture (WinSLAMM)	Hydrologic Soil Group (P8)
Sand	Group A
Silt	Group B
Clay	Group C

Map 1 in Appendix A shows the distribution of soil textures within the study area.

4.4 STREET SWEEPING

TSS reduction achieved through street sweeping was estimated using the WinSLAMM model. The street sweeping efficiency predicted by WinSLAMM was used as an input to the P8 model in place of P8's own internal street sweeping routine. P8 was then solved to determine the combined TSS removal of street sweeping and structural BMPs (ponds).

WinSLAMM is capable of modeling both mechanical and high-efficiency (vacuum) street sweeping. Sweeping intervals may be altered and sweeping may be evaluated with and without parking restrictions. Parking restrictions assume that cars are not allowed to park on streets on days when sweeping is to occur.

Street sweeping frequency data was provided by the Village of Cottage Grove street department. According to the department, the Village's sweeping program allows for the Village to be swept twice annually. Map 7 in Appendix A defines swept area.

Note that WDNR modeling protocols require model simulations, and hence street sweeping durations, span the entire 'non-winter' season; for the Cottage Grove area the 'non-winter' date range is March 12 through December 2.

The WNDR and USGS have provided the following guidance on their website regarding application of street sweeping to water quality models:

> *"For developed urban areas under s. NR 151.13, permitted municipalities must reduce the TSS load by 20% in 2008 and 40% in 2013. Again, this should be reported on an average annual basis. However, there are no identified rainfall years for the developed urban area performance standards in NR 151.13. Since a single*

year did not fairly represent the impact of street cleaning, a series of rainfall files (5 consecutive years) must be used..."

The reason for this requirement is that it was found that identical street sweeping programs provided substantially different TSS reduction rates depending on the annual rainfall record selected for the simulation. It is speculated by the authors of the WinSLAMM model that this is the result of interactions between the randomness of rainfall events and the fixed schedule of sweeping. For example, if one rainfall record has comparatively more rainfall events on Mondays while street sweeping occurs consistently on Tuesdays then many of the pollutants that would be captured by the sweeper will have been washed off by the previous day's rainfall. On the other hand, if rainfalls occur more commonly at the end of the week, then the Tuesday sweeping schedule will capture comparatively more sediment, as there will be more 'dry' days of accumulation prior to the sweeping event. By running five years of rainfall data through the model it was felt that the impact of the randomness of rainfall occurrences would be minimized.

4.5 STRUCTURAL BMPs

There are currently 66 structural stormwater quality management devices within the Village of Cottage Grove's storm water management system, as can be seen on Map 5 in Appendix A. The Village's engineering department provided construction plans as available for these devices, documenting necessary geometric data such as storage volume and outlet device configuration. MSA gathered outlet size and elevation information for devices that had no construction plans available. The location of each BMP was identified in GIS and the drainage area tributary to each device was delineated (see Map 5 in Appendix A). The land use and soil characteristics of each BMP drainage area was determined by intersecting the land use-soil type and BMP drainage area shapefiles in GIS, and summing the area of each land use and soil type within each drainage area. This information was used to create two P8 models (due to the software's limitation on the number of devices in a single model), which collectively covered the entire Village. Output from the P8 models consolidated and entered into a spreadsheet where the results were modified to account for street sweeping. These results are summarized in Tables 1 and 2 in Appendix B, and show that the cumulative effect of the existing structural BMPs and street sweeping program described in the previous section comes to 31.0% of the Villages 40% reduction requirement.

It bears repeating to note that excluded areas were included in the P8 model for purposes of properly accounting for the stormwater runoff from these areas so that the efficiency of downstream treatment devices could be properly evaluated. Additionally, treatment devices within excluded areas were also included in the model, also to properly account for their effect on stormwater runoff routing. However, pollutant loads for excluded areas were suppressed. It is for this reason that many of the devices in the summary tables included in the appendix show no trapped load and 0% for treatment efficiency.

5.0 FINDINGS AND DISCUSSION

5.1 MODEL RESULTS

The table below demonstrates the significance of applying the various exemptions and exclusions documented in the WDNR modeling guidance memorandum.

Village of Cottage Grove
Baseline Annual Total Suspended Solids Loads

Description	**Area**	**Annual TSS Load**
Study Area	3160.0 ac	326.5 tons/yr
Village Limits	2,084.9 ac	268.2 tons/yr
Regulated Areas within Village	1,290.0 ac	204.2 tons/yr

The table below documents the estimated performance of the Village's stormwater management system at removing TSS from the regulated areas within the Village.

Village of Cottage Grove
Current Total Suspended Solids Reduction Performance

No Controls Annual Regulated Load	204.2 tons/yr
TSS Removed by Street Sweeping[1]	8.4 tons/yr
Additional TSS Removed by Structural BMPs	54.9 tons/yr
Total TSS Removed	63.3 tons/yr
TSS Reduction Rate	**31.0%**

1. TSS removal determined by applying percent removal rate from 5-yr evaluation in WinSLAMM to 1-yr TSS loading values from P8. See section 5.2.

With its current management practices, the Village of Cottage Grove meets the 2008 20% TSS reduction requirement and is only 9% away from reaching the 2013 40% TSS reduction requirement.

5.2 STREET SWEEPING EFFICIENCY

The following table summarizes the efficiency of the current street sweeping program for the Village of Cottage Grove. *Note that per WDNR guidance the model results show the annual summary of an evaluation of five years' of rainfall records. As a result the annual TSS load (by weight) determined by the model does not match that for tables presenting*

single-year loads. The TSS reduction reported in the table below was applied to single-year loads by using the percent-reduction values.

Village of Cottage Grove
Street Sweeping Program TSS Reduction Performance

Location	Frequency	Load Generated (tons)	Load Removed (tons)	Reduction
Regulated Village Limits	2x per year	1045.1	43.2	4.1%

Table 3 in Appendix B titled 'Street Sweeping Model Results' details the TSS reductions achieved by the street sweeping program.

5.3 STRUCTURAL BMP PERFORMANCE

P8 modeling results of the 66 existing structural BMPs show that individually, the ponds are capable of removing 26.9% of the Village's regulated annual TSS load. *However, this total removal rate does not account for the fact that street sweeping will occur within the drainage areas tributary to each alternative BMP*. Under the Village's existing street sweeping program 4.1% of the annual regulated load is captured by sweeping activities. Street sweeping occurs throughout the Village and so occurs within drainage areas tributary to existing structural BMPs. Because the sediment collected by street sweeping is not available to be captured by a structural BMP the efficiency of each BMP must be reduced by 4.1% to account for the TSS already captured by street sweeping.

Note that MSA's method of calculating "eligible" TSS removal in areas served by BMPs and street sweeping is designed to avoid double-counting removal of the same size particles when BMPs such as street sweeping and detention/retention facilities are applied in series, and the total TSS removal in any given watershed or drainage area does equal to the removal rate of the most effective BMP serving that watershed. This is because although credit for sweeping is given in all swept watersheds, the TSS removal achieved by sweeping is subsequently subtracted from the removal rate achieved by the downstream BMP. Calculations are done in this way so that the sequence of calculations represent the sequence of the actual real-world events (in the "real world", TSS is removed first by sweeping, and then this reduced TSS load is routed onto a BMP, where additional removal occurs, although admittedly not of the same particle size fraction already removed)

It is admitted that this approach is not as rigorous as it could be; however, it is a conservative and reasonably valid method of combining model results given the limitations of the WinSLAMM model and the translation of WinSLAMM results into the P8 model. This approach has been used in other DNR-approved NR 216 master plans and was accepted as a method by Bryan Hartsook and Maureen McBroom of the DNR during a meeting held on January 12, 2010.

Tables 1A and 1B in Appendix B document the TSS reductions achieved by each of the individual existing structural BMPs and the effect of street sweeping on their efficiencies.

6.0 RECOMMENDATIONS

With its current management practices, the Village of Cottage Grove meets the 2008 20% TSS reduction requirement and falls within 9.0% of the 2013 40% TSS reduction requirement. Therefore, change to the current street sweeping program or the construction of additional structural stormwater management practices is warranted at this time.

To investigate opportunities for additional TSS removal, eight potential locations for improved BMPs have been identified and preliminarily analyzed. All eight locations currently act as some type of stormwater management facility. The following changes will be recommended for the existing BMPs: convert existing dry basin to wet basin (4 BMPs), convert existing dry basin to infiltration basin (2 BMPs), Retro-fit the existing outlet of a wet basin (1 BMP) and add 2-feet of wet-storage to existing semi-wet basin and retro-fit outlet (1 BMP). Specifics on changes made to each of the eight improved BMP locations can be found in Appendix B, Table 4. The existing outlets remained the same for all but 2 of the improved BMPs because in most cases by just creating wet storage in the existing basin 80% TSS removal or greater was achieved.

Half of these sites lie outside of areas that have wetland indicators, while the remaining four sites lie partially or wholly within areas of wetland indicators. *Wetland indicators reflect soils mapped by the USDA Natural Resources Conservation Service in the drainage classes of somewhat poorly, poorly and very poorly drained soils. Soils mapped within these drainage classes are soil types typically found within areas designated as wetlands.* Of the four sites located within areas of wetland indicators all are existing basins that were constructed for purposes of stormwater management. Keeping that in mind, after years of acting as a detainment facility for runoff, some wetland indicators are bound to be present. MSA is not proposing to expand the footprint of these basins but only to improve their overall function. However, with that being said, these sites would still be investigated thoroughly for wetlands prior to progressing with any plans for construction. None of the sites lie within areas mapped as wetland on the Wisconsin Wetland Inventory maps. Map 8 in Appendix A shows the location of these BMPs around the Village, Maps 3 and 4 show possible limitations to these locations by exhibiting hydric soils and wetlands (respectively). In addition, concept plan drawings and associated cost estimates can be found in Appendix D.

Each of the 8 BMPs that could be implemented has been prioritized according to cost-effectiveness. Individual BMPs have been ranked according to the ratio of the BMPs anticipated project cost per ton of TSS reduction. Table 4 in Appendix B shows a detailed summary of removal efficiency and cost comparisons. This table assumes that all 8 improved BMPs have been constructed and therefore for some of the BMPs in series with each other these values change slightly when different combinations of BMPs are constructed. To see the individual removal rate and rate of different combinations refer to Table 5 in Appendix B, Proposed Pond Locations in Series. The table below illustrates

suggested pond combinations for the Village that take into consideration the regulated area TSS reduction and cost to get to the 40% target.

Village of Cottage Grove
Potential BMPs for Additional TSS Reduction

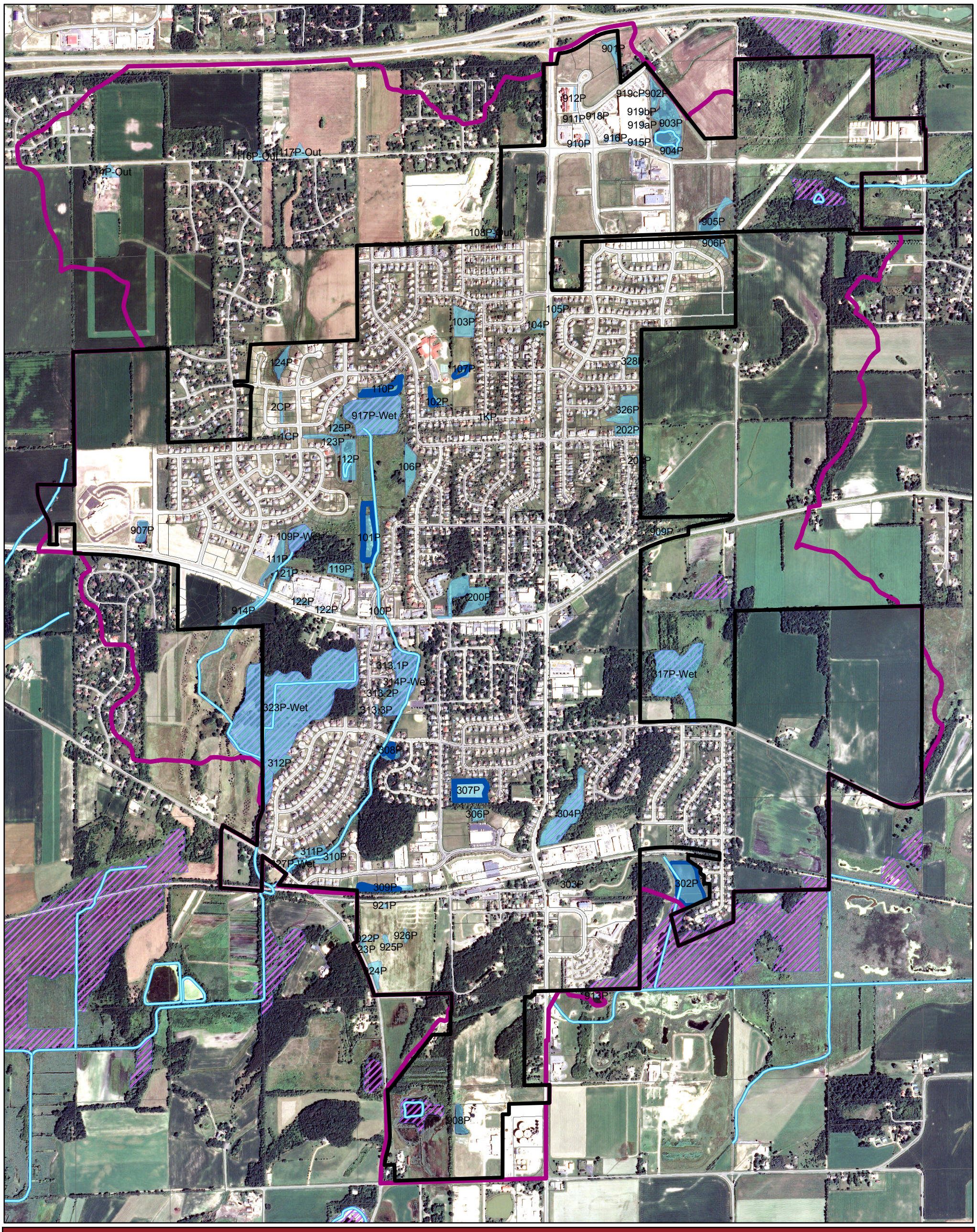
BMP	Cumulative TSS Removal for Constructed BMPs		Total Cost of Constructed BMPs	Cumulative TSS Removal for Constructed and Existing BMPs
Construct BMP 101P	19.1 tons/yr	9.3%	$139,215	40.3%
Construct BMPs 102P, 107P, 110P and 309P	20.5 tons/yr	10.0%	$372,779	41.0%
Construct BMPs 102P, 107P, 302P, 307P and 309P	18.2 tons/yr	8.9%	$426,208	39.9% *
Construct all 8 Potential BMPs	37.5 tons/yr	18.4%	$718,861	49.4%

* This combination will require a slight increase to the street sweeping program to get that 0.1%.

To investigate opportunities for enhancing the street sweeping program by attempting to get better removal using a different alternative, three additional street sweeping scenarios have been analyzed. The first alternative increases the frequency from 2x per year (Every 26-weeks) to every 8 weeks. This scenario yielded only slightly increased the percent removal to 4.8%. The second and third alternatives suggest the same frequency of sweeping, every 2 weeks, but the third enforces parking controls and the second does not. Both the second and third scenarios achieved a much higher TSS removal rate than the first with percent removals of 8.7% and 13.6% respectively. Table 6 in Appendix B lists the current program along with all three alternative scenarios and details the frequency and type of sweeping under each scenario.

Appendix A

Figures



Proposed BMP Overview

MAP-8

Village of Cottage Grove

Dane County, Wisconsin

Legend

- Corporate Limits
- Study Limits
- Final Proposed Ponds
- Existing Ponds
- Wetlands
- Tax Parcels

N
W E
S

1,300 650 0 1,300 Feet

Sources:
- City Base Data

MSA
PROFESSIONAL SERVICES
TRANSPORTATION • MUNICIPAL • REMEDIATION
DEVELOPMENT • ENVIRONMENTAL

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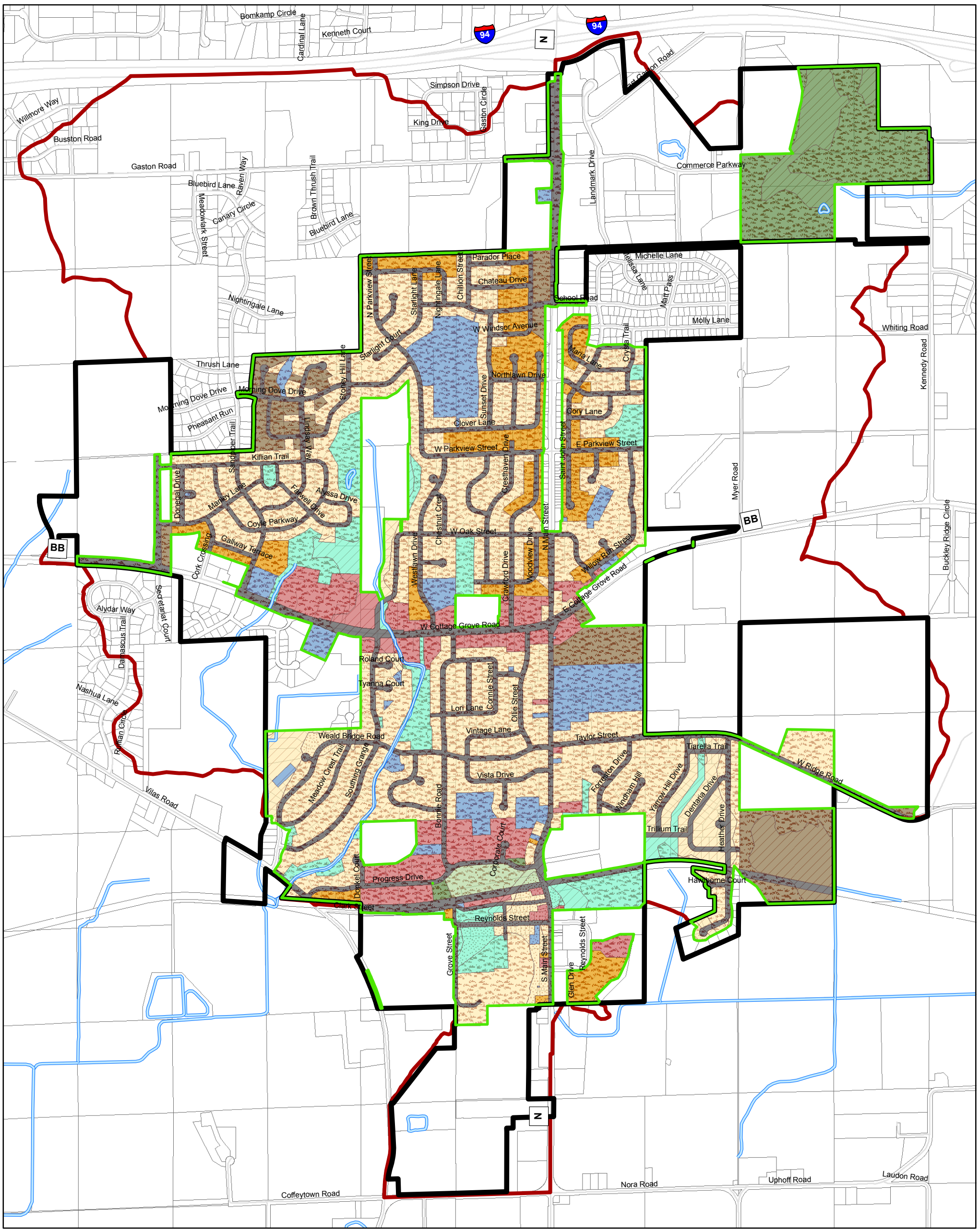

Street Sweeping

MAP-7

Village of Cottage Grove

Dane County, Wisconsin

Legend

- Street Sweeping Boundary
- Corporate Limits
- Study Limits
- Waters of the State
- Tax Parcels

SLAMM Soil Texture

- SAND
- SILT
- CLAY

SLAMM Land Use

- Commercial
- Institutional
- Light Industrial
- Medium Industrial
- Multi-Family Residential
- Park
- Single Family Residential
- Transportation
- Undeveloped

N W E S

1,300 650 0 1,300 Feet

Sources:
- City Base Data

MSA PROFESSIONAL SERVICES
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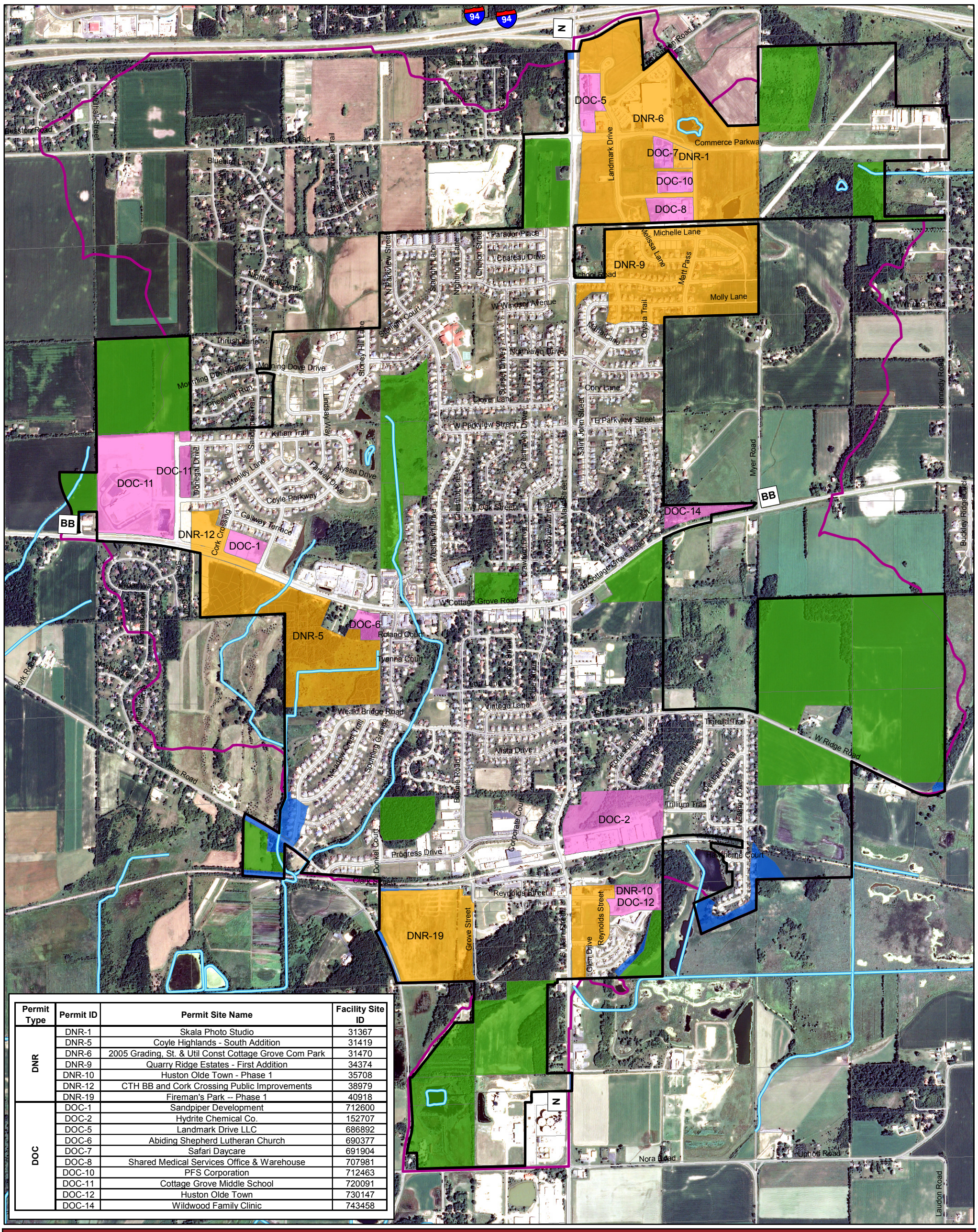

Permit Type	Permit ID	Permit Site Name	Facility Site ID
DNR	DNR-1	Skala Photo Studio	31367
	DNR-5	Coyle Highlands - South Addition	31419
	DNR-6	2005 Grading, St. & Util Const Cottage Grove Com Park	31470
	DNR-9	Quarry Ridge Estates - First Addition	34374
	DNR-10	Huston Olde Town - Phase 1	35708
	DNR-12	CTH BB and Cork Crossing Public Improvements	38979
	DNR-19	Fireman's Park -- Phase 1	40918
DOC	DOC-1	Sandpiper Development	712600
	DOC-2	Hydrite Chemical Co.	152707
	DOC-5	Landmark Drive LLC	686892
	DOC-6	Abiding Shepherd Lutheran Church	690377
	DOC-7	Safari Daycare	691904
	DOC-8	Shared Medical Services Office & Warehouse	707981
	DOC-10	PFS Corporation	712463
	DOC-11	Cottage Grove Middle School	720091
	DOC-12	Huston Olde Town	730147
	DOC-14	Wildwood Family Clinic	743458

Exempt Areas

MAP-6

Village of Cottage Grove

Dane County, Wisconsin

Legend

Exempt Areas

- DNR
- DOC
- Drains Out
- Vacant Greater than 5-acres
- Corporate Limits
- Study Limits
- Tax Parcels

N
W E
S

1,300 650 0 1,300 Feet

Sources:
- City Base Data

MSA PROFESSIONAL SERVICES
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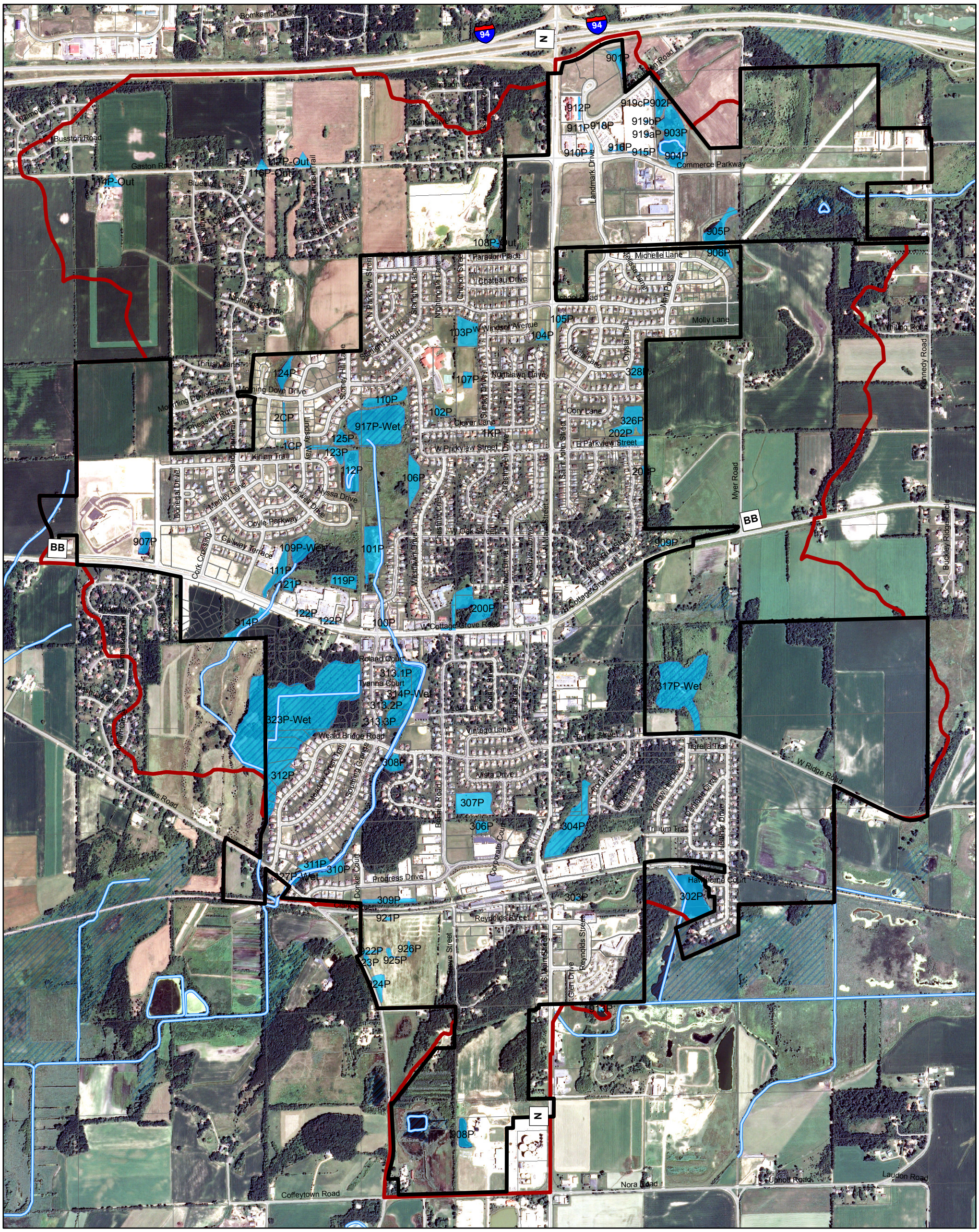

Existing BMP's

MAP-5

Village of Cottage Grove

Dane County, Wisconsin

Legend

- Corporate Limits
- Study Limits
- Waters of the State
- Tax Parcels
- Wetlands
- Existing Ponds

N
W E
S

1,300 650 0 1,300 Feet

Sources:
- City Base Data

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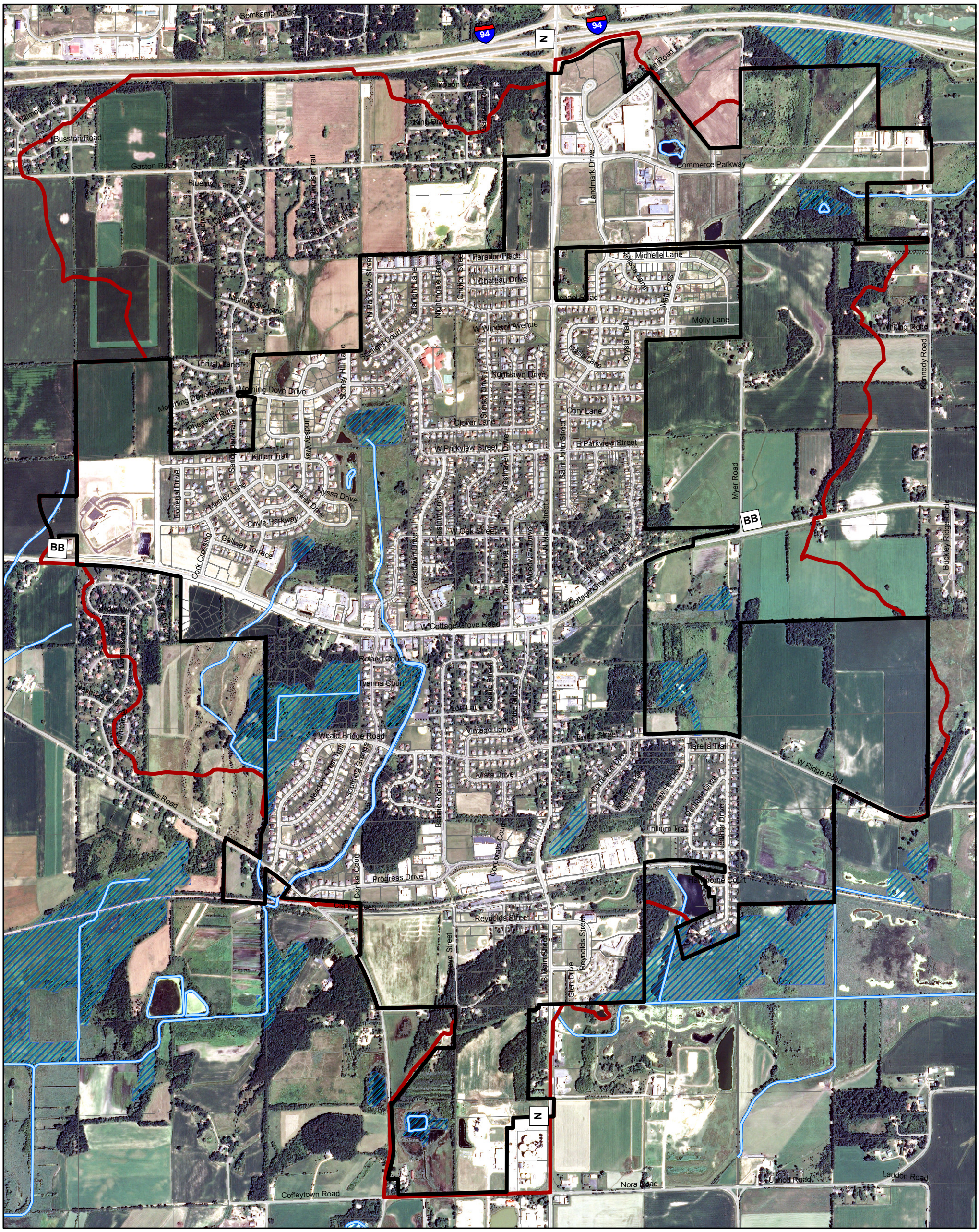

Wetlands

MAP-4

Village of Cottage Grove

Dane County, Wisconsin

Legend

- Corporate Limits
- Study Limits
- Waters of the State
- Tax Parcels
- Wetlands

N
W E
S

1,300 650 0 1,300 Feet

Sources:
- City Base Data

MSA PROFESSIONAL SERVICES
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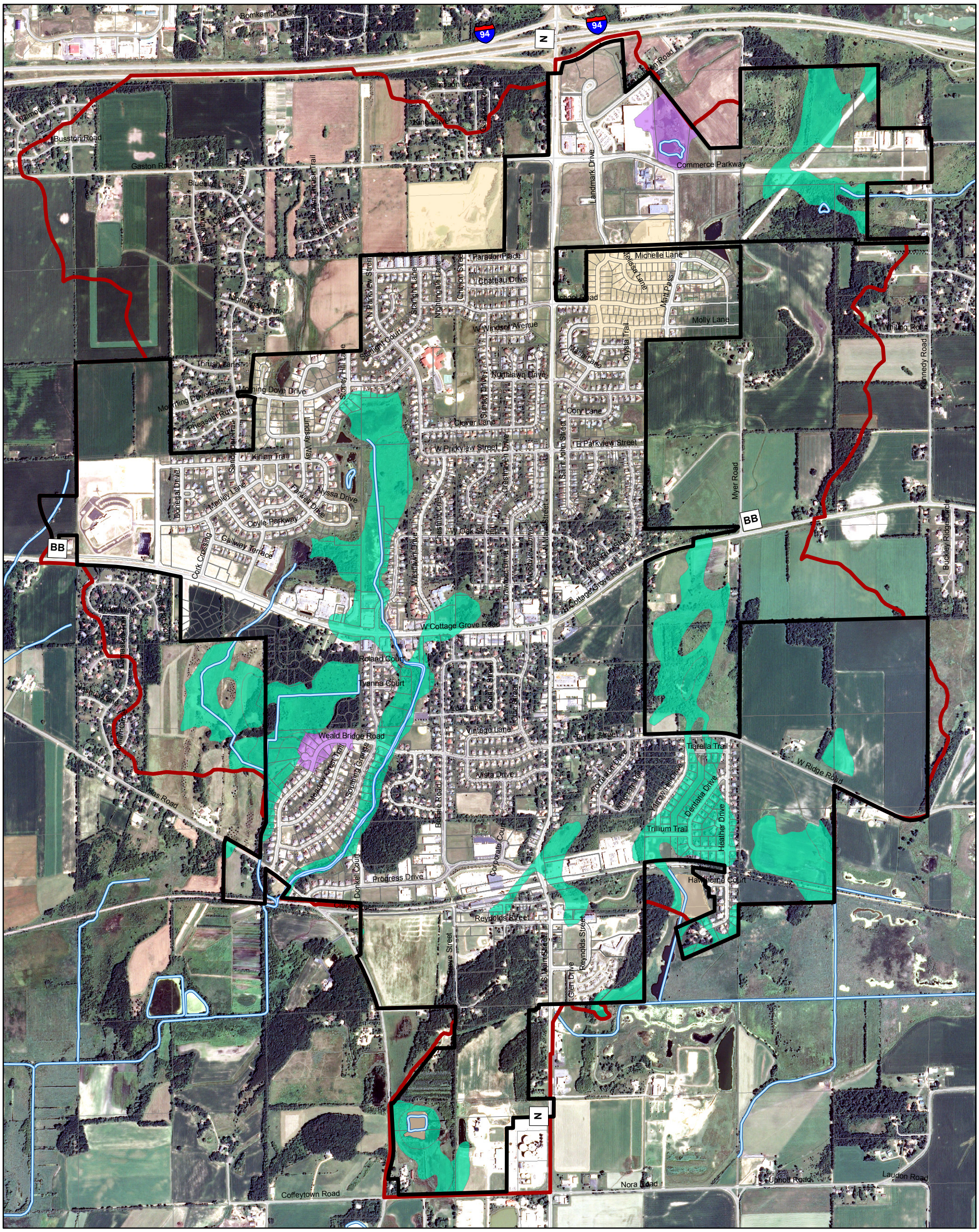

Hydric Soils

MAP-3

Village of Cottage Grove

Dane County, Wisconsin

Legend

- Corporate Limits
- Study Limits
- Waters of the State
- Tax Parcels

Hydric Soils

- All hydric
- Partially hydric
- Unknown

N
W E
S

1,300 650 0 1,300 Feet

Sources:
- City Base Data

MSA PROFESSIONAL SERVICES
TRANSPORTATION • MUNICIPAL • REMEDIATION
DEVELOPMENT • ENVIRONMENTAL

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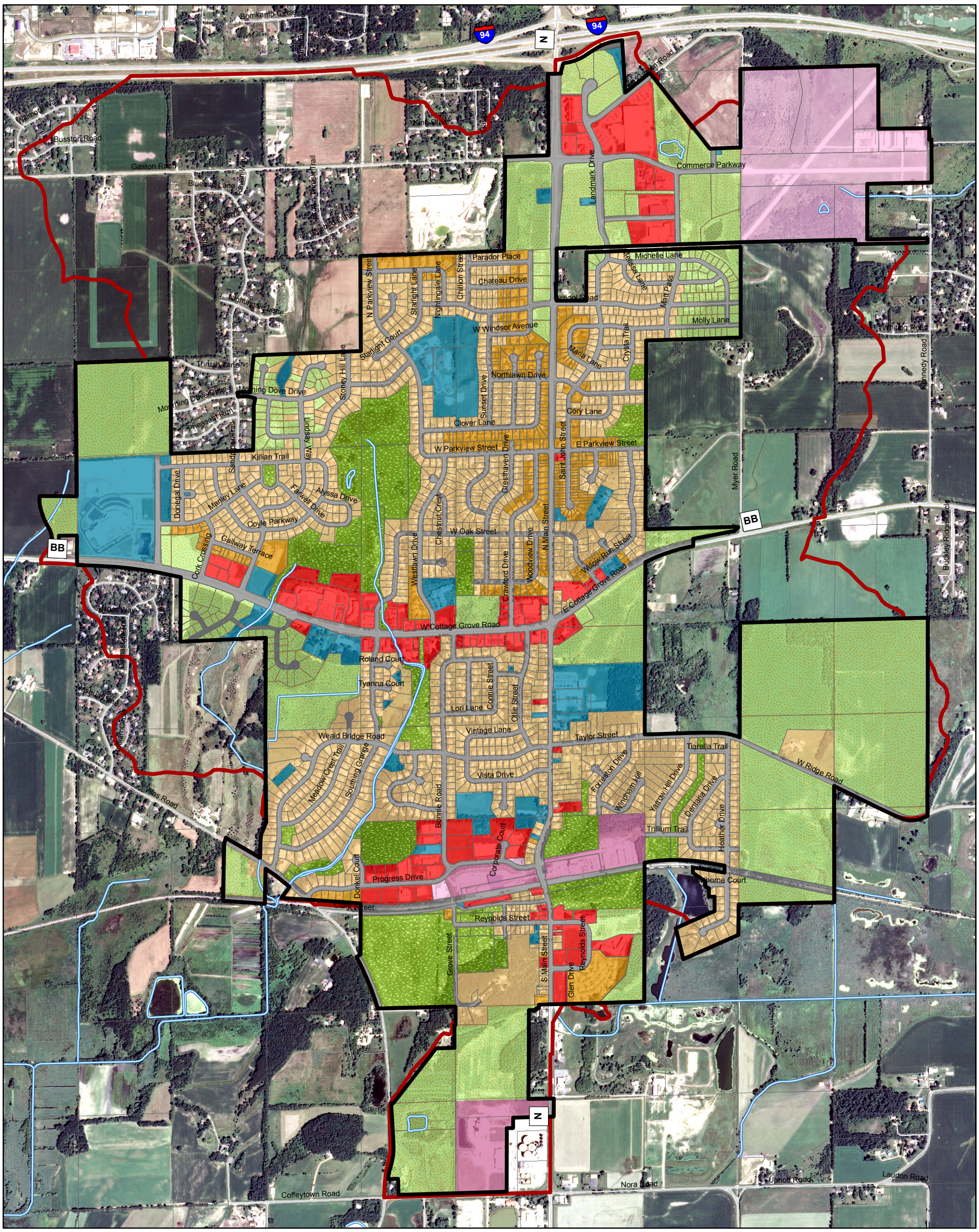


Existing Land Use

MAP-2

Village of Cottage Grove

Dane County, Wisconsin

Legend

- Corporate Limits
- Study Limits
- Waters of the State
- Tax Parcels

Land Use Catagories

- Undeveloped
- Park
- Single Family Residential
- Multi-Family Residential
- Commercial
- Light Industrial
- Medium Industrial
- Institutional
- Freeway
- Transportation

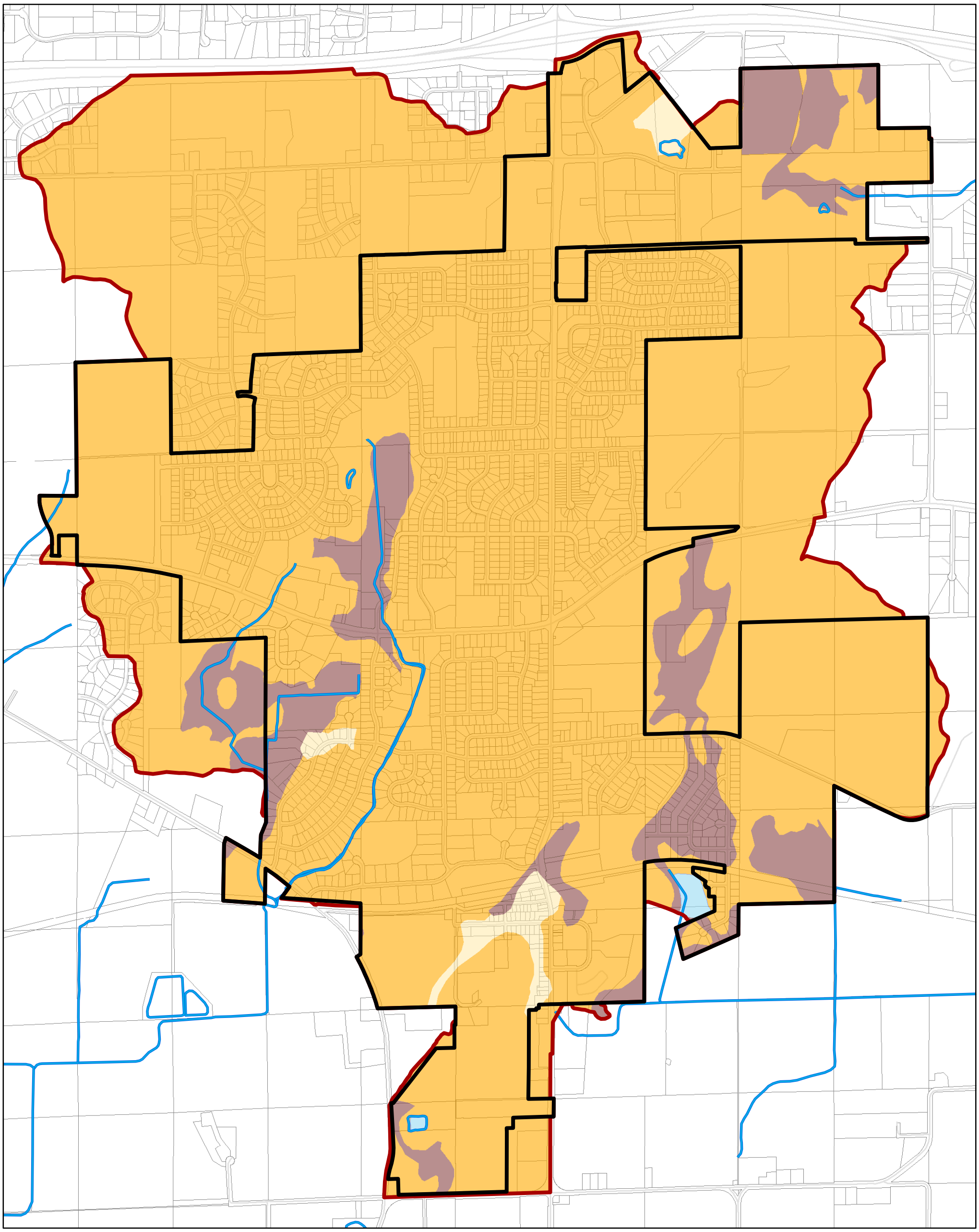
N W E S

1,300 650 0 1,300 Feet

Sources:
- City Base Data

MSA PROFESSIONAL SERVICES
TRANSPORTATION • MUNICIPAL • REMEDIATION
DEVELOPMENT • ENVIRONMENTAL

Rev Drafted - GMD, Date - 01-14-10, File - G:\projects\940s\940\094017\GIS\MXD



Soils Texture

MAP-1

Village of Cottage Grove

Dane County, Wisconsin

Legend

- Corporate Limits
- Study Limits
- Waters of the State
- Tax Parcels

Soils Textures

- SAND
- SILT
- CLAY
- WATER

N
W E
S

1,300 650 0 1,300 Feet

Sources:
- City Base Data

MSA PROFESSIONAL SERVICES
TRANSPORTATION • MUNICIPAL • REMEDIATION
DEVELOPMENT • ENVIRONMENTAL

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Appendix B

Tables

Village of Cottage Grove Stormwater Quality Plan
TABLE 1A - Individual Existing BMPs and Street Sweeping Removal Efficiencies (Model 1)

	BMP ID	BMP Location	Pond Type	Regulated Watershed Load (tons/year)			TSS Removal Efficiency (%)			TSS Trapped by BMP after Sweeping (tons/yr)
				Direct	Upstream	Total	Stand Alone BMP[1]	Stand Alone Street Sweeping	Net BMP After Street Sweeping	
MODEL 1	304P	Hydrite Pond - Forest Ridge Area	Dry Basin	5.2	0.0	5.2	0.0%	4.1%	0.0%	0.00
	306P	Swanson bldng pnd N. of bldng (Business Park outlot 3)	Wet Basin	6.9	0.0	6.9	75.3%	4.1%	71.2%	4.90
	307P	Tanglewood pond west of Tanglewood Ct (outlot 1)	Wet Basin	5.3	1.6	6.9	62.5%	4.1%	58.4%	4.05
	909P	Wildwood Family Clinic Basin	Wet Basin	0.1	0.0	0.1	92.1%	4.1%	88.0%	0.08
	906P	Quarry Ridge Northeast Corner	Wet Basin	0.0	0.0	0.0	0.0%	4.1%	0.0%	0.00
	919aP	Johnson Health Tech south warehouse area (loading docks)	Infiltration Basin	0.0	0.0	0.0	0.0%	4.1%	0.0%	0.00
	919bP	Johnson Health Tech central warehouse area (loading docks)	Infiltration Basin	0.0	0.0	0.0	0.0%	4.1%	0.0%	0.00
	919cP	Johnson Health Tech north warehouse area	Infiltration Basin	0.0	0.0	0.0	0.0%	4.1%	0.0%	0.00
	918P	Johnson Health Tech west parking area	Infiltration Basin	0.0	0.0	0.0	0.0%	4.1%	0.0%	0.00
	912P	Ghidorzi multi-use building	Infiltration Basin	0.0	0.0	0.0	0.0%	4.1%	0.0%	0.00
	911P	Ghidorzi empty lot near intrsctn of Landmark Dr and E. Gaston Rd	Infiltration Basin	0.0	0.0	0.0	0.0%	4.1%	0.0%	0.00
	910P	Kwik Trip, Carwash, and Arby's	Infiltration Basin	0.0	0.0	0.0	72.1%	4.1%	68.0%	0.01
	916P	Johnson Health Tech front office building near Commerce Prkwy	Wet Basin	0.0	0.0	0.0	0.0%	4.1%	0.0%	0.00
	915P	Johnson Health Tech warehouse area near Commerce Parkway	Infiltration Basin	0.0	0.0	0.0	0.0%	4.1%	0.0%	0.00
	904P	Commerce Park Outlot 3 -South Pond	Wet Basin	0.7	0.0	0.7	91.6%	4.1%	87.5%	0.58
	901P	Commerce Park Outlot 2 -near I-94	Wet Basin	0.1	0.0	0.1	79.5%	4.1%	75.4%	0.04
	902P	Commerce Park Outlot 3 -North Pond	Wet Basin	0.2	0.0	0.2	97.4%	4.1%	93.3%	0.15
	903P	Commerce Park Outlot 3 -Central Pond	Wet Basin	0.0	0.0	0.0	88.4%	4.1%	84.3%	0.04
	905P	Commerce Park Outlot 1 -Southeast Corner	Wet Basin	0.0	0.0	0.0	79.4%	4.1%	75.3%	0.01
	328P	Quarry Ridge at intersection of Crysta and Maria	Dry Basin	1.4	0.0	1.4	0.0%	4.1%	0.0%	0.00
	326.1P	Willow Run Estates east of Cory	Dry Basin	2.9	1.4	4.3	0.0%	4.1%	0.0%	0.00
	326.2P	Willow Run Estates east of Cory	Infiltration Basin	0.0	4.3	4.3	96.5%	4.1%	92.4%	3.94
	326.3P	Willow Run Estates east of Cory	Dry Basin	0.0	0.1	0.1	0.0%	4.1%	0.0%	0.00
	317P-Wtlnd	Cottage Grove Elementary Wetland Area east of school	Wetland	6.9	0.1	7.0	0.0%	4.1%	0.0%	0.00
	302P	Arrowwood Estates pond west of Hawthorne Ct (Old Quarry)	Wet Basin	14.1	6.7	20.8	87.5%	4.1%	83.4%	17.35
	303P	DNR Glacial Drumlin Trail parking area pond	Wet Basin	0.4	0.0	0.4	95.3%	4.1%	91.2%	0.40
	913P	Huston Olde Town Pond	Wet Basin	2.9	0.0	2.9	88.7%	4.1%	84.6%	2.47
	908P	Landmark pond of LP gas expansion	Wet Basin	3.4	0.0	3.4	89.7%	4.1%	85.6%	2.87
	924P	Fireman's Park pond south of proposed parking lot near Vilas Rd	Infiltration Basin	0.1	0.0	0.1	99.9%	4.1%	95.8%	0.05
	923P	Fireman's Park pond west of proposed parking lot near Vilas Rd	Bioretention Basin	0.0	0.0	0.0	99.9%	4.1%	95.8%	0.01
	925P	Fireman's Park pond between ne and nw fields on the south side	Infiltration Basin	0.0	0.0	0.0	0.0%	4.1%	0.0%	0.00
	926P	Fireman's Park pond at southeast corner of northeast field	Infiltration Basin	0.0	0.0	0.0	99.9%	4.1%	95.8%	0.00
	922P	Fireman's Park pond south of the northwest field	Dry Basin	0.0	0.0	0.0	0.0%	4.1%	0.0%	0.00
	921P	Fireman's Park WRC clubhouse pond near Clark Street	Bioretention Basin	0.0	0.0	0.0	0.0%	4.1%	0.0%	0.00
	309P	Drainage area south of Progress Drive near railroad tracks	Dry Basin	4.9	0.0	4.9	0.0%	4.1%	0.0%	0.00
	312P	Southlawn 1st Addtn west of Wealdbridge Road midblock	Dry Basin	2.0	0.0	2.0	0.0%	4.1%	0.0%	0.00
	323P-Wtlnd	Coyle Highland South Wetland	Wetland	1.5	2.0	3.5	0.0%	4.1%	0.0%	0.00

Village of Cottage Grove Stormwater Quality Plan
TABLE 1B - Individual Existing BMPs and Street Sweeping Removal Efficiencies (Model 2)

	BMP ID	BMP Location	Pond Type	Regulated Watershed Load (tons/year)			TSS Removal Efficiency (%)			TSS Trapped by BMP after Sweeping (tons/yr)
				Direct	Upstream	Total	Stand Alone BMP[1]	Stand Alone Street Sweeping	Net BMP After Street Sweeping	
MODEL 2	310P	Southlawn pond south of Southing Grange near creek	Dry Basin	1.4	0.0	1.4	0.0%	4.1%	0.0%	0.00
	311P	Southlawn pond west of Donkel Court near creek	Dry Basin	1.5	0.0	1.5	0.0%	4.1%	0.0%	0.00
	308P	Oakengate pond south of Community Park (outlot 1)	Dry Basin	2.9	0.0	2.9	0.0%	4.1%	0.0%	0.00
	313.1P	Southlawn pond southeast of Roland Court (outlot 1)	Dry Basin	0.5	0.0	0.5	0.0%	4.1%	0.0%	0.00
	313.2P	Southlawn pond southeast of Tyanna Court (outlot 2)	Dry Basin	0.4	0.0	0.4	0.0%	4.1%	0.0%	0.00
	313.3P	Southlawn pond along Southing Grange (outlot 3)	Dry Basin	0.4	0.0	0.4	0.0%	4.1%	0.0%	0.00
	203P	Pond east of Willow Run at center block	Dry Basin	0.8	0.0	0.8	0.0%	4.1%	0.0%	0.00
	106P	Westlawn 2nd Addtn West of Westlawn Drive.	Dry Basin	2.7	0.0	2.7	0.0%	4.1%	0.0%	0.00
	122P	Piggly Wiggly South	Wet Basin	2.0	0.0	2.0	60.1%	4.1%	56.0%	1.11
	121P	Piggly Wiggly North	Dry Basin	1.5	0.8	2.3	0.0%	4.1%	0.0%	0.00
	907P	Glacial Drumlin Middle School pond	Dry Basin	1.3	0.0	1.3	0.0%	4.1%	0.0%	0.00
	111P	Coyle Highland North pond E of Sandpiper Trail near Post Office	Wet Basin	7.3	1.3	8.6	83.5%	4.1%	79.4%	6.80
	109P-Wtlnd	Wetland in southeast quadrant of Coyle Highland North	Wetland	1.2	3.6	4.8	0.0%	4.1%	0.0%	0.00
	119P	Apartment building Pond east of Piggly Wiggly	Dry Basin	1.6	0.1	1.7	0.0%	4.1%	0.0%	0.00
	914aP	Coyle Highland South Basin	Wet Basin	0.8	4.6	5.4	79.8%	4.1%	75.7%	4.07
	914bP	Coyle Highland Outlot Basin	Infiltration Basin	0.0	1.1	1.1	41.7%	4.1%	37.6%	0.40
	112P	Coyle Highlands Northeast Corner of Plat	Wet Basin	1.0	0.0	1.0	96.5%	4.1%	92.4%	0.94
	125P	Westlawn 3rd Addtn Southeast of Stoney Hill	Wet Basin	2.0	0.0	2.0	94.5%	4.1%	90.4%	1.77
	105P	Quarry Ridge Near CTH N	Dry Basin	2.1	0.0	2.1	0.0%	4.1%	0.0%	0.00
	104P	Northlawn Near CTH N	Dry Basin	0.5	2.1	2.6	0.0%	4.1%	0.0%	0.00
	124P	Westlawn 3rd Addtn between Conservancy Ct and Lindsay Ct	Dry Basin	1.6	0.0	1.6	0.0%	4.1%	0.0%	0.00
	2CP	Drainage Swale between Lindsay and Smithland	Dry Basin	0.1	1.6	1.7	0.0%	4.1%	0.0%	0.00
	1CP	Drainage Swale south of Smithland	Dry Basin	0.1	1.7	1.8	0.0%	4.1%	0.0%	0.00
	123P	Coyle Highlands, North Plat Line near Lindsay Way	Wet Basin	0.1	1.8	1.9	76.1%	4.1%	72.0%	1.37
	103P	Northlawn Northeast of Taylor Prairie School	Dry Basin	5.3	3.0	8.3	0.0%	4.1%	0.0%	0.00
	107P	Northlawn East of Taylor Prairie School	Dry Basin	5.8	1.5	7.3	0.0%	4.1%	0.0%	0.00
	102P	Northlawn South of Taylor Prairie School	Dry Basin	4.0	16.8	20.7	0.0%	4.1%	0.0%	0.00
	202P	Planned Park Area N of Parkview and Willow Run intersection	Wet Basin	1.6	0.7	2.3	66.6%	4.1%	62.5%	1.45
	200P	Crawford Plat drainage area between CTH BB and Woodview	Dry Basin	17.9	0.8	18.8	0.0%	4.1%	0.0%	0.00
	110P	Westlawn South of Mourning Dove	Dry Basin	4.0	0.3	4.3	0.0%	4.1%	0.0%	0.00
	917P-Wtlnd	Wetland in Westlawn 3rd Addtn	Wetland	2.8	24.9	27.7	0.0%	4.1%	0.0%	0.00
	101P	Westlawn 2nd Addtn west of West Oak Street	Dry Basin	1.7	32.5	34.2	0.0%	4.1%	0.0%	0.00
	100P	Monona State Bank Pond	Dry Basin	2.1	33.5	35.7	0.0%	4.1%	0.0%	0.00
	314P-Wtlnd	Wetland south of Black Bear Tavern west of Community Park	Wetland	11.5	55.6	67.1	0.0%	4.1%	0.0%	0.00
	327P-Wtlnd	Southlawn wetland near old lift station site	Wetland	0.0	73.0	73.0	0.0%	4.1%	0.0%	0.00

Village of Cottage Grove Stormwater Quality Plan
TABLE 2 - Sum Total of Individual Existing BMPs and Street Sweeping Removal Efficiencies

	TSS Load Removed (Tons/Year)	Percent of Regulated Load
Total TSS Load Captured by Existing Street Sweeping	8.4	4.1%
Total TSS Load Captured by Existing BMPs after Street Sweeping	54.9	26.9%
Total TSS Removed by Existing BMPs from Regulated City Load:	63.3	31.0%

Village of Cottage Grove Stormwater Quality Plan
TABLE 4. Proposed Pond Locations Removal Efficiency

BMP-ID	Location & BMP Description	Direct Watershed Load (tons/yr)	Upstream Load (tons/yr)	Total Load (tons/yr)	Existing BMP TSS Load Trapped (tons/yr)	Stand Alone BMP Removal Efficiency[1] (%)	TSS Load Trapped (tons/yr)	Street Sweeping Removal Efficiency[2] (%)	Net BMP Removal Efficiency after Street Sweeping[3] (%)	TSS Trapped by BMP after Street Sweeping and Existing Pond Removal (tons/yr)	Overall Regulated Area TSS Reduction (%)	Estimated Pond Cost[4]	Cost Effective-ness ($ per ton removed)	Stand-Alone Cost Effective-ness Rank
Prop-101P	Existing Dry Pond, Westlawn 2nd Addtn west of West Oak Street, Convert to wet basin	1.7	14.9	16.6	0.0	72.1%	11.9	4.1%	68.0%	11.3	5.5%	$ 139,215	$ 12,358	1
Prop-102P	Existing Dry Pond, Northlawn South of Taylor Prairie School, Convert to Infiltration basin	4.0	10.2	14.1	0.0	51.4%	7.3	4.1%	47.3%	6.7	3.3%	$ 93,093	$ 13,931	2
Prop-309P	Existing Dry Pond, Drainage area south of Progress Drive near RR tracks, Convert to wet basin	4.9	0.0	4.9	0.0	80.5%	4.0	4.1%	76.4%	3.8	1.8%	$ 53,922	$ 14,303	3
Prop-107P	Existing Dry Pond, Northlawn East of Taylor Prairie School, Convert to Infiltration basin	5.8	1.5	7.3	0.0	90.7%	6.6	4.1%	86.6%	6.3	3.1%	$ 122,044	$ 19,379	4
Prop-308P	Existing Dry Pond, Oakengate pond south of Community Park, Convert to wet basin	2.9	0.0	2.9	0.0	81.1%	2.4	4.1%	77.0%	2.2	1.1%	$ 49,718	$ 22,224	5
Prop-110P	Existing Dry Pond, Westlawn South of Mourning Dove, Convert to wet basin	4.0	0.0	4.0	0.0	91.7%	3.7	4.1%	87.6%	3.5	1.7%	$ 103,720	$ 29,242	6
Prop-302P	Existing Wet Pond, Arrowwood Estates pond west of Hawthorne Ct, Retro-fit outlet	14.1	4.6	18.7	17.4	92.6%	17.3	4.1%	88.5%	1.2	0.6%	$ 46,540	$ 39,116	7
Prop- 307P	Existing 1-ft deep wet Pond, Tanglewood pond west of Tanglewood Ct, Add 2-ft of Wet Storage to basin and retro-fit outlet	5.3	1.6	6.9	4.1	92.4%	6.4	4.1%	88.3%	2.6	1.2%	$ 110,609	$ 43,362	8

1. Stand Alone BMP Removal Efficiency is equal to the Total Watershed TSS Load Received/TSS Load Trapped.
2. Stand Alone Street Sweeping Removal is the percent removal achieved by existing street sweeping schedule
3. Net BMP Removal Efficiency After Street Sweeping is equal to the Stand Alone BMP Efficiency minus the Stand Alone Street Sweeping Efficiency
4. Pond cost is the estimated construction cost, plus the assessed land value of parcel (if not City owned)

Village of Cottage Grove Stormwater Quality Plan
TABLE 5. Proposed Pond Locations in Series

Series Set		Scenarios	Overall Regulated Area TSS Reduction for Specific Scenario (%)	Estimated Cost of Combination	Cost Effectiveness ($ per ton removed)
Series Set A Pond 307P → Pond 302P	A1.	Pond 307P on, Pond 302P off	0.35%	$110,609	$154,763
	A2.	Pond 302P on, Pond 307P off	0.40%	$46,540	$56,978
	A3.	Pond 307P and Pond 302P on	0.60%	$157,149	$128,264
Series Set B Pond 107P → Pond 102P → Pond 101P	B1.	Pond 107P on, Ponds 102 & 101 off	3.08%	$122,044	$19,405
	B2.	Ponds 107 & 101 off, Pond 102 on	3.54%	$93,093	$12,878
	B3.	Ponds 107 & 102 off, Pond 101 on	9.34%	$139,215	$7,299
	B4.	Ponds 107 & 102 on, Pond 101 off	6.50%	$215,137	$16,209
	B5.	Ponds 107 & 101 on, Pond 102 off	12.04%	$261,259	$10,626
	B6.	Ponds 102 & 101 on, Pond 107 off	10.50%	$232,308	$10,835
	B7.	All three ponds on	13.32%	$354,352	$13,028
Series Set C Pond 110P → Pond 101P	C1.	Pond 110 off, Pond 101 on	9.34%	$139,215	$7,299
	C2.	Pond 110 on, Pond 101 off	1.74%	$103,720	$29,192
	C3.	Ponds 110 & 101 on	9.78%	$242,935	$12,165
Stand Alone 308P	D1.	Pond 308P on	1.10%	$49,718	$22,134
Stand Alone 309P	E1.	Pond 309P on	1.80%	$53,922	$14,670

Village of Cottage Grove Stormwater Quality Plan
TABLE 6 - Proposed Street Sweeping Model Alternatives

	Location	Sweeping Type	Frequency	Parking Controls	Regulated TSS Load (tons/5yr)		Percent Removal by Sweeping
					Generated	Removed by Sweeping	
Existing	Regulated Village Limits	Vacuum	2x per Year	No	1045.1	43.2	4.1%
Proposed	Regulated Village Limits	Vacuum	Every 8 Weeks	No	1045.1	50.4	4.8%
	Regulated Village Limits	Vacuum	Every 2 Weeks	No	1045.1	91.3	8.7%
	Regulated Village Limits	Vacuum	Every 2 Weeks	Yes	1045.1	142.6	13.6%

Appendix C

WDNR Modeling Guidance

CORRESPONDENCE/MEMORANDUM

State of Wisconsin

DATE: June 6, 2005

TO: Regional Water Leaders, Basin Leader & Experts
Storm Water Permit Staff (via Email)

FROM: Russ Rasmussen, Director
Bureau of Watershed Management

SUBJECT: Developed Urban Areas and the 20% and 40% TSS Reductions
Sections NR 151.13(2) and NR 216.07(6), Wis. Adm. Code

This document is intended solely as guidance, and does not contain any mandatory requirements except where requirements found in statute or administrative rule are referenced. This guidance does not establish or affect legal rights or obligations, and is not finally determinative of any of the issues addressed. This guidance does not create any rights enforceable by any party in litigation with the State of Wisconsin or the Department of Natural Resources. Any regulatory decisions made by the Department of Natural Resources in any matter addressed by this guidance will be made by applying the governing statutes and administrative rules to the relevant facts.

Issue

Under s. NR 151.13 (2), Wis. Adm. Code, a municipality subject to the municipal storm water permit requirements of subch. I of ch. NR 216, Wis. Adm. Code, must, to the maximum extent practicable, implement a 20% and a 40% reduction in total suspended solids in runoff that enters waters of the state as compared to no controls, by March 10, 2008 and March 10, 2013, respectively. Staff who work with affected municipalities need guidance on what areas under the municipalities' jurisdictions will be included in this requirement. They also need to know what is meant by "no controls" and "with controls", and what methods are acceptable for making these calculations.

Discussion

Chapter NR 216, Wis. Adm. Code, is the implementation code for the developed urban area performance standard. Applicability for permit coverage purposes is dictated by s. NR 216.02, Wis. Adm. Code. Under this provision, owners or operators of the following municipal separate storm sewer systems (MS4s) are required to obtain coverage under a WPDES municipal storm water permit:

- MS4s serving populations of 100,000 or more.
- Previously notified owners or operators of municipal separate storm sewer systems.
- MS4s within urbanized areas as identified by EPA.
- MS4s serving populations over 10,000 unless exempted by DNR.

"MS4" means a conveyance or system of conveyances, including roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, constructed channels or storm drains, which meets all the following criteria:

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- Owned or operated by a municipality.
- Designed or used for collecting or conveying storm water.
- Not a combined sewer conveying both sanitary and storm water.
- Not part of a publicly owned wastewater treatment works that provides secondary or more stringent treatment.

Under s. NR 216.07(6)(a), Wis. Adm. Code, a municipality must develop a stormwater management program to achieve compliance with the developed urban area performance standard (s. NR 151.12(2), Wis. Adm. Code). Developed areas are generally those that were not subject to the post-construction performance standards (s. NR 151.12 or NR 151.24, Wis. Adm. Code). The total suspended solids control requirements of s. NR 151.13(2)(b)1.b. and 2., Wis. Adm. Code, may be achieved on an individual municipal basis. Control does not have to apply uniformly across the municipality. The control may also be applied on a regional basis by involving several municipalities.

A municipality is required under s. NR 216.07(6)(b), Wis. Adm. Code, to provide an assessment of the actions taken to comply with the performance standards. This assessment may take the form of an annual progress report. The initial assessment must include a pollutant-loading analysis using a model such as SLAMM, P8 or equivalent methodology that is approved by the department. At a minimum, a pollutant-loading analysis must be conducted for total suspended solids and phosphorus. A model would not be run again after the initial assessment unless significant management changes occurred that should be accounted for, or the progress report indicates a re-run is necessary.

DNR Guidance

To comply with the code, the developed urban area must be modeled under a "no control" condition and a "with controls" condition. The 20% and 40% TSS reductions are assessed against the "no control" condition for the entire area served by the MS4 as defined below. They are not applied uniformly across the municipality, nor are they applied drainage area by drainage area within the municipal boundary. In most cases however, a calculation drainage basin by drainage basin will be used to determine the total loading and the achieved reductions.

Areas Required to be Included in the Calculations

A municipality must include the following areas when calculating compliance with the developed urban area standard (s. NR 151.13, Wis. Adm. Code):

1. Any developed area that was not subject to the post-construction performance standards of s. NR 151.12 or 151.24, Wis. Adm. Code, that went into effect October 1, 2004 and that drains to the MS4 owned or operated by the municipality.
2. Any area covered by an NOI submitted prior to October 1, 2004 where development is still underway. The pollutant load shall be based on full build out. If it is known that the future development of some parcels may require compliance with s. NR 151.12 or NR 151.24, Wis. Adm. Code, then these areas may be excluded from the calculation.
3. Any undeveloped (in-fill) areas under 5 acres. These areas must be modeled as fully developed, with a land use similar to the properties around them.
4. For municipalities with large areas of agricultural lands separating areas of development, only the areas within the urbanized area as defined by the U.S. Census Bureau.

5. Non-manufacturing areas of industrial facilities such as customer or employee parking lots. (The manufacturing, outside storage and vehicle maintenance areas of these industrial facilities are covered under a subch. II of ch. NR 216, Wis. Adm. Code, industrial permit.)
6. Any industry that has certified a condition of "no exposure" in accordance with s. NR 216.21(3), Wis. Adm. Code.
7. Any developed urban area where it is already established that the area will be annexed by the municipality prior to March 10, 2008. There must be an agreement with the municipality that will be losing the area, to prevent double counting.

Areas Prohibited from Inclusion in the Calculations

Areas and loadings that shall not be included:

1. Lands zoned for agricultural use and operating as such.
2. Pollutant loadings from an upstream MS4 (independent of whether it is regulated under a ch. NR 216, Wis. Adm. Code, permit)
3. Any internally drained area with natural infiltration. (This does not included engineered or constructed infiltration areas.) However, an internally drained area that discharges to a karst feature is not likely to be receiving adequate treatment prior to any contact with the groundwater. The municipality is encouraged to look at this area for possible treatment options.
4. Undeveloped land parcels over 5 acres within the municipality. These areas will be subject to s. NR 151.12 or 151.24, Wis. Adm. Code, when developed.

Optional Areas to Include in the Calculations

Areas a municipality may, but is not required to, include in the developed urban area load calculation:

1. Property that drains to *waters of the state* without passing through the permittee's MS4. Waters of the state include surface water, wetlands and groundwater and has the meaning given in s. 283.01(20), Stats. Waters of the state may overlap with the definition of MS4. For this purpose, if a waterway meets the definition of an MS4 it will be regulated as an MS4. The definition for MS4 is given in s. NR 216.002(17), Wis. Adm. Code. The significant language in that definition is whether or not the municipality owns or operates the drainage way (i.e., maintains, has easement access for work, etc.). For example, when a "stream" is designed or used for collecting or conveying storm water such as flowing through a municipally owned or operated culvert or bridge restriction, that "stream" is part of the MS4.
2. Any area that discharges to an adjacent municipality's MS4 (Municipality B) without passing through the jurisdictional municipality's MS4 (Municipality A). Municipality B that receives the discharge into their MS4 may choose to be responsible for this area from Municipality A. If Municipality B has a treatment device that serves a portion of A as well as a portion of B, then the practice must be modeled as receiving loads from both areas, independent of who carries the responsibility for the area.
3. Industrial facilities subject to a permit under subch. II of ch. NR 216, Wis. Adm. Code. This exclusion covers the facilities that are required to have permit coverage. Contact the regional stormwater specialist or central office to get a list of permitted facilities within a municipality.
    - The industrial NR 216 permit covers areas with industrial materials and activities, specifically areas with manufacturing, vehicle maintenance, storage of materials, etc.

A municipality may include any of the areas identified above in their developed urban area as part of their load calculation provided the areas are not prohibited from inclusion in the calculation. If they choose to include an area, it must be included in both the "no controls" and "with controls" condition. Inclusion of areas they choose to be responsible for will allow them to take credit for any of those areas that may have

controls in place. For example, if an industrial park would have been excluded because all the industries in the industrial park have an NR 216 industrial permit, but the municipality chooses to keep this area in their "no controls" area, then any best management practices existing or built to serve the industrial park can be included in the "with controls" scenario.

Model Inputs

Model Version:
To model the TSS load in the area served by the MS4 the municipality must select a model that can track particle distribution. Such models include SLAMM and P8. In general, a municipality must use the most current version of a model that is available at the time of the analysis. However, a municipality may use an earlier version of a model if it was previously used to calculate loads in the municipality and these loads were documented in a stormwater management plan, database, or other report. The most current versions of SLAMM and P8 will be accessible through the DNR website with links to the authors. A summary of past versions and the changes made with each SLAMM update will also be posted. The DNR has recently received a grant to help upgrade P8 to a Windows format.

As part of the reporting process, the municipality must identify which version it is using. It must use the same version for both the "no controls" scenario and the "with controls" scenario. If an older version of the model is used, this may mean that as the model is updated a municipality cannot take credit for some practices that are only available in the most recent models. In order to take credit for practices that are in recent versions of the models, both the "no controls" and "with controls" scenario must be run with the latest model. A municipality must run all drainage basins in the developed urban area with the same model and model version.

"No control"
The "no controls" condition can be based on the standard land use files for different land uses in SLAMM. This assumes certain default parameter files, an assumed level of disconnection and an assumed distribution of road smoothness. For the drainage system, the default will be curb and gutter (even if the drainage system is currently swale drainage), in fair condition. For "no controls" there will be no recognition of street sweeping, catch basin cleaning, swale drainage, or the existence of any engineered best management practices. These practices and facilities will be accounted for under the "with controls" condition. A municipality is not required to use the standard land use files if it has surveyed the land uses in its developed urban area and has "real" source area data on which to base the input files.

"With controls"
The "with controls" condition is applied to the developed urban area with the inclusion of the practices and facilities (existing and proposed). Modeling is a means to confirm a device's efficiency for the conditions found in Wisconsin. If the model cannot predict efficiencies for certain practices that the municipality identifies as water quality practices, then a literature review must be conducted to estimate the reduction value. However, proprietary devices that utilize settling as their means of solids reduction should be modeled as catch basins with sumps. The efficiency of proprietary devices that utilize filtration as a means of solids reduction cannot currently be modeled using SLAMM.

Practices on private property that drain to an MS4 can be included in the "with controls" scenario for a municipality, if the municipality is able to ensure that the practice will continue to be maintained. The efficiency of the practice on private property must be modeled using the best information the municipality

can obtain on the design of the practice. For example, permanent pool area is not sufficient information to know the pollutant reduction efficiency of a wet detention basin even if it matches the area requirements identified in Technical Standard 1001 Wet Detention Basin for an 80% reduction. Information on the depth of the sediment storage layer and the outlet design are critical features that determine whether a detention pond is providing 80% TSS reduction.

As information on proprietary practices or new stormwater designs becomes available through monitoring, the model will be adjusted to reflect changes in efficiency.

Again, future versions of the model can be used to evaluate the "with controls" condition, but only if the "no controls" scenario is also run with the new version.

Further clarifications

- If a portion of a municipality's MS4 drains to a stormwater treatment facility in an adjacent municipality, the municipality generating the load will not receive any treatment credit unless there is an inter-municipal agreement for maintenance of the BMP. This contract must be in writing with signatures from both municipalities at the time of the evaluation.
- The model results will be the basis for determining compliance with the permit for "no controls" and "with controls" TSS load. No credit will be given for implementation of ordinances or information and education programs.
- For reporting purposes, the pollutant load must be summarized as the cumulative total for the developed urban area served by the MS4. Additionally pollutant loads for grouped drainage areas as modeled shall also be reported. Drainage areas may be grouped at the discretion of the modeler for such reasons as to emphasize higher priority areas, balance model development with targeting or for cost-effectiveness.

Approved By:

Gordon Stevenson, Chief
Runoff Management Section

Eric S. Rortvedt
Storm Water Program Coordinator

Appendix D

Alternative Structural BMPs
Concept Designs
&
Cost Estimates

Village of Cottage Grove Stormwater Analysis

Proposed Water Quality Pond

Pond Prop-308P
Oakengate Pond South of Community Park

Legend

- Corporate Limits
- Study Limits
- Proposed Storm Sewer
- Existing Storm Sewer
- City Parcels
- Proposed Pond
- Wetland Indicators

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Prop-308P	**Oakengate Pond south of Community Park (Outlot 1)**					
	Proposed Water Quality Pond					
	Convert Existing Dry Pond to Wet Pond					
Item	**Description**	**Unit**	**Unit Price**	**Quantity**	**Extension**	
1)	Excavation	CY	$4	1,290	$5,160	
2)	Outlet Structure Inspection	EA	$300	1	$300	
3)	Erosion Control	LS	$1,600	1	$1,600	
4)	Re-Stabilization	SY	$2.00	2,900	$5,800	
	DIRECT COST SUBTOTAL				$12,860	
	Additional Detailed Engineering Studies				$3,000	
	Unexpected Design Details		30%		$3,858	$25,000 Cap
	* Engineering Costs		15%		$30,000	$30,000 Min.
	PROBABLE CONSTRUCTION COST ESTIMATE				$49,718	
5)	Land Purchase	LS	$0	1.0	$0	
	Prorate from Assessed to Market Value		10%		$0	
	TOTAL CONCEPTUAL COST ESTIMATE (2008)				**$49,718**	

Notes:
* Engineering Cost to include: Geotechnical, Environmental, Construction Mgmt., Survey, Legal Costs, Property Investigation, Environmental Phase 1 & 2, Design, Plans & Specs., Bid, Construction Observation.

Village of Cottage Grove Stormwater Analysis

Proposed Water Quality Pond

Pond Prop-302P
Arrowwood Estates Pnd
West of Hawthorne Ct

Legend

- Corporate Limits
- Study Limits
- Proposed Storm Sewer
- Existing Storm Sewer
- City Parcels
- Proposed Pond
- Wetland Indicators

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Prop-302P	**Arrowwood Estates Pond west of Hawthorne Ct.**					
	Retro-fit Outlet of Existing Water Quality Pond					
	Retro-fit Existing Outlet					
Item	**Description**	**Unit**	**Unit Price**	**Quantity**	**Extension**	
1)	Excavation	CY	$4	0	$0	
2)	RCP Cost and Installation	LF	$45	67	$3,015	
3)	Outlet	EA	$4,500	1	$4,500	
4)	Erosion Control	LS	$1,650	1	$1,650	
5)	Re-Stabilization	SY	$2.00	625	$1,250	
	DIRECT COST SUBTOTAL				$10,415	
	Additional Detailed Engineering Studies				$3,000	
	Unexpected Design Details		30%		$3,125	$25,000 Cap
	* Engineering Costs		15%		$30,000	$30,000 Min.
	PROBABLE CONSTRUCTION COST ESTIMATE				$46,540	
6)	Land Purchase	LS	$0	1.0	$0	
	Prorate from Assessed to Market Value		10%		$0	
	TOTAL CONCEPTUAL COST ESTIMATE (2008)				**$46,540**	

Notes:
* Engineering Cost to include: Geotechnical, Environmental, Construction Mgmt., Survey, Legal Costs, Property Investigation, Environmental Phase 1 & 2, Design, Plans & Specs., Bid, Construction Observation.

Village of Cottage Grove Stormwater Analysis

Proposed Water Quality Pond

Pond Prop-307P
Tanglewood Pond West
of Tanglewood Ct.

Legend

- Corporate Limits
- Study Limits
- Proposed Storm Sewer
- Existing Storm Sewer
- City Parcels
- Proposed Pond
- Wetland Indicators

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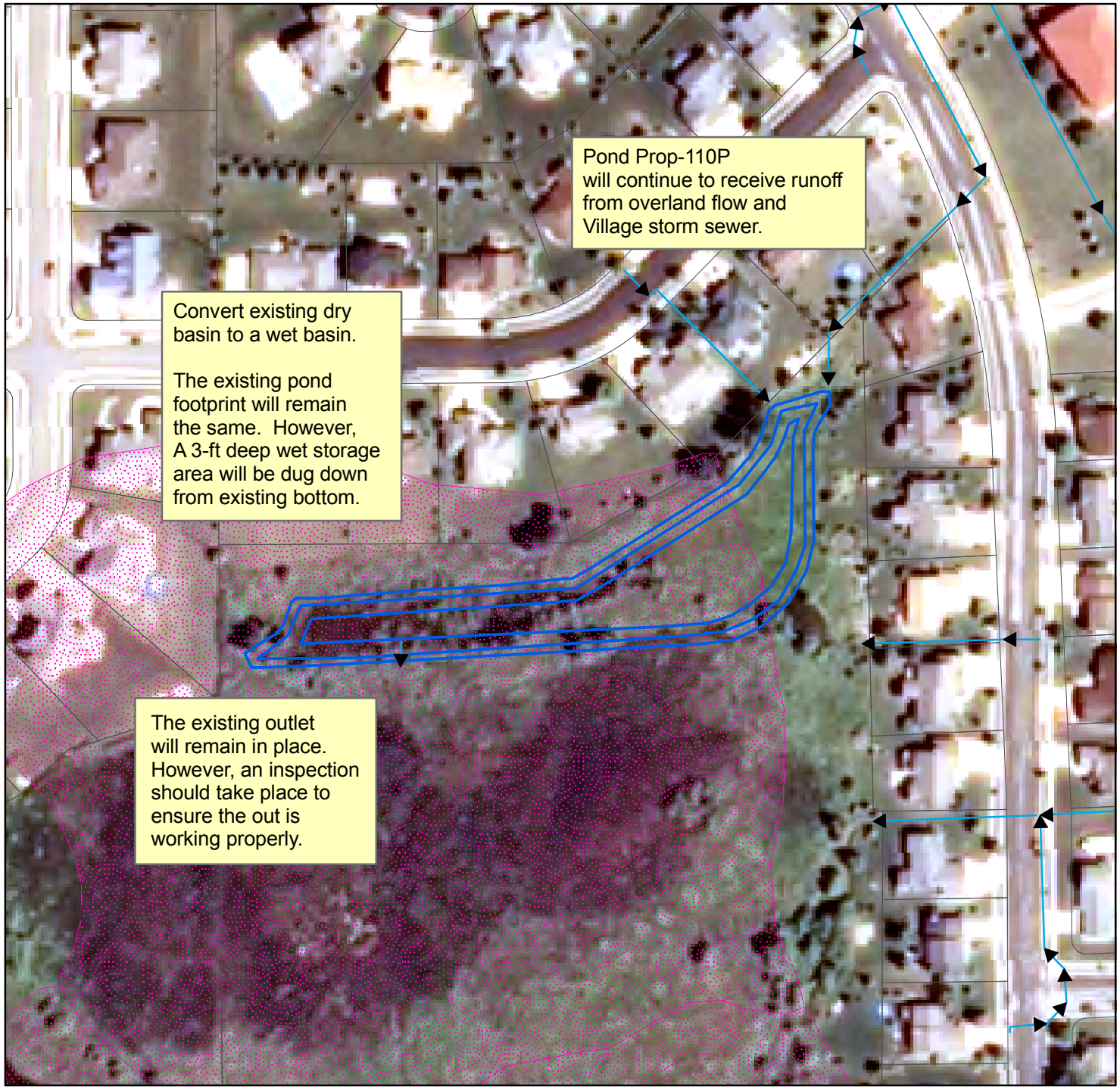
Prop-307P	**Tanglewood Pond West of Tanglewood Ct (outlot 1)**					
	Proposed Water Quality Pond					
	Convert Existing Dry Pond to Wet Pond and Retro-fit Existing Outlet					
Item	**Description**	**Unit**	**Unit Price**	**Quantity**	**Extension**	
1)	Excavation	CY	$4	10,650	$42,600	
2)	RCP Cost and Installation	LF	$45	50	$2,250	
3)	Outlet	EA	$3,000	1	$3,000	
4)	Erosion Control	LS	$3,525	1	$3,525	
5)	Re-Stabilization	SY	$2.00	4,162	$8,324	
	DIRECT COST SUBTOTAL				$59,699	
	Additional Detailed Engineering Studies				$3,000	
	Unexpected Design Details		30%		$17,910	$25,000 Cap
	* Engineering Costs		15%		$30,000	$30,000 Min.
	PROBABLE CONSTRUCTION COST ESTIMATE				$110,609	
6)	Land Purchase	LS	$0	1.0	$0	
	Prorate from Assessed to Market Value		10%		$0	
	TOTAL CONCEPTUAL COST ESTIMATE (2008)				**$110,609**	

Notes:
* Engineering Cost to include: Geotechnical, Environmental, Construction Mgmt., Survey, Legal Costs, Property Investigation, Environmental Phase 1 & 2, Design, Plans & Specs., Bid, Construction Observation.



Village of Cottage Grove Stormwater Analysis

Proposed Water Quality Pond

Pond Prop-110P
Westlawn South of Mourning Dove

Legend

- Corporate Limits
- Study Limits
- Proposed Storm Sewer
- Existing Storm Sewer
- City Parcels
- Proposed Pond
- Wetland Indicators

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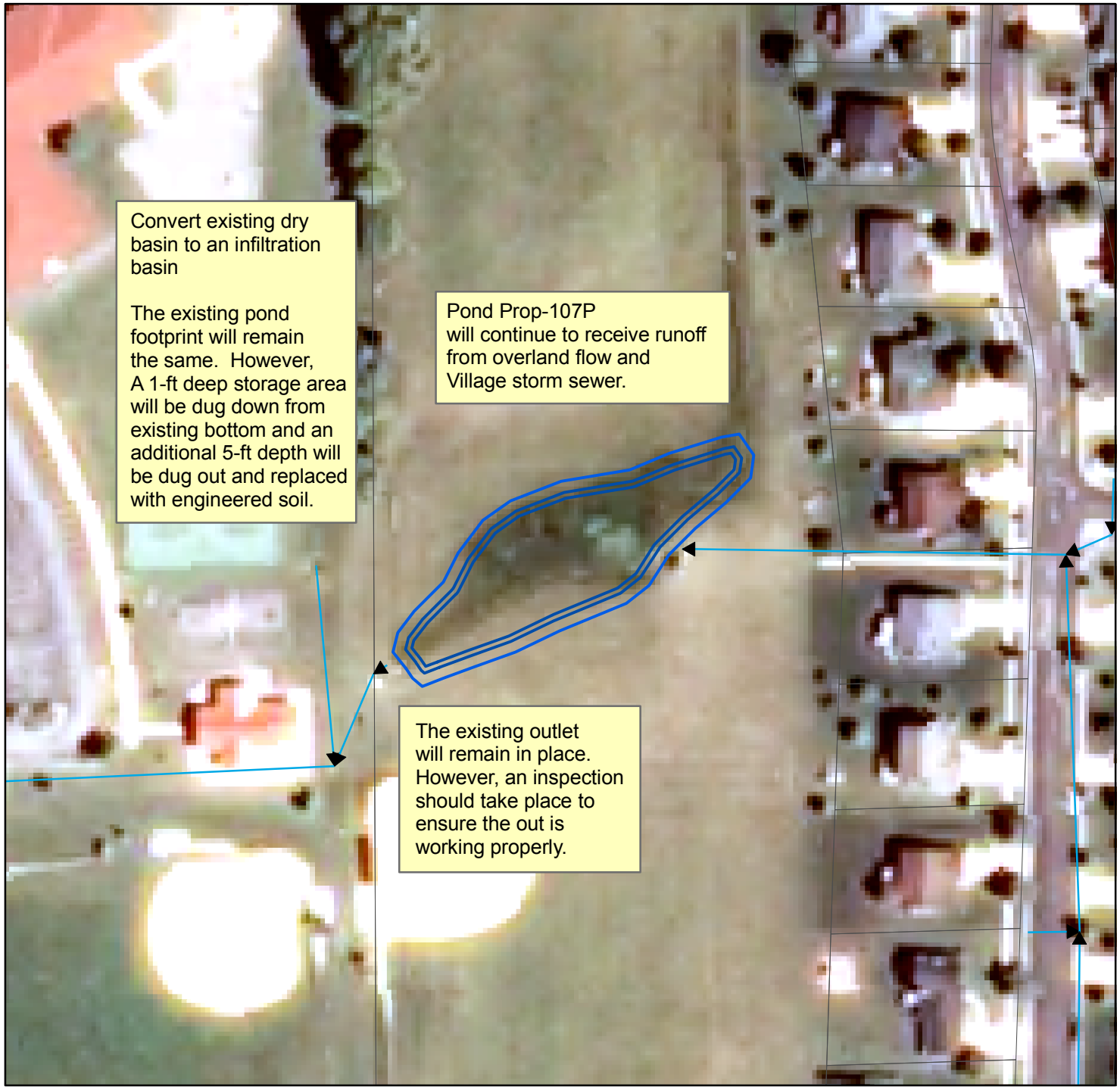
R-110P	**Westlawn, South of Mourning Dove**					
	Proposed Water Quality Pond					
	Convert Existing Dry Pond to Wet Pond					
Item	**Description**	**Unit**	**Unit Price**	**Quantity**	**Extension**	
1)	Excavation	CY	$4	11,070	$44,280	
2)	Outlet Structure Inspection	EA	$300	1	$300	
3)	Erosion Control	LS	$2,650	1	$2,650	
4)	Re-Stabilization	SY	$2.00	3,585	$7,170	
	DIRECT COST SUBTOTAL				$54,400	
	Additional Detailed Engineering Studies				$3,000	
	Unexpected Design Details		30%		$16,320	$25,000 Cap
	* Engineering Costs		15%		$30,000	$30,000 Min.
	PROBABLE CONSTRUCTION COST ESTIMATE				$103,720	
5)	Land Purchase	LS	$0	1.0	$0	
	Prorate from Assessed to Market Value		10%		$0	
	TOTAL CONCEPTUAL COST ESTIMATE (2008)				**$103,720**	

Notes:
* Engineering Cost to include: Geotechnical, Environmental, Construction Mgmt., Survey, Legal Costs, Property Investigation, Environmental Phase 1 & 2, Design, Plans & Specs., Bid, Construction Observation.



Village of Cottage Grove Stormwater Analysis

Proposed Water Quality Pond

Pond Prop-107P
Northlawn East of
Taylor Prairie School

Legend

- Corporate Limits
- Study Limits
- Proposed Storm Sewer
- Existing Storm Sewer
- City Parcels
- Proposed Pond
- Wetland Indicators

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Prop-107P	**Northlawn East of Taylor Prairie School**					
	Proposed Infiltration Basin					
	Convert Existing Dry Pond to Infiltration Basin					
Item	**Description**	**Unit**	**Unit Price**	**Quantity**	**Extension**	
1)	Excavation	CY	$4	2905	$11,620	
2)	Engineered Soil	CY	$25	2,200	$55,000	
3)	Outlet Structure Inspection	EA	$300	1	$300	
4)	Erosion Control	LS	$1,575	1	$1,575	
5)	Re-Stabilization	SY	$2.00	2,130	$4,260	
	DIRECT COST SUBTOTAL				$68,495	
	Additional Detailed Engineering Studies				$3,000	
	Unexpected Design Details		30%		$20,549	$25,000 Cap
	* Engineering Costs		15%		$30,000	$30,000 Min.
	PROBABLE CONSTRUCTION COST ESTIMATE				$122,044	
6)	Land Purchase	LS	$0	1.0	$0	
	Prorate from Assessed to Market Value		10%		$0	
	TOTAL CONCEPTUAL COST ESTIMATE (2008)				**$122,044**	

Notes:
* Engineering Cost to include: Geotechnical, Environmental, Construction Mgmt., Survey, Legal Costs, Property Investigation, Environmental Phase 1 & 2, Design, Plans & Specs., Bid, Construction Observation.

Village of Cottage Grove Stormwater Analysis

Proposed Water Quality Pond

Pond Prop-101P
Westlawn 2nd Addition
West of W. Oak St.

Legend

- Corporate Limits
- Study Limits
- Proposed Storm Sewer
- Existing Storm Sewer
- City Parcels
- Proposed Pond
- Wetland Indicators

200 100 0 Feet

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Prop-101P	**Westlawn 2nd Addtion, West of West Oak Street**					
	Proposed Water Quality Pond					
	Convert Existing Dry Pond to Wet Pond					
Item	**Description**	**Unit**	**Unit Price**	**Quantity**	**Extension**	
1)	Excavation	CY	$4	12475	$49,900	
2)	Outlet Structure Inspection	EA	$300	1	$300	
3)	Erosion Control	LS	$4,400	1	$4,400	
4)	Re-Stabilization	SY	$2.00	13,552	$27,104	
	DIRECT COST SUBTOTAL				$81,704	
	Additional Detailed Engineering Studies				$3,000	
	Unexpected Design Details		30%		$24,511	$25,000 Cap
	* Engineering Costs		15%		$30,000	$30,000 Min.
	PROBABLE CONSTRUCTION COST ESTIMATE				$139,215	
5)	Land Purchase	LS	$0	1.0	$0	
	Prorate from Assessed to Market Value		10%		$0	
	TOTAL CONCEPTUAL COST ESTIMATE (2008)				**$139,215**	

Notes:
* Engineering Cost to include: Geotechnical, Environmental, Construction Mgmt., Survey, Legal Costs, Property Investigation, Environmental Phase 1 & 2, Design, Plans & Specs., Bid, Construction Observation.

Village of Cottage Grove Stormwater Analysis

Proposed Water Quality Pond

Pond Prop-102P
Northlawn South of Taylor Prairie School

Legend

- Corporate Limits
- Study Limits
- Proposed Storm Sewer
- Existing Storm Sewer
- City Parcels
- Proposed Pond
- Wetland Indicators

100 50 0 Feet

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Prop-102P	**Northlawn South of Taylor Prairie School**					
	Proposed Infiltration Basin					
	Convert Existing Dry Pond to Infiltration Basin					
Item	**Description**	**Unit**	**Unit Price**	**Quantity**	**Extension**	
1)	Excavation	CY	$4	1940	$7,760	
2)	Engineered Soil	CY	$25	1,290	$32,250	
3)	Outlet Structure Inspection	EA	$300	1	$300	
4)	Erosion Control	LS	$1,475	1	$1,475	
5)	Re-Stabilization	SY	$2.00	2,220	$4,440	
	DIRECT COST SUBTOTAL				$46,225	
	Additional Detailed Engineering Studies				$3,000	
	Unexpected Design Details		30%		$13,868	$25,000 Cap
	* Engineering Costs		15%		$30,000	$30,000 Min.
	PROBABLE CONSTRUCTION COST ESTIMATE				$93,093	
6)	Land Purchase	LS	$0	1.0	$0	
	Prorate from Assessed to Market Value		10%		$0	
	TOTAL CONCEPTUAL COST ESTIMATE (2008)				**$93,093**	

Notes:
* Engineering Cost to include: Geotechnical, Environmental, Construction Mgmt., Survey, Legal Costs, Property Investigation, Environmental Phase 1 & 2, Design, Plans & Specs., Bid, Construction Observation.