DRAFT ZUMBRO RIVER WATERSHED WRAPS MATERIAL

For review leading up to the Zumbro River Watershed (ZRW) WRAPS finale meeting on January 28, 2017 some of the text and figures from the draft WRAPS document are included below. Because monitoring, assessment, and stressor identification results have been discussed at length and published online, the material is focused on new substance: goals, TMDLs, strategies and targeting for restoration and protection of water resources in the Zumbro River watershed. The meeting agenda will allow for overview of this material via brief presentation followed by discussion and feedback. Note that given the draft nature of the text, there are currently numerous generic references to figures and tables (e.g. "Figure X") that will be adjusted as the WRAPS document is finished.

Goals

Pollutant reduction goals for nitrogen (45% by 2040 with interim goal of 20% by 2025) and phosphorus (12% by 2025) were taken from Minnesota's Nutrient Reduction Strategy (2014). For local impairments in the ZRW, the respective nutrient reduction goals are listed for each water body. Some HUC-10 watersheds do not include local nutrient-caused impairments, but example goal attainment scenarios are included because each watershed must pursue reductions per NRS goals. Example estimated scales of adoption of BMP combinations were carefully constructed with stakeholders to attain the interim goal of 20% nitrogen reduction and the final goal of 12% phosphorus reduction for one or more HUC-10 watershed each watershed lobe.

For nitrate impaired or stressed streams, the 20% reduction goal would approximate goal attainment. For many phosphorus impaired lakes, a 12% reduction in phosphorus may not attain goals, but more information is needed to understand the relative contributions of watershed and internal nutrient loads; further there are no available tools to estimate scales of adoption needed for goal attainment at very small scales (e.g. a small lake watershed). For these reasons stakeholders agreed that pursuit of the 12% reduction described in the NRS is an appropriate goal for 2025 (a year that closely coincides with the next Zumbro WRAPS iteration, which will allow for re-examination of conditions and goals).

While TSS and pathogen goals are described in the table, in most cases the strategies for addressing these pollutants are shared with those for phosphorus. This is consistent with other WRAPS in southeast Minnesota (e.g. the approved Mississippi River Lake Pepin WRAPS grouped *Strategies for addressing volume, sediment, phosphorus and pathogens*) in that the BMPs address runoff-driven pollutant loads. Further, there is no available tool to estimate scales of adoption specific to TSS or pathogen goal attainment at small scales (e.g. HUC-10).

Core Strategies for Restoration

Restoration strategies are largely focused on nonpoint source nutrient reduction because (1) many ZRW impairments are driven by nonpoint nutrient loads, (2) the best tools for examining estimated scales of adoption to achieve reduction goals are centered on nitrogen and phosphorus. The strategies included in Table X are founded on core combinations of best management practices that were examined closely by technical practitioners and vetted with local stakeholders in both meeting and work session environments. The nutrient BMP spreadsheets for both nitrogen and phosphorus (developed by University of Minnesota) were used to iteratively examine the combinations of practices and the resultant load reductions. The spreadsheets represent the best available tools for engaging stakeholders in this context. The HSPF model scenario simulations show general agreement with the reduction estimates provided by the spreadsheets.

To achieve the 2025 nitrogen reduction goal, stakeholders made use of the following core strategies as starting points for constructing combinations of BMPs that together resulted in goal attainment.

- **Source reduction**: Between 75-90% of corn acres receive target N rate - no N-inhibitors or timing shift.
- **Vegetative changes:**
  - Between 50-80% of short season crop acres (including corn silage) are planted to a rye cover crop.
  - Between 20-25% of corn and soybean acres are planted to cereal rye cover crop.
  - Between 5-50% of marginal corn and soybean acres are planted to perennial vegetation or crops.

To achieve the 2025 phosphorus reduction goal, the base combination of BMPs includes the nitrogen-focused practices above plus gains in reduced tillage on greater than 30 % of row crop acres and full implementation of the buffer rule. The selected BMPs and estimated scales of adoption for both nitrogen and phosphorus were developed by local stakeholders and have been supported as attainable watershed goals. In the five watershed scale examples below, the combinations of BMPs that attain the goals vary somewhat but are founded on these core strategies, which summarize *what needs to happen* with regard to nutrient reduction in the ZRW.

Core Strategies for Protection

- Protect high quality water and land resources via easements and fee title acquisition with focus provided by tools summarized in Section 3.1.
- Pursue DNR Fisheries management easements on streams as a protection measure and a means of focusing habitat improvement money.
- Enforce the Wetlands Conservation Act and work toward no net loss of wetlands in the watershed (i.e. mitigation of wetland impacts to be kept within the confines of the ZRW watershed).
- Protect the base flow of the ZRW trout streams.

Estimated Scales of Adoption needed to Meet Goals

A summary of the BMP Tool spreadsheet work is included in the following five pages.

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Nitrogen (N) BMPs	S. Fk. Zumbro HUC 10 (01), % Adoption or Acres Treated	South Br. Middle Fk. HUC 10 (02), %Adoption or Acres Treated	North Fk. Zumbro HUC 10 (04), % Adoption or Acres Treated	Lower Zumbro HUC 10 (05), % Adoption or Acres Treated	Zumbro HUC 8, %Adoption or Acres Treated
Acres of Cropland	125,000	99,000	113,000	137,000	578,000
Corn acres receiving target N rate, no inhibitor/shift	80% or 44,370	80% or 28,930	75% or 41,640	90% or 66,010	90% or 234,190
Fall N target rate acres receiving N inhibitor	75% or 7,310	80% or 12,830	400% or 23,030		90% or 42,500
Fall N applications switched to Spring		20% or 640		100% or 4,360	50% or 2,360
Fall N switch to Spring/side dressing	25% or 610	40% or 1,280			
Restored Wetlands		5% or 480			
Tile line bioreactors	5% or 320	5% or 530	5% or 140		20% or 5,600
Controlled drainage		5% or 530			
Saturated Buffers	2% or 130	10% or 1,060	5% or 140		20% or 5,600
Riparian Buffers, 100/2= 50ft wide [model adjmt.]	100% or 2,700	100% or 1,880	100% or 2,710	96% or 3,670	96% or 12,600
Rye cover crop after beans __% and corn grain __%	10% or 6,200	20% or 16,910	10% or 9,120	10% or 7,150	25% or 22,670
Short season crops planted to a rye cover	80% or 4,170	50% or 2,500	60% or 2,990	80% or 5,240	80% or 21,000
Perennial crop % of marginal corn bean acres	50% or 3,270	5% or 350		50% or 4,440	20% or 6,960
Cropland N load reduction % with these Adoption Rates or Acres Treated	19.7%	19.8%	23.4%	24.0%	19.4%
Treatment Cost/yr.	$1,440,000	$1,700,000	$1,360,000	$1,870,000	$5,960,000
N fertilizer cost savings from reduced inputs	$670,000	$290,000	$760,000	$1,110,000	$3,620,000
Net BMP Treatment Cost	$770,000	$1,400,000	$600,000	$760,000	$2,340,000

Phosphorus (P) BMPs	South Fk. Zumbro HUC 10 (01), % Adoption or Acres Treated	South Br. Middle Fk. HUC 10 (02), %Adoption or Acres Treated	North Fk. Zumbro HUC 10 (04), % Adoption or Acres Treated	Lower Zumbro HUC 10 (05), % Adoption or Acres Treated	Zumbro HUC 8, %Adoption or Acres Treated
Acres of Cropland	125,000	99,000	113,000	137,000	578,000
Target P205 rate	80% or 90,420	80% or 73,480	70% or 69,260	80% or 90,940	80% or 412,000
Fall corn fertilization to pre-plant/starter		25% or 830		50% or 1,950	50% or 9,000
Use reduced tillage on corn, soy, and small grains >2%	10% or 4,190	25% or 8,480	50% or 19,040	80% or 32,890	80% or 154,000
Riparian Buffers, 50 ft. wide, 100 ft. treated	100% or 6,770	95% or 4,240	100% or 7,230	95% or 10,340	95% or 32,000
Perennial crop % of marginal corn and soybean land	50% or 3,170	5% or 340		50% or 4,250	20% or 7,000
Rye cover after beans __% and corn grain __%	6% or 6,460	20% or 17,400	10% or 9,390	7% or 7,470	10% or 34,000
Short season crops planted to a rye cover crop	80% or 4,310	50% or 2,530	60% or 3,060	80% or 5,550	80% or 22,000
Controlled Drainage		5% or 530			20% or 6,000
Alternative Tile Intakes	3% or 580				20% or 15,000
Inject/incorporate manure	50% or 5,050	90% or 5,830	30% or 2,990	50% or 7,450	50% or 24,000
Cropland P load reduction % with these Adoption Rates	15.7%	15.7%	15.0%	16.2%	17.2%
Treatment Cost/yr.	$1,390,000	$1,390,000	$1,010,000	$1,500,000	$4,150,000
P fertilizer cost savings from reduced inputs	$1,430,000	$690,000	$1,115,000	$1,330,000	$3,160,000
Net BMP Treatment Cost (black text = + net)	$40,000	$700,000	$105,000	$170,000	$990,000

The Task for the Group Meetings

WRAPS are required to provide estimated scales of adoption of BMPs that would result in attainment of water quality goals. A core engagement component of the Zumbro WRAPS process was to meet with each county in the ZRW to discuss and formulate examples of how to best meet statewide nutrient reduction goals for phosphorus and nitrogen for specific HUC 10 sub-watersheds within their counties. The Minnesota Agricultural Water Resource Center (MAWRC) and crop consultants in the ZRW were also engaged in the same task, only at a HUC 8 or entire watershed scale. Tables __ and __ above summarize example combinations of practices that were developed by county personnel, the MAWRC, and crop consultants within the N/P BMP Tool to meet a 12% reduction goal for phosphorus and a 20% reduction goal for nitrogen. These scenarios recommend practices that would work in those specific watersheds by estimating percent adoption rates and acres treated for those practices that they thought would be achievable.

The Tool also translates "percent adoption rates" for specific BMPs into numbers of "acres treated" based on the number of acres suitable for the practice. For example, if a specific BMP could be implemented on 10,000 suitable acres, an adoption rate of 20% would mean that 2000 acres would be "treated" and receive the practice. The county's conservation personnel could then use those 2000 acres as a measurable goal to achieve during the 10-year window of the WRAPS and 1W1P plans. Counties could utilize these acre and adoption goals for grants and other incentives for landowners to implement these practices**.**

Lessons Learned Working with the BMP Tool

During the course of the group work sessions, attendees would ask how many "acres treated" a specific adoption rate percentage would represent. Both the P and N-BMP make that conversion. Based on recommendations from attendees, both the adoption rate percentages and the acres treated are listed in the Summary Table.

Additional recommendations from attendees include listing "existing acres" for each BMP. However, the Tool does not consistently give estimates of existing acres; nor does there exist, in every case, the information required to accurately estimate "existing acres" treated by a BMP. The P-BMP Tool has estimates for "existing acres" for specific BMPs; the N-BMP Tool does not. The point was also raised that the number of acres in any given year that receive BMPs can fluctuate based on weather conditions and available conservation funds from federal and states government programs. Given the difficulty in utilizing these numbers in a piecemeal fashion, "existing acres" are not listed in the Summary Tables. A caveat when using the BMP Tool would be to understand that its application is intended to present examples of nutrient reduction goal attainment across very complex landscapes and as such they are estimates of land use changes necessary to reduce nutrient loadings to receiving waters.

The rye cover crop following corn and soybeans BMP also ran into difficulties with respect to "suitable acres." The default setting in the Tool for suitable acres for this practice is 100%, meaning all corn and soybean acres are suitable for a rye cover crop in the fall. In most cases, meeting attendees would apply an approximate 10% adoption rate to these suitable acres to arrive at the total acres of cover crops to be implemented. A notable exception occurred with the crop consultant and MAWRC attendees: they insisted that suitable acres for rye cover should be adjusted

downward to 25% of acres after soybeans going into corn grain and 10% of corn grain acres going into soybeans. This reflected their experience with the difficulty of planting cereal rye in the late fall after harvest. To this lower number of suitable acres, the group then applied a higher rate of adoption of the cover crop practice (25%, see Table x).

Finally, the N-BMP and P-BMP "acres treated" for the 50-foot riparian buffer do not match because the P-BMP is acres *treated* by the practice, while N-BMP acres would be acres *taken out of production* for this practice. The P-BMP Tool uses a formula to come up with treated acres that extend beyond the buffer 50-foot corridor. This approach utilizes the fact that most phosphorus is transported in a particle form and the buffer would be treating a number of upstream acres, for example, surrounding cultivated fields where the phosphorus movement originates. The opposite is true for nitrogen that is primarily transported in a dissolved form in groundwater. Dissolved nitrogen, in a nitrate form from upstream acres, usually bypass riparian buffers as it moves through the buffers in tile drains and groundwater seeps. The acres treated by buffers in the N-BMP tool, therefore, would represent only those acres that would be converted within the 50-foot riparian corridor from cultivated to perennial cover.

Questions concerning assumptions, calculations, and applications of the BMP Tool should be directed to Dave Wall at the MPCA. His email is: david.wall@state.mn.us.

Summaries of the Tables

The Counties in the ZRW recommended some notable approaches to the two nutrient reduction exercises with the N/P BMP Tool.

To meet the >12% reduction goal for Phosphorus in the next 10 years:

-All scenarios had high adoption rates for targeting P2O5 rate that would reduce P fertilizer inputs and consequently save farmers money. Overall, source reduction of phosphorus fertilizer accounted for slightly more than one-fourth of the phosphorus reductions.

-Counties varied widely on the BMP using reduced tillage on row crop acres with >2% slopes – from 10% to 80% adoption rates. For example, in the Lower Zumbro, Wabasha County estimated an 80% adoption rate for this BMP to be applied on 32,890 acres, while Olmsted County estimated a 10% adoption rate for the South Fork Zumbro HUC 10 to be applied on 4,190 acres.

- The 50-foot stream riparian buffers will be adopted on all of the suitable acres in the ZRW according to the Stream Bank Buffer Laws passed in 2015-16. Stream bank buffers will work to attain one-third to one-half of the overall P-reduction goal.

-Counties also had widely varying adoption rates converting marginal row crop acres to perennial crops. Adoption rates varied from 5% in Dodge County to 50% in Olmsted and Wabasha Counties.

-Rye cover crop adoption rates on short season crops were fairly consistent - in the range of 50-80%. The rye cover cropping BMP of short season crops, although covering few acres (3-6,000 in each of the HUC10s), resulted in an estimated one-twelfth of the needed P-reduction goal.

To meet the >20% reduction goal for Nitrogen in the next 10 years:

-All counties proposed significant adoption rates – 75-90%- for corn acres receiving target N rate with no inhibitors or timing shift of N applications. This BMP alone could meet one-half to three-quarters of the 20% nitrogen reduction goal. In addition, the adoption of this BMP could save farmers in the ZRW between $3-4,000,000 in N-fertilizer costs. Other source reduction N BMPs were utilized by counties but proposed widely different adoption rates. For example, Goodhue and Wabasha Counties did not utilize the BMP of switching Fall N applications to spring, but Dodge County proposed a 40% adoption rate.

-All structural BMPs for meeting the N reduction goal (restored wetlands, tile line bioreactors, controlled drainage, and saturated buffers) were not proposed as widely adopted solutions for reducing N. These BMPs are more expensive to implement and maintain, have high initial costs, and most of the watershed's geography is not appropriate for implementation.

- The 50-foot stream riparian buffers will be adopted on all of the suitable acres in the ZRW according to the Stream Bank Buffer Laws passed in 2015-16. Stream bank buffers will work to attain approximately one-tenth of the overall N-reduction goal. Riparian buffers work much better at P-reduction than N-reduction.

- Short season crops planted to a rye cover crop was proposed at 50-80% adoption rate of suitable acres. Although proposed for a small number of acres, this BMP accounts for one-tenth of the N-reduction goal.