MAPPING POTENTIALLY RESTORABLE WETLANDS IN THE ROCK RIVER BASIN

Final Report to the U.S. Environmental Protection Agency, Region V
Wetland Grant # CD 96544501-0

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Executive Summary

The Rock River Basin area is the third location in Wisconsin where potentially restorable wetlands (PRWs) have been mapped. The Rock River Basin is the largest area to be analyzed so far, at 2.3 million acres, covering some or all of 11 counties. Using the previous two study sites as guides, the methods have been refined and improved. To expedite the process time, input datasets have been chosen that have statewide cover. Therefore, the mapping decisions made for this basin, can be applied to other watersheds or basins in the future.

Our calculations show that the Rock River Basin had about 632,297 acres of wetlands in presettlement times. Of those, 270,667 acres, or 42.8%, have been lost due to agricultural, residential and transportation development. This coarse analysis shows that 87.6% of the lost wetland acres in the Rock River Basin have some potential to be restored.

To be considered a PRW, an area must have hydric soil, not be currently mapped as a wetland, and have a land use compatible with restoration techniques. Maps made with the layer can be used for a landscape level analysis of wetland restoration potential. For example, the layer can be used as the input for plans to improve water quality, provide flood storage, expand wildlife habitat or to increase recreational opportunities.

Metrics calculated for each subwatershed can help to compare their relative need for restoration within the basin. The Relative Need score reflects both the relative amount of wetlands lost and the prevalence of original (pre-settlement) wetlands in the subwatershed. Subwatersheds of higher Need are those that originally had a larger percentage of wetlands, but have lost a large amount. The Potential Opportunity score indicates where a large percentage of the lost wetlands can potentially be restored.

This PRW layer will initially be used to aid implementation of a watershed plan to clean up rivers, stream and lakes impaired by polluted runoff in the Rock River Basin. The plan, known as a Total Maximum Daily Load (TMDL) analysis, identified pollutant reduction goals needed to bring over 40 waterbodies into compliance with water quality standards. The PRW layer will allow managers to locate where wetland restoration can contribute the most toward achieving the pollutant reduction goals.

With all of the advancements in GIS technology, the data processing techniques change quite a bit with each new area analyzed. The process outlined in this report uses the most current GIS analysis tools, but it should not be considered a fixed procedure. As new basins are analyzed, the decision rules will have to be reevaluated, to account for differences in the landscape.

CHAPTER 1: INTRODUCTION

Previous Studies

Figure 1: Study Areas

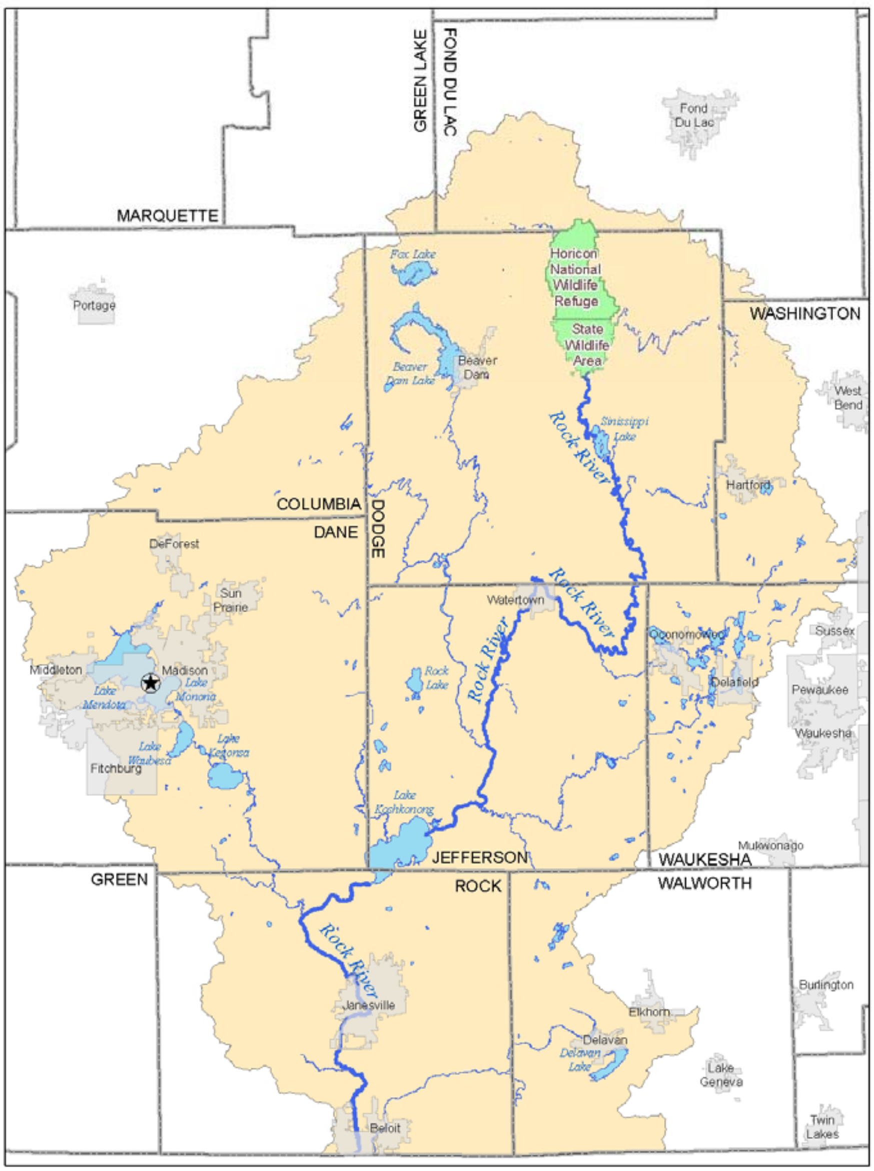
The process to map potentially restorable wetlands in Wisconsin was first developed through an EPA grant-funded DNR project in the Milwaukee River Basin in 2006. The methodology was repeated, with some modifications, for Mead Lake Watershed in 2007. Local landuse datasets, with different landuse categories, were used in each of the studies. Because of regional differences, decisions on what would be considered a hydric soil also differed. Rock River Basin marks the third time this process has been carried out. This time, however, the data sources were all statewide datasets, so the process outlined below should be applicable to future watershed projects. The methods have also changed slightly each time because the GIS software has been updated to new versions with new tools available each time.

The proposed objective for this study is to create a dataset that can be incorporated into the Water Assessment Tracking and Electronic Reporting System (WATERS), to help expand the WDNR's capacity for wetland management at the watershed scale. The addition of wetland condition as a component of the 305(b) reports to EPA will be a first step in better integrating wetland assessment into the surface water program.

The Rock River Basin

The Rock River Basin is comprised of 2.3 million acres of land in the glaciated portion of south central Wisconsin. The most dominant geologic features are extensive drumlin fields in several counties. The Wisconsin portion of the Rock River Basin covers approximately 3,750 square miles, and includes parts or all of eleven counties. The basin is largely agricultural, with expanding urban areas. The basin includes the internationally recognized Horicon Marsh, a migration stopover for many birds. The area is home to Madison, the state capital, and the Yahara chain of lakes. The Rock River continues to flow southwest and meets the Mississippi River in Illinois.

Figure 2: Rock River Basin in Wisconsin



Application to Total Maximum Daily Load (TMDL) Efforts

The DNR is in the process of developing a TMDL to improve impaired waters in the Rock River Basin. Over 40 waterbodies in the basin are listed as impaired waters. Impaired waters are defined in Section 303d of the federal Clean Water Act as not meeting the state's water quality standards or use designations. The Rock River TMDL will focus on the waterbodies that are impaired by excessive sediment and phosphorus. These pollutants can cause low dissolved oxygen, degraded habitat and excessive turbidity in waterways, resulting in harm to fish and aquatic life, water quality, recreation and even navigation. The TMDL will provide a quantitative analysis of the amount of sediment and/or phosphorus that the waterbodies can receive from both point and nonpoint sources and still meet water quality standards.

The potentially restorable wetlands layer will be useful in implementation of the TMDL, because it allows analysis of wetland restoration as part of the solution to the impaired water problem. Wetlands can act as filters and can function to remove sediment and nutrients from polluted runoff before it reaches downstream waterbodies. The PRW layers can be used to plan out different scenarios of wetland restoration and analyze their potential contribution to reducing sediment and phosphorous loads to downstream waters.

For more information on the Rock River TMDL analysis, go to http://www.dnr.state.wi.us/org/water/wm/wqs/303d/RockRiverTMDL/

Additional Applications of the PRW layer

In addition to applying the PRW layer to TMDL implementation, there are other applications of the data. Two major uses are described below.

The Need and Opportunity scores can be used as global measures to target areas where wetland restoration can have the greatest benefits. These should be particularly useful to federal state and local agencies planning restoration and acquisition efforts in the Basin.

The Department will be refining GIS decision tools to assess specific functional benefits that wetland restoration can achieve for water quality improvement, flood storage and wildlife habitat. The tools will analyze the provision of these key ecosystem services by existing wetlands and allow a relative comparison of where wetland restoration can provide the most benefit for each service. The PRW layer is an essential input for these tools.

CHAPTER 2: POTENTIALLY RESTORABLE WETLANDS

IDENTIFYING POTENTIALLY RESTORABLE WETLANDS

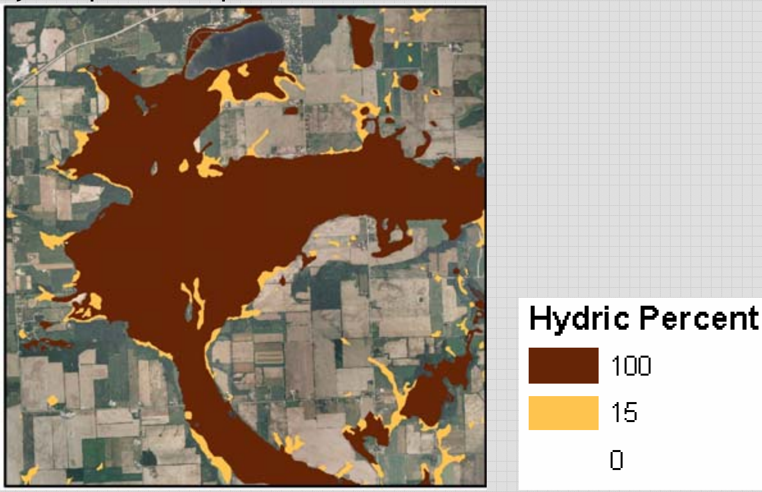
The original pilot study in the Milwaukee River Basin (MRB) began by evaluating the role of existing wetlands in improving water quality, flood control, or wildlife habitat, and then focused on identifying where restored wetlands would have the greatest ecological impact. The concept of a potentially restorable wetland (PRW) emerged, and is based on **three criteria**:

- there had to be favorable soil conditions to support a wetland (hydric soils);
- the site could not currently be mapped as a wetland (if so, it could be a candidate for an enhancement or rehabilitation project rather than a restoration);
- there had to be opportunities for restoring a site to a functioning wetland. Opportunity was defined as having a compatible land use.

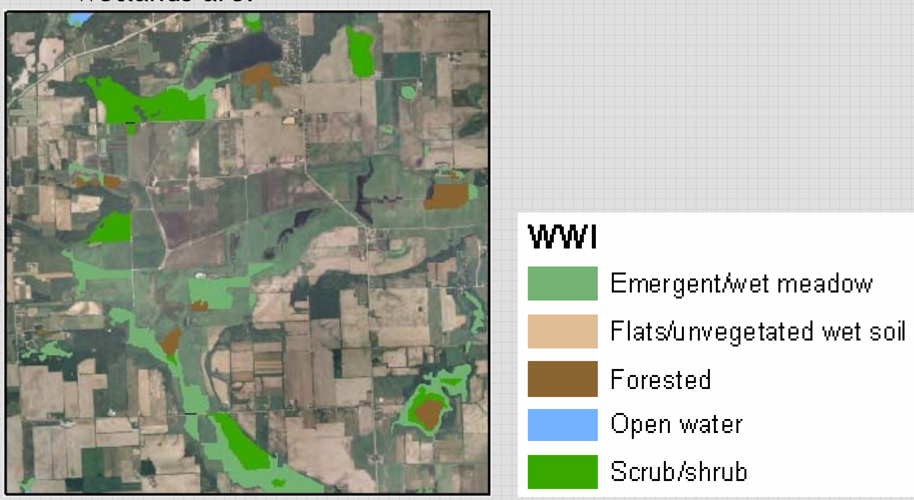
These key concepts were the core elements of both the MRB project and the Mead Lake Watershed project. Figure 3 below illustrates in simplified fashion, how GIS data sets (discussed in Chapter 3) were utilized to develop the potentially restorable wetland (PRW) layer. The area in Figure 3 is a subset of the subwatershed known as L0105, in Walworth County.

Figure 3: Photo Series of GIS Process

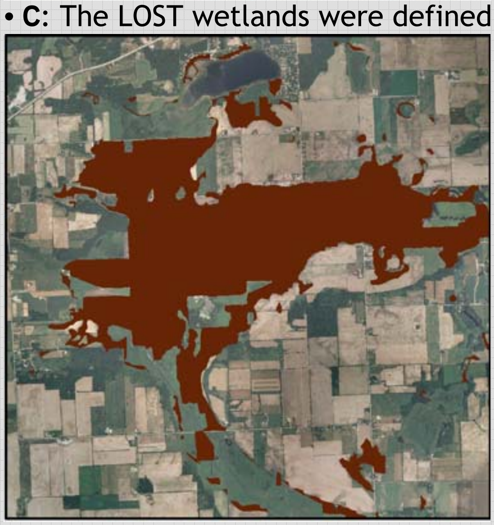
• **A**: The soils polygons from NRCS were classified by percent hydric. Those ≥85% hydric provide a picture of the ORIGINAL wetlands.



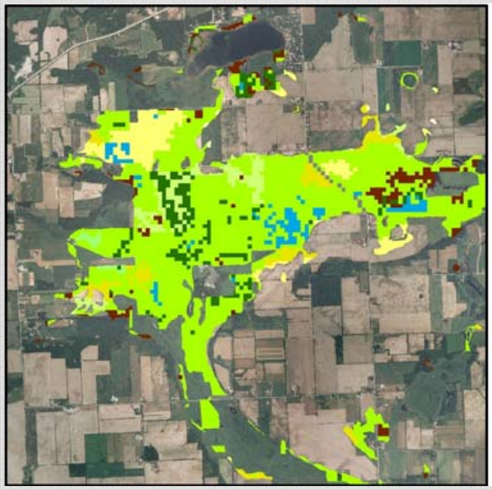
• **B**: The Wisconsin Wetland Inventory (WWI) layer showed where the REMAINING wetlands are.



• **C**: The LOST wetlands were defined as original, but no longer remaining.



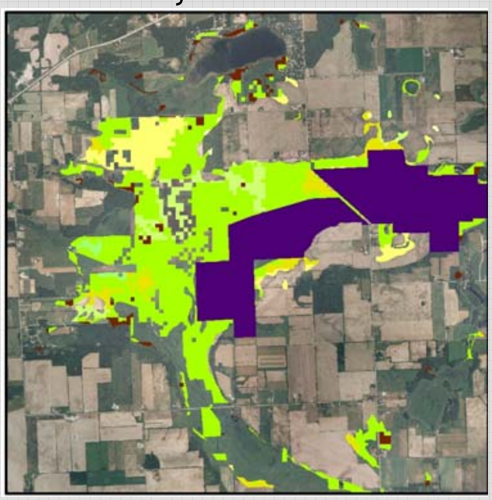
• **D:** Areas marked as wetlands in National Agriculture Statistics Service's (NASS) 2006 cropland layer were also considered REMAINING**.** Land uses were taken from NASS and overlaid on the LOST wetlands to locate areas with land use likely to be compatible with restoration (cropland, fallow fields, shrubland, and woodland).



Land Uses

Corn, all
Soybeans
Idle Cropland/Fallow/CRP
Pasture, Non-ag, Range, Waste, Farmstead
Woodland
Water
Wetlands

• **E**: Previously restored sites are excluded. These came from GIS data compiled from existing databases from USDA-NRCS, USFWS and from WDNR field staff reports in 2006 and 2007.



USDA-NRCS WRP sites

Restored Areas

• **F**: Potentially Restorable Wetlands (PRWs) emerge as areas that have favorable soil conditions, compatible land uses, and are not existing wetlands. PRW1 soils are potentially restorable areas currently in open land cover. PRW2 soils are potentially restorable areas currently in shrub or wooded land cover.

Potentially Restorable Wetlands

open (cropped or idle fields)
wooded (shrub or woodland)

LIMITATIONS

The scope of this study is limited to a landscape level of analysis, which cannot replace on-site investigation for any individual restoration project. The data allow for relative comparisons between subwatersheds in relation to the needs and opportunities for wetland restoration. However, the feasibility of any individual wetland restoration requires much more detailed site analysis than this study provides. For instance, land owners must be willing, and the ability to complete a wetland restoration without adversely affecting neighbors' properties must be ascertained before a restoration can be feasible.

Before choosing a site for restoration, a more thorough analysis of the area is necessary. Other data sources could be referenced, including historical aerial photos, anecdotal evidence of previous land cover or water and soil conditions, and ground-truth surveys to verify the data in the PRW layer.

The user should be aware that the input data layers had varying dates of currency and resolution. We had to make decisions about which layer to "trust" when there were discrepancies between them. The decision rules are detailed in Appendix C. Subsequent projects elsewhere in the state will need to review and possibly modify the decision rules used here.

CHAPTER 3: DATA

DATA PROCESSING

Data Processing Environment

All of the data processing was performed in Environmental Systems Research Institute's, (ESRI) ArcGIS v.9.2 environment, which is the WDNR's standard GIS software. The processing steps included the initial assembly of the data, a clean-up phase, and then the development of the data table. The data table was exported into Microsoft Office Access 2003 to create the metrics tables.

Data Format

There were three main data sources; shapefiles in SDE (Spatial Database Engine), feature classes in a file geodatabase, and raster data in grid format. It was decided to convert all of the inputs to feature class format within a file geodatabase. The raster grid was converted to a polygon feature class.

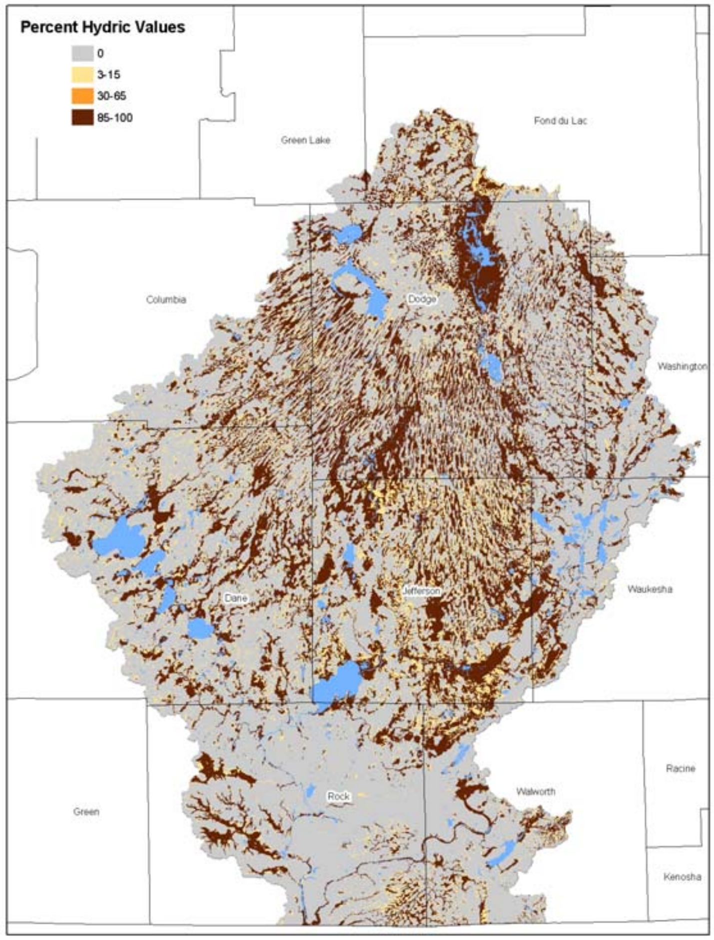
DATA LAYERS

This section outlines the data sources and data processing steps used to create the Rock River Basin Potentially Restorable Wetlands layer. This output layer was used to create the wetland landscape metrics.

Input Layer: HYDRIC SOILS from Natural Resource Conservation Service

For a site to have potential for wetland restoration, it must have soils capable of supporting a wetland. We assumed that the presence of hydric soils where there currently wasn't a mapped wetland was evidence that there had once been a functioning wetland on that site. A hydric soil is defined as a soil that formed under conditions of saturation, flooding or ponding long enough during the growing season to develop anaerobic conditions in the upper part (59 Fed.Reg.35680, 7/13/94).

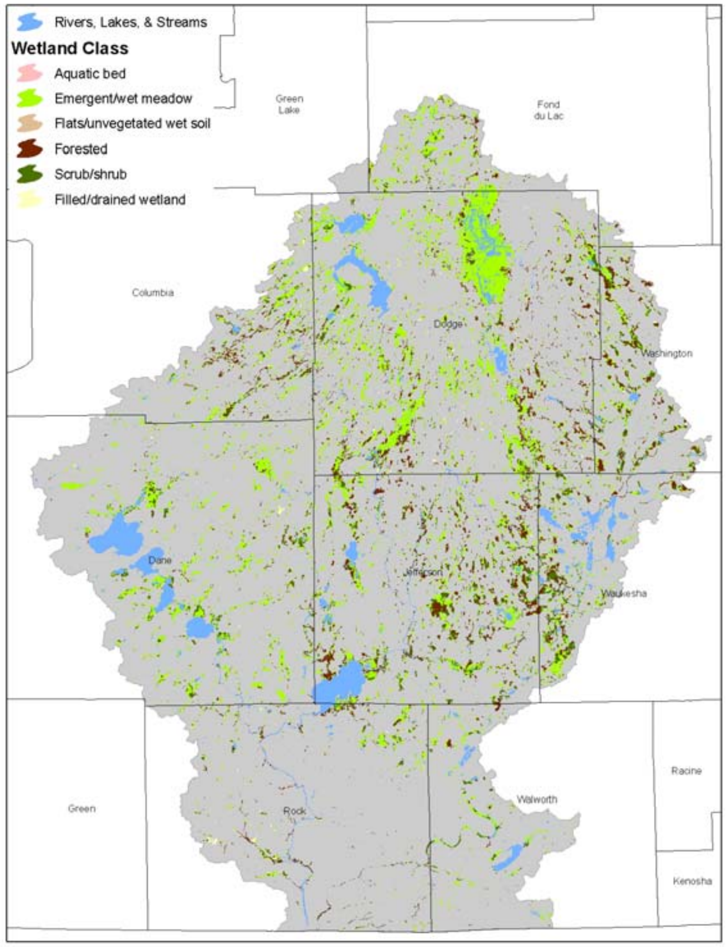
Figure 4: Hydric Soils



In the previous two studies, the hydric rating attribute was used to distinguish hydric soils from non-hydric soils. In the Milwaukee River Basin, only mapping units with a rating of "ALL" were included, meaning the entire mapping unit was hydric, not just parts of it. In Mead Lake, mapping units with a rating of either "ALL" or "PART" were included. For the Rock River Basin, we used a different attribute to distinguish the hydric soils. We looked at the percent hydric value. We determined that any value 85% or greater would be considered hydric. Figure 4 shows the percent hydric values grouped into 3 classes. The darkest shade is the grouping we considered as hydric for our PRW criteria. The map also illustrates that there is a negligible amount of soils in the 30-65% grouping, present only in Dodge and Fond du Lac counties. This made us more confident in our selection of 85% as the cut off. The soil features in this map also bring out the distinctive pattern of the drumlin fields, referred to on page 3.

The Wisconsin Department of Agriculture, Trade and Consumer Protection created a statewide seamless layer of the USDA Natural Resource Conservation Service (NRCS) Soil Survey Geographic (SSURGO) county soils layers. This layer was joined to tabular data from the National Soils Information System (NASIS) database. Field mapping methods using national standards are used to construct the SSURGO soil maps database, the most detailed level of soil mapping done by the NRCS. This level of mapping is designed for use by landowners, townships, and county natural resource planning and management. Digitization is still on-going by NRCS in other states, while currently all counties in Wisconsin have digitized SSURGO soils maps. Information on the SSURGO soils maps can be found at: http://www.soils.usda.gov/survey/geography/ssurgo/

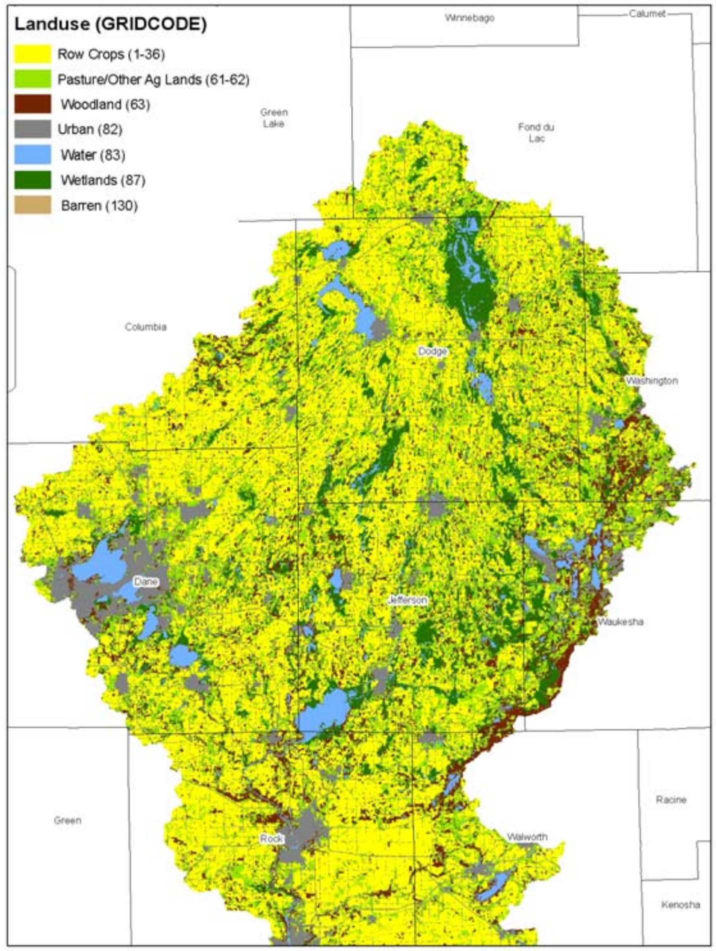
Figure 5: Mapped Wetlands



Input Layer: MAPPED WETLANDS from Wisconsin Wetland Inventory

An up-to-date digital wetland layer is essential to the PRW identification process. By definition, a PRW site cannot currently be functioning as a wetland. The WDNR is charged with maintaining a statewide inventory of wetlands for the purpose of obtaining an accurate record of wetland acreage across the state. The data is called the Wisconsin Wetland Inventory (WWI). The WWI provides additional information on vegetation cover and hydrologic type of mapped wetlands. Figure 5 shows major wetland cover classes. Note the predominance of emergent/wet meadow in the basin. More information about ordering the data or viewing it online in the Surface Water Data Viewer can be found at: http://www.dnr.state.wi.us/wetlands/mapping.html

Figure 6: Land Use



Input Layer: LAND USE from National Agriculture Statistics Service

Wetland restoration opportunities are based on the assumption that certain present land uses are favorable for restoring the site as a functioning wetland. Land uses that were defined as favorable included all cropped fields, idle cropland, fallow fields, CRP fields, pasture, shrubland and woodland. Examples of land uses that were not considered favorable for wetland restoration include urban, water, and barren. Figure 6 shows the different land use categories. Some of the more detailed crop cover classes were grouped together into a single class for display on the map. In the legend, the gridcodes in parentheses show any grouping that may have occurred. All the row crops were treated the same in the decision matrix (in Appendix C). The gridcodes 61 and 62 were both considered to be compatible land uses in the PRW criteria.

The USDA National Agriculture Statistics Service produces yearly a cropland digital data layer for Wisconsin. The 2006 layer was used for this project. Only the crop categories are updated yearly, while the other categories are actually taken from the National Land Cover Dataset produced in 2001. In earlier years this dataset was not considered to be very accurate, but in 2006 changes were made to greatly increase the reliability of the data. This data layer was chosen because it is a statewide layer and the processing and analysis decisions made for this large river basin can be repeated for others. For more information about NASS and to download the data, go to http://www.nass.usda.gov/research/Cropland/SARS1a.htm.

Input Layer: RESTORED WETLANDS from various tracking efforts

Four sources of GIS data were available showing wetland restoration sites. Two were products from DNR: the GIS data layer from the Restoration Tracking Database (RTD) and the digitized restoration sites from the Glacial Habitat Restoration Area (GHRA). Each of the two DNR sources had spatial and temporal pros and cons to using them. The RTD is quite comprehensive, but is still rather new and only has a few years worth of restorations in it. The GHRA does not cover the whole Rock River Basin (only Fond du Lac, and parts of Dodge and Columbia), but it traces back 14 years of restorations. The data from the restoration tracking database is viewable online as a layer in the Surface Water Data Viewer at http://dnrmaps.wisconsin.gov/imf/imf.jsp?site=SurfaceWaterViewer. The third source was from USDA-NRCS, outlining Wetlands Reserve Program (WRP) sites, and the last source was from USFWS, outlining Waterfowl Production Areas (WPA). For the purposes of this mapping project, within the boundaries of both WRPs and WPAs, we assumed that any work that could have been done restoring the wetlands, has been done already.

Input Layer: SUBWATERSHEDS from Soil and Water Assessment Tool (SWAT)
The U.S. Geological Survey (USGS) developed a hierarchical hydrologic unit code (HUC) for the United States. Hydrologic unit boundaries define the aerial extent of surface water drainage to a given point. With every level in the hierarchy, an additional 2-digits are added to the code. For more background on HUCs, go to
http://www.ncgc.nrcs.usda.gov/products/datasets/watershed/history.html

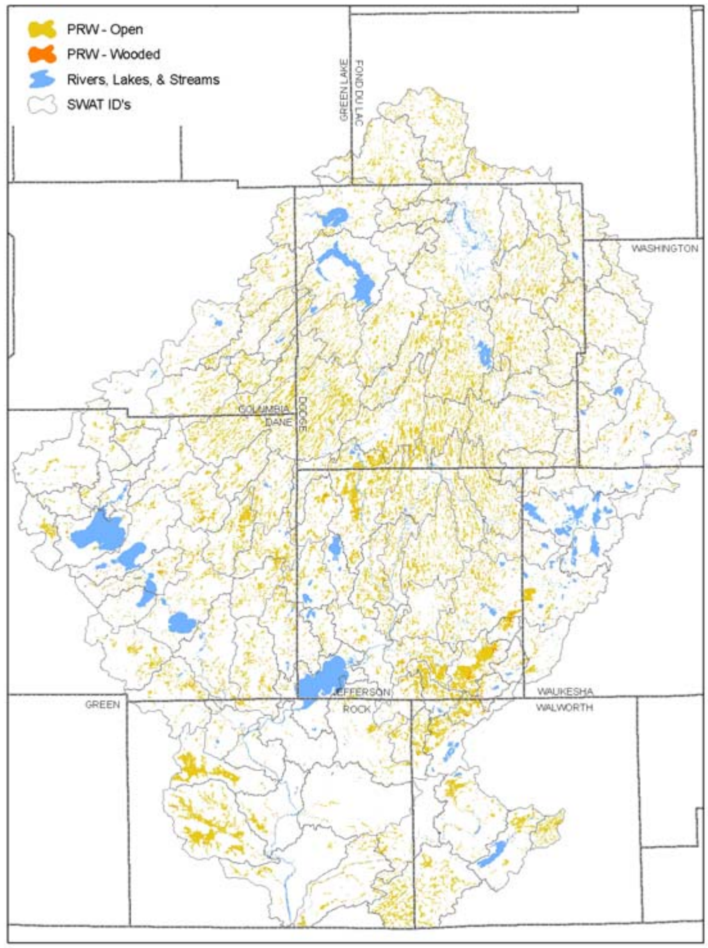
Figure 7: Subwatersheds

The exact HUC boundaries were altered slightly for the Rock River TMDL, in order to separate impaired water segments from the rest of the stream and provide more meaningful inputs for TMDL development.

The Rock River Basin combines two sub-basins, the Lower Rock and the Upper Rock. Each sub-basin is roughly equivalent to an 8-digit HUC. The Rock River Basin contains 20 watersheds. These are similar to the 10-digit HUCs, ranging from 40,000 to 250,000 acres. To calculate metrics that could be used in the TMDL development, a level generally comparable to the 12-digit HUC was used. Smaller units were used to relate to impaired stream segments. These are known as subwatersheds, and there are 112 in the Rock River Basin. In Figure 7, the subwatersheds are labeled in the legend as SWAT ID's, because they were first created for the SWAT modeling tool. The metrics reported in Appendix A are for the 112 SWAT subwatersheds. For more information about the subwatershed boundaries used in this project, contact Kevin Kirsch at kevin.kirsch@wisconsin.gov.

Output Layer: Potentially Restorable Wetlands (PRW)

Figure 8: Potentially Restorable Wetlands



The output layer represents the geometric intersection of hydric soils, mapped wetlands, land use, and subwatersheds. These geo-spatial layers form the foundation for identifying a potential restoration site and understanding the watershed and landscape functions of wetlands. Combined they give an estimate of present conditions in order to conduct a "first cut" identification of wetland restoration opportunity and feasibility. The subwatershed layer was added to facilitate generating metrics. The result is a rich, dense layer that contains information from all input layers. This allows users to determine at any point on the ground conditions such as what soil type is mapped, if there is a mapped wetland, and/or what land use is practiced. The output layer for the Rock River Basin was developed following the processes that were developed for the Milwaukee River Basin and the Mead Lake Basin. One of the major advantages of the output layer is that the user has access to all the attributes from the input layers at his/her disposal. To take full advantage of the output layer, the user will need to thoroughly understand the sources and how the layer was generated.

CHAPTER 4: METRICS, RELATIVE NEED & POTENTIAL OPPORTUNITY

Metrics for the 112 individual subwatersheds are shown in Appendix A. For the basin as a whole, Table 1 shows the total and average values for each category.

Table 1. Rock River Basin Metrics (in Acres)

ACRES	LOST, RESTORED	LOST, PRW1 OPEN	LOST, PRW2 WOODED	LOST, WATER	LOST, URBAN	LOST, FILLED/ DRAINED	LOST, BARREN	REMAINING WETLAND	AG UPLAND PRW 99	OPEN/ WOODLAND UPLAND	URBAN UPLAND	OPEN WATER
TOTAL	5,182	219,709	17,423	4,285	23,157	841	63	361,629	1,291,934	179,305	206,890	62,795
AVERAGE	46	1,962	156	38	207	8	1	3,229	11,535	1,601	1,847	561

The original (pre-settlement) wetlands in the Rock River Basin made up 26.6% of the landscape. Only 57.2% remain. Of the 42.8% lost, 87.6% are potentially restorable based on our analysis. Factors, such as landowner willingness and limiting hydrologic impacts to neighboring properties, will reduce the actual feasibility of restoration. We estimate that roughly 2% of the lost wetlands have been restored, to date, based on WDNR restoration tracking data (WDNR 2007, WDNR 2008).

Relative Need is a landscape scale relative measure of the degree to which wetland restoration in a subwatershed has the potential to make an improvement in wetland functions, such as flood storage, water quality and habitat. This is a global measure based on the assumption that wetland restoration will provide functional improvement, without specifying particular functions. Relative Need reflects both the relative amount of wetlands lost and the prevalence of original (pre-settlement) wetlands. Relative Need is expressed as the ratio of lost wetland acres to remaining wetland acres, multiplied by the percent of the subwatershed that was original wetland. Some of the lost acres have recently been restored through federal, state and non-profit partnerships. These must be subtracted to give a more accurate measure for lost wetlands.

$$\frac{\text{(LOST ACRES – RESTORED ACRES)}}{\text{REMAINING ACRES}} \times \frac{\text{ORIGINAL ACRES}}{\text{SUBWATERSHED ACRES}} \times 100$$

The resulting NEED value does not have units associated with it, and is primarily useful in comparing the relative need of the subwatersheds within the Rock River Basin, at a landscape scale.

Potential Opportunity is similar to Relative Need. The difference is that it takes into account the current landuse, using the relative amount of potentially restorable wetlands, instead of wetlands lost. Potential Opportunity is expressed as the ratio of potentially restorable wetland acres to remaining wetland acres, multiplied by the percent of the subwatershed that was original wetland.

$$\frac{\text{POTENTIALLY RESTORABLE ACRES}}{\text{REMAINING ACRES}} \times \frac{\text{ORIGINAL ACRES}}{\text{SUBWATERSHED ACRES}} \times 100$$

Both the Relative Need scores and the Potential Opportunity scores were adjusted to fit a scale of 100. This makes the score more meaningful to the user. The subwatershed with the highest score for each however, was so high that it was considered an outlier. As a result, the second highest score was adjusted to 100 with the remaining scores scaled below.

Figures 9 and 10 show the Relative Need scores and the Potential Opportunity scores, respectively. They are thematic maps, showing the values grouped into four different classes. The class breaks are the natural breaks, rounded to the nearest whole number. The outlier was given its own color and not included in the classes. The potentially restorable wetlands are visible on top of the class colors. Note that the highest concentrations of PRWs are within the subwatersheds with the highest class of need and potential opportunity scores.

This analysis does NOT consider factors that may be very important in analyzing site-specific restoration conditions. Such factors might include the landscape position of the site in relation to headwaters, connectivity to floodplains and other wetlands, amount and distribution of alluvial sediment deposition, and drainage systems through the site.

Figure 9: Wetland Restoration Relative Need

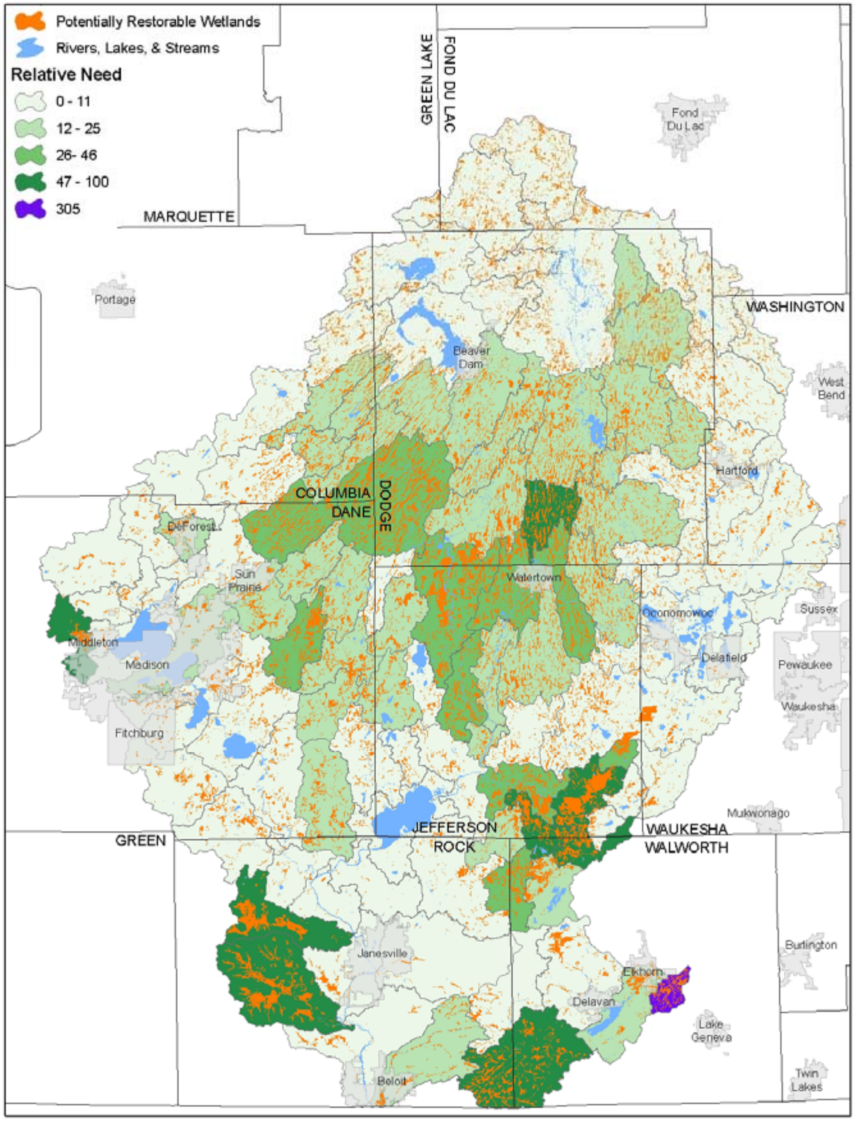
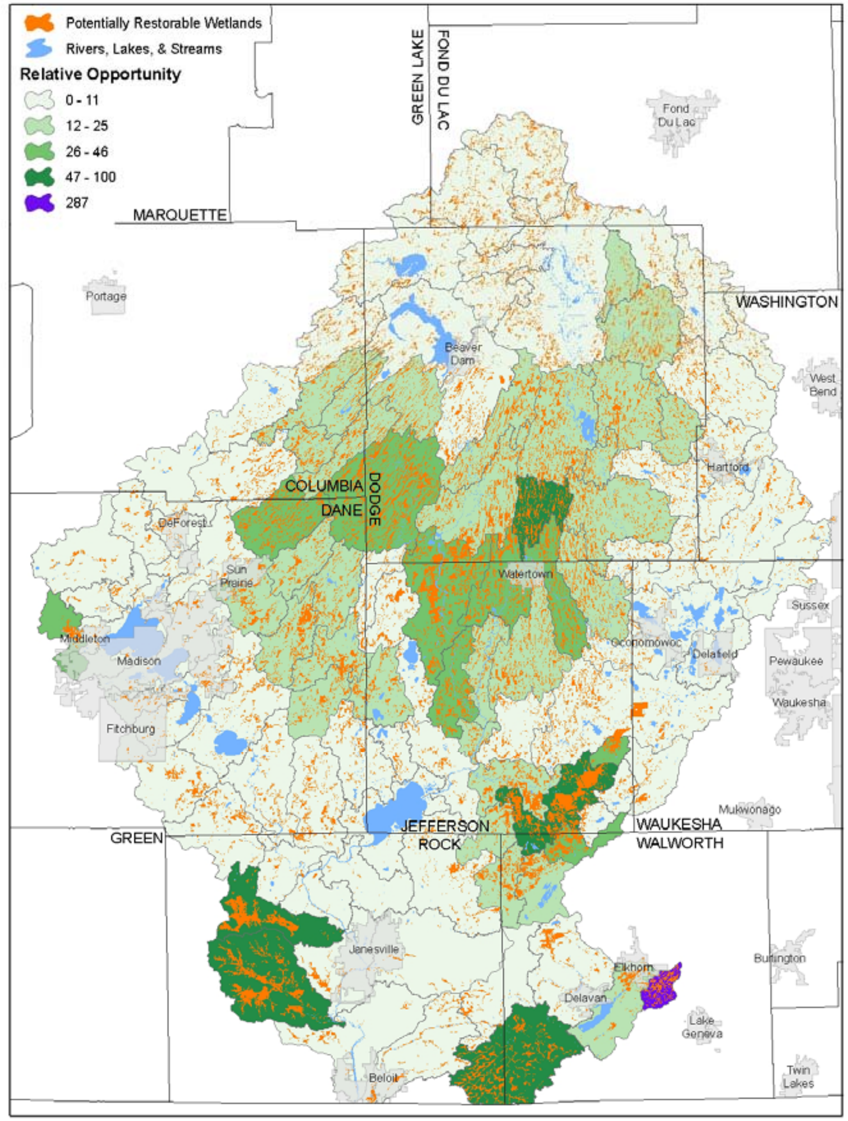


Figure 10: Wetland Restoration Relative Potential Opportunity



CHAPTER 5: SUMMARY

USING ROCK RIVER BASIN PRW INFORMATION

Before using any of the products of the RRPRW project, the User needs to become familiar with the scope and limitations of the PRW process and with the assumptions that underlie the base data layers and the output data layer. Some general considerations include:

- The RRPRW project is a 'first step' in wetland planning. Its products are intended for landscape level analysis. Where this analysis leads to specific sites, decisions to develop further plans at those sites will require on-the-ground assessment.
- The RRPRW project output data layer is intended to be used in conjunction with other planning tools to help meet wetland and water quality related goals of State and local governments, public and private conservation organizations and individual landowners.
- The RRPRW project data is not intended for regulatory use. Wetland boundaries are based on the best available data as of 2007. The least accurate data is at a scale of 1:24000, so site-specific projects will require a field evaluation to determine actual boundary locations.
- The RRPRW project assumes that all wetlands have value and deserve protection. Site-specific factors will cause actual wetlands and potential restoration sites to vary in the type and degree of functions they provide.
- Existing and restored wetlands are not a substitute for other best management practices used to control flooding and to maintain water quality and wildlife habitat.

Voluntary Wetland Restoration

Efforts to restore and rehabilitate wetlands rely on locating potential project sites. Searches for potential wetland restoration sites require time-consuming map reviews and screening before any planning can begin. The identified PRW locations reduce the site search effort. By combining PRW sites with the subwatershed metrics that show which areas have the most restorable wetlands, and where historical wetland loss has had the greatest cumulative effect, we can promote restorations that address ecological needs beyond their project boundaries.

Improved Watershed Planning

The RRPRW project demonstrates that a watershed or basin scale PRW layer can be built with a reasonable amount of expertise and effort, utilizing generally available GIS data layers. The result is far more useful information about the regional status of wetlands and impacts of wetland loss than has been available before. State wetland data lags far behind that of other surface water resources. A broader expansion of the RRPRW project would allow planners a more meaningful view of wetland resources and past wetland impacts and could greatly improve the wetland aspect of the Wisconsin's 305b report.

Flood Storage Analysis

Another potential use of the output layer is in flood remediation analysis. There was a major flooding event in the Basin and in southwestern Wisconsin in June of 2008. As part of the emergency response, a new data layer was developed showing flooded areas. By comparing the PRW layer, the flooded areas layer, and the WWI, an analysis can be conducted to characterize flooded watersheds. Metrics can be calculated to compare the amount of existing wetlands that were flooded, to the amount of lost wetlands that were flooded, and the amount of potentially restorable wetlands that were flooded. It would be instructive to examine where the flooding occurred relative to the wetland status of the flooded areas in different subwatersheds. Further analysis of flood-prone areas from hydraulic models could identify high priority PRW sites for acquisition and restoration.

LESSONS LEARNED: GIS PROCESSING

Deciding on all your input data up front.

The process flow chart shows that the restoration data was added after the “Initial Assembly of Data” step. This is because we did not decide to include it as an input until after that step had been completed. In the future, it is best to decide on all of your input data up front in order to avoid tacking on data in the end. The “Preparation of Restored Wetlands Data” step could have been combined with the “Initial Assembly of Data” step in the beginning so that the restoration data could have been included in the beginning union steps as well. However, having said that, most of the restorations are under 0.5 acre, so they might have been eliminated if they had been included before the clean up phase.

Multipart to Singlepart before or after Eliminate

We only discovered the need to use the multipart to singlepart tool after we ran the first elimination iterations. It was necessary to run the elimination iterations again after the multipart to singlepart tool. We would recommend using the multipart to singlepart tool before any of the eliminations to reduce having to repeat them. However, having said that, there was an initial problem of having too many polygons in the beginning for the eliminate tool to function properly. This was the reason for clipping the layer to the subbasins. We wonder if running the multipart to singlepart tool before the elimination iterations might create too many polygons again. Would this necessitate having to clip the layer into smaller parts?

Buffering the basin boundary before clipping the raster data

We should have buffered the basin boundary before clipping the NASS raster data to prevent a stair step appearance of the grid data along the watershed boundary. Also, there were some areas of the soils and wetlands union that did not overlay with the grid data because of the stair step edge. These are small and really inconsequential, but to have a cleaner output we should have done the buffer first.

CHAPTER 6: LITERATURE CITED

Wisconsin Department of Natural Resources. 2006. Milwaukee River Basin Wetland Assessment Project. Final Report to U.S. EPA – Region V Wetland Grant #97593901.

Wisconsin Department of Natural Resources. 2007. Mead Lake Watershed Wetland Assessment Project: Developing Wetland Landscape Metrics for Effective Planning and Adapting the Milwaukee River Basin Approach for a Small Agricultural Watershed. Final Report to U.S. EPA – Region V Wetland Grant #96511801. PUB-WT-865-2007.

Wisconsin Department of Natural Resources. 2007. Wetland Activities in Wisconsin: Status Report for 2006: Gains, Losses, and Acre Neutral Activities. PUB-WT-882-2007.

Wisconsin Department of Natural Resources. 2008. Wetland Activities in Wisconsin: Status Report for 2007: Gains, Losses, and Acre Neutral Activities. PUB-WT-882-2008.

Earth Tech, Inc. 2000. Prediction of Phosphorus Loads in the Rock River Basin, WI Using SWAT (Soil & Water Assessment Tool). Madison, WI.

APPENDIX A: Comprehensive Land use and PRW Metrics

Note:
Lost, Restored Wetlands
+ Lost, Restorable Open
+ Lost, Restorable Wooded
+ Lost, Not Restorable Water
+ Lost, Not Restorable Urban
+ Lost, Not Restorable Filled/Drained
+ Lost, Not Restorable Barren
= Total Lost Wetland Acres

Note:
Total Lost Wetland Acres
+ Remaining Wetland Acres
+ Ag Upland, PRW 99
+ Open Water
+ Open/Wooded Upland
+ Urban Upland
= SWAT Acres = Total Area

SWAT_ID	LOST, RESTORED WETLANDS	LOST, RESTORABLE OPEN	LOST, RESTORABLE WOODED	LOST, NOT RESTORABLE WATER	LOST, NOT RESTORABLE URBAN	LOST, NOT RESTORABLE FILLED / DRAINED	LOST, NOT RESTORABLE BARREN	TOTAL LOST WETLAND ACRES	REMAINING WETLAND ACRES	AG UPLAND, PRW 99	OPEN WATER	OPEN/WOODED UPLAND	URBAN UPLAND	SWAT ACRES
AFT01	0	120	75	4	13	2	0	213	290	8703	413	3291	719	13630
AFT02	24	4449	57	0	73	0	0	4604	603	14366	0	2422	1071	23071
AFT03	0	337	69	2	140	8	0	555	237	34300	64	2765	7255	45171
AFT04	578	7066	268	5	279	48	0	8243	2004	27336	0	2146	1856	41579
AFT05	0	748	77	41	396	8	0	1269	1477	24326	624	3073	7048	37816
AFT06	0	903	78	19	116	1	0	1117	650	12848	464	2351	7848	25277
AFT07	0	329	131	47	145	0	0	652	5076	8854	10188	2712	1543	29025
AFT08	29	989	116	56	328	3	0	1520	3180	11421	281	1950	3002	21354
AFT09	65	2490	248	3	268	11	0	3085	3521	16112	5	2091	2341	27144
AFT10	1	1572	180	9	116	4	0	1882	3915	13680	189	2043	1008	22714
AFT11	0	1757	206	49	64	0	0	2076	4714	24871	591	4209	1741	38202
AFT12	6	380	39	6	13	0	0	445	1842	4468	8	727	328	7818
AFT13	386	1741	130	414	158	0	0	2829	3008	8550	525	1096	1333	17341
AFT14	0	88	38	1	5	0	0	130	414	12158	348	3509	2683	19242
L0101	0	1542	279	13	217	3	0	2053	786	21145	38	2170	4282	30471
L0102	0	1064	73	4	35	0	0	1176	911	19259	22	1666	1196	24228
L0103	0	1521	33	2	107	0	0	1663	102	3206	7	141	398	5521
L0104	1	1406	69	16	580	0	0	2072	754	11318	1954	1569	2812	20488
L0105	566	2058	201	94	135	0	0	3054	3000	20135	165	2933	3400	32688
L0106	0	6124	115	13	262	0	0	6514	1420	29372	14	1086	2867	41280
L0601	0	292	55	6	21	0	0	375	985	9520	97	1487	468	12931
L0602	125	1996	216	77	236	0	4	2653	5002	21197	3380	3009	4180	39421
L0603	0	1472	219	11	152	4	0	1858	2956	17676	304	2233	3476	28502

SWAT_ID	LOST, RESTORED WETLANDS	LOST, RESTORABLE OPEN	LOST, RESTORABLE WOODED	LOST, NOT RESTORABLE WATER	LOST, NOT RESTORABLE URBAN	LOST, NOT RESTORABLE FILLED/DRAINED	LOST, NOT RESTORABLE BARREN	TOTAL LOST WETLAND ACRES	REMAINING WETLAND ACRES	AG UPLAND, PRW 99	OPEN WATER	OPEN/WOODED UPLAND	URBAN UPLAND	SWAT ACRES
L0701	1	39	15	0	5	0	0	59	216	855	0	97	47	1275
L0702	32	1619	105	21	326	0	0	2104	2091	16672	70	2422	2686	26056
L0703	134	1719	153	19	56	4	0	2085	2663	19173	85	1390	1167	26563
L0801	0	846	232	22	827	2	2	1932	3243	3536	1071	1436	7415	18637
L0802	0	180	88	5	95	0	0	369	1471	6356	1096	1656	941	11891
L0803	0	648	107	33	2903	4	0	3695	1842	4805	3627	1283	14204	29457
L1001	0	273	32	4	39	0	0	349	640	3999	386	393	649	6415
L1002	0	284	12	0	23	0	0	319	521	6449	1	284	539	8113
L1003	0	146	97	20	655	0	0	917	722	1729	9432	1675	8355	22830
L1004	0	801	26	12	383	0	0	1223	142	7026	5	647	2681	11733
L1005	0	595	21	6	161	2	0	785	1546	20921	9	1559	2524	27358
L1201	23	2159	135	149	114	0	0	2580	2899	7605	6	1935	641	15667
L1202	92	3090	185	258	198	1	0	3824	3118	8310	4	1123	825	17202
L1203	36	2019	149	123	644	4	1	2976	1679	10296	177	751	3179	19057
L1204	100	1687	136	74	99	0	0	2095	1857	8308	2	1403	1132	14797
L1301	14	3717	199	60	100	0	3	4094	3731	9180	106	1060	845	19016
L1302	0	82	116	6	100	4	0	309	1429	4160	1780	4022	3910	15613
L1303	0	378	167	10	90	0	3	647	2332	9963	248	2988	2681	18876
L1304	31	5770	861	297	390	5	0	7355	22232	25027	841	8795	3906	68164
L1401	0	2461	61	1	177	0	0	2700	1043	3899	60	375	1419	9497
L1402	0	1213	142	19	65	7	0	1446	1677	5744	2	1089	744	10702
L1403	0	1992	122	115	57	0	0	2286	1931	5345	1004	3613	697	14880
L1404	5	2137	105	73	117	0	0	2438	1603	7142	2	1280	651	13115
L1501	504	5489	277	8	157	1	2	6437	2335	5753	0	705	340	15570
L1502	0	667	140	13	42	0	0	861	5589	4491	19	4211	438	15614
L1503	38	444	76	4	23	0	0	584	1118	2889	73	1371	471	6507
L1504	0	755	77	0	14	0	0	846	519	2206	0	526	133	4230
L1505	0	1809	201	11	64	0	0	2085	873	2844	5	2728	385	8923
L1506	0	424	89	4	18	0	0	535	1371	1417	146	1315	327	5112
U0101	123	1358	153	289	76	0	0	2000	6797	6908	6	1156	760	17628
U0102	0	532	50	13	78	0	0	673	464	2929	185	384	384	5020
U0103	33	4177	355	53	343	0	6	4966	6915	13872	4	1553	1630	28940
U0104	0	3783	246	56	414	6	0	4505	2971	10409	206	831	2423	21341
U0105	0	1392	150	38	190	0	0	1770	1841	6345	419	815	1532	12722
U0106	116	2413	148	203	148	0	2	3030	1594	9618	131	799	932	16104
U0107	255	9083	432	192	463	10	0	10434	7396	16461	542	1614	2241	38688
U0108	74	458	67	11	32	0	1	644	2215	4391	1429	676	647	10002
U0109	29	10562	494	146	669	20	0	11920	7892	28983	113	1901	2267	53072

Rock River Basin: Mapping its Potentially Restorable Wetlands

SWAT_ID	LOST, RESTORED WETLANDS	LOST, RESTORABLE OPEN	LOST, RESTORABLE WOODED	LOST, NOT RESTORABLE WATER	LOST, NOT RESTORABLE URBAN	LOST, NOT RESTORABLE FILLED / DRAINED	LOST, NOT RESTORABLE BARREN	TOTAL LOST WETLAND ACRES	REMAINING WETLAND ACRES	AG UPLAND, PRW 99	OPEN WATER	OPEN/WOODED UPLAND	URBAN UPLAND	SWAT ACRES
U0301	1	2433	128	21	99	10	0	2692	4435	10665	0	770	755	19315
U0302	0	5644	330	23	246	6	0	6250	9869	13989	132	1256	791	32283
U0303	378	1732	109	32	194	71	0	2516	5574	20299	6587	959	3020	38898
U0304	120	2244	96	15	155	15	0	2644	5719	24375	2695	937	2084	38449
U0305	278	2066	226	6	93	8	0	2677	4540	11646	0	1446	872	21188
U0306	0	3912	249	12	257	23	0	4453	3968	13028	65	816	1341	23657
U0307	9	3053	178	17	327	10	0	3594	5248	18659	21	892	2867	31276
U0501	0	750	70	6	109	0	1	936	1787	5396	4	1206	851	10180
U0502	0	4423	148	38	226	0	0	4835	2007	14950	1	663	1272	23728
U0503	154	1593	57	82	61	0	0	1947	2992	8384	2	454	375	14155
U0504	18	1744	146	11	62	0	0	1981	3527	7086	2	1689	663	14948
U0505	7	2038	154	54	197	119	1	2569	2139	10389	12	1426	1116	17634
U0601	0	1353	103	1	90	0	3	1550	1851	6220	82	721	494	10916
U0602	0	1597	50	0	56	17	0	1721	1444	5920	0	325	299	9707
U0603	28	2376	96	15	258	11	2	2787	2861	8180	31	461	937	15253
U0604	49	759	151	5	49	5	0	1016	3912	15180	3	2881	993	23989
U0605	28	2491	145	9	135	0	0	2807	3446	18537	1	1260	1048	27099
U0606	117	1969	149	4	105	17	0	2360	3024	9132	0	1142	531	16187
U0801	31	3312	192	75	276	34	0	3919	1542	7891	21	720	602	14691
U0802	23	3083	283	114	525	5	0	4033	2421	9207	179	1064	1922	18826
U0803	0	812	65	5	90	0	0	973	3588	4610	13	428	324	9936
U0804	0	1335	212	13	162	0	0	1722	4846	15419	229	2297	1277	25789
U0805	0	5655	318	86	527	35	8	6623	7484	14845	2849	1431	2031	35250
U0806	11	3553	371	52	262	30	5	4284	2922	16303	21	2012	1300	26837
U0807	0	1007	39	7	66	7	0	1126	2086	2631	27	212	277	6359
U0808	0	4294	346	50	197	13	5	4905	8032	16792	22	2711	1230	33688
U0809	0	3679	232	38	213	14	2	4177	4908	11675	61	1174	965	22951
U0901	0	1020	143	5	221	0	0	1388	4348	6595	224	786	1888	15230
U0902	0	246	113	9	152	2	0	523	2811	8997	4940	4261	5249	26780
U0903	1	1585	598	20	106	23	0	2335	6661	20258	513	9536	2434	41738
U1101	0	1087	160	1	80	3	0	1332	928	8346	0	710	562	11877
U1102	0	865	60	22	190	24	0	1160	2245	7117	7	458	1868	12855
U1103	0	1693	266	41	165	0	1	2166	3562	10898	37	1914	900	19478
U1104	0	163	46	7	49	2	0	267	1132	2804	444	989	808	6446

SWAT_ID	LOST, RESTORED WETLANDS	LOST, RESTORABLE OPEN	LOST, RESTORABLE WOODED	LOST, NOT RESTORABLE WATER	LOST, NOT RESTORABLE URBAN	LOST, NOT RESTORABLE FILLED / DRAINED	LOST, NOT RESTORABLE BARREN	TOTAL LOST WETLAND ACRES	REMAINING WETLAND ACRES	AG UPLAND, PRW 99	OPEN WATER	OPEN/WOODED UPLAND	URBAN UPLAND	SWAT ACRES
U1201	262	4820	461	30	502	35	4	6114	34637	26164	43	2673	2516	72144
U1202	18	844	34	11	47	10	0	963	1898	9510	0	314	597	13272
U1203	13	1028	53	8	74	0	0	1177	3536	5837	1	188	434	11172
U1204	135	3416	137	12	271	1	3	3975	5414	24723	4	1168	2513	37802
U1205	41	3071	160	15	146	7	0	3441	6471	18383	2	992	1182	30479
U1301	0	702	94	0	55	26	0	877	440	8105	0	396	503	10299
U1302	0	1713	171	11	218	25	1	2148	5834	11902	22	1326	1754	22991
U1303	0	2828	321	11	336	15	4	3515	5502	21022	0	2303	2095	34438
U1304	0	687	136	4	59	20	0	906	2213	7712	0	1253	606	12688
U1305	0	1092	70	0	74	4	0	1240	1249	15095	0	643	893	19124
U1306	0	3614	416	11	379	18	1	4439	3184	15685	35	2292	2182	27812
YA01	39	396	11	0	49	0	0	495	1129	18372	2	539	1428	21971
YA02	0	744	14	2	82	0	0	841	523	10941	11	885	791	13996
YA03	0	506	44	7	196	12	0	765	475	5230	6	301	1982	8760
YA04	0	123	26	11	218	0	2	380	873	1678	474	468	896	4769
YA05	0	823	54	0	122	1	0	1000	2391	11819	0	922	2478	18610
YA06	0	88	1	0	118	0	0	208	636	2493	2	98	493	3929
Total	5182	219709	17423	4285	23157	841	63	270667	361629	1291934	62795	179305	206890	2373148
Average	46	1962	156	38	207	8	1	2417	3229	11535	561	1601	1847	21189

Metrics Tables: Definitions and Processing

Rock River PRWs.mdb is the Access database containing all the metrics tables. The dbf file for PRW_RR_final was exported from ArcGIS and imported into Access. Queries were run matching those in the Decision Matrix. The desired result was to have summary statistics for each of the 112 subwatersheds within the Rock River Basin. Once the queries were run and the results were combined, the table was exported into Excel to prepare for print. The metrics calculated can be found in RR_Metrics.xls

The following is a list of the metrics calculated and an explanation of how each was defined:

1) Lost, But Restored Wetlands – *those acres that were historically wetland and have been restored to wetland in recent years*
RESTORED = ‘YES’
2) Lost, PRW1 Acres – *those areas that were historically wetland and are now in agriculture, and therefore are open potential wetland restoration sites*
LOST = ‘YES’ AND PRWCODE = 1
3) Lost, PRW2 Acres – *those areas that were historically wetland, but now are wooded or shrubby and therefore are wooded potential wetland restoration sites*
LOST = ‘YES’ AND PRWCODE = 2
4) Lost, But Not Restorable Water – *those areas that were historically wetland, but now are under water and therefore not likely to be restored without draining*
LOST = ‘YES’ AND GRIDCODE = 83
5) Lost, But Not Restorable Urban – *those areas that were historically wetland, but now are developed and therefore cannot be restored without demolition*
LOST = ‘YES’ AND GRIDCODE = 82
6) Lost, But Not Restorable Filled/Drained – *those areas that were historically wetland, but are now filled/drained. It is assumed that these are not likely to be restored*
WETL_CLASS = ‘FILLED / DRAINED WETLANDS’ AND LOST = ‘YES’ AND GRIDCODE <> 63 AND GRIDCODE <> 82 AND GRIDCODE <> 83 AND PRWCODE = 99
7) Lost, But Not Restorable Barren – *those areas that were historically wetland, but now are barren and the ground is not suitable for wetland restoration. This is, by far, the smallest category.*
LOST = ‘YES’ AND GRIDCODE = 130
8) Total Lost Wetland Acres – *the sum of the first seven metrics*
LOST = ‘YES’
9) Remaining Wetland Acres – *those areas that are mapped as wetland*
REMAINING = ‘YES’
10) Ag Upland, PRW99 – *those areas in agriculture that do not have soil suitable for wetlands and were not mapped as wetlands*
DIS_AGRIC = ‘A’ AND PRWCODE = 99 AND REMAINING = ‘NO’
11) Open Water – *those areas that are open water*

ORIGINAL = ‘NO’ AND (GRIDCODE = 83 OR GRIDCODE = 87) AND DIS_AGRIC = ‘X’
12) Open/Wooded Upland – *those areas that are neither ag nor open water nor urban nor hydric soil, and not mapped as wetlands*
ORIGINAL = ‘NO’ AND (GRIDCODE = 63 OR GRIDCODE = 130 OR GRIDCODE = 136) AND DIS_AGRIC = ‘X’
13) Urban Upland – *those areas that are urban/developed and not mapped as wetlands*
ORIGINAL = ‘NO’ AND GRIDCODE = 82 AND DIS_AGRIC = ‘X’
14) SWAT Acres – *the sum of metrics eight through thirteen*
SUM OF FINAL_ACRE

APPENDIX B:

Data Dictionary for Rock River Basin Potentially Restorable Wetlands Layer

Source = the name of the intermediate layer created from the original source

Source 2 = the name of the original source

If Source and Source 2 are blank, then this is a derived field, new to this layer.

FIELD	SOURCE	SOURCE 2	DEFINITION	FORMAT / DATA TYPE	EXAMPLE/DOMAIN
OBJECTID				OBJECT ID	
SHAPE				GEOMETRY	
DNR_CNTY_CODE	ROCK_RIVER_WETLANDS	DigitalWetlandInventory.gdb	This attribute contains a 2 digit minor civil division coding system number.	SHORT INTEGER	For example:Adams County = 01; Wood County = 72
DNR_CNTY_NAME	ROCK_RIVER_WETLANDS	DigitalWetlandInventory.gdb	This attribute is the full county name	TEXT (12)	Ex. Outagamie.
DIGITIZED_DATE	ROCK_RIVER_WETLANDS	DigitalWetlandInventory.gdb	The date when the WWI map was originally digitized	TEXT (10)	e.g. 04/23/2000
ORIGINAL_WETCODE_CODE	ROCK_RIVER_WETLANDS	DigitalWetlandInventory.gdb	The WWI classification system describes the dominant vegetative class, subclass, hydrologic characteristics and special features of the wetland as of the date the data was originally interpreted.	TEXT (10)	Wetland classification codes typically include up to 4 alphanumeric characters (E2Kg), but when a second vegetative type covers 30% or more of the area, codes for both types of vegetation are described and separated by a "/". (e.g. S3/E2Kg).

FIELD	SOURCE	SOURCE 2	DEFINITION	FORMAT / DATA TYPE	EXAMPLE/DOMAIN
CURRENT_WETCODE_CODE	ROCK_RIVER_WETLANDS	DigitalWetlandInventory.gdb	The current WWI Classification Code for the represented area.	TEXT (10)	Wetland classification codes typically include up to 4 alphanumeric characters (E2Kg), but when a second vegetative type covers 30% or more of the area, codes for both types of vegetation are described and separated by a "/". (e.g. S3/E2Kg).
WETLAND_CLASS_DESC	ROCK_RIVER_WETLANDS	DigitalWetlandInventory.gdb	Generalized description of the WWI Classification Code based on WETCODE	TEXT (10)	{Aquatic Bed, Deep Water Lake, Emergent/wet meadow, Filled/drained wetland, Flats/unvegetated wet soil, Forested, Open Water, River, Road, Scrub/Shrub, Upland}
UPDATED_DATE	ROCK_RIVER_WETLANDS	DigitalWetlandInventory.gdb	The latest date that the wetland polygon was revised on the original hardcopy map	TEXT (10)	e.g. 03/02/1997
UPDATE_CHANGE_TEXT	ROCK_RIVER_WETLANDS	DigitalWetlandInventory.gdb		TEXT (30)	{AD, Classification change, Linework change, Wetland addition}
UPDATE_REASON_DESC	ROCK_RIVER_WETLANDS	DigitalWetlandInventory.gdb	Describes why the wetland was updated.	TEXT (30)	{Filled or drained, Map error}

FIELD	SOURCE	SOURCE 2	DEFINITION	FORMAT / DATA TYPE	EXAMPLE/DOMAIN
DIGITAL_UPDATE_DATE	ROCK_RIVER_WETLANDS	DigitalWetlandInventory.gdb	The date that a revised wetland polygon was last digitally updated. If a wetland polygon has not been revised since it was originally digitized this item will be left blank. If the date indicated in the UPDATED attribute is later than the date in the DIGUP attribute, the digital linework has not been updated.	TEXT (10)	e.g. 05/31/2003
BASEMAP_YEAR	ROCK_RIVER_WETLANDS	DigitalWetlandInventory.gdb	Represents the year(s) of the original 1:24,000 scale ratioed and rectified photographic base maps	TEXT (14)	
PHOTO_YEAR	ROCK_RIVER_WETLANDS	DigitalWetlandInventory.gdb	The year of 1:20,000 scale 9x9 black and white infrared stereoscopic aerial photography used to photo interpret wetland delineations and classifications. The year of the base map photography may be different than the date of the stereoscopic photography used to interpret wetlands.	TEXT (14)	

FIELD	SOURCE	SOURCE 2	DEFINITION	FORMAT / DATA TYPE	EXAMPLE/DOMAIN
MAP_SOURCE_DESC	ROCK_RIVER_WETLANDS	DigitalWetlandInventory.gdb	This attribute describes the photographic base map used when drafting wetland delineations and point symbols	TEXT (35)	{Non-ortho PLSS mylar, Rectified aerial photography}
WETLAND_ID	ROCK_RIVER_WETLANDS	DigitalWetlandInventory.gdb	This is an 11 digit identification number assigned to each polygon that contains the COUNTYID attribute, PLS attribute and a unique 4 digit polygon identification number assigned to each polygon by ArcGIS. It can be used to relate the wetland data to existing or future spatial or tabular databases.	DOUBLE	Example: WET_ID = 05424200047
ACRES_AMT	ROCK_RIVER_WETLANDS	DigitalWetlandInventory.gdb	This is not an accurate field. Refer to the Final_Acres field for a more accurate measurement	DOUBLE	
MUSYM_CODE	ROCK_RIVER_SOILS	EN_WI_SOIL_MAPUNIT_AR_20K	The symbol used to uniquely identify the soil mapunit in the soil survey	*TEXT (6)*	
MUKEY_KEY	ROCK_RIVER_SOILS	EN_WI_SOIL_MAPUNIT_AR_20K	A non-connotative string of characters used to uniquely identify a record in the Mapunit table.	*TEXT (9)*	

FIELD	SOURCE	SOURCE 2	DEFINITION	FORMAT / DATA TYPE	EXAMPLE/DOMAIN
PCTHYDRIC_NUM	ROCK_RIVER_SOILS	SDEDNR_EN_WI_SOIL_HYDRIC_REF	An indication of the proportion of the map unit, expressed as a percent, that is "hydric", based on the hydric classification of individual map unit components.	*DOUBLE*	{1-100, 9999 represents an mapunit that is unknown}
HYDRICRTNG_TEXT	ROCK_RIVER_SOILS	SDEDNR_EN_WI_SOIL_HYDRIC_REF	An indication of the proportion of the map unit, expressed as a class, that is "hydric", based on the hydric classification of individual map unit components.	*TEXT (21)*	{predominately hydric, hydric inclusions, moderately hydric, Not Hydric, Unknown}
MUNAME_NAME	ROCK_RIVER_SOILS	SDEDNR_EN_WI_SOIL_MAPUNIT_REF	Correlated name of the mapunit.	*TEXT (83)*	
MUKIND_TEXT	ROCK_RIVER_SOILS	SDEDNR_EN_WI_SOIL_MAPUNIT_REF	Code identifying the kind of mapunit.	*TEXT (20)*	{Association, Complex, Consociation, Undifferentiated group}
FARMLNDCL_TEXT	ROCK_RIVER_SOILS	SDEDNR_EN_WI_SOIL_MAPUNIT_REF		TEXT (97)	{prime farmland, farmland of statewide importance, farmland of local importance}
DIS_WETL_CODE			Indicates whether a feature is considered a wetland or non-wetland.	TEXT (5)	{W - Wetland, X - Not a Wetland}
GRIDCODE_CODE	RR_NASS_POLY		Categorization code	DOUBLE	{1-144}
LANDUSE_TEXT	RR_NASS_POLY		The classification of land according to how it is used.	TEXT (40)	EX. PASTURE, NON-AG, RANGE, WASTE, FARMLAND

FIELD	SOURCE	SOURCE 2	DEFINITION	FORMAT / DATA TYPE	EXAMPLE/DOMAIN
WETL_CLASS_DESC			Provides a text description of the wetland classifications developed/used for this project.	TEXT (50)	{Aquatic Bed, Cropped Wetland, Emergent/Wet Meadow, Filled/Drained Wetland, Flats/Unvegetated Wet Soil, Forested, Not Existing Wetland, Open Water Wetland, Scrub/Shrub, Surface Water, Upland, Wetland}
SWAT_ID			unique identification code for watershed delineations of subbasins defined by the Soil and Water Assessment Tool (SWAT)	TEXT (10)	Ex. AFT02
PRWCODE_CODE			Code indicates whether a feature fulfills the definition of a potentially restorable wetland (prw).	SHORT INTEGER	{1, 2, 5, 6, 7, 8, 99}
ORIGINAL_FLAG			Indicates whether a site was originally a wetland. The criteria used to make this determination includes any area that has hydric soils conditions or is currently mapped as a wetland, or a filled or drained wetland.	TEXT (3)	{YES, NO}

FIELD	SOURCE	SOURCE 2	DEFINITION	FORMAT / DATA TYPE	EXAMPLE/DOMAIN
LOST_FLAG			Indicates if the wetland has been converted to another use. The site must be identified as an original wetland but not currently mapped as a wetland.	TEXT (3)	{YES, NO}
REMAINING_FLAG			Indicates if a site is currently mapped as a wetland from any of the data sources used for this project.	TEXT (3)	{YES, NO}
DIS_AGRIC_CODE			Designates land cover/land use as being agricultural or non-agricultural, based on NASS categories.	TEXT (8)	{A - Agricultural, X - Non-agricultural}
FINAL_ACRES_AMT			Calculates the final acre amount for each polygon.	DOUBLE	
SHAPE_LENGTH				DOUBLE	
SHAPE_AREA				DOUBLE	
RESTORED_FLAG			Indicates whether the site has been restored.	TEXT (10)	{YES, NO}

APPENDIX C:

Decision Matrix for Rock River Basin Potentially Restorable Wetlands Layer

The tan shaded cells signify that these values are from the original input data sources. The olive shaded cells signify derived values in the newly created data layer. The clear cells are all YES/NO fields, but only the YES values are entered. This was done for easier reading. These are also derived fields. They are the fields used in calculating metrics for the subwatersheds in Appendix A.

This matrix was made as a QA/QC step in the GIS process to assure that every possible combination of the three input sources is accounted for. It also helped organize the outputs into the categories used in the metrics.

Below is an example of how the matrix works. Field names are orange and cell values are blue, both are in all capital letters. Following the steps, work from left to right on the first page, second row down (at the red arrow):

1) GRID CODE is 1-36. (That comes from the NASS layer, and 1-36 is all cropland.)

2) CURRENT_WETCODE is UPLAND. (That comes from the WWI, and it is showing that it is not currently a wetland.)

3) MUSYM is N/A (Not Applicable) for this combination of GRID CODE and CURRENT_WETCODE.

4) As a derived attribute, the WETL_CLASS is UPLAND. (Each value for WETL_CLASS is derived from the combination of the GRID CODE value and the CURRENT_WETCODE value. Sometimes it is a combined value from the two (CROPPED WETLAND), and sometimes it shows that one source is taking precedence over the other (one says fallow field, the other says lake).

5) It is classified as X in DIS_WETL because it is not currently a wetland.

6) It is classified as A in DIS_AGRIC because it is currently cropped.

7) PCTHYDRIC is the next input. (That comes from the SSURGO soils). It can either be {85, 90 or 100} OR {<85 or 9999}.

8)a. If PCTHYDRIC was {85, 90 or 100} in step 7, then it is considered an ORIGINAL wetland and is classified YES for this attribute.

b. If PCTHYDRIC was {<85, or 9999} in step 7, then it is considered to be not an ORIGINAL wetland and is classified NO for this attribute.

9)a. If it was YES as an original wetland, it is NO for REMAINING because it is currently an UPLAND in the WWI.

b. If it was NO as an original wetland, it is NO for REMAINING because it can never be REMAINING if it was not an original to begin with.

10)a. If it was YES for original and NO for remaining, then it is YES for LOST because it is considered to be a lost wetland.

b. If it was NO for original and NO for remaining, then it is NA for LOST because it was not a wetland to begin with.

11)RESTORATION SOURCE can be either blank (for none), GHRA, WRP, WPA, or RTD. These are the four different sources of restoration data.

12)a. If the RESTORATION SOURCE was blank, and it is considered a lost wetland, then the PRWCODE is 1. (This means that it is a potentially restorable wetland).

b. If the RESTORATION SOURCE was GHRA, then the PRWCODE is 5.

c. If the RESTORATION SOURCE was WRP, then the PRWCODE is 6.

d. If the RESTORATION SOURCE was WPA, then the PRWCODE is 7.

e. If the RESTORATION SOURCE was RTD, then the PRWCODE is 8.

f. If the RESTORATION SOURCE was blank, and it is considered not to be a lost wetland, then the PRWCODE is 99. (This means that it is not a potentially restorable wetland).

13) At this point, a YES is put in the appropriate column in the clear cells. If the PRWCODE is 1, then it gets a YES in the LOST, PRW1 column. If the PRWCODE is 5,6,7, or 8, then it gets a YES in the LOST, RESTORED column. If the PRWCODE is 99, then it gets a YES in the AG UPLAND PRW 99 column.

1.GRID CODE	2.CURRENT_ WETCODE	3.MUSYM	4.WETL_CLASS	5.DIS_WETL	6.DIS_ AGRIC	7.PCTHYDRIC	8.ORIGINAL	9.REMAINING	10.LOST	11.RESTORATION SOURCE	12.PRW_CODE	LOST, RESTORED	LOST, PRW1	LOST, PRW2	LOST, WATER	LOST, URBAN	LOST, FILLED/ DRAINED	LOST, BARREN	REMAINING WETLAND	AG UPLAND PRW 99	OPEN/ WOODLAND UPLAND	URBAN UPLAND	OPEN WATER
1-36	RIVER	N/A	SURFACE WATER	X	A	85, 90, 100	YES	NO	YES		1		YES										
										GHRA	5	YES											
										WRP	6	YES											
										WPA	7	YES											
										RTD	8	YES											
						<85 OR 9999	NO	NO	NA		99									YES			
	UPLAND		UPLAND	X	A	85, 90, 100	YES	NO	YES		1		YES										
										GHRA	5	YES											
										WRP	6	YES											
										WPA	7	YES											
										RTD	8	YES											
						<85 OR 9999	NO	NO	NA		99									YES			
	"A" SERIES		CROPPED WETLAND	W	A		YES	YES	NO		99								YES				
	"E" SERIES		CROPPED WETLAND	W	A		YES	YES	NO		99								YES				
	"F" SERIES		CROPPED WETLAND	W	A		YES	YES	NO		99								YES				
	"S" SERIES		CROPPED WETLAND	W	A		YES	YES	NO		99								YES				
	"T" SERIES		CROPPED WETLAND	W	A		YES	YES	NO		99								YES				
	"W" SERIES		CROPPED WETLAND	W	A		YES	YES	NO		99								YES				
	$		FILLED / DRAINED WETLAND	X	A	85, 90, 100	YES	NO	YES		1		YES										
										GHRA	5	YES											
										WRP	6	YES											
										WPA	7	YES											
										RTD	8	YES											
						<85 OR 9999	YES	NO	YES		99						YES						
	NULL		NOT EXISTING WETLAND	X	A	85, 90, 100	YES	NO	YES		1		YES										
										GHRA	5	YES											
										WRP	6	YES											
										WPA	7	YES											
										RTD	8	YES											
						<85 OR 9999	NO	NO	NA		99									YES			

1.GRID CODE	2.CURRENT_ WETCODE	3.MUSYM	4.WETL_CLASS	5.DIS_WETL	6.DIS_ AGRIC	7.PCTHYDRIC	8.ORIGINAL	9.REMAINING	10.LOST	11.RESTORATION SOURCE	12.PRW_CODE	LOST, RESTORED	LOST, PRW1	LOST, PRW2	LOST, WATER	LOST, URBAN	LOST, FILLED/ DRAINED	LOST, BARREN	REMAINING WETLAND	AG UPLAND PRW 99	OPEN/ WOODLAND UPLAND	URBAN UPLAND	OPEN WATER
61	DEEP WATER LAKE	N/A	UPLAND	X	A	85, 90, 100	YES	NO	YES		1		YES										
										GHRA	5	YES											
										WRP	6	YES											
										WPA	7	YES											
										RTD	8	YES											
						<85 OR 9999	NO	NO	NA		99									YES			
	ROAD		UPLAND	X	A	85, 90, 100	YES	NO	YES		1		YES										
										GHRA	5	YES											
										WRP	6	YES											
										WPA	7	YES											
										RTD	8	YES											
						<85 OR 9999	NO	NO	NA		99									YES			
	UPLAND		UPLAND	X	A	85, 90, 100	YES	NO	YES		1		YES										
										GHRA	5	YES											
										WRP	6	YES											
										WPA	7	YES											
										RTD	8	YES											
						<85 OR 9999	NO	NO	NA		99									YES			
	$		FILLED / DRAINED WETLAND	X	A	85, 90, 100	YES	NO	YES		1		YES										
										GHRA	5	YES											
										WRP	6	YES											
										WPA	7	YES											
										RTD	8	YES											
						<85 OR 9999	YES	NO	YES		99						YES						
	NULL		NOT EXISTING WETLAND	X	A	85, 90, 100	YES	NO	YES		1		YES										
										GHRA	5	YES											
										WRP	6	YES											
										WPA	7	YES											
										RTD	8	YES											
						<85 OR 9999	NO	NO	NA		99									YES			

1.GRID CODE	2. CURRENT_ WETCODE	3.MUSYM	4. WETL_CLASS	5.DIS_WETL	6.DIS_ AGRIC	7. PCTHYDRIC	8.ORIGINAL	9.REMAINING	10.LOST	11. RESTORATION SOURCE	12.PRW_CODE	LOST, RESTORED	LOST, PRW1	LOST, PRW2	LOST, WATER	LOST, URBAN	LOST, FILLED/ DRAINED	LOST, BARREN	REMAINING WETLAND	AG UPLAND PRW 99	OPEN/ WOODLAND UPLAND	URBAN UPLAND	OPEN WATER
62	DEEP WATER LAKE	N/A	UPLAND	X	A	85, 90, 100	YES	NO	YES		1		YES										
										GHRA	5	YES											
										WRP	6	YES											
										WPA	7	YES											
										RTD	8	YES											
						<85 OR 9999	NO	NO	NA		99									YES			
	ROAD		UPLAND	X	A	85, 90, 100	YES	NO	YES		1		YES										
										GHRA	5	YES											
										WRP	6	YES											
										WPA	7	YES											
										RTD	8	YES											
						<85 OR 9999	NO	NO	NA		99									YES			
	RIVER		SURFACE WATER	X	A	85, 90, 100	YES	NO	YES		1		YES										
										GHRA	5	YES											
										WRP	6	YES											
										WPA	7	YES											
										RTD	8	YES											
						<85 OR 9999	NO	NO	NA		99									YES			
	UPLAND		UPLAND	X	A	85, 90, 100	YES	NO	YES		1		YES										
										GHRA	5	YES											
										WRP	6	YES											
										WPA	7	YES											
										RTD	8	YES											
						<85 OR 9999	NO	NO	NA		99									YES			
	"T" SERIES		FORESTED	W	A		YES	YES	NO		99								YES				
	"W" SERIES		OPEN WATER WETLAND	W	A		YES	YES	NO		99								YES				
	$		FILLED / DRAINED WETLAND	X	A	85, 90, 100	YES	NO	YES		1		YES										
										GHRA	5	YES											
										WRP	6	YES											
										WPA	7	YES											
										RTD	8	YES											
						<85 OR 9999	YES	NO	YES		99						YES						
	NULL		NOT EXISTING WETLAND	X	A	85, 90, 100	YES	NO	YES		1		YES										
										GHRA	5	YES											
										WRP	6	YES											
										WPA	7	YES											
										RTD	8	YES											
						<85 OR 9999	NO	NO	NA		99									YES			

1. GRID CODE	2. CURRENT_ WETCODE	3. MUSYM	4. WETL_CLASS	5. DIS_WETL	6. DIS_AGRIC	7. PCTHYDRIC	8. ORIGINAL	9. REMAINING	10. LOST	11. RESTORATION SOURCE	12. PRW_CODE	LOST, RESTORED	LOST, PRW1	LOST, PRW2	LOST, WATER	LOST, URBAN	LOST, FILLED/ DRAINED	LOST, BARREN	REMAINING WETLAND	AG UPLAND PRW 99	OPEN/ WOODLAND UPLAND	URBAN UPLAND	OPEN WATER
63	DEEP WATER LAKE	N/A	SURFACE WATER	X	X	85, 90, 100	YES	NO	YES		2			YES									
										GHRA	5	YES											
										WRP	6	YES											
										WPA	7	YES											
										RTD	8	YES											
						<85 OR 9999	NO	NO	NA		99										YES		
	RIVER		SURFACE WATER	X	X	85, 90, 100	YES	NO	YES		2			YES									
										GHRA	5	YES											
										WRP	6	YES											
										WPA	7	YES											
										RTD	8	YES											
						<85 OR 9999	NO	NO	NA		99										YES		
	ROAD		UPLAND	X	X	85, 90, 100	YES	NO	YES		2			YES									
										GHRA	5	YES											
										WRP	6	YES											
										WPA	7	YES											
										RTD	8	YES											
						<85 OR 9999	NO	NO	NA		99										YES		
	UPLAND		UPLAND	X	X	85, 90, 100	YES	NO	YES		2			YES									
										GHRA	5	YES											
										WRP	6	YES											
										WPA	7	YES											
										RTD	8	YES											
						<85 OR 9999	NO	NO	NA		99										YES		
	"T" SERIES		FORESTED	W	X		YES	YES	NO		99								YES				
	"W" SERIES		OPEN WATER WETLAND	W	X		YES	YES	NO		99								YES				
	$		FILLED / DRAINED WETLAND	X	X		YES	NO	YES		2			YES									
										GHRA	5	YES											
										WRP	6	YES											
										WPA	7	YES											
										RTD	8	YES											
	NULL		NOT EXISTING WETLAND	X	X	85, 90, 100	YES	NO	YES		2			YES									
										GHRA	5	YES											
										WRP	6	YES											
										WPA	7	YES											
										RTD	8	YES											
						<85 OR 9999	NO	NO	NA		99										YES		

1.GRID CODE	2.CURRENT_ WETCODE	3.MUSYM	4.WETL_CLASS	5.DIS_WETL	6.DIS_AGRIC	7.PCTHYDRIC	8.ORIGINAL	9.REMAINING	10.LOST	11.RESTORATION SOURCE	12.PRW_CODE	LOST, RESTORED	LOST, PRW1	LOST, PRW2	LOST, WATER	LOST, URBAN	LOST, FILLED/ DRAINED	LOST, BARREN	REMAINING WETLAND	AG UPLAND PRW 99	OPEN/ WOODLAND UPLAND	URBAN UPLAND	OPEN WATER
82	ROAD	N/A	UPLAND	X	X	85, 90, 100	YES	NO	YES		99					YES							
						<85 OR 9999	NO	NO	NA		99											YES	
	UPLAND		UPLAND	X	X	85, 90, 100	YES	NO	YES		99					YES							
						<85 OR 9999	NO	NO	NA		99											YES	
	"T" SERIES		FORESTED	W	X		YES	YES	NO		99								YES				
	"W" SERIES		OPEN WATER WETLAND	W	X		YES	YES	NO		99								YES				
	$		FILLED / DRAINED WETLAND	X	X		YES	NO	YES		99					YES							
	NULL		NOT EXISTING WETLAND	X	X	85, 90, 100	YES	NO	YES		99					YES							
						<85 OR 9999	NO	NO	NA		99											YES	
83	DEEP WATER LAKE	N/A	SURFACE WATER	X	X	85, 90, 100	YES	NO	YES		99				YES								
						<85 OR 9999	NO	NO	NA		99												YES
	RIVER		SURFACE WATER	X	X	85, 90, 100	YES	NO	YES		99				YES								
						<85 OR 9999	NO	NO	NA		99												YES
	UPLAND		SURFACE WATER	X	X	85, 90, 100	YES	NO	YES		99				YES								
						<85 OR 9999	NO	NO	NA		99												YES
	ROAD	ANY OTHER THAN "W"	UPLAND	X	X	85, 90, 100	YES	NO	YES		99				YES								
						<85 OR 9999	NO	NO	NA		99												YES
	"T" SERIES	N/A	FORESTED	W	X		YES	YES	NO		99								YES				
	"W" SERIES		OPEN WATER WETLAND	W	X		YES	YES	NO		99								YES				
	$		FILLED / DRAINED WETLAND	X	X		YES	NO	YES		99				YES								
	NULL		NOT EXISTING WETLAND	X	X	85, 90, 100	YES	NO	YES		99				YES								
						<85 OR 9999	NO	NO	NA		99												YES

1. GRID CODE	2. CURRENT_ WETCODE	3.MUSYM	4. WETL_CLASS	5. DIS_WETL	6. DIS_ AGRIC	7.PCTHYDRIC	8.ORIGINAL	9.REMAINING	10.LOST	11. RESTORATION SOURCE	12. PRW_CODE	LOST, RESTORED	LOST, PRW1	LOST, PRW2	LOST, WATER	LOST, URBAN	LOST, FILLED/ DRAINED	LOST, BARREN	REMAINING WETLAND	AG UPLAND PRW 99	OPEN/ WOODLAND UPLAND	URBAN UPLAND	OPEN WATER
87	DEEP WATER LAKE	N/A	WETLAND	W	X		YES	YES	NO		99								YES				
	ROAD		WETLAND	W	X		YES	YES	NO		99								YES				
	UPLAND		WETLAND	W	X		YES	YES	NO		99								YES				
	RIVER		SURFACE WATER	X	X		NO	NO	NA		99												YES
	"A" SERIES		AQUATIC BED	W	X		YES	YES	NO		99								YES				
	"E" SERIES		EMERGENT / WET MEADOW	W	X		YES	YES	NO		99								YES				
	"F" SERIES		FLATS / UNVEGETATED SOIL	W	X		YES	YES	NO		99								YES				
	"S" SERIES		SCRUB/SHRUB	W	X		YES	YES	NO		99								YES				
	"T" SERIES		FORESTED	W	X		YES	YES	NO		99								YES				
	"W" SERIES		OPEN WATER WETLAND	W	X		YES	YES	NO		99								YES				
	$		FILLED / DRAINED WETLAND	X	X		YES	NO	YES		99						YES						
	NULL		WETLAND	W	X		YES	YES	NO		99								YES				
130	UPLAND	N/A	UPLAND	X	X	85, 90, 100	YES	NO	YES		99							YES					
						<85 OR 9999	NO	NO	NA		99										YES		
	"T" SERIES		FORESTED	W	X		YES	YES	NO		99								YES				
	$		FILLED / DRAINED WETLAND	X	X		YES	NO	YES		99						YES						
	NULL		NOT EXISTING WETLAND	X	X	85, 90, 100	YES	NO	YES		99							YES					
						<85 OR 9999	NO	NO	NA		99										YES		
136	ROAD	N/A	UPLAND	X	X	85, 90, 100	YES	NO	YES		2			YES									
										GHRA	5	YES											
										WRP	6	YES											
										WPA	7	YES											
										RTD	8	YES											
						<85 OR 9999	NO	NO	NA		99										YES		
	"T" SERIES		FORESTED	W	X		YES	YES	NO		99								YES				
	"W" SERIES		OPEN WATER WETLAND	W	X		YES	YES	NO		99								YES				
	$		FILLED / DRAINED WETLAND	X	X		YES	NO	YES		99						YES						
	NULL		NOT EXISTING WETLAND	X	X	85, 90, 100	YES	NO	YES		2			YES									
										GHRA	5	YES											
										WRP	6	YES											
										WPA	7	YES											
										RTD	8	YES											
						<85 OR 9999	NO	NO	NA		99										YES		

APPENDIX D: Hydric Soils

*Note: The Saprists and Aquents have the MUKIND of Undifferentiated Group. These consist of two or more components that are not consistently associated geographically, but are included as the same named mapunit because they have similar use and management concerns. The Fluvaquents and Udifluvents have the MUKIND of Consociation. At some point it was determined that describing these various mapunits any further in the taxonomic system would gain little in terms of interpretation. Marsh is a miscellaneous area and is usually considered a non soil area.

Mapunit Symbol	Mapunit Name	Percent Hydric
Ac,Ad	Adrian Muck	100
AcA	Ackmore silt loam, 0-3% slopes	100
Af, An, Aw	Alluvial land, wet	100
Ww	Wet alluvial land	100
Af	Alluvial land, sandy, wet	100
Ah	Alluvial land, loamy, wet	100
Ak	Adrian mucky peat	100
Ar	Adrian variant muck	100
Ata	Ashkum silty clay loam, 0-3% slopes	100
BaA	Barry silt loam, 0-3% slopes	100
Bb	Barry loam, 0-3% slopes	100
Br	Brookston silt loam	100
BsA	Brookston silt loam, 0-3% slopes	100
BtA	Brookston stony silt loam, 0-3% slopes	100
BuA	Brookston silty clay loam, 0-3% slopes	100
Co, Cw	Colwood silt loam	100
Co	Colwood silty clay loam	85
CoA	Colwood fine sandy loam, 0-3% slopes	100
Dt	Drummer silt loam, gravelly substratum	100
Ed	Edwards muck	100
Ev	Elvers silt loam	100
Fn	Fluvaquents	100
Fu	Fluvaquents	85
GaA	Gilford fine sandy loam, stratified substratum, 0-3% slopes	100
Gd	Gilford loam	100
Gd	Gilford sandy loam	100
Gb	Granby variant fine sandy loam	90
Gb, Gn	Granby loamy sand	100
Gf	Granby fine sandy loam	100
Ho, Ht	Houghton muck	100
Hu	Houghton muck	85
HtA	Houghton muck, 0-2% slopes	100
HtB	Houghton muck, 2-6% slopes	100
Hu	Houghton mucky peat	100
Hv	Houghton peat, acid variant	100
Hw	Houghton muck, ponded	85
Kb, Km	Keowns silt loam	100
Ke	Keowns silt loam	90

Mapunit Symbol	Mapunit Name	Percent Hydric
Ma	Mahalasville silt loam	100
Mb	Mahalasville silt loam, overwash	100
Mb, Mc, Mf	Marsh	100
Mc, Mh	Marshan silt loam	100
Mc, Md	Marshan loam	100
Me	Maumee loamy sand	100
Mf	Millington silt loam	100
MoA	Montgomery silty clay loam, 0-3% slopes	100
Mzb	Mongtomery silty clay loam	100
Mr	Milford silty clay loam	100
Mzk	Mussey loam	100
MzkA	Mussey loam, 0-3% slopes	100
Na	Navan silt loam	100
Oc	Ogden muck	100
Od	Ogden mucky peat	100
Os	Orion silt loam, wet	100
Os	Ossian silt loam	100
OsA	Ossian silt loam, 0-3% slopes	100
Ot	Otter silt loam	90-100
Pa	Palms muck	85-100
Pb	Palms muck, ponded	100
Pc	Palms mucky peat	100
Ph	Pella silt loam	100
Ph	Pella silty clay loam	90
PhA	Pella silt loam, 0-3% slopes	100
Pk	Pella variant silt loam	90
Pm	Pella silt loam, moderately shallow variant	100
PnA	Pella silty clay loam, 0-2% slopes	100
Rs	Rollin muck	100
Ru	Rollin muck, deep	100
Rv	Rollin muck, shallow	100
Rw	Rollin mucky peat	100
SaA	Sable silty clay loam, 0-3% slopes	100
Se	Sebewa silt loam	100
Sm	Sebewa silt loam	90-100
SmA	Sebewa silt loam, 0-2% slopes	100
Sn	Sebewa silt loam, clayey substratum	100
Sg	Sawmill silt loam, calcareous variant	100
Sk	Saprists and Aquents	100
Uf	Udifluvents	100
Wa	Wacousta silty clay loam	100
Wa	Wacousta mucky silt loam	100
Wa, Wb	Wallkill silt loam	100
WsA	Washtenaw silt loam, 0-2% slopes	100

APPENDIX E:
Processing Documentation for Potentially Restorable Wetlands Layer

OBJECTIVE: Create a GIS data layer that represents areas of potential wetland restoration sites using hydric soils, wetlands, and agricultural lands as the base layers. The theory is that if an area can be identified as likely to be historic wetland, but is not currently mapped as a wetland and if the area is currently in agricultural production, then it may represent a potential site for wetland restoration.

PURPOSE: This datalayer is designed for landscape scale watershed analysis. It corresponds to EPA Level 1 monitoring. Existing data sets were used as the base layers.

PROCESSING ENVIRONMENT: The GIS data analysis was done in ESRI's ArcGIS v. 9.2 on a Windows XP desktop. The metrics tables were developed in Microsoft Access.

A. DATA SOURCES:
- A.1. Hydric Soils
  NRCS Statewide Seamless Soils Layer
- A.2. Wetlands
  WDNR Statewide Seamless Wisconsin Wetlands Inventory
  Updated to 1978-79 for Walworth, Washington, and Waukesha counties
  Updated to 1986 for Dane and Jefferson counties
  Updated to 1994 for Dodge and Fond du Lac counties
  Updated to 1999 for Columbia and Green Lake counties
  Updated to 2000 for Rock county
- A.3. Agricultural Lands
  USDA – National Agriculture Statistics Service's 1:100,000-scale 2006 Cropland Data Layer, A Crop-Specific Data Layer for Wisconsin, 2007, March 14
- A.4. Rock River Basin
  WDNR Watershed Management Units
- A.5. SWAT subwatersheds
  Montgomery Associates
- A.6. GHRA
  Glacial Habitat Retoration Areas (compiled from WDNR, FWS, and NRCS covering 1991-2005)
- A.7. WRP
  NRCS Wetland Reserve Program parcel boundaries
- A.8. WPA
  FWS Waterfowl Production Area parcel boundaries
- A.9. Restoration Tracking Database (compiled from WDNR, FWS, and NRCS covering 2005-2006)

B. DATA PROCESSING – HYDRIC SOILS

B.1. NRCS Soils (SDEDNR.EN_WI_SOIL_MAPUNIT_AR_20K)

a) The polygon SDE layer was first joined to two tables (SDEDNR.EN_WI_SOIL_MAPUNIT_REF AND SDEDNR.EN_WI_SOIL_HYDRIC_REF) using the attribute MUKEY as the join field.
b) The layer was then clipped to the Rock River Basin as defined in the wsdrwmu.shp as the Upper and Lower Rock River. Output is called Rock_River_Soils.

C. DATA PROCESSING - WETLANDS

C.1. Wisconsin Wetlands Inventory (DigitalWetlandInventory.gdb)

a) The polygon feature class in the geodatabase was clipped to the Rock River Basin as defined in the wsdrwmu.shp as the Upper and Lower Rock River. Output is called Rock_River_Wetlands.

D. DATA PROCESSING – AGRICULTURAL LANDS

D.1. NASS 2006 (wi06nass_awifs_cdl.tif)

a) The EXTRACT BY MASK tool was used to cut the raster landcover dataset to the Rock River Basin as defined in the wsdrwmu.shp as the Upper and Lower Rock River.
b) The raster was then converted to a polygon feature class.
c) The VALUE field was renamed GRIDCODE, and the field LANDUSE was added and populated with the category names for each of the gridcodes. Output is called RR_NASS.

GRIDCODE	LANDUSE
1	Corn, all
5	Soybeans
21	Barley
24	Winter Wheat
25	Other Grains/Hay
27	Rye
28	Oats
36	Alfalfa
61	Idle Cropland/Fallow/CRP
62	Pasture, Non-ag, Range, Waste, Farmstead
63	Woodland
82	Urban
83	Water
87	Wetlands
130	Barren
136	Shrubland

E. DATA PROCESSING – SWAT SUBWATERSHEDS
  E.1. Montgomery Associates (Rock River Basins.shp)
    a) Project the shapefile into the wtm 83-91 projection to match all the other layers. Output is called rockbsn_wtm.shp.

F. DATA PROCESSING – RESTORATIONS
  F.1. Glacial Habitat Restoration Area (GHRA_11_19_07)
    a) Clip the GHRA feature class to the rockbsn_wtm.shp.
    b) Select all COVER_TY LIKE WTLD_% AND COVER_TY <> 'WTLD_NAT' AND COVER_TY <> 'WTLD_WRP'. In this step we are trying to avoid the naturally occuring wetlands as well as counting the WRP areas twice. Export selected features.
    c) Select all (PARTNER_1 = NRCS OR PARTNER_1 = NRCS-WRP OR PARTNER_1 = FWS-WPA) AND (PARTNER_2 = NRCS OR PARTNER_2 = NRCS-WRP OR PARTNER_2 = FWS-WPA) AND (PARTNER_3 = NRCS OR PARTNER_3 = NRCS-WRP OR PARTNER_3 = FWS-WPA). In this step we are trying to avoid counting the WRP or the WPA areas twice.
    d) Delete selected features. Output is called GHRA_WTLD_RR.
    e) Add the field PRWCODE_GHRA. Populate it with the value of 5.
    f) Delete all the fields except PRWCODE_GHRA.
  F.2. Wetlands Reserve Program (wrp_a_wi.shp)
    a) Clip the WRP feature class to the rockbsn_wtm.shp. Output is called WRP_clipRR.
    b) Add the field PRWCODE_WRP. Populate it with the value of 6.
    c) Delete all the fields except PRWCODE_WRP.
  F.3. Waterfowl Production Area (wpapw924)
    a) Clip the WPA feature class to the rockbsn_wtm.shp. Output is called WPA_RR.
    b) Add the field PRWCODE_WPA. Populate it with the value of 7.
    c) Delete all the fields except PRWCODE_WPA.
  F.4. Restoration Tracking Database
    a) Clip the restoration tracking database feature class to the rockbsn_wtm.shp. Output is called restorations_RR.
    b) Select all features overlapping GHRA_WTLD_RR , WRP_clipRR, or WPA_RR. In this step we are trying to avoid having the same restorations areas come from multiple sources.
    c) Delete selected features. Save.
    d) Select all features equal to 5 acres OR where CoverType = UPGRASS.
       The features equal to 5 acres have not been edited to the correct size or shape. They are just buffered circles surrounding the original points provided by FWS.
    e) Delete selected features. Save.
    f) Add the field PRWCODE_wet. Populate it with the value of 8.
    g) Delete all the fields except PRWCODE_wet.

G. DATA PROCESSING – POTENTIALLY RESTORABLE WETLANDS LAYER

a) Union Rock_River_Soils and Rock_River_Wetlands. Output is called RR_Union_Wetlands_Soils.
b) Union RR_Union_Wetlands_Soils with RR_NASS. Output is called RR_Union_Wetlands_Soils_NASS.
c) Delete all FID fields and duplicate fields.
d) Taking the SWAT layer (rockbsn_wtm.shp), select the subwatersheds within each subbasin and create 23 new subbasin feature classes.
e) Clip RR_Union_Wetlands_Soils_NASS to each new subbasin feature class. This is done because the next step could not be done on the whole dataset. There were more than a million polygons and the software kept coming up with errors.
f) For each of the 23 clipped feature classes, select all polygons less than 0.5 acre (< 2023.45 square-meters). Run the ELIMINATE tool. This merges each selected polygon with a neighboring unselected polygon by dropping the shared border. The neighboring polygon is the one with the longest shared border. Repeat this step (selecting and eliminating) iteratively until there are no more polygons less than 0.5 acre. This step has to be repeated because if a selected polygon has no neighboring unselected polygons, it cannot be eliminated. The outer selected polygons have to be eliminated before the inner ones can be. Usually it took 2 or 3 iterations to eliminate them all.
g) For each of the 23 feature classes, run the MULTIPART TO SINGLEPART tool.
h) Then repeat step (e) above, running the eliminations iteratively again on each of the 23 feature classes.
i) For each of the 23 feature classes, run the SPLIT tool using the rockbsn_wtm.shp as the split features and the SWAT_ID as the split field, creating 112 new feature classes total.
j) In each new feature class, add a new field SWAT_ID, and populate it with its corresponding SWAT_ID from rockbsn_wtm.shp.
k) Append all 112 feature classes into one. Output is called RR_final.
l) Add fields DIS_WETL, WETL_CLASS, DIS_AGRIC, ORIGINAL, REMAINING, LOST, PRW_CODE. Populate using queries in flowchart or decision matrix.

H. DATA PROCESSING – COMBINING RESTORATIONS WITH PRW LAYER

a) Union RR_final to GHRA_WTLD_RR. Output is called Union_RR_GHRA.
b) Select all features with PRWCODE_GHRA = 5 and (PRWCODE = 1 or PRWCODE = 2).
c) Change the PRWCODE = 5 for all selected features.
d) Delete the PRWCODE_GHRA field and the FID fields.

e) Union WRP_clipRR to Union_RR_GHRA. Output is called Union_RR_GHRA_WRP.
f) Select all features with PRWCODE_WRP = 6 and (PRWCODE = 1 or PRWCODE = 2).
g) Change the PRWCODE = 6 for all selected features.
h) Delete the PRWCODE_WRP field and the FID fields.
i) Union WPA_RR to Union_RR_GHRA_WRP. Output is called Union_RR_GHRA_WRP_WPA.
j) Select all features with PRWCODE_WPA = 7 and (PRWCODE = 1 or PRWCODE = 2).
k) Change the PRWCODE = 7 for all selected features.
l) Delete the PRWCODE_WPA field and the FID fields.
m) Union restorations_RR to Union_RR_GHRA_WRP_WPA. Output is called PRW_RR_final.
n) Select all features with PRWCODE_wet = 8 and (PRWCODE = 1 or PRWCODE = 2).
o) Change the PRWCODE = 8 for all selected features.
p) Delete the PRWCODE_wet field and the FID fields.
q) Add fields FINAL_ACRES and RESTORED. Populate using queries in flowchart or decision matrix.

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