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MINNESOTA DRAINAGE LAW ANALYSIS AND EVALUATION

FINAL REPORT

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August 15, 2011

With technical assistance from:

Houston Engineering Inc.

I&S GROUP *One* firm - start to finish™

EOR water ecology community

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ENVIRONMENT AND NATURAL RESOURCES TRUST FUND

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I. INTRODUCTION AND OVERVIEW

The glacial landscape of Minnesota is the land of 10,000 lakes, a few more wetlands, and a good deal of high groundwater. The state's past and continuing prosperity would not be possible without the ability to make productive use of land by drainage. Roads, settlements, agriculture all have relied, and will continue to rely, extensively on the ability to manage surface and groundwaters through systems of ditch and tile.

But we also have come to appreciate more with time the benefits of protecting our wet environments, the places where ground and surface waters meet. Our recognition grows of the benefits of preserving these areas, both economic and non-economic -- the "ecological services" that these areas provide.

Certainly it is not unusual to encounter competing public values, nor is it unusual that these values may be challenging to reconcile, particularly through the imperfect instrument of the laws. It is good public policy to pause periodically and assess how we are doing.

The LCCMR commissioned this study to analyze Minnesota drainage laws and related economic and environmental considerations, and to explore alternative strategies that would best protect both the state's surface waters and the rights of property owners to make beneficial use of their land through drainage. Such a study requires strong engagement of stakeholders in order to develop creative, integrated solutions to natural resource protection and productive land use.

We established a study advisory committee composed of individuals from diverse backgrounds and expertise. (A list of the study advisory committee members appears at Appendix A.) Many committee members are also members of the Drainage Work Group that advises the Minnesota Board of Water and Soil Resources; we added other advisory committee members to provide for additional perspectives. We exceeded our study's commitments to advisory committee meetings and regional forums. We convened the study advisory committee nine times, from December 2009 through May 2011. We also presented this study to the Minnesota Association of Watershed Districts annual meeting in 2009 and 2010; three times to the Drainage Work Group; and to the Red River Watershed Management Board in June 2011.

This study presents an overview of the drainage code and related water resource laws; identifies critical issues where potential conflicts between the drainage code and other laws create barriers to successful resource protection; and identifies three prototypical demonstration scenarios to inform the study's analysis of these critical issues. This process -- building on a legal review, identification and analysis of critical issues, and exploration of demonstration scenarios – provided the foundation for us to pursue the policy recommendations through a number of review sessions with the study advisory committee and other forums.

Our recommendations may be summarized as follows:

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- Give drainage authorities more tools and resources for watershed-based planning.

- Give drainage authorities more tools and resources to implement projects with integrated drainage, flood control, conservation and water quality benefits.

- Better integrate effects on wetlands and water quality into drainage authority decisions about drainage system work.

- Provide drainage authorities with more clarity in legal authority to address drainage system alignment, grade, cross section, and hydraulic capacity of bridges and culverts for multipurpose design of drainage system establishment, improvement, or repair.

- Extend the authority to establish a locally based wetland regulatory framework under a CWPMP to public water wetlands.

- Create replacement alternatives within a CWPMP for a landowner causing wetland impact who may not have a high-valued replacement option on site.

- Coordinate USACE Section 404 jurisdiction with a watershed-based CWPMP or other implementing framework.

- Integrate MnDOT right-of-way, other state-managed lands and local road authority activities within a CWPMP framework.

- Foster reliability of CWPMP outcomes through coordination of local land use authority and wetland regulatory authority.

Our policy recommendations are presented in detail at Section V of this report, and include both pertinent findings and specific recommended actions. More detailed draft legislation to implement these recommendations is included at Appendix A.

We intend for these recommendations to provide tools for the legislature or local authorities to make policy choices in how best to integrate drainage and natural resource management. Accordingly, the recommendations are the product of robust discussion, but not complete consensus. The recommendations are the responsibility of the authors, and reflect a judgment that they have adequate support among diverse stakeholders to be worthy of consideration.

While the responsibility of making policy recommendations has been assumed by the authors, we must express our gratitude to the members of the study advisory committee, many of whom devoted countless hours to study and deliberation of these issues. We are also grateful for the technical assistance with the demonstration scenarios provided by three engineering firms, Houston

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Engineering, Inc., I & S Group, and EOR, as well as the economic analysis provided by Dr. Steve Taff. The quality of the work presented here is certainly stronger as a result of their participation.

We hope this study provides useful information to the Legislature, and we look forward to continued discussion of the recommendations.

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II. LEGAL REVIEW

The Minnesota Drainage Code must be understood in the context of many water – related statutes. This section of the report surveys the drainage code and related state and federal wetland conservation laws. The section concludes with an assessment of this legal framework and suggests several ways in which its approach to reconciling public interests in drainage and conservation may not be optimal

A. Authority to Establish and Maintain Public Drainage Systems

The drainage law is a means by which a number of adjoining landowners, with relative efficiency, can construct, maintain and equitably share costs for a drainage and conveyance system across multiple parcels of land. The legal framework to accomplish this within the State of Minnesota has not changed very much since 1883, when county commissioners first were authorized to accept petitions and establish public drainage systems. Laws 1883, c. 108. Under this framework, system alignment and dimensions are determined, landowner benefits and damages are estimated by disinterested "viewers," and the county commissioners – and now in many cases watershed district boards of managers – judge whether net benefit will result from the proposed work. If so, assessments are certified to the county auditor and work proceeds. The drainage law prescribes procedures for constructing and expanding drainage systems, performing work on system outlets, and system maintenance.

The relationship of drainage system management and conservation reflects an evolution, over 100 years, of legislative thinking about the public interest in the state's surface waters. This history reflects an evolving legislative judgment about where the boundary lies as between the private "right" to drainage and the public "right" to the natural condition of surface waters, and therefore about how the costs of conservation should be allocated as between landowners and the general public. In recent decades federal law has created a second regulatory overlay. As we will see, the legal framework tends to presume that where drainage and conservation goals intersect, one or both must be compromised, and the framework tends to undermine opportunities to achieve both goals.

B. Evolution of Public Interest in Waters

Already in 1867, it was a misdemeanor to drain a meandered lake, with a fine of as much as five thousand dollars. Laws 1867, c. 40. In 1883, county commissioners were authorized to allow the draining of "shallow, grassy, meandered lakes under four feet in depth" with the concurrence of all riparian landowners. Laws 1883, c. 139. Forty-two years later, the legislature restricted this authority by prohibiting the drainage of any meandered lake without state approval. Laws 1925, c. 415, §2. The state department of conservation was created in 1931, Laws 1931, c. 186, and in 1933 the state's authority to consent to drainage was given to the conservation commissioner. Laws 1933, c.312, §1.

Separately, the legislature's view of those waters meriting protection on behalf of the citizens of Minnesota – designated as "public waters" – was evolving and expanding. As early as 1897, the

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legislature designated as public waters meandered lakes larger than 160 acres and deep enough to support beneficial uses "such as fishing, fowling and boating." Laws 1897, c. 257. In 1937, the "public waters" designation was extended to all streams and lakes, meandered or not, that were "navigable in fact." Laws 1937, c. 468. Then in 1946, this protection was extended to all streams, lakes and other waterbodies "navigable in fact" that provided "substantial beneficial use." 1947 Laws, c. 142. This is the first instance in which the legislature included certain wetlands within the definition of public waters.

In 1955, the legislature enacted the Watershed Act, providing for the creation of watershed districts. Laws 1955, c. 799. Raymond Haik, one of the key drafters of the act, has explained that one of its important goals was to provide for a special purpose local unit of government that could protect wetlands and other water resources in parallel with local drainage authorities (R. Haik, September 30, 2009). While the legislature provided for the establishment of watershed districts for conservation purposes and to protect and improve water quality, it also authorized watershed districts to "improve stream channels for drainage," and "reclaim or fill wet and overflowed land." Minn. Stat. §103D.201, subd. 1, 2(2) and (3).

The new law gave watershed districts the authority "[t]o take over when directed by the district court or county board all judicial and county drainage systems within the district, together with the right to repair, maintain and improve the same." Laws 1955, c. 799, §10(11). But the role of drainage authority was confused by further language providing for watershed districts to construct, improve and repair systems essentially at the direction of the county board or district court, with the latter continuing to exercise the decisionmaking role. Id., §32. Four years later, the legislature clarified that on transfer of authority from the county board or district court, a watershed district would assume all drainage authority powers. Laws 1959, c. 240, §1.

In 1957, the legislature defined the state interest in public waters:

> Subject to existing rights all waters in streams and lakes within the state which are capable of substantial beneficial public use are public waters subject to the control of the state. The public character of water shall not be determined exclusively by the proprietorship of the underlying, overlying , or surrounding land or on whether it is a body or stream of water which was navigable in fact or susceptible of being used as a highway for commerce at the time this state was admitted to the union.

Laws 1957, c. 502. This statement of policy announced that the state's interest in its surface waters did not derive solely from its ownership interest in adjacent land or the bed of the waterbody, nor did it depend on the specific public use of the waterbody for navigation. It endorsed an interest as broad as the "beneficial uses" to which the surface water might be put. At the same time, the status of wetlands was somewhat confused by their omission from the scope of the declaration.

Over this same period consideration of conservation values in drainage proceedings gradually was expanding. The 1937 law expanding "public waters" to all streams and lakes navigable-in-fact also prohibited any change to the "course, current, or cross-section" of any such water without the conservation commissioner's approval. Laws 1937, c. 468, §5.

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Wetlands not considered "lakes" first received protection in drainage proceedings in 1955, when the legislature mandated that conservation values be weighed by drainage authorities in deciding whether to establish, improve or repair drainage systems. The drainage code was amended to require the drainage authority to duly consider "conservation of soil, water, forests, wild animals, and related natural resources, and … other public interests affected" in deciding whether to authorize work on a drainage system. Laws 1955, c. 681, §1. This language remains in the drainage code today. Minn. Stat. §103E.015, subd. 2. It has been supplemented by a further directive to consider conservation interests before construction of any new drainage system, system lateral or improvement, or outlet. Minn. Stat. §103E.015, subd. 1. However, its impact is limited. While a drainage authority might be encouraged to consider these conservation values, the Minnesota Supreme Court has confirmed that judicial enforcement of this exhortation is limited. Titrud v. Achterkirch, 298 Minn. 68, 213 N.W.2d 408 (1973).

In the 1970's there was much legislative interest to advance the cause of the environment. The Minnesota Environmental Rights Act (MERA) was enacted, empowering citizens to challenge any action threatening "pollution, impairment or destruction" of natural resources. Laws 1971, c. 952. Two years later, the Minnesota Environmental Policy Act (MEPA), mirroring the 1969 National Environmental Policy Act, established requirements for environmental review of significant undertakings. Laws 1973, c. 412. Both of these laws remain. In their broad compass, they apply to drainage system work.

More specifically, the decade of the 1970's was a time of intense, and at times complicated, activity by the state legislature and the Department of Natural Resources to refine the category of "public waters" and decide how the interest in protecting these waters should be reflected in drainage proceedings.

In 1973, the legislature returned to the 1957 declaration finding all streams and lakes serving beneficial public uses to be public waters, and expanded it to encompass all "waters of the state," itself broadly defined to include wetlands. (This adjustment established consistency with the 1946 legislation, chapter 146, cited above.) Laws 1973, c. 315, §§2-4. This legislation, importantly, also codified for the first time a long definition of "beneficial public purposes," which included flood management, conservation purposes such as water quality and wildlife habitat protection, and recreational uses such as hunting, fishing and boating. Laws 1973, c. 315, §§2-4.

Three years later, the legislature directed the Department of Natural Resources to inventory and designate as public waters waterbodies serving a "material beneficial public purpose." Laws 1976, c. 83, §7. The administrative challenge of assessing the "beneficial purpose" of each individual waterbody across the state for the purpose of public waters designation, the consequences of that designation, and the resulting discontent of landowners and county boards led the legislature in 1979 to replace the "beneficial purpose" criterion with a set of more objective definitions. Specifically, wetlands to be designated as public waters would now be defined as "types 3, 4 and 5 wetlands, as defined in U.S. Fish and Wildlife Service Circular No. 39 (1971 edition) … which are ten or more acres in size in unincorporated areas or 2-1/2 or more acres in incorporated areas." Laws 1979, c. 199, §3. This remains the definition of public waters wetlands. Minn. Stat. §103G.005, subd. 15a.

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The 1979 law also specifically exempted from the DNR permit requirement drainage system work in watercourses when accomplished in accordance with the drainage code. Laws 1979, c. 199, §15. The effect of this exemption was substantially dampened in 1985, when the drainage code was amended to require DNR approval for any action that would drain a public water. Laws 1985, c. 172, §2. While a formal permit is not required, there is little practical difference between DNR "approval" and a DNR "permit."

In 1991, the legislature decided that the beneficial public uses of wetlands were not restricted to the category of wetlands defined as "public waters wetlands" in the 1979 legislation, and adopted the Minnesota Wetland Conservation Act (WCA). The WCA regulates draining and fill impacts to all wetlands, which are defined as lands possessing, under normal circumstances, the three attributes of hydrology, hydric soils and hydric vegetation. Laws 1991, c. 354, art. 6, §6. The legal framework is similar to that for reviewing proposed impacts to public waters: permission to drain or fill must be obtained from the implementing agency based on a "sequencing analysis" showing that the wetland impact cannot be avoided and has been minimized. If, as a result of this analysis, wetland impact is allowed, lost acreage and wetland functions must be replaced elsewhere. However, the implementing agency is not the DNR, but the local city, town, county or watershed district, and the details of the review process diverge. The WCA includes specific exemptions for work on existing drainage systems, including: (a) maintenance that does not drain wetlands in existence for more than 25 years; (b) work subject to Section 404 of the Clean Water Act but exempted by the U.S. Army Corps of Engineers (USACE) from the permit requirement; and (c) certain work authorized under a Section 404 general permit.

C. **Federal Regulation of Fill in Wetlands**

Parallel federal regulation came into being in 1972. Section 404 of the National Water Pollution Control Act (NWPCA) prohibited placing fill or dredged materials in "waters of the United States" without a permit from the USACE. As defined in the NWPCA and the implementing rules of the USACE and U.S. Environmental Protection Agency, these waters include natural and artificial tributaries of navigable waters, and thus encompass many public ditch systems in artificial or altered natural channels. Similar to state law, Section 404 requires that the placing of fill or dredged material be justified and that the area and impact on waterbody functions be replaced elsewhere.

Although Section 404 applies only to filling activity and not to the removal of sediments or obstructions from ditches, such activities often involve the incidental movement or redeposit of sediments within the channel or spoils placement within jurisdictional areas adjacent to the channel. The 1977 amendments to the NWPCA, also known as the Clean Water Act (CWA), added Section 404 exceptions for incidental fill from drainage ditch maintenance activity. In addition, the CWA authorized the USACE to allow smaller-scale impacts through the expedited mechanism of a "general permit."

Relying on this authority, USACE general permit RGP-03-MN applies to actions such as structure maintenance, stream and wetland restoration, and minor discharges of fill or dredged material. Impacts must be avoided where possible and, except for minor discharges, impact area and functions must be replaced. In addition, present general permit GP-001-MN authorizes all work subject to and authorized by the DNR. Under GP-001-MN, standard conditions require that the

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work be performed with care, but the impact need not be justified and there is no replacement requirement beyond that imposed by the DNR.

D. **Allocating Costs to Conserve Wetlands**

When the legislature directed that public waters be inventoried and designated, it declared that the public should bear the cost of protecting these waters. That is, it obligated the DNR, on receipt of a request to drain a waterbody, to offer to purchase drainage rights (permanently or for a term of years) from the landowner. However, if the offer were made and the landowner declined, the waterbody could be drained only pursuant to DNR approval and only if the public water were "replaced by a waterbasin which will have equal or greater public value." Laws 1976, c. 83, §8.

Legislation in 1979 also directed that if maintenance of an established public drainage system would drain a wetland owned by the state, the public should bear the cost to protect the wetland without interfering with the proper function of the drainage system. Laws 1979, c. 199, §11. See also Laws 1985, c. 172, §52 (the state shall manage certain publicly owned wetlands to avoid interference with drainage proceedings for outlets).

In 1987, the legislature repealed the requirement that the DNR offer to compensate a landowner in exchange for the yielding of the public water wetland drainage right. Laws 1987, c. 357, §20. Since that time, a landowner has had no legal right to drain a public water wetland except pursuant to DNR approval and with replacement.

In that year the legislature also took a small step to adjust how drainage system maintenance costs are allocated. The drainage code was amended to provide that drainage benefit determinations should discount for the likelihood that lands within the benefited area could not be drained due to state and federal regulatory constraints. Laws 1987, c. 239, §74.

Finally, WCA as enacted in 1991 authorized landowner compensation from the Board of Water and Soil Resources if WCA conditions made the proposed action "unworkable or not feasible." Compensation was established by statute as "50 percent of the average equalized estimated market value of agricultural property in the township as established by the commissioner of revenue at the time application for compensation is made." Laws 1991, c. 354, art. 6, §17. A 1994 amendment established alternative compensation at 50 percent of "the assessed value per acre of the parcel containing the wetland, based on the assessed value of the parcel as stated on the most recent tax statement." However, in exchange for compensation, the landowner was required to convey to the BWSR a permanent conservation easement on the land. Laws 1994, c. 627, §10. The compensation formula was further adjusted two years later. Compensation claims under this statute have been very few.

Alongside the traditional regulatory approach, the Minnesota legislature long has offered mechanisms for landowners to voluntarily preserve wetlands for conservation purposes in exchange for some form of compensation: by authorizing public acquisition of land or easements, offering term agreements or granting tax benefits for preserved lands.

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As early as 1925, legislation authorized the game and fish commissioner to acquire land for hunting grounds and game refuges. 1925 Laws, c. 419. In 1951, federal funds were made available to acquire wetlands for state wildlife management areas. In 1953, a tax reduction was extended to those who preserved marshland as wildlife habitat area. 1953 Laws, c. 688. Similar laws followed concerning public acquisition of wildlife areas, 1957 Laws, c. 644, and scientific and natural areas, Laws 1969, c. 470.

In 1976, the legislature, piggybacking on an earlier-enacted federal law, enacted a "water bank" program under which landowners would protect wetlands under 10-year contracts with the state. Laws 1976, c. 83. The year 1979 saw the legislature establishing tax credits for wetlands. Other state and federal programs, enacted since that time and still operating, offer landowner payments in exchange for term agreements to maintain wetlands. The 1991 legislation enacting WCA also established programs to create wetland preserves and wetland preservation areas with willing landowners and authorized programs to work with such landowners on wetland establishment and restoration.

E. **Summary of Legal Framework and Potential Shortcomings**

With this long and complex legislative history, it may be helpful to attempt a succinct summary of the current basic legal framework to reconcile public drainage and wetland conservation. Drainage systems may be constructed, expanded and maintained via procedures that have been generally in place for a century. The drainage authority may approve a new system, new lateral, improvement or system outlet if it finds that the benefits to affected lands exceed the costs and that public interests will not be disserved. It may repair and maintain these systems largely as it judges to be in the interest of landowners benefited by the system, again subject to consideration of public interests.

If this drainage activity would involve wetland fill, drain a wetland or otherwise alter its hydrology, it is first subject to a sequencing analysis. Here, it must be shown that wetland impact cannot be avoided, and that the impact is minimized. Any impact that cannot be avoided must be reduced or eliminated over time or, ultimately, replaced withwetland acreage and biological function elsewhere. By statute, replacement must achieve "no net loss" in wetland public value, as that term is defined at Minnesota Statutes §103B.3355. Where an impact may be substantial or affected wetlands have particularly high value, the drainage authority or the wetland regulatory body may forbid the activity.

- If the affected wetland is a "public waters wetland" as defined at Minnesota Statutes §103G.005 (Type 3, 4 or 5 wetland of at least 10 acres within an unincorporated area or 2.5 acres within an incorporated area), the DNR will review wetland impacts.

- If the wetland does not meet this definition, wetland impacts will be reviewed by the local land use authority or watershed district.

- Separately, if the wetland is within a navigable water, or pursuant to federal law has a sufficient hydrologic connection to such a water, and if fill or dredged material will be placed within it, the USACE will review as well.

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Some drainage system activities, primarily maintenance of existing systems that continue to provide a reasonable level of beneficial drainage, enjoy exemptions from wetland conservation requirements.

All drainage activities also are subject to general environmental standards. These include Minnesota Statutes §103E.015, which directs the drainage authority to consider environmental and other public interests in deciding to proceed with drainage system work; 33 CFR 320.4, authorizing the USACE to engage in a broad "public interest review" during Section 404 permitting; the Minnesota Environmental Rights Act (MERA), under which a public or private plaintiff can challenge a proposed activity as an environmental impairment; and the Minnesota and National Environmental Protection Acts (MEPA, NEPA), which can impose extensive environmental analysis requirements before work may occur.

While this regulatory framework may be procedurally clear, the rules reconciling public drainage and wetland conservation are less well-developed on the allocation of benefits and costs resulting from regulatory decisions. Generally, those who will benefit from the construction or improvement of a drainage system must bear the cost to maintain or replace wetland values under applicable regulations. Conversely, except where a system has fallen extensively out of repair, impacts to wetlands from system maintenance are excused and measures to protect wetlands from those impacts generally fall to the general public. Similarly, landowners that choose to forego otherwise operable drainage of their lands may obtain compensation for doing so from a number of state and federal programs by means of term contracts or permanent easements.

The survey of legal history suggests several ways in which the legal framework to reconcile public interests in drainage and conservation may not be optimal.

First, we are still working largely with a framework enacted in 1883. At that time, the circumstances for which drainage systems needed to account were relatively simple. It could be assumed that stakeholders, fairly uniformly, would consider drainage to be beneficial. Accordingly, feasibility and cost were pretty much the only relevant questions. In addition, drainage and conveyance needs were defined almost exclusively by agricultural land use, and not by urban stormwater management needs or conservation management regimes. Finally, broader social interests, such as those in water quality and wildlife habitat, were not prominent. The evolution of our land uses, the continued drainage needs and advancement of drainage practices, and current legislative judgments on natural resources conservation all are factors that might recommend adjusting the legal framework.

Second, the present laws governing public drainage and wetland/water quality protection are the result of legislative actions accumulated over the course of more than a century. As a result, the legal framework is not perfectly joined, addresses some aspects in piecemeal fashion, and contains unresolved ambiguities.

Finally, the laws reflect basically two means to mediate drainage and wetland conservation interests. Either (a) the drainage authority establishes an uneasy compromise, in which neither interest is fully realized; or (b) the public at large pays to reserve, for conservation, lands that otherwise could benefit both private and public interests through productive use. It is in the interest of all concerned to identify alternative outcomes.

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Beyond merely updating the legal framework to address gaps and ambiguities, it will be even more valuable to discover potential legislative changes to allow both drainage and conservation goals to be better realized. It is important also to recognize that these drainage/conservation judgments now apply to settings that may range from agricultural, to suburban residential, to a mix of land uses served by a single public system.

Increasingly, conditions exist that allow for "win-win" solutions:

- A more comprehensive understanding continues to develop concerning the effects of non-point pollution and hydraulic forces on water quality.
- There is an ever-improving capacity to model and refine hydrologic systems and to evaluate flooding, hydraulic and water quality impacts of those systems.
- Settlement patterns and social values continue to evolve, calling on hydrologic systems to serve multiple land uses and beneficial uses encompassing the functional and the ecological.
- Innovation increases the choices for on- and off-line techniques to incorporate water quality practices into conveyance systems.
- A diversity of drainage authority funding mechanisms allows the costs of hydrologic/conveyance systems to be accurately matched to the varied benefits these systems provide.

Three prior acts of the Legislature foreshadow this direction toward more successful and comprehensive realization of drainage and conservation goals:

In 1991, Minnesota Statutes §103E.701 was amended to state: "Repair of a drainage system may include the preservation, restoration, or enhancement of wetlands; wetland replacement under section 103G.222; and the realignment of a drainage system to prevent drainage of a wetland." Laws 1991, c. 354, art. 10, §2.

Several years thereafter, §103E.011, subdivision 5, was added to affirm that drainage authorities could apply funding mechanisms within their authority other than benefits-based assessments to fund that portion of drainage system work consisting of wetland preservation or restoration, creation of water quality improvements or flood control. Laws 2000, c. 488, art. 3, §27.

And, in 1996, section 103G.2243 was added to the WCA authorizing implementing agencies to create comprehensive wetland protection and management plans (CWPMPs). Laws 1996, c. 463, §33. CWPMPs rest on an assessment of local hydrology and ecology, allow wetland management to be tailored to local conditions, and enable the benefits and impacts of regulatory decisions to be considered on a subwatershed rather than site basis.

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These legislative measures reflect a new approach in which hydrologic system design, sensitive to the watershed setting, can integrate drainage and conservation goals to provide effective drainage for productive use of land while preserving higher-valued ecological resources.

In order to pursue this new approach in greater detail, we turn next to a more detailed identification and analysis of critical legal or policy issues where drainage and resource protection goals conflict.

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III. CRITICAL ISSUES

The authors worked with the study advisory committee and gained input from the Drainage Work Group, the Minnesota Association of Watershed Districts, and the Water Policy Team for the Water Resources Sustainability Framework to identify key issues for this study. From this process, the following five issues emerged as the most critical:

A. Conservation Drainage

"Conservation drainage" is a term of recent coinage that may have different meanings to different people. Here, we use it to refer broadly to structures and techniques incorporated within the drain water collection and conveyance system specifically to manage flows and reduce transport of sediment and pollutants. Conservation drainage includes features such as buffer strips, culvert sizing for temporary in-system storage, side inlet sediment filtration and flow controls, contour tiling and two-stage ditch profile design. Conservation drainage also includes methods to isolate wetlands from drained lands, such as ditch realignment and wetland outlet controls.

These methods reflect how drainage system design and retrofit increasingly integrates ecological concerns. As these methods are shown to be reliable and cost-effective, they bridge the gap between the traditional poles of drainage and wetland preservation. This integration, of course, was foreign when the drainage code was enacted. Therefore, there are questions about the circumstances under which a drainage authority may mandate the incorporation of conservation drainage features into drainage systems. There are also questions about whether the tools exist to incorporate these features and allocate the cost of their installation and maintenance appropriately. Who should pay for their installation and maintenance? Are they a cost of the drainage system, to be included in calculating whether a drainage project should proceed and to be paid by assessing benefited lands? Or do they operate to protect resources benefitting the public, so that they are appropriately funded on a regional, watershed or statewide basis?

With the use of conservation drainage methods, efficiency losses in drainage systems are accepted in order to gain meaningful public conservation and water quality benefits. However, drainage code standards typically reflect a world of absolutes. For example, a drainage authority may approve the impoundment of water within a public system only if it finds that the impoundment "will not impair the utility of the ditch or deprive affected land owners of its benefit." Minn. Stat. §103E.227, subd. 3.

Drainage practitioners traditionally have worked within a grey area in applying this standard. Proposed actions may affect channel elevations under certain precipitation events but not others, or may affect the frequency or duration of elevated water in limited ways. Realigning a ditch may affect drainage, but only very near the realigned section. Conservation drainage, however, is different in that it reflects an actual intent to adjust drainage system hydrology. Accordingly, if these methods are to be explicitly incorporated into the drainage code, the existing standards need to be carefully examined and adjusted, as necessary, to articulate the extent of impact they may have on drainage system function.

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When public drainage systems are constructed and operated so that water resources simultaneously are conserved, sound legislation will afford ditch authorities judgment as to how costs are distributed among lands benefited by a drainage system and the broader publics benefited by conservation. Ditch authorities must have the authority to allocate costs fairly; they also must have the statutory ability to do so.

A fairly recent amendment to Minnesota Statutes §103E.011 authorizes a drainage authority to

> accept and use funds from sources other than, or in addition to, those derived from assessments based on the benefits of the drainage system for the purposes of wetland preservation or restoration or creation of water quality improvements or flood control.

This language, however, refers essentially to grant funds. In itself, it does not create a mechanism for a drainage authority to raise funds by means other than assessing benefited lands. It is important that drainage authorities, whether counties, joint county boards or watershed districts, can raise revenues in a way that allows costs to be allocated consistent with legislatively enunciated policies.

Finally, conservation drainage practices may trigger requirements that may not be appropriate and that could create obstacles to their use. For example, a two-stage channel likely would require that channel banks be regraded, which in turn would require that benefits of the ditch system be redetermined on a parcel basis. Minn. Stat. §103E.715, subd. 6. It is important that additional right-of-way to implement conservation design practices can be acquired efficiently and fairly. However, redetermination of benefits is an administratively burdensome process that would preclude the innovation in most cases. At the federal level, moving soils or incorporating structural features within a conveyance may constitute "filling" requiring permit review under Section 404. It is important that state laws and rules be reviewed for unintended impediments to incorporating beneficial practices. The USACE should be engaged to do the same with respect to its Section 404 program.

B. Subwatershed-Based Planning/Permitting

The subwatershed-based approach uses science and planning to minimize conflicts between water resource conservation and productive use of land. The resource management authority must understand hydrologic and ecologic function within the drainage area. It must identify the areas of substantial ecologic value and the drivers of ecologic health within the subwatershed. And it must understand present and future land uses within the area and the infrastructure needs those uses will prompt.

The goal is both productive use and preservation of hydrologic/ecologic function within the planning area. Implementation occurs through permitting rules (and, ideally, consistent local land use ordinances) that allow for productive land use in locations suited to it and, by mandate or incentive, preserve valued water resources and their function. The subwatershed-based approach also offers more predictability as to permitting outcomes.

Funding for this project was provided by the Minnesota Environment and Natural Resources Trust Fund as recommended by the Legislative-Citizen Commission on Minnesota Resources (LCCMR).

This approach is contrasted with the traditional regulatory framework that looks only at the single parcel proposed for use or development. This narrow focus normally ensures that a conflict between drainage and wetland conservation cannot be resolved. At the same time, it offers no guarantee that the level of protection afforded the resource will correspond with its function within, and value to, the hydrologic and ecologic systems of which it is a part.

Both state and federal wetland laws provide a framework for the subwatershed-based approach.

- The WCA gives BWSR the authority to approve comprehensive wetland protection and management plans (CWPMPs) that establish alternative wetland impact standards set on an area-wide basis. Minn. Stat. §103G.2243; see Minn. Rules 8420.0830.

- Under Section 404 and published USACE regulatory guidance, the USACE may approve Special Area Management Plans that authorize wetland impacts on the basis of a plan and related assurances providing for wetland functions to be replaced and preserved on an area basis.

These tools were not created specifically for areas served by public drainage systems. But they can be used in this context to establish a predictable regime in which a drainage system and the productive land uses that it serves can be maintained.

To facilitate the use of subwatershed-based approaches, we would address specific features of existing authorities that can make the process to obtain approval of subwatershed-based regulatory programs prohibitively time- and resource-consuming, or that stand as obstacles to gaining the most value from these approaches. This effort primarily would concern wetland statutes and regulations, the drainage code less so. As a specific example, the CWPMP statute now applies only to regulating impacts to WCA wetlands and not public waters wetlands. It may be possible to extend this approach to include public waters wetland impacts without legislative action. As another example, a CWPMP framework may be upset by a change in the designation of WCA implementing agency for the area in question.

More substantial obstacles exist at the federal level. One obstacle, for example, is the USACE's limited willingness to forego the required "alternatives analysis" required for project-specific applications. If the alternatives analysis, and the risk of a USACE finding that it does not justify the proposed action, still await each landowner after a SAMP is in place, then the SAMP does not carry nearly as much regulatory certainty as it might. In addition, the cost of performing this analysis reduces the value of a SAMP approach. This and similar issues rest on the fact that while the USACE has established the SAMP vehicle and continues to advance the watershed-based approach in policy documents, permit review still remains almost entirely ensconced within a regulatory framework with a traditional, parcel-specific focus. There is room within federal law to make progress on these matters, but ultimately there are likely to be limits on the extent to which these approaches can be facilitated without changes to that law or to USACE policies adopted at a national level.

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C. Updating Definitions and Use of Terms "Benefits" and "Damages" in the Drainage Code

Key to operation of the drainage code are the benefits and damages that will accrue to specific parcels from drainage system work. The determination of drainage benefits and damages plays three roles in the drainage code:

- First, it is used to judge whether a proposed action will be of overall net benefit, a finding that is a prerequisite to approval by the drainage authority.

- Second, the original determination of net benefit from drainage system construction is a ceiling onsubsequent assessments and expenditures for work on the system.

- Third, it determines how assessments will be apportioned among properties benefited by the drainage system.

The two terms are not found in the general definitions section of the drainage code, Minnesota Statutes §103E.005. Rather they are defined by treatment within the body of the code itself. E.g., Minn. Stat. §103E.315 (describing on what viewers may base benefits determinations and how damages may be calculated). Accordingly, definitions are not comprehensive and are augmented by (uncodified) practices of viewers and court decisions. Practitioners are aware of artifacts within the code that stand in the way of rational drainage system management. For example, a drainage authority may not authorize repair work requested by petition if the cost of that work will exceed the benefits "determined in the original drainage system proceeding." Minn. Stat. §103E.715, subd. 4. A spending limit based on benefits determined a century ago and not adjusted for inflation may not allow for necessary and reasonable work. In summary, revisiting and adjusting the definitions and uses of "benefits" and "damages" under the code likely would have general benefit.

More specifically with respect to wetland conservation, the benefits and damages that drainage authorities must weigh to decide whether drainage system work should be authorized are articulated in the code almost exclusively (apart from state-owned lands, see Minn. Stat. §103E.025) as private benefits and damages accruing to landowners within the drainage area. Benefits and damages to public resources are absent from consideration. See, e.g., Minn. Stat. §103E.315, subds. 5, 6, 8. Indeed, where the code does define public benefit, it does so in a way that may strike the present-day reader as incomplete:

> "Public benefit" includes an act or thing that tends to improve or benefit the general public, either as a whole or as to any particular community or part, including works contemplated by this chapter, that drain or protect roads from overflow, protect property from overflow, or reclaim and render property suitable for cultivation that is normally wet and needing drainage or subject to overflow.

Minn. Stat. §103E.005, subd. 27.

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Drainage authorities are mandated by Minnesota Statutes §103E.015 to consider conservation and other public values as well. However, the statute does not require the effect on these values to be quantified; the amount of "consideration" to be given is left to drainage authority discretion and generally is, at most, supplemental to the "hard numbers" of private benefits and damages.

With drainage and wetland laws both in play, the legislature is delegating to drainage authorities the responsibility to manage public drainage systems to achieve outcomes that best reconcile the public interests in drainage and wetland conservation. The decision making standards prescribed by the legislature therefore should provide for these interests to be fully considered together. Further, drainage management is evolving – or mandated - toward incorporating conservation drainage and other mitigating practices in drainage work. Accordingly, the decision making framework must allow drainage authorities to adjudge when these practices are required, and to what extent, and how their incorporation will affect project benefits, costs and parcel-based assessments.

Integrating water resource benefits and damages into drainage authority decision making is of course easier said than done. Wetlands, in particular, provide numerous functions with public (and private) value, including floodwater retention, water quality treatment, flow dissipation, wildlife habitat, groundwater recharge and economic uses. Upstream drainage systems can disrupt wetland ecology through sediment and pollutant delivery, channel erosion and hydrologic disruption caused by changes from the natural hydrograph. However, how proposed work will affect these phenomena may be very difficult or costly to assess technically and nearly impossible to quantify precisely in terms of monetized public benefit or damage. Nevertheless, an updated approach to defining "benefits" and "'damages"' in the drainage code can help greatly to integrate drainage and conservation goals.

D. Anticipating the Evolution of the Total Maximum Daily Load (TMDL) Program

Typically, work in public drainage systems is not subject to regulatory oversight for water quality and, therefore, does not incorporate measures specifically to limit water quality impacts. Over time, the Total Maximum Daily Load (TMDL) program is likely to change this situation.

The TMDL program, under the federal Clean Water Act, requires the MPCA to identify waters in the state that are not meeting water quality standards, identify pollutant sources contributing to this condition, and determine pollutant load reductions needed to bring the waterbody into compliance with the standards. Then, for each TMDL, the MPCA requires an implementation plan identifying specific actions to be taken to achieve the needed load reductions. For impaired watercourses or receiving waters that are within or downstream of a public drainage system, the drainage system likely is contributing to the pollutant load.

Presently, this process does not tend to result in legally binding obligations on pollutant sources for two reasons. First, implementation plans tend to be general. They identify categories of activity contributing pollutants to the impaired waterbody and categories of actions that can help to reduce pollutant load. Typically, they don't identify specific sources or assign specific pollutant reductions to those sources.

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Second, means to reduce pollutant load identified in implementation plans are not legally binding until they are incorporated into another, legally binding vehicle. Under its stormwater permitting program, the MPCA requires that measures identified in a TMDL implementation plan as applicable to a person or entity subject to a stormwater permit be incorporated into the permit. Drainage authorities that qualify as municipal separate storm sewer systems (MS4s) - those that own or manage stormwater conveyances within certain urban and urbanizing areas named by the MPCA - operate under general stormwater permits and therefore must incorporate load reduction measures as legally binding permit terms. However, for drainage authorities that are not MS4s (most outstate authorities), there is no such vehicle at present.

As TMDL implementation matures, it is likely that implementation plans will become more specific, and that the MPCA will create other vehicles for identified reductions to be imposed in a legally binding way on sources. If this occurs, then the regulatory regime in which drainage authorities operate will become somewhat more complicated and the additional regulatory burdens may need to be addressed within the drainage code.

A drainage authority operates a public drainage system. With respect to activities on the land that drains to the system, the drainage authority's role is limited to enforcing, where it applies, the requirement to maintain a vegetated buffer strip adjacent to the ditch. Minn. Stat. §103E.021, subd. 4. Otherwise, it does not control or regulate activities on the land. At most, in very limited ways and indirectly, the code provides incentives for landowners to limit pollutant movement into a system. E.g., Minn. Stat. §103E.315, subd. 6 (drainage authority may base a parcel's benefits on the sediment it contributes to the system). Actions within the system and this limited enforcement authority certainly can reduce loads to an impaired downstream waterbody. However, much of the load that a drainage channel conveys is best controlled by practices on the land.

Drainage authorities, such as watershed districts, counties or joint county boards, possess other police powers and often use those powers to regulate, outside of the drainage code, activity that may affect ditch systems. However, ordinances or rules typically are focused on protecting the physical integrity of the system by limiting actions that may cause bank erosion or channel instability. To our knowledge, the legal authority and willingness of ditch authorities to use their police powers to regulate adjacent lands for water quality purposes are untested.

As the TMDL program evolves, the MPCA could drive this question by imposing TMDL implementation plan obligations on drainage authorities and looking to those authorities to exercise jurisdiction over land-based activities contributing to pollutant loads carried by the drainage system. There is precedent for this in the obligations that the MPCA general permit imposes on MS4s to regulate stormwater impacts by private landowners within MS4 boundaries.

If there is a legislative desire to anticipate this evolution, the broadest question is whether a drainage authority, as the manager of a part of the state's surface water system, should be legally empowered to secure pollutant load reductions from lands draining to its system. If so, there are choices about the form this may take, ranging from regulation, to the use of financial penalties in assessing landowners for system maintenance and environmental compliance measures, to the authority to work with and provide financial incentives to landowners to improve practices.

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More narrowly, if TMDL implementation does follow this trajectory, the drainage code will need to address how a drainage authority will consider water quality obligations that are a condition of drainage work in assessing the benefits and costs of the work, and how the cost of meeting those obligations will be paid. And it will need to provide the tools that drainage authorities need to allocate those costs fairly to those who should pay them.

A drainage authority's role in implementing a TMDL is further complicated by the fact that the drainage system will drain road right-of-way and lands within one or more municipalities, both under the control of units of government that independently may be MS4 stormwater permittees. Or, this overlapping jurisdiction may allow a drainage authority to simplify its role. Instead of expanding the role of ditch authorities to include responsibility for activities on the land, ditch authorities could look to its road authorities to act under their MS4 permits, and to its municipalities to use their traditional land use authorities to reduce pollutant discharge into the drainage system.

By its assessment structure or structure of charges, a drainage authority could create incentives for municipalities to manage land uses to this end. A model for this exists in the drainage code: project benefits for land within an incorporated area, as well as maintenance costs for systems that serve as municipal stormsewer outlets, may be assessed against the municipality and left for the municipality to apportion among its property owners (Minn. Stat. §§103E.315, subdivision 2; 103E.411).

E. Ensuring Regulatory Requirements are Clear, Consistent and Appropriate

Oversight of drainage system activity for the purpose of wetland conservation occurs primarily through DNR regulation of impacts to public waters wetlands and WCA regulation of impacts to other wetlands. Public water wetlands, characterized more by open and standing water and more susceptible to being meandered, were recognized earlier in the state's history for the public benefits they provide. However, with our present understanding of surface water systems, we no longer presume that a public water wetland is by that fact alone of greater public importance or benefit than a wetland regulated under the WCA.

That these two wetlands fall under the jurisdiction of different regulatory bodies has its explanation in history but perhaps now lacks a compelling scientific rationale. This was implicitly recognized in 2000, when the DNR and local units of government that implement WCA were authorized to shift regulatory jurisdiction between each other. Laws 2000, c. 382, §17. This was intended principally to enhance efficiency and consistency where a proposed activity affects both public water and WCA wetlands.

DNR reviews potential public water wetland impacts under Minnesota Rules Chapter 6115 and less formal policies. WCA wetland impacts are reviewed by local government units pursuant to Board of Water and Soil Resources rules at Minnesota Rules Chapter 8420. The approach in both cases is similar, but there are differences in the details. Also, because DNR review relies to a greater degree on uncodified agency policies, it can be somewhat less predictable.

In addition, the Minnesota Pollution Control Agency (MPCA) reserves the right to exercise parallel authority over wetland impacts. Minn. Rules 7050.0186. And, as noted, if fill or a structure is to be placed in a channel or tile system, there may be USACE jurisdiction under Section 404. It should be

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mentioned, as well, that local land use authorities and watershed management organizations also retain ordinary police power authority to regulate impacts to wetlands under local rules and ordinances. Finally, work in drainage systems for the purpose of wetland conservation may trigger regulatory thresholds under federal water quality permitting by virtue of broad or ambiguous jurisdictional language in federal statutes and regulations. The MPCA implements this permit program by delegation from the U.S. Environmental Protection Agency.

Thus, wetland impacts are subject to the oversight of several different units of government under different statutes and rules. This introduces complexity into an effort to remove legal barriers to reconcile drainage and wetland conservation. To the extent that statutes, rules or policies should be adjusted to remove barriers, it means that several different regulatory authorities need to be engaged, and preferably to adopt similar regulatory approaches.

We have noted the potential value of adjusting the definitions of "benefits" and "damages" under the drainage law to incorporate benefits and damages to public wetland resources that would result from the proposed work. This is important both so that: (a) drainage authority decisions incorporate all relevant benefits and costs; and (b) costs are allocated fairly, as among benefited landowners and as between landowners and the general public. Predictability and consistency among regulatory authorities is important here as well.

The Minnesota legislature, of course, does not have authority over the USACE and its application of federal law under Section 404. However, there is active coordination among the USACE and state authorities, illustrated by a recent memorandum of agreement between the USACE and BWSR agreeing on activities qualifying as wetland impact mitigation and the amount of credit given for those activities. The USACE has within its Section 404 authority a substantial flexibility to facilitate approaches discussed in this report. A process that engages the USACE in developing consistent standards and procedures could be productive for both state and federal regulatory review.

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IV. DEMONSTRATION SCENARIOS

After a review of the drainage code, related water resource laws, and critical issues where the drainage code and potential conflicts with other laws create barriers to successful resource protection, the next step for this study was to identify three prototypical demonstration scenarios. The tension between drainage and conservation goals arise in particular land use settings. The study advisory committee assisted in identifying and developing three scenarios in which to explore these issues further:

SCENARIO A: Rural agricultural drainage system improvements

- aging drainage system;
- improvements in capacity needed;
- redetermination of benefits issues;
- need to analyze costs and benefits in different terms;
- private drainage, lands later brought into system;
- need to explore alternative funding mechanisms.

SCENARIO B: Rural agricultural drainage system and TMDL

- drainage system viewed as pollutant loading source;
- exploring conservation drainage alternatives;
- explore alternative funding mechanisms
- need for early engagement

SCENARIO C: Developing watershed

- beyond single parcel to subwatershed planning;
- comprehensive wetland protection & management;
- identifying high value wetlands, isolation from drainage system;
- integrating drainage system maintenance, improvements.

A. RURAL AGRICULTURAL DRAINAGE SYSTEM IMPROVEMENTS

Agricultural land owners in the Red River Valley have experienced ongoing flooding problems that jeopardize agricultural production and building sites. The flooding also causes temporary ponding on a county highway during larger storm events. The upper reach of the drainage system has an old meandering low-flow channel, and there has been a history of sloughing side slopes.

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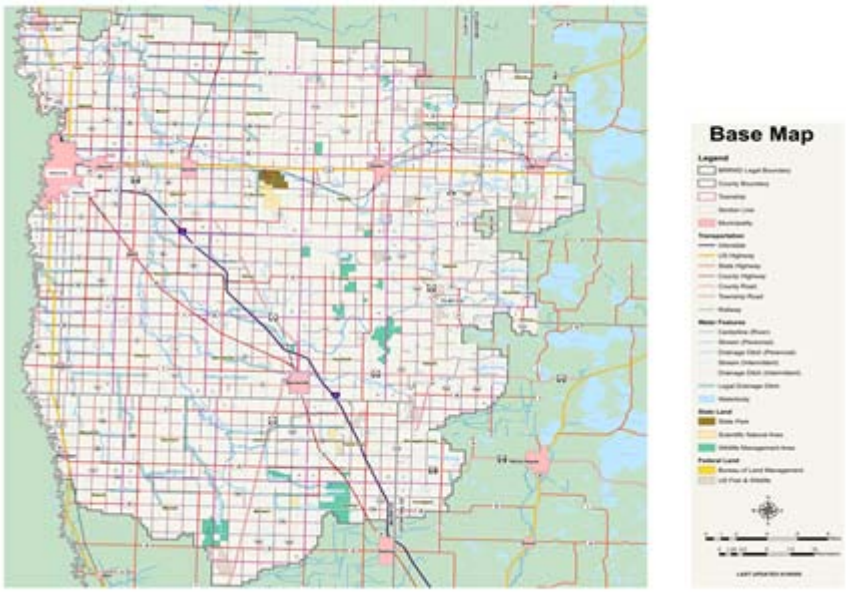
Bison Creek Watershed District



The land owners petitioned the local drainage authority, the Bison Creek Watershed District, to improve and extend Judicial Ditch 5, Branches 2, 3, and 5. All of the land owners along the proposed improvement and extension of Branches 2, 3, and 5 have signed the petition.

The watershed district's preliminary survey of Branch 2, 3, and 5 shows that the grade line of the ditch is nearly flat, that several culverts at the county highway crossing may be undersized, and that fallen trees and brush also impede the flowage in the drainage system. The proposed work would excavate Branch 2, 3, and 5, and extend each of them by another 0.5 mile or more to create a gradeline of at least 0.05% or steeper. Grass buffer strips 16.5 feet wide on each side of the ditch will be established along the entire length of Branches 2, 3, and 5.

The BCWD Engineer's report explores several possible alternatives to the proposed improvement and extension of Branches 2, 3, and 5, including detention of flood waters by resizing culverts, creating new detention basins, and restoring previously drained wetlands. A local chapter of Water for Waterfowl, a conservation organization, has appeared at several meetings to promote the wetland restoration concept. The District Engineer determined that all of these alternatives were less feasible or cost-effective.

The BCWD Engineer prepared a detailed survey report and plans from the proposed improvement and extension of Branches 2, 3, and 5, and submitted them to the Minnesota Board of Soil and Water Resources (BWSR) for an advisory report. The BWSR provided advisory comments, noting that the proposed new culverts and ditch channel capacity seem larger than necessary. The BWSR report also suggests that a two-stage ditch design, consistent with the characteristics of natural streams, would potentially result in reduced erosion and sedimentation, reduced nitrate loads, and also reduced ditch maintenance. A low flow channel designed for a two year return period, and a

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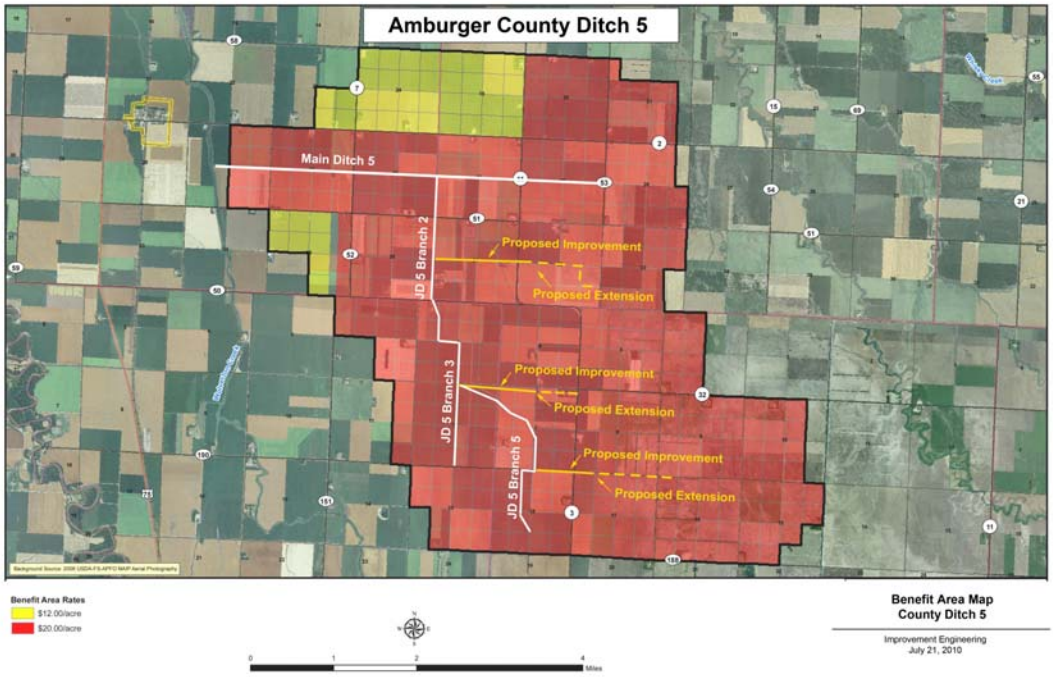
bench placed at that elevation, would manage most of the drainage volume, while the overall ditch could be designed for a five year or greater return period. BWSR also suggests that culvert sizing could be evaluated further to provide more management of downstream peak flows, while still providing adequate drainage in the affected area.



The BCWD Watershed Management Plan includes goals to reduce or alleviate damage caused by floodwaters, to administer and maintain public drainage systems, to protect and improve water quality, to reduce erosion and promote sedimentation management, and to cooperate with other governmental partners to pursue these goals. The BCWD Engineer and Board of Managers recognize that that the BWSR suggestions are consistent with these water management goals of the District, and also have technical merit. County highway improvements are also planned in the future, and the District is exploring how the road work may relate to the drainage project.

Nevertheless, the District is concerned that the conservation drainage suggestions from the BWSR could involve greater cost, or could reduce the efficiency of the drainage system. Some members of the Board of Managers are concerned that the petitioning land owners will strongly object to bearing these increased costs for what they perceive to be the same drainage benefits as the more traditional plan. One of the land owners has also pointed out that erosion and sediment is a much larger problem that involves more than just the owners along Branches 2, 3, and 5.

There are two additional motivations for conservation measures:

- The Red River Watershed Management Board has adopted a retention strategy to achieve 20% reduction in peak flow for the main stem of the Red River, and each

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watershed has a corresponding target reduction; accordingly, the RRWMB has encouraged the BCWD to incorporate retention in this project;

- The Red River Center for Environmental Urgency has brought lawsuits in the past to challenge drainage projects that in their view have adverse environmental impacts; the RRCEU is more recently a collaborator to help find comprehensive solutions; here, the RRCEU is encouraging the BCWD to incorporate retention, conservation drainage, and wetland restoration into the project; the RRCEU also presses for a more rigorous evaluation of the overall environmental impacts of the project and points to the goals of the BCWD plan for further support.

Following further deliberation, the BCWD explores how to incorporate the following additional conservation measures:

- 300 acre retention area, part of which is a wetland restoration that provides both retention and habitat benefits;
    - Perpetual Easement Costs: Straight RIM: $2,000 – $3,000 / acre (say $2,300/acre median); RIM/WRP: $2,500 - $3,700 / acre (median $2,900/acre)
    - Wetland Area Restoration Costs: $600 - $1,000 / acre (use toward the lower side for larger wetland restoration area)
    - Upland Area Restoration Costs: $300 - $400 / acre
- Two stage ditch construction in upper 10% of system; and
- Culvert sizing work in tandem with road authorities and near retention site.

The BCWD also identifies that there are multiple potential funding sources appropriate for these various project elements, as reflected in the following table:

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Project Element	**Est. Cost**	**Funding Sources**
Drainage improvements:	1,150,000	Drainage System (DS)
Upper watershed retention basin: and wetland restoration		Watershed Dist/DS
300 acre easement @ $2,600/acre	780,000	
150 acre wetl restor. @ $600/acre	90,000	
150 acre upland rest. @ $300/acre	45,000	
Two stage ditch sections;	40,000	Watershed Dist/DS
Road crossing improvements:	190,000	Road authorities
TOTAL:	2,295,000	

The integrated project combining drainage and retention yields multiple benefits, including peak runoff reduction and pollutant loading reduction. See Houston Engineering Inc. Memorandum of June 23, 2011, Appendix B, and Dr. Steve Taff, Economic Value Assessment, Appendix D.

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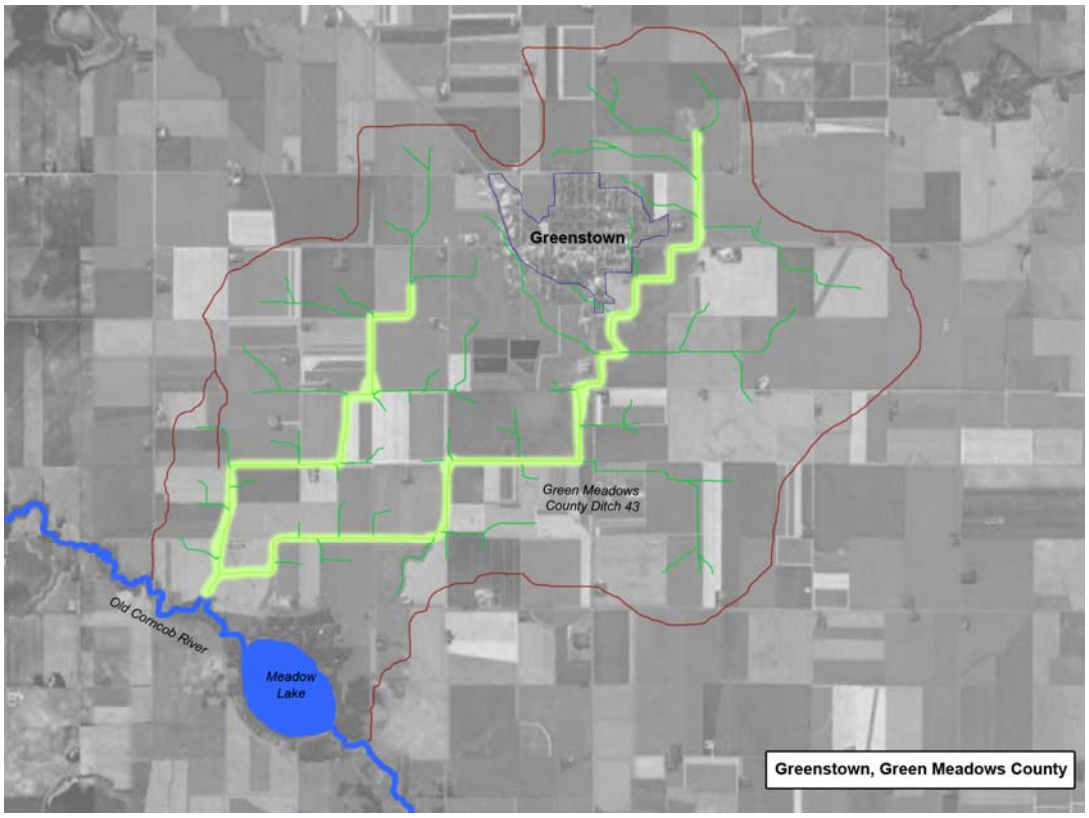
B. RURAL AGRICULTURAL DRAINAGE SYSTEM AND TMDL

Green Meadows County Ditch 43 drains nearly 7,000 acres of gently rolling hills. Ditch 43 constructed originally in 1919, is primarily a tiled system with an open ditch outlet. The ditch discharges into the Old Corncob River, which in turn is a tributary to the Minnesota River.

The land use in this watershed is mostly agricultural. The City of Greenstown is the county seat and is located in the center of the county. The Ditch 43 system has been altered significantly within Greenstown, as portions of the ditch are now either in practical terms abandoned or integrated into the city storm sewer system. The City's storm sewers discharge at several points into the drainage system, and its wastewater treatment lagoons also discharge into Ditch 43. As Greenstown population has grown, the volume of water discharging into Ditch 43 has steadily increased.

Most of the tiled sections of Ditch 43 are now in poor condition and in need of replacement. A number of agricultural land owners in the upper watershed of Ditch 43 are concerned with persistent flooding and crop loss problems. The Natural Resources Conservation Service (NRCS) guidelines generally indicate a minimum drainage coefficient of 0.75 inches per day for field crops in this area, but the existing drainage coefficients are in the range of 0.20 to 0.40 inches per day. The land owners have filed a petition with the Green Meadows County Board of Commissioners, which serves as the drainage authority, for an improvement to the Ditch 43 system in order to provide drainage capacity at the 0.75 inches per day recommended coefficient.



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At the lower portion of the watershed, the Old Corncob River drains into Meadow Lake. Meadow Lake has an active lakeshore homeowner's organization which has helped cabin owners with milfoil problems. A number of Greenstown residents own cabins or fish on Meadow Lake, and they are increasingly concerned about water quality. Many of the septic systems around the lake are outdated. Both Meadow Lake and the Old Corncob River are in the state's impaired waters list. Meadow Lake is impaired for nutrients, and the Old Corncob River is impaired for nutrients and turbidity.

As the TMDL process has begun for the Old Corncob River and Meadow Lake, several other organizations have become involved. Physicians Hunting Pheasants and Doctors for Healthy Ducks are two nonprofit sportsmen's groups which have joined with the Meadow Lake Association to advocate for water quality improvements. They have encountered a fair amount of initial conflict with the Corngrowers Guild and Soybean Society over the nature and causes of water pollution in the lake and river. The water quality advocates are also very concerned that the petition to improve the capacity of Ditch 43 will only make things worse.

Marilyn Goodheart is the local conservationist with the Green Meadows County Soil and Water Conservation District. She has worked for many years with farmers in the county to find cost sharing funds for small conservation projects. She has discussed the Ditch 43 improvement project with many of them, identifying water storage, two stage ditch sections, and other conservation measures that could be incorporated into the project. Most landowners, though, feel that it would be unfair for them to pay the assessments to cover these elements. They tell her that they expect to pay for the costs of improved drainage, but even in a good year, the price of corn doesn't pay them enough to justify bearing the costs of conservation measures, 'just so some fellows from Minneapolis can come hunt ducks once a year in Green Meadows County.'

Improvement & Repair Proceeding I: Traditional Approach

The Green Meadows County Board of Commissioners, acting as the Ditch 43 drainage authority, accepted the improvement petition from the landowners, and directed the Engineer to examine the drainage system and make an improvement report. The Board also noted that some of the proposed work would involve repair to the existing drainage system and therefore directed the Engineer, Charlie Bronson, to identify and allocate the costs of repair to be assessed against the owners of the entire system, and the costs of improvement to the owners benefited by the improvement. The Board also appointed viewers to assess benefits and damages.

The Engineer's Report briefly considered the "environment and land use" criteria of Section 103E.015, and concluded that the proposed work would not result in appreciable adverse impacts. The Board proceeded to hold a first a preliminary and then later a final public hearing on the Engineer's Report and the Viewers' Report. The Department of Natural Resources sent an advisory report that identified some concerns with potential impacts of the project and also highlighted opportunities for conservation measures for which Marilyn Goodheart had been advocating.

While the landowners continued to express their ardent support for the drainage improvements and repairs, the project became a source of big controversy in Green Meadows County. The Meadow

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Lake Association and the other conservation groups lobbied to get state agencies more involved in analyzing the project. Some advocates were talking about somehow using the TMDL process to "stop the Ditch 43 project."

Rodney Strong, the Chair of the County Board, told the crowd gathered for the public hearing that" it doesn't take a genius to see when you have a mess on your hands." He said that, as a farmer himself, he saw the need for drainage improvements, but it seemed like a good idea to pause on the project and see if there would be any chance of a compromise. At Chair Strong's suggestion, the Board tabled the matter for 60 days. He asked Marilyn Goodheart and the county ditch inspector, Greg Ostensen, to get a group together and see if they could come up with a different approach.

General Principles: Commissioner Strong's Wise Counsel

The next morning, Rodney Strong invited Marilyn Goodheart, Greg Ostensen, and Charlie Bronson to the local café for breakfast. He told them that he was getting tired of all of the drainage controversies, he was convinced it was time to try something new and different, and that he wanted the best work that Marilyn, Greg, and Charlie could provide. Commissioner Strong said he would give them some broad principles to work from:

1. *Green Meadows County's economy depends on agriculture.* We need drainage, and we need the drainage repairs and improvements to provide for productive lands, or 'there'll be hell to pay come next election.'

2. *We need to fix the pollution problem for Old Corncob River and Meadow Lake.* We can't argue with the fact that the river and lake are polluted. We need to restore water quality for ourselves, our children, and our grandchildren. And if we don't, sooner or later, some environmental group or state agency is going to make us do it anyway.

3. *We need a plan for the drainage system and the watershed.* The only way we can have drainage and address water pollution is with a good watershed plan that accounts for agricultural land uses, growth at the City of Greenstown, and the needs of natural resources.

4. *Find a way to spread the costs fairly.* You give me a plan that provides for drainage and clean water. Come up with some good ideas on how to pay for it without pinching either the drainage landowners or the general public too much.

5. *Don't confine yourselves to existing law.* What I want most of all is a good plan. We can either find some good drainage lawyers, or better yet, our Green Meadows County legislators are very influential at the Capitol. They can help us with any changes in the law that we need.

Marilyn, Greg, and Charlie told Commissioner Strong that these principles all sounded nice, but he was asking them to "pull a rabbit out the hat." Commissioner Strong took a long sip of coffee, and thought a moment. "Look, I know I'm pushing you folks hard," he said. "But I have been on the County Board for 32 years. I'm really tired of all of the drainage fights. Before I leave office, we're

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going to come up with a better way to do business, and I am counting on you to help me to do that."

"And if you can't, you better say so right now, and I'll go find me someone who is up to the job." Commissioner Strong gave them two weeks to do some homework, and report back.

The New Plan: Combining Conservation and Drainage Improvements

Marilyn, Greg, and Charlie sure enough did their homework and came back to Commissioner Strong with a plan to combine the drainage repairs and improvements with other conservation and water quality measures. The Engineer developed cost estimates for the various project elements, and they developed a basic framework to guide the funding:

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Project Element	**Est. Cost**	**Funding Sources**
Drainage repairs:	575,000	Drainage System
Drainage improvements:	210,000	Drainage System
Upper watershed storage basins:	250,000	City SWU/County/DS
Two stage ditch sections;	40,000	County SWU/DS
In-channel sediment storage;	30,000	County SWU/DS
Native grass buffers - open ditch:	30,000	County SWU/DS
Road crossing improvements:	190,000	Road authorities
TOTAL:	1,325,000	

Funding Notes

1. Benefitted landowners should be assessed for the costs of the repair and improvement as appropriate, and also for a contribution, say 10%, of the conservation measures.

2. The upper watershed storage basins are largely to manage impacts from City stormwater, and should be funded through a municipal storm water utility.

3. A "County Stormwater Utility" would likely require legislation, but would create a means of funding the conservation measures. Assessments in this utility could be based on phosphorus contribution from predominant land use types, or estimated volume of runoff. [Many technical details to address here.]

4. A system of incentives should be created for both city and rural land owners to reduce volume of runoff from their property and receive a corresponding credit to reduce assessment.

5. The TMDL could inform the development of the storm water utility in terms of allocating the phosphorus loading to different general sources within the watershed.

6. Assume that state grants may be available but are competitive and thus cannot be counted on as funding sources.

Again, an integrated project combining drainage and conservation measures yields multiple benefits, including significant pollutant loading reduction. See I & S Group Report of May 2011, Appendix C, and Dr. Steve Taff, Economic Value Assessment, Appendix D.

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C. DEVELOPING WATERSHED

1. Background

Eddson County lies at the eastern edge of the metropolitan area. Dander Township was settled in the 1880's and initially was dominated by row cropping and grazing. Between 1900 and 1918, Eddson County constructed a system of public ditches and tile to drain the lower part of the watershed. The system, with a number of private outlets, had mixed success in the peaty sands characterizing this area. The public system is known as Eddson County Ditch (ECD) 8 and outlets into Eddson Creek. **Figure 1** is a map of the area showing the ECD 8 alignment.

There is evidence of ditching and tiling activity on ECD 8 during wet periods over the next fifty years, on private lands and within the public system. Agricultural activity evolved over time to predominantly pasturing, haying and sod production. Homes were built on 40-acre lots. The drainage system continued to provide a measure of beneficial drainage. However, maintenance largely ceased apart from occasional work by the drainage authority to remove deadfall and debris, repair sloughing and localized tile failure, and clean out culverts under public and private ditch crossings.

Scattered urbanization began in the early 1980's, mostly at the top of the system in what was now incorporated as the City of Cosego. A number of parcels were platted and developed in two- and five-acre lots. With Interstate 24 nearby, the area became attractive to urban homeowners looking for lower land costs. The population of Cosego grew to almost 10,000, and in 2002 the Metropolitan Council programmed extension of a regional wastewater interceptor for construction in 2009-10. Property values in Cosego continued to rise and commercial developers eyed the larger parcels in the township visible from I-24.

With the crash of the economy, development largely stopped. When growth inevitably resumes, it may be more moderate. Replacement of less intensive land uses by residential and commercial development may follow a much more gradual trajectory. But the communities would like to be prepared.

The Eddson Creek Watershed District (ECWD) is the drainage authority for ECD 8. It also levies *ad valorem* taxes for water quality and conservation projects, issues permits for development, and is the governmental authority implementing the Minnesota Wetland Conservation Act within both communities.

2. The Land

The lower watershed is rich in surface water resources. The Dander Wildlife Management Area contains a 118-acre Type 3/4 wetland favored by hunters and birders. There are a variety of wetland types following the watershed gradient, with interspersed uplands and isolated depressional wetlands

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in the glacial landscape. Many wetland acres were partly or entirely drained for agriculture, but many have reestablished themselves and others could be restored. **Figure 2** shows wetland and soils conditions within the watershed.

As the watershed rises moderately toward Cosego, there is less water on the landscape but the soils become tighter and less well drained. The ECWD is concerned about downgradient flooding as the higher land develops. Also, it sees a potentially rich wetland resource in the lower watershed that retains high-functioning areas and restoration potential. This resource is at risk of being further fragmented and degraded with development and increased stormwater flows from higher areas. The interstate bisects this area. When the economy improves, local legislators' pressure for interstate access will intensify. Access design within this wet landscape would be challenging.

Several agricultural landowners in the lower part of the system wanted ECD 8 to be cleaned out to reestablish the drainage system as constructed. Development in Cosego, at the upper end of the drainage system, has increased the amount of stormwater flowing into the system and the peak rates of flow. The landowners believed that their lands were taking longer to dry out after rains and that this was due to greater demands on the system from the urban development above. They feared this would only worsen as Cosego continues to develop.

Also, they were hopeful that the economy would rebound in time for their land to serve as their "retirement fund." They wanted to establish the right to as much upland as possible in anticipation of a renewed development interest in their lands.

However, if ECD 8 were excavated to the same depth and dimensions as originally constructed, there would be substantial drainage of the Dander WMA and drainage of other wetlands within or near the system. Many of these wetlands were drained in the earlier part of the 1900's, after the system was constructed and contributing lands were ditched by farmers. But over the course of the past 50 years, the absence of diligent maintenance caused the hydraulic efficiency of the system to decrease. As a result, these surface water features reestablished themselves.

At the same time, extensive peaty inclusions in the area soils raised questions about how predictable the drainage effect of a repair would be within this flat, scattered wetland terrain. And this, in turn, raised another question. Proposed impacts on wetlands, either draining them or filling them for development, would need to go through regulatory review. Some impacts would be subject to review under WCA. Impacts to wetlands qualifying as public waters would require Department of Natural Resources approval. Also, the U.S. Army Corps of Engineers might have authority over some wetland impacts under Section 404 of the Clean Water Act. Given the uncertainty as to how the landscape would respond to an ECD 8 repair, permit review also carried the risk of a complicated technical debate and an uncertain outcome. Questions, then, about the ability to clean out the drainage system, how successful it would be in creating developable upland, and the timing of regulatory approvals suggested that the market value of these lands for development might not be quite what the landowners would like to think.

Finally, local conservationists were concerned about fragmentation of ecological resources in this part of Eddson County. There was fear that property owners would force a drainage repair with substantial wetland impacts and that as development occurred, fragmented wetlands would be filled

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to allow for development sites to be created. Conservationists had allies in the MnDNR and the local chapter of Ducks Unlimited, which were concerned about impacts on the Dander WMA and surrounding habitat.

3. Repair Proceeding I: Conventional Repair

To undertake a repair, the drainage authority first must make certain findings. In short (and a bit oversimplified), owners of lands originally assessed to build ECD 8 may obtain a repair if the economic benefit to their lands from the repair would exceed the cost of the work (Minn. Stat. §103D.715). Because environmental compliance costs are paid by the landowners, the cost of the work includes the cost to replace drained wetlands under state and federal laws.

The ECWD suspected that landowners would have a right to repair. Systemwide repair, just to allow consistent flow through the system, could improve soil moisture conditions without greatly affecting wetlands or triggering large compliance costs. Further, given the transitioning land use, the higher land value for development was likely to justify any repair that would add even modestly to buildable upland.

However, for several reasons the ECWD did not believe a repair proceeding would be the best way to sort out the drainage situation in the subwatershed:

- First, the ECWD could foresee the administrative costs and challenges of a repair proceeding. Assessing landowners' legal right to a repair would begin with the original elevation, dimensions and profile of ECD 8. But the original construction records were incomplete. It was clear that over the course of a century, the ditch was deepened and widened in places, but available records didn't show that the drainage authority approved the work. Without drainage authority approval, these improvements didn't legally "count" and only confused the ability to ascertain the as-constructed baseline.

- Second, under drainage law the cost of the repair would be assessed to benefited landowners in the same proportions as the assessment for the original construction. In 1912, land at the top of ECD 8 required the drainage least and was assessed the least. However, much of that land long had been subdivided. Now it benefitted substantially, by virtue of the need for developed parcels to move water quickly. It seemed clear that in advance of the repair project, the ECWD would need to retain viewers to redetermine the allocation of benefits as among all lands served by ECD 8. This would be an expensive process and would require valuing benefits for agricultural lands, urbanized lands and lands presently in agriculture but likely to be valued for development in the near future.

- Third, additional development in the upper part of the watershed would mean more water moving through ECD 8 and the Dander WMA. The system was designed, 100 years ago, to drain regular, lower-magnitude rainfall events from cultivated soils. However, a system serving urban development needs to manage peak events such as the five-year, 10-year and 100-year events from an area with a high proportion of hard surface. The ECWD

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recognized that ECD 8 was not designed to do this, and that even with a cleanout, the system was limited in its ability to serve urban development.

- Finally, a repair could reinstate beneficial drainage for less-intensive agricultural uses within the lower part of the watershed. But it was not an optimal tool for landowners seeking development value for their land. In conjunction with private tiling, a repair could reduce soil moisture adjacent to system inlets by efficiently conducting away water from ordinary precipitation events. But the original system was not designed to reduce the 100-year flood elevation within a larger contiguous area that determines the footprint of developable land. A repair, then, would benefit continued agricultural use in the lower part of the system, but would be only of limited value for future, more intensive uses of the land.

Ultimately, a repair petition (Minn. Stat. §103E.715) was filed with the ECWD by several landowners in the lower part of the watershed. As required, the ECWD Board of Managers directed its engineer to prepare a repair report showing the repairs and their estimated cost.

The engineer's task was to assess how excavating the ditch to its original depth and dimensions would affect the drainage of adjacent lands, and how much it would cost to do the work. There would be the cost of the excavation itself and the disposal of the dredged sediments. But there also was the uncertain cost to replace wetland resources drained by the maintenance.

WCA and Section 404 both include exemptions that allow wetland to be drained in the process of maintaining public drainage systems:

- Under WCA, type 3, 4 and 5 wetlands that have existed for 25 years may not be drained without replacement, but all other wetlands may. (Cultivated lands also may be drained as well; this exemption did not apply within the ECD 8 subwatershed.) Any wetland meeting the criteria for a "public water" (Type 3, 4 or 5 wetland, at least 2.5 acres in size within Cosego or 10 acres in size within Dander Township, Minn. Stat. §103G.005, subd. 15a) is protected by the DNR and may not be drained without replacement.

- Section 404 also allows wetlands to be drained without replacement, provided the draining is the result of ongoing work on a regularly maintained drainage system. Once wetlands are reestablished within a system in which maintenance has lapsed, they may not again be drained without replacement.

Further, the ECWD could realign the system in places (Minn. Stat. §103E.701, subd. 6). This could reduce drainage of adjacent wetlands and the accompanying cost to replace them. But this would reduce the amount of beneficial drainage, increase construction cost and require additional right-of-way from private landowners. In Eddson County, the ECWD was looking at replacement costs of about $35,000 per wetland acre, reflecting recent payments for banked wetland credits in the county. Alternatively, the ECWD could negotiate with landowners for flowage rights and construct replacement wetland on its own. It would do this most readily by disabling private tiling.

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The second challenge faced by the engineer was to fix the bottom elevation and cross-sectional profile of the ditch channel as it was originally constructed. The engineer obtained core samples of soils beneath the channel bottom and did field work to locate survey benchmarks referenced in the 100-year-old engineer's report. This work cost a fair sum, and some of the evidence was ambiguous, but the engineer felt that its reconstruction of the original system dimensions had a reasonable foundation.

However, any repair that might affect the level of a public water requires that both the DNR and the county conservation district agree on the repair depth (Minn. Stat. §103E.701, subd. 2). At the same time, the public waters law says that if the state owns a public waters wetland on or adjacent to the drainage system, it is responsible for any work needed to protect the wetland while allowing the system to function (Minn. Stat. §103G.225). The ECWD thought that the DNR's financial interest, combined with pressure from its wildlife habitat constituency, might affect its position on an acceptable repair depth. The law was not clear on what happens if there is not consensus on the repair depth; impasse was a possibility.

One additional uncertainty remained. For all of the above reasons, the engineer was certain that a full repair, returning the system to its as-constructed dimensions, could not be justified by the ECWD Board of Managers. He expected, on the other hand, that less extensive work would still improve drainage to an extent and could be cost-justified. However, the statute (Minn. Stat. §103E.701, subd. 1) defines "repair" as a restoration of the system to its original conditions. The ECWD and its engineer were not certain that they had the authority under the petition process to evaluate anything other than a full repair to the original grade and dimensions.

Nonetheless, in addition to a repair to the original grade and profile, the engineer evaluated a second approach. This approach would involve moderate removal of sediment and obstructions sufficient to establish a flow gradient through the system, but without causing impact to wetlands and triggering the substantial replacement cost for that impact. The engineer estimated repair costs by assuming that the DNR would accept a very limited lowering of the Dander WMA or would provide funds to realign some 500 feet of channel to avoid that effect.

Finally, the ECWD faced questions of fairness in how repair costs would be paid. Under the drainage law, costs are paid by benefited landowners in proportion to assessment of the original costs of construction. Original benefits were determined 100 years ago based entirely on the impact of drainage on cultivation. Lands in the lower part of the watershed benefited most and were assessed at higher rates. However, the system now was serving as a stormsewer system for many smaller developed lots on higher ground in Cosego. Further, the Dander WMA and other wetland resources were providing hunting and recreational benefits to many folks from outside of the subwatershed and regionally. More broadly, some argued that preserving the ecosystem served a wide public interest and should be supported by state funds from the DNR or otherwise. This raised the question of whether it was fair to impose all of the costs to preserve these resources on the properties benefited by the drainage system.

4. Outcome: Conventional Repair

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The engineer's modeled outcome of the conventional repair is depicted in **Figure 3**. The wetland impacts and repair costs are included in **Tables 1 and 2**.

The cost of this repair, encompassing an average two-foot depth of excavation through the system, is an estimated $5.57 million. This cost includes a measure of crossing repairs and replacements, with private crossings an expense of the system and public crossings the responsibility of the road authorities. On top of this cost is the cost to replace non-exempt wetland acres. Some 135.2 acres would be drained, and another 12.5 acres partly drained, under the WCA exemption and would not require replacement. However another 232.5 acres of non-exempt Type 3, 4 and 5 wetlands would be partly drained and would require replacement. The replacement cost for this acreage is estimated at $8.14 million.

As **Figure 3** shows, the result of this expense would be to drain or reduce moisture on corridors in proximity to ditch or tile. With inclusions of poorly drained soils throughout the lower part of the watershed, the width of these corridors will vary. Private pattern tiling will extend the scope of drainage for agricultural use, but will not support upland assembly for large-parcel development. As **Figure 3** shows, floodplain will remain distributed throughout the lower watershed absent very aggressive pattern tiling that would not function to control groundwater for more intensive land uses. Therefore, this repair would be compromised in its capacity to enhance land value for development. If an interchange is built at I-24, no WCA exemption will apply and MnDOT will be subject to WCA requirements to explore alignments that limit wetland impacts and replacement obligations.

The conventional repair, further, risked getting caught up in procedural complexity and disagreement.

First, a redetermination of benefits would be needed before the cost of the work could be assessed. The Board of Managers would need to assess relative benefits as between municipal users at the top of the system and agricultural users at the bottom. Determining benefits for development on uncertainly drained lower lands could be contentious. Further, as a result of the redetermination, land for vegetated buffer strips along the ditch would need to be acquired at substantial administrative and potentially legal cost (Minn. Stat. §103E.021).

Second, the conventional repair as modeled would partially drain several public waters wetlands including the Dander WMA wetland. The DNR would be likely to object and disagreement on repair depth could preclude the work or delay it for some time.

5. Outcome: Limited Repair

The engineer's modeled outcome of the limited repair is depicted in **Figure 4**. The wetland impacts and repair costs for this alternative are shown as well in **Tables 1 and 2**.

The limited repair carries a proportionately reduced excavation cost, estimated here at half the material and half the cost of the conventional repair. The repair is defined as that which would provide the greatest extent of positive flow without draining non-exempt wetlands. Therefore, there

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would be no wetland replacement cost. Compared to some $13.71 million for the conventional repair, the cost for the limited repair is estimated at just $2.79 million.

In addition, the limited repair was more likely to avoid objection from the DNR and hunting and conservation interests.

However, as **Figure 4** shows, the moderate effectiveness of the conventional repair, particularly for a transition to more intensive land use in the lower watershed, would be even more compromised by the limited repair. The lateral effect of the cleanout would be more narrow, resulting in less fully drained land and a slightly larger urban-area floodplain, as compared with the conventional repair. This approach also would not help to reconcile the conflict between development and resource protection lurking at the site of the I-24 interchange.

6. Repair Proceeding II: Watershed-Based Management

After receiving the engineer's report, the ECWD Board of Managers paused to ponder the bigger picture. Under a 100-year-old law, it had begun a proceeding limited to the question about how deep to dig a 100-year-old ditch. But the uses of the land and the needs to be served were more complicated now.

An urbanized area at the top of the system was sending storm runoff into the system much more quickly, with little discharge at other times. With further growth, this feature of the watershed's hydrology would be accentuated. It made more sense to control those peaks than to design a conveyance system that would be large enough to contain them but, as a result, would be oversized most of the time. At the bottom of the system, there was a need to manage soil moisture for agricultural use. But there also was a future in which what the conveyance system really would need to do would be to define the 100-year-floodplain and protect land above it by maintaining groundwater separation. All of this, at the same time, recognizing the ecological and other public benefits of the shallow water-land interface.

The Board of Managers asked for further study of the ECD 8 subwatershed to understand how water moves through the watershed and how this could fit with both productive use of the land and the watershed's ecological health.

The engineer modeled watershed hydrology. This included surface flow (hydrologic model), groundwater flow to the drainage system (lateral effect model), and flow within ECD 8 itself from its private segments to its outlet at Eddson Creek (hydraulic model). The engineer did this for present conditions, and also for a future scenario in which both the lower and upper parts of the subwatershed were built out for their planned land uses.

At the same time, the engineer assessed wetlands and areas of former wetland within the watershed for the extent to which they contributed or, with restoration, could contribute to the functioning of the hydrologic system. The engineer used a wetland method approved by the Minnesota Board of Water and Soil Resources to evaluate the wetlands' capacity to:

- Retain flood waters and stormwater

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- Augment low flows
- Trap and assimilate sediments and nutrients
- Provide aquatic, riparian and plant habitat
- Serve public recreation purposes including hunting, fishing and wildlife viewing

(Minn. Stat. §103B.3355.)

Some areas of wetland or restorable wetland were identified as highly valued for their role in the ecologic and hydrologic systems within the watershed. Others were isolated or quite degraded without sound restoration potential. These were identified as less functional. **Figure 2** is a simplified depiction of the results of the wetland functional assessment.

This inventory and assessment was the foundation for a comprehensive wetland protection and management plan (CWPMP). This is an alternative watershed-based regulatory approach authorized under Minnesota Statutes §103G.2243. Under this statute, the ECWD could replace the standard WCA rules at Part 8420 with a tailored set of rules to manage wetland impacts within the defined watershed encompassing the drainage system.

In place of "standard-issue" replacement requirements under the regular WCA rules, the ECWD could fashion rules with incentives to avoid impacts to higher-value wetland resources and to replace impacts to other wetlands in a way that would enhance those resources. In addition, the drainage system alignment also could be adjusted to avoid sensitive wetland/groundwater areas and better serve developable areas (Minn. Stat. §103E.701, subd. 6). The Board of Managers felt that if this approach were coordinated with local zoning and the development intentions of landowners, the system could be managed to:

- Provide the "targeted" drainage needed to consolidate upland and enhance the development value of the lower lands, and

- Allow the ECWD and landowners to collaborate in restoring and preserving higher-value wetland resources where they are best situated in the landscape.

The engineer started from the "limited repair" scenario in the engineer's report. This scenario reflected the most extensive drainage system repair that would provide a net benefit to landowners and so, in theory, be legally approvable. Therefore it constituted the drainage baseline that landowners could expect under conventional drainage law. The ECWD's intent was to define its outcomes and develop its rules in a way that would demonstrate economic benefit to landowners, improved tax base, and an enhanced wetland resource through the use of a CWPMP.

During this time, ECWD staff coordinated with planners for Eddson County as the zoning authority for Dander Township and township officials. This allowed the ECWD to better understand development plans for the lower subwatershed, and gave input to the county and township about guiding development and programming roads to avoid sensitive areas. Any adjustments to the comprehensive land use plans of these authorities would need to be consistent with the Metropolitan Council's plans for wastewater service to Cosego.

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As the ECWD engineer worked with staff to develop a framework, several questions emerged:

- The location of wetland impact and an opportunity to protect or restore high-quality wetland might not co-exist on the same parcel. It would be important to have a mechanism by which a property owner causing wetland impact could contribute to enhancement of high-quality resources even when those resources were located on another property.

  The ECWD considered several ways to do this. In its rule, it could allow wetland replacement credits to be created and "banked" by a landowner, and allow another landowner to purchase them in a private transaction. However, within this single subwatershed there might not be a sufficient "market" and credits might not be available in a timely way. It could collect a fee from a property owner lacking an on-site replacement opportunity and use the funds to perform wetland work itself, by agreement with another property owner or by using eminent domain to acquire flowage rights. Or, the zoning authorities - Eddson County and the City of Cosego - could adopt ordinances allowing development rights to be transferred between parcels. This would allow for owners of higher-valued wetlands to host more extensive protection and restoration efforts and be compensated by increased development value on other lands.

- With CWPMP authority, the ECWD could customize an approach to managing impacts to WCA wetlands. However, the DNR would keep all of its existing jurisdiction in regulating impacts to the Dander WMA wetland and the other public waters wetlands. There was no guarantee that the DNR would agree to the watershed-based regulatory approach of the CWPMP. Also, although it was rarely exercised, the Minnesota Pollution Control Agency held its own authority to regulate wetland impacts (Minn. Rules 7050.0186).

  As far as the ECWD could tell, the public waters wetlands within the watershed could be managed consistent with the CWPMP. The DNR could waive jurisdiction over those wetlands so that they would be treated like WCA wetlands under the CWPMP (Minn. Rules 8420.0105, subp. 2.E). Or, the DNR could adopt a parallel framework for impacts to public waters wetlands consistent with the CWPMP. But this second approach might require a rulemaking process just for the purpose of the ECD 8 watershed.

  Without one of these steps, there would be less ability to separate development and resource areas. Also the CWPMP would be less predictable due to ambiguity in the public waters laws and the DNR's discretion in applying them. The law seemed to make the DNR responsible (at state cost) to take any steps to protect a public waters wetland from draining due to ditch repair (Minn. Stat. §103G.225). However, that would be the case only for public water wetlands on or "adjacent" to ECD 8 (an undefined term) and might or might not apply to wetlands affected by a realigned section of ditch. It also was unclear whether the DNR could require wetland replacement for any impact to a public water wetland subject to this statute.

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This was made even more ambiguous by a statute that provides for the drainage authority to compensate the state for any "taking" of land or water area owned by the state (Minn. Stat. §103E.025). Finally, it was unclear whether the DNR could simply prohibit any repair action that might drain a public waters wetland (Minn. Stat. §103E.701, subd. 2).

- The CWPMP also did not in any way affect federal wetland requirements under Section 404. The ECWD did not know to what extent the USACE would be able or willing to adopt a watershed-based framework consistent with the CWPMP.

  The ECWD was aware of the USACE policy allowing for the creation of Special Area Management Plans (SAMPs). Similar to the CWPMP, a SAMP rests on understanding wetland resources on a hydrologic system basis. Section 404 permit requirements then can be customized to allow for development while protecting important wetland resources. However, the Section 404 regulations require an applicant to evaluate alternative development approaches to avoid the proposed wetland impacts. Typically, this cannot be done until a particular development goal is articulated for a specific parcel. The SAMP works best for a defined area where the zoning authority is steering development. The ECWD was working for strong integration between the CWPMP and the long-range comprehensive land use plans of Eddson County and Cosego, but neither of these zoning authorities intended to drive the market and neither had the resources for the intensive planning exercise the SAMP might require.

  Short of creating a SAMP, in a couple of cases the St. Paul District had coordinated with a watershed district to establish a consistent scheme to measure wetland impacts and credit wetland replacement. The ECWD thought that if the USACE were willing to accept the science underlying the CWPMP, it might agree to a consistent regulatory framework that would help reduce the uncertainty of duplicate regulation. This, in turn, would help preserve the "predictability" valued by landowners under the CWPMP.

- Finally, under WCA, a state agency self-regulates as to wetland impacts on land it controls (Minn. Stat. §103G.005, subd. 10e). If MnDOT were to expand I-24 or construct an access affecting the wetland area, the agency would self-regulate for those impacts and they would not be managed under the CWPMP framework.

Ultimately, the ECWD adopted a CWPMP and a set of wetland rules to implement it. By varying replacement ratios, the rules created a strong incentive to limit impacts to higher-value wetland areas and encouraged replacement for impacts to focus on enlarging and enhancing those areas. The rule required replacement to be within the watershed and gave credit for stormwater peak retention measures such as biofiltration in the upper watershed. The ECWD engaged the USACE and got informal but written concurrence in the replacement framework of the CWPMP rule.

The rule also created a framework for banking credits, although the ECWD Board of Managers was skeptical that this would see much activity. In addition, the rule allowed property owners without access to higher-valued wetland replacement opportunities to pay a fee equal to replacement cost into a fund the ECWD would use to perform wetland protection and restoration work itself.

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The Board of Managers then had the engineer review the repair scenarios. The engineer revised the alternative repair scenario to include two realigned sections to limit wetland drawdown and create larger contiguous upland areas for development. This was the scenario adopted by the Board.

The ECWD now had a framework for the watershed that gave consideration to several sets of interests. It provided drainage system benefits by establishing a repair regime to maintain flow through the system while both creating incentives to manage peak flows in the upper watershed and using floodplain storage to accommodate those flows. It established a wetland management framework that would allow for drainage system realignment and selective wetland fill as lower-watershed uses shifted from agriculture to large-parcel development. And it recognized the public benefits of a healthy wetland resource and created incentives to protect and enhance the resource.

In part, the ECWD would implement the CWPMP by maintaining the drainage system and replacing the wetland loss caused by system maintenance. The CWPMP otherwise would be implemented as urban development in the upper watershed and large-parcel development in the lower watershed progressed. Developers would aggregate upland and wetland resources in pursuit of development plans and would limit peak flow increases in the system by retaining water in the upper watershed for replacement credit. The ECWD could make further choices, in its discretion, to spend funds on independent wetland restoration activities within aggregated wetland resource areas. State funds might be available as well, for example for realignments to avoid impacts to public waters wetlands.

The Board of Managers quickly concluded that it would not be appropriate to require landowners assessed for ECD 8 to fund all of these activities. Further, it determined that its activities to maintain the drainage system for these multiple purposes would be administratively simpler to fund by way of a utility charge system rather than through special assessments under the drainage law. Accordingly, it elected to use several revenue mechanisms:

- A water management district bounding all parcels draining into ECD 8 was created (Minn. Stat. §103D.729). Annual charges would be collected against these properties for all repair and maintenance work on ECD 8 including wetland replacement costs. The Board of Managers determined a methodology to split costs among the developed areas of Cosego and the less intensively used lower watershed parcels.

- The ECWD also planned to charge the upper watershed more specifically for the cost of retention above ECD 8 not accomplished by developers' actions for replacement credit. It intended to work with Cosego and, preferably, allow Cosego to assume responsibility for retention using stormwater charges or development fees.

- Concluding that broader public benefits were involved, the Board also established a policy to use watershed-wide *ad valorem* funds for a part of the wetland preservation work required to minimize impacts from the repair. Other ecosystem work would be funded by landowners as regulatory compliance during development.

Funding for this project was provided by the Minnesota Environment and Natural Resources Trust Fund as recommended by the Legislative-Citizen Commission on Minnesota Resources (LCCMR).

- Finally, the Board of Managers remained uncertain as to the role the DNR would play or the funds it would provide for public waters wetland protection, but any funding would be used to offset local property taxation.

7. Outcome: Watershed-Based Approach

The modeled outcome of the watershed-based approach in shown in **Figure 5.** Wetland impacts and cost estimates for this approach are included in **Tables 1** and **2**.

The watershed-based plan preserves the hydraulic efficiency of ECD 8 at the same level as the limited repair. This is done by utilizing wetland and floodplain storage within expanded wetland corridors and thereby reducing the need to excavate channel materials. The rules establish expectations that allow for isolated, lower-value wetlands within the lower watershed to be filled.

Initially, agricultural lands in the lower watershed were able to continue existing uses by virtue of basic limited repair of the lower system. As property owners transitioned those lands to large-parcel development, they were able to take advantage of replacement ratios in the rules to fill depressional wetlands and replace filled-wetland acres and function. In exchange, wetland and adjacent vegetated buffer within the designated higher-valued corridors were augmented. MnDOT approached interchange construction similarly.

The CWPMP at core is a wetland regulatory structure. The structure creates flexibility that allows drainage capacity to be maintained and allows for land use and development in conjunction with protecting the wetland resource. Beyond the regulatory structure, however, and by virtue of the understanding of watershed hydrology that is the foundation of the watershed-based approach, land use and water management decisions can be better integrated. Stormwater conveyance and peak management needs for the urban area can reflect an understanding of the capacity for natural systems downgradient to assimilate peak flows and nutrients. The city, the watershed district and other public bodies with capital funding can work with landowners to address localized flooding and enhance ecologic resources.

Figure 5 denotes substantial ditch realignments in two locations to circumvent large public waters wetlands, including within the Dander WMA. This is driven by the incentive to limit compliance costs and to avoid administrative delay or impasse. Of the $2.81 million watershed-based approach in **Table 2** for "Compliance & Conservation," $1.99 million represents the cost of these realignments. However, it also is a means to improve the ecologic values of the wetland systems (and, consequently, their public recreational values) by separating these wetlands more decisively from the drainage system.

Table 1 indicates 148.3 acres of impact to exempt wetlands under the watershed-based approach. This reflects CWPMP implementation as shown in **Figure 5**, where the impacts largely result from wetland filling and draining in the process of development by property owners and MnDOT. Much of this wetland impact in fact may not be exempted because it will not be the necessary result of drainage system repair; however, the cost of replacement will be a private or road authority cost, and not a cost to the drainage system. It will be undertaken as a voluntary development decision.

Funding for this project was provided by the Minnesota Environment and Natural Resources Trust Fund as recommended by the Legislative-Citizen Commission on Minnesota Resources (LCCMR).

Table 2 includes a column titled "Urban Peak Management." This column denotes costs that will be incurred by the City of Cosego and developers to build stormwater retention facilities sufficient to maintain peak runoff rates for the 100-year event under the city's build-out. This cost is reduced to the extent peak flow can be managed in downstream natural systems without ecologic impact. This capacity depends on the attributes of the system in question. Under the watershed-based approach, the ECWD is in a much better position to evaluate this opportunity and to help reduce public costs for runoff management.

Similarly, while some wetland systems release phosphorus into surface waters that flow through them, others can be effective nutrient uptake systems. **Table 2** includes an "Avoided Stormwater Management" column showing a potential benefit of $2.56 million for the watershed-based approach. This number reflects the added flowed-wetland acreage under CWPMP implementation and the assumption of average phosphorus assimilation capacity for those wetlands. This number reflects the potential avoided infrastructure costs for water quality treatment that may be required under a Total Maximum Daily Load, nondegradation requirement or other regulatory obligation for the City of Cosego.

This scenario, and the costs reviewed above, are wholly illustrative. Each watershed - its hydrologic systems and land use needs - will be unique. The chief characteristics of the watershed-based approach are: (a) the foundational understanding of watershed hydrology and land uses and (b) the back-end flexibility to use regulation and capital/project funding to reduce conflicts and optimize both economic and ecologic outcomes. Essential to this is a range of funding authorities that can allow the drainage authority to allocate costs in accordance with benefits. In this scenario, this includes owners of agricultural lands, property owners within the urban area, and the broader publics benefitting from the recreational and ecologic properties of a well-managed hydrologic system.

Funding for this project was provided by the Minnesota Environment and Natural Resources Trust Fund as recommended by the Legislative-Citizen Commission on Minnesota Resources (LCCMR).

FIGURES

Funding for this project was provided by the Minnesota Environment and Natural Resources Trust Fund as recommended by the Legislative-Citizen Commission on Minnesota Resources (LCCMR).

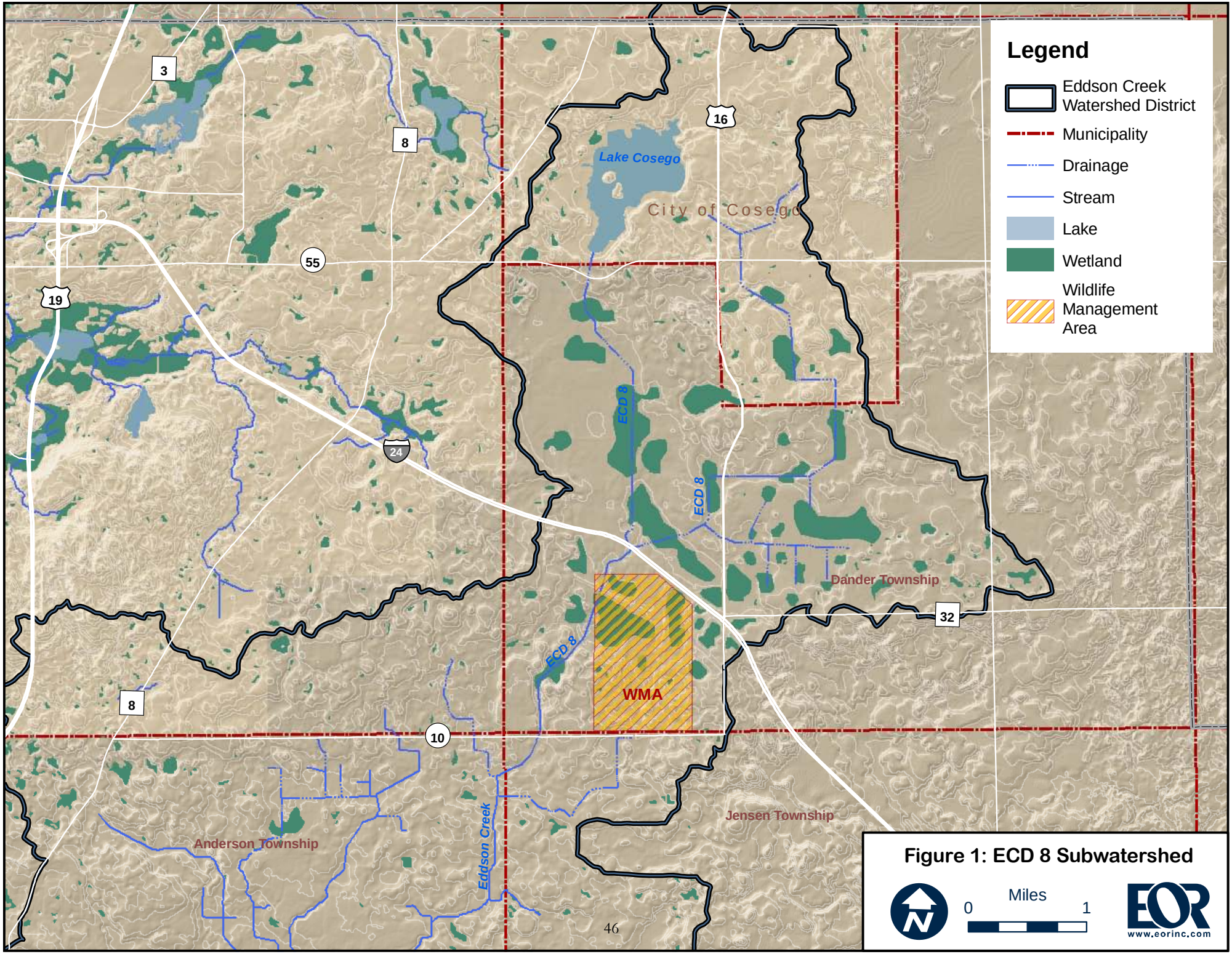

Figure 1: ECD 8 Subwatershed

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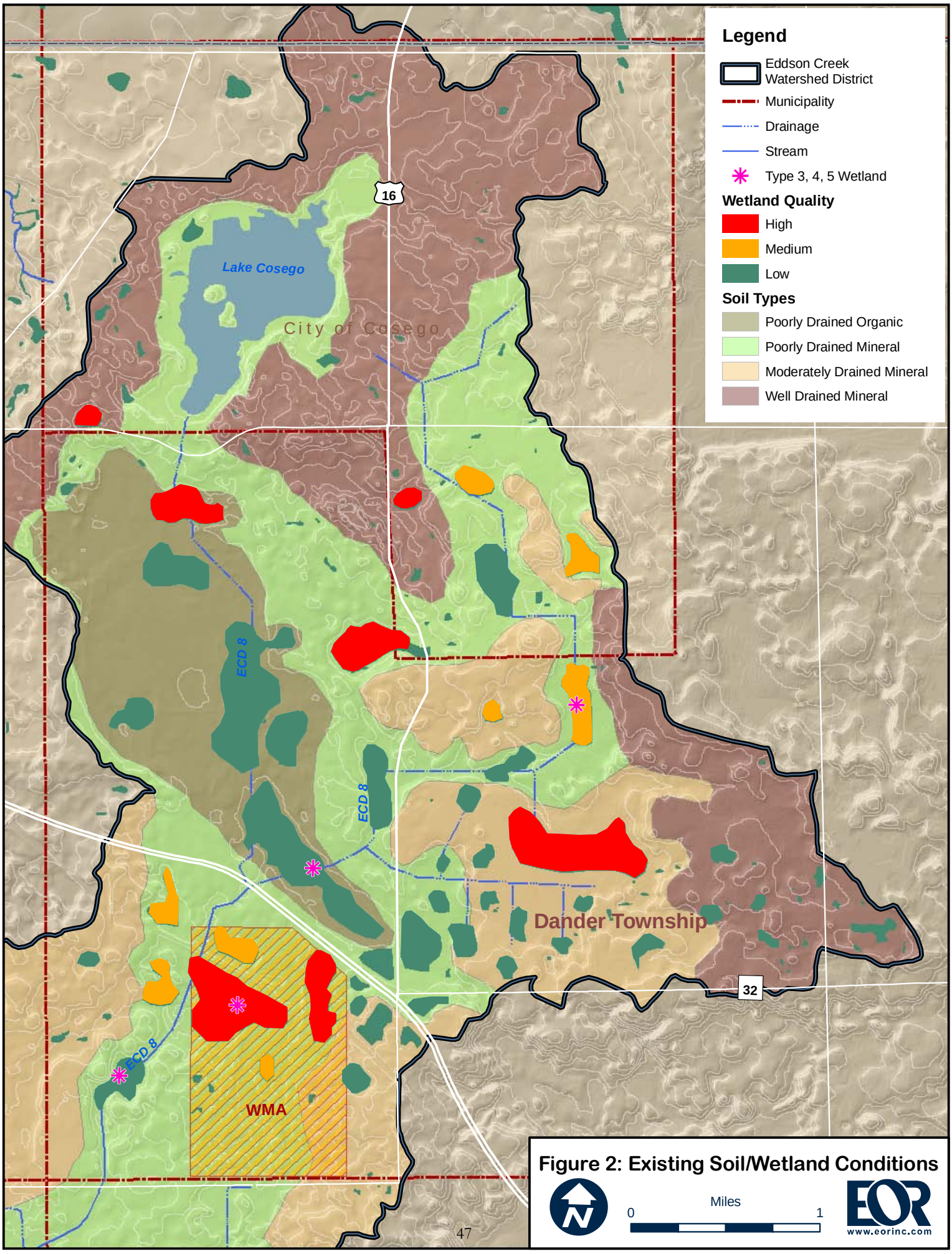

Figure 2: Existing Soil/Wetland Conditions

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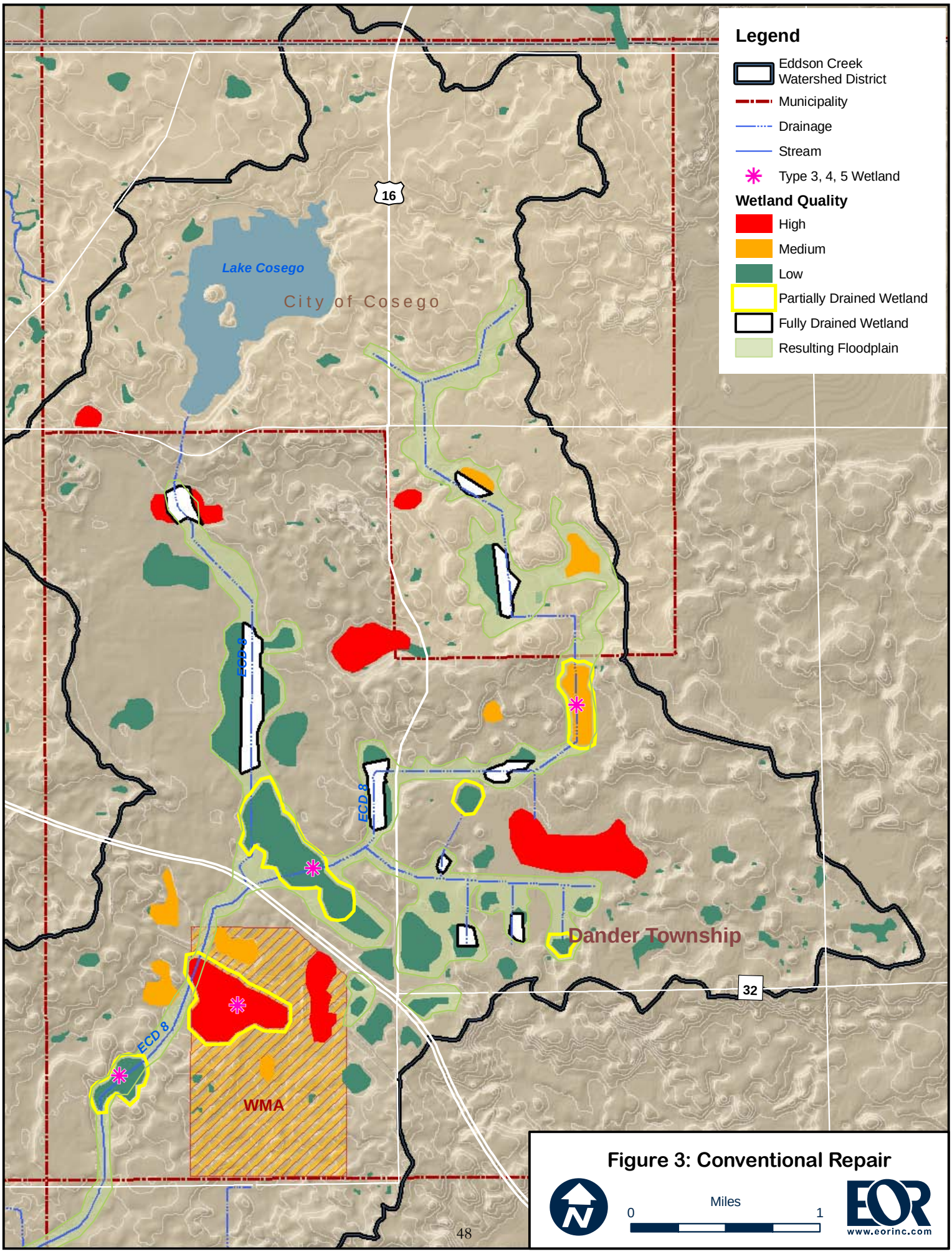

Figure 3: Conventional Repair

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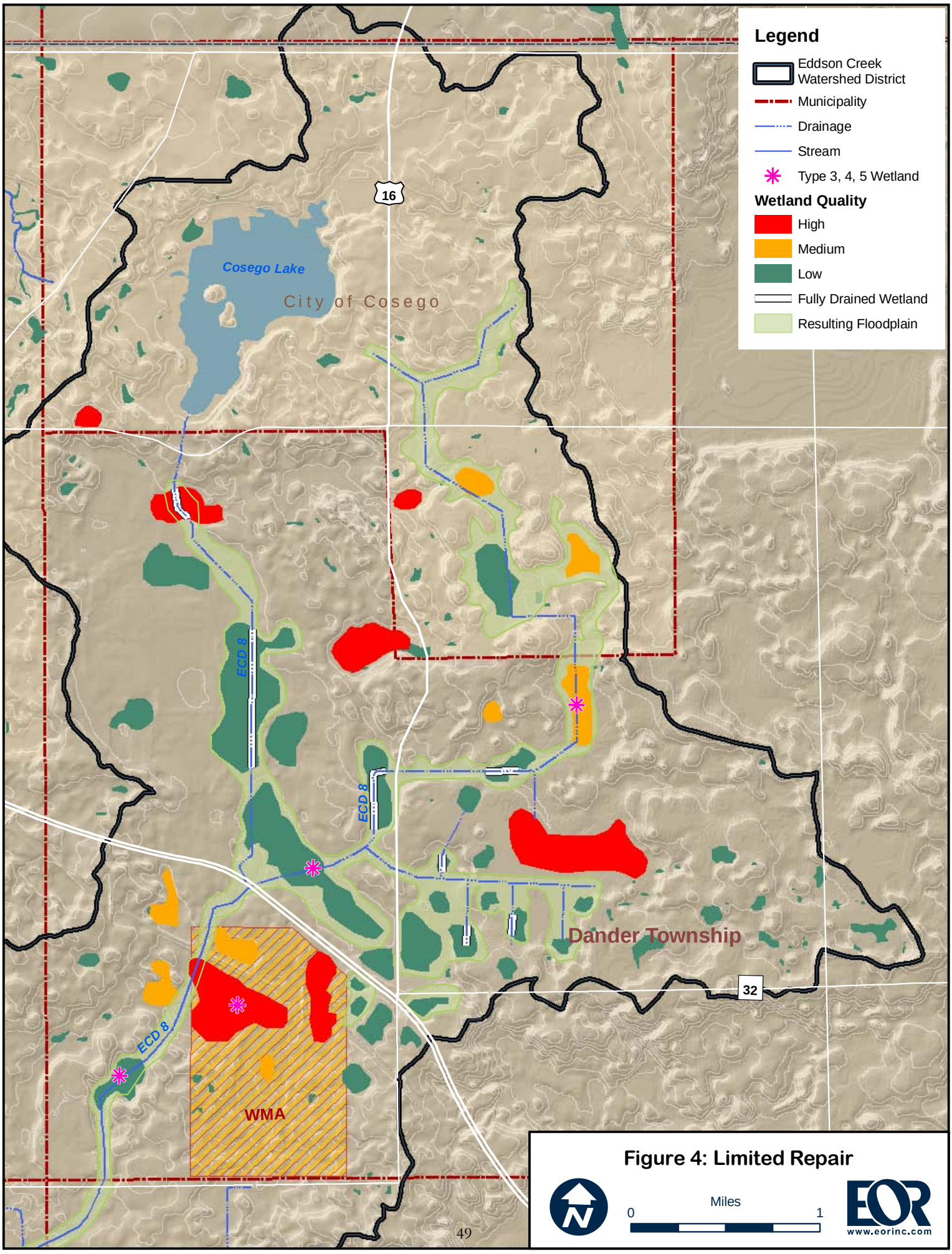

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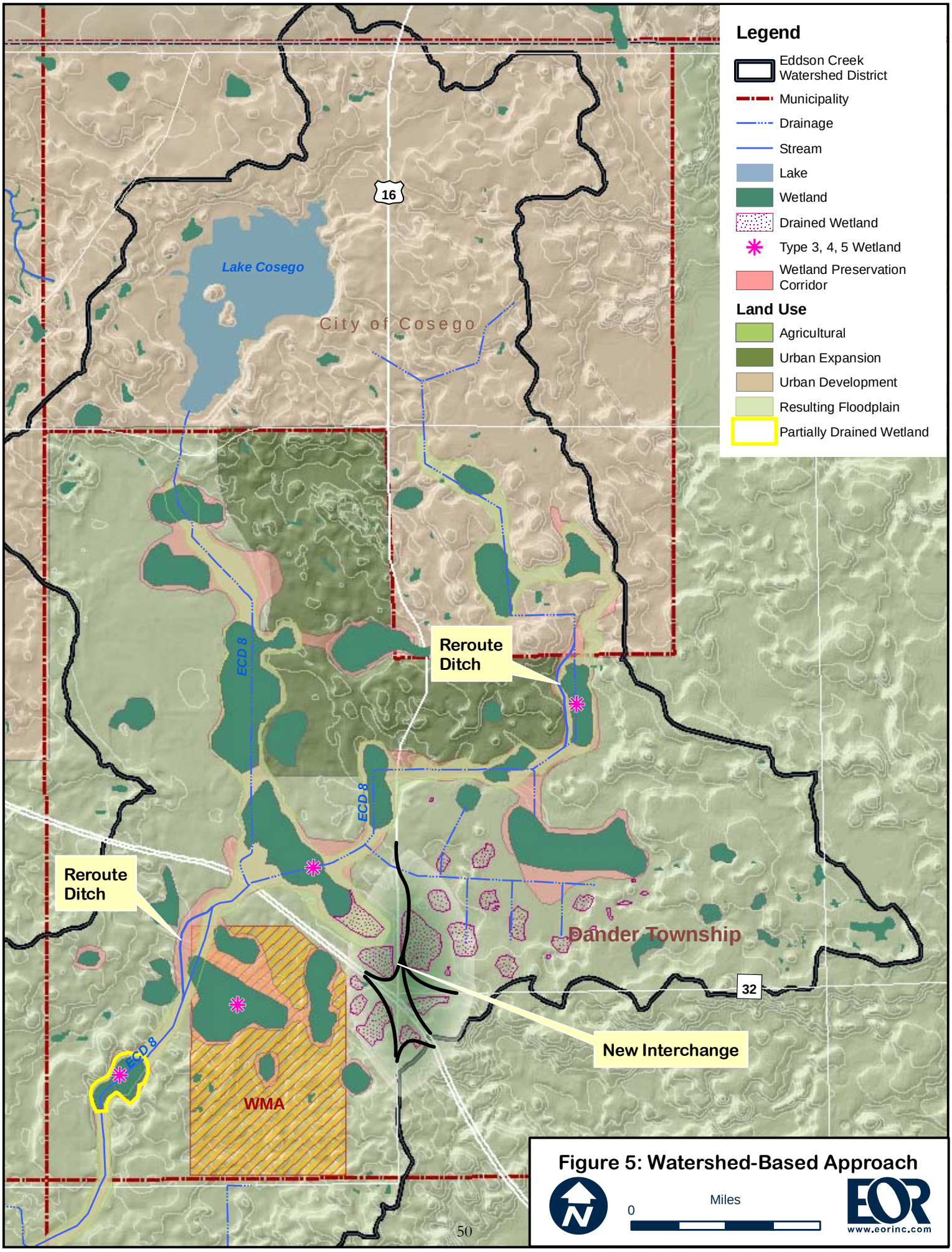

Figure 5: Watershed-Based Approach

TABLES

Scenario C – Table 1

WATER RESOURCE IMPACTS for REPAIR ALTERNATIVES (acres)			
	EXEMPT WETLANDS[1]		NON-EXEMPT WETLANDS[2]
	DRAINED or FILLED	PARTLY DRAINED[3]	PARTLY DRAINED[3]
CONVENTIONAL REPAIR	135.2	12.5	232.5
LIMITED REPAIR	24.5	0	
WATERSHED-BASED APPROACH	148.3[4]	0	23.5

NOTES

[1] Wetlands that may be drained without replacement obligation under a Wetland Conservation Act statutory exemption.

[2] Public waters wetlands or Wetland Conservation Act type 3, 4, 5 wetlands for which replacement is required.

[3] Partial drainage causing no loss of acreage but loss of wetland resource function. Impact acreage assumed as 50% of partly drained surface area.

[4] Impact acres predominantly from private development upland aggregation rather than drainage system repair.

Funding for this project was provided by the Minnesota Environment and Natural Resources Trust Fund as recommended by the Legislative-Citizen Commission on Minnesota Resources (LCCMR).

Scenario C – Table 2
COST of REPAIR ALTERNATIVES

	DRAINAGE SYSTEM REPAIR	URBAN PEAK MANAGEMENT[1]	AVOIDED STORM WATER MANAGE-MENT[2]	COMPLIANCE & CONSERVATION[3]
CONVENTIONAL REPAIR	$5.57 Million	$2.73 Million	--	$8.14 Million
LIMITED REPAIR	$2.79 Million	$2.83 Million	--	$0
WATERSHED-BASED APPROACH	$0.82 Million	$2.57 Million	($2.56 Million)	$2.81 Million[4]

NOTES:

[1] Facilities that would need to be constructed on or adjacent to upper ECD 8 to provide adequate capacity for urban peak flow management for build-out under City of Cosego comprehensive land use plan. A part of this cost would be defrayed by the capacity of the downgradient wetland/floodplain to absorb peak flows without ecologic deterioration.

[2] Avoided cost of water quality basins that would accompany build-out under City of Cosego comprehensive land use plan due to runoff assimilation capacity of downgradient wetland resources. This cost savings would be for water quality benefits beyond those afforded by peak management (retention) facilities.

[3] For watershed-based approach, includes system reconfiguration (reroutes) to limit wetland impact and replacement cost.

[4] This cost does not include replacement costs for draining or filling of exempt wetland. Much of this impact will not be exempt but will not be a cost of the drainage system. It will be borne by property owners and MnDOT in voluntary action to aggregate upland for development.

Funding for this project was provided by the Minnesota Environment and Natural Resources Trust Fund as recommended by the Legislative-Citizen Commission on Minnesota Resources (LCCMR).

V. RECOMMENDATIONS

Based on the legal review, analysis of critical issues, and exploration of demonstration scenarios, the study team developed the following legal and policy recommendations. The study advisory committee reviewed and refined multiple drafts of the recommendations, and comments from larger group presentations were incorporated as well.

We intend for these recommendations to provide tools for the legislature or local authorities to make policy choices in how best to integrate drainage and natural resource management. Accordingly, the recommendations are the product of robust discussion, but not complete consensus. The recommendations are the responsibility of the authors, and reflect a judgment that they have adequate support among diverse stakeholders to be worthy of consideration.

Several of the recommended actions include *"options to consider."* The authors deem these options to be worthy of further consideration by policy makers, but at this time either lack essential stakeholder support or require further discussion with affected agencies or parties.

Recommendations #1 – 4 address drainage and watershed management, and Recommendations #5-9 address drainage and wetlands management.

DRAINAGE AND WATERSHED MANAGEMENT

Minnesota's drainage laws should be updated to embrace a multipurpose watershed-based approach. Consistent with the legislature's finding in Minnesota Statutes §103A.212 that the state's water resources should be managed from the watershed perspective, the drainage law can integrate more with the other purposes of water policy, such as water conservation, water pollution, preservation and management of wildlife, soil conservation, public recreation, forest management, and municipal planning. A watershed-based approach to managing drainage systems can reduce conflict between public interests in drainage and conservation, and promote more cost effective outcomes. In a developed or developing area, this approach also can provide a framework to reconcile conflict among multiple land uses, limit public and private costs to maintain conveyance systems, and improve conservation outcomes.

RECOMMENDATION #1: Give drainage authorities more tools and resources for watershed-based planning.

Findings: Watershed-based management and regulation may require a significant up-front investment in engineering and scientific study. The cost of such study may not be justifiable in traditional terms to the landowners in the drainage system, particularly if the outcome is not known. If the risk of bearing the cost falls only on the drainage petitioner, and if benefits of the approach are not fully captured by benefitted lands, disincentives to use the approach are created.

Recommended actions:

a. Enact incentives for drainage systems to be included in a watershed-based plans through coordination of existing comprehensive plan, local water management plan, watershed

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management plan and Total Maximum Daily Load implementation plan processes; provide for BWSR performance-based grants (including from Legacy Funds) and a coordination process to eliminate duplication; include incentives for counties to use existing authority to transfer this responsibility to watershed districts where locally preferred and feasible.

b. Enact specific statutory authority in Minnesota Statutes chapter 103D for watershed districts and chapter 103B for counties to provide drainage authorities watershed and subwatershed ad valorem levy and utility charge authorities for the purpose of watershed-based drainage system planning where not otherwise funded by water planning process of chapter 103B. Clarify that the Minnesota Statutes §103B.311 county water planning process must specifically include drainage systems.

c. Specify in Minnesota Statutes chapter 103E that cost of multipurpose watershed-based planning is not to be borne solely by benefitted properties in drainage system.

d. Provide statutory confirmation in Minnesota Statutes §103E.011, subdivision 5, that watershed-based planning activities of drainage authority are eligible for external sources of grant funding.

e. Require that watershed-based plans for drainage systems assess drainage system impacts on water quality, volume and flooding and include prioritized projects to address the same while preserving essential drainage capacity.

RECOMMENDATION #2: Give drainage authorities more tools and resources to implement projects with integrated drainage, flood control, conservation and water quality benefits.

Findings: A drainage authority must be able to allocate implementation costs of multipurpose watershed-based management fairly. Watershed districts can use an ad valorem levy or a stormwater utility to fund these needs, but where a county is the drainage authority and there is no watershed district, funding options may be more constrained. The absence of an appropriate funding mechanism may impose costs in a way that creates a disincentive to act or in a way that creates stakeholder opposition to a watershed-based approach. As a result, a drainage authority seeking to implement a watershed-based approach to projects with multiple benefits may be hampered in its access to timely and equitable implementation funding.

Recommended actions:

a. Establish ad valorem levy authority for watershed districts (in chapter 103D) and counties (in chapter 103B) to help pay for outcomes of watershed-based management plans.

b. Establish subwatershed ad valorem levy authority for watershed districts/counties (chapters 103D/103B) to pay for subwatershed-wide outcomes of watershed-based

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management plans; codify subwatershed units as special taxing districts (Minnesota Statutes §275.066).

c. Establish stormwater utility charge authority for watershed-based system management by counties (chapter 103B) where no watershed district exists to serve as the drainage authority.

d. Create process in Minnesota Statutes chapter 103E to move all or part of a drainage system repair to a utility-based charge system under drainage authority control.

Options to consider:

e. Provide drainage authorities the option to assess the system costs of drainage work with consideration of benefitted-parcel contribution to increasing or decreasing environmental compliance costs.

RECOMMENDATION #3: Better integrate effects on wetlands and water quality into drainage authority decisions about drainage system work.

Findings: Under the drainage code, drainage authority decisions require a quantitative weighing of benefits and costs to property owners but only general consideration of "public benefits," a term that itself is ill-defined in the law. Decisions that best reconcile public interests in drainage and in wetland/water quality protection are served by better integration of those interests in the decisionmaking process. However, public benefits and costs from wetland and water quality impacts are difficult to measure and quantify, and a requirement to do so would be premature.

Recommended actions:

a. Require that engineer's reports for drainage projects and repairs under Minnesota Statutes §§103E.245, 103E.285, 103E.705 and 103E.715 evaluate impacts of proposed work on wetlands, flow conditions, and pollutant transport and means of reducing impacts consistent with drainage system requirements.

b. Clarify that Minnesota Statutes §103E.015, subdivision 2, directing the drainage authority to consider "public utility, benefit or welfare," applies to drainage system repair.

c. Refine the definition of "public benefit" in Minnesota Statutes §103E.005 to include public values of wetlands, downgradient water quality, protection of natural geomorphology, downgradient channel stability, and protection of public infrastructure. Include a definition of "public cost" to refer to the loss of public benefit.

d. (Non-legislative) Foster work to further the understanding of drainage system impacts on wetlands, flow conditions and pollutant transport, and to further the means quantify and value those impacts cost-effectively.

RECOMMENDATION #4: Provide drainage authorities with more clarity in legal authority to address drainage system alignment, grade, cross section, and hydraulic capacity

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of bridges and culverts for multipurpose design of drainage system establishment, improvement, or repair.

Findings: Watershed-based approaches to drainage system projects, repairs and retrofits tend to involve multiple design characteristics and challenges. Under the drainage law, theextent of permissible localized impacts to drainage efficiency from realignment or reconfiguration is uncertain. Often records are insufficient to establish "official" alignment, dimensions and grade of drainage systems established many years ago. Without official alignment, dimensions and grade to serve as a baseline, evaluating proposed realignment or reconfiguration for actual and legal impacts is problematic. Field investigation to establish official alignment and grade is expensive and can be inconclusive.

Recommended actions:

a. Amend consolidation statute (§103E.801) to establish process to "officially designate" drainage system after investigation.

b. Amend realignment/impoundment/repair statutes (§§103E.227, 103E.701) to define range of permissible impacts on hydraulic efficiency (general or localized) when implementing statutes.

c. Provide for mechanisms to allocate costs of technical work for system redesignation and realignment proceedings in same manner as indicated in Recommendations #1 and #2, above.

d. Clarify that a drainage authority may direct that the engineer's report include multiple purposes in design of a drainage project or repair, so long as these purposes are consistent with the applicable watershed-based management plan and approved by the drainage authority.

DRAINAGE AND WETLANDS MANAGEMENT

RECOMMENDATION #5: Extend the authority to establish a locally based wetland regulatory framework under a CWPMP to public water wetlands.

Findings: Technical evaluation and planning can integrate WCA and public water wetlands, but WCA LGU has no authority to manage and regulate public waters in accordance with CWPMP except through case-by-case DNR waiver of jurisdiction. Landowner benefits in the form of expectations/certainty are undermined by preservation of full DNR regulatory prerogative. Benefits of clear, efficient process are undermined by ambiguous Minnesota Statutes §103E.701 language concerning DNR approval of repair. Drainage authority ability to fairly allocate management costs is complicated by uncertainty over the statutory cost to protect public water wetlands affected by drainage system (e.g., §103G.225).

Recommended actions:

Funding for this project was provided by the Minnesota Environment and Natural Resources Trust Fund as recommended by the Legislative-Citizen Commission on Minnesota Resources (LCCMR).

a. Clarify DNR authority under Minnesota Statutes §§103G.2243 and 103G.245 to (i) programmatically waive jurisdiction to WCA LGU under CWPMPs and (ii) establish a parallel CWPMP framework by agreement with the LGU.

b. Establish an efficient administrative process with record review under Minnesota Statutes §103E.701 to involve DNR in determination of repair depth when public waters may be affected.

c. Revisit Minnesota Statutes §103G.225 and related statutes for clear legislative articulation of when the public shall bear the cost to protect public waters against the impacts of lawful drainage work.

Options to consider:

d. Collapse DNR public water wetland regulatory authority into WCA program by removing public waters wetlands from the purview of Minnesota Statutes §103G.245 and including them under WCA jurisdiction.

RECOMMENDATION #6: Create replacement alternatives within a CWPMP for a landowner causing wetland impact who may not have a high-valued replacement option on site.

Findings: A CWPMP will incorporate incentives to replacement wetlands within particular areas of the watershed to enhance overall wetland value. As a result, certain landowners may be situated with access to higher-valued restoration options and others may not. CWPMP potential is diminished if a landowner is forced to a lower-valued replacement option.

Recommended actions:

a. State authority in Minnesota Statutes §103G.2243 for WCA LGU to establish and manage own watershed-based wetland replacement bank under CWPMP.

b. Affirm in Minnesota Statutes §103G.2243 that a WCA LGU, notwithstanding land use law concerning exactions, may: (i) collect fees in lieu of replacement provided fees are used to create or purchase replacement credits meeting CWPMP requirements; and (ii) require as condition of replacement plan approval that a property owner dedicate an easement allowing public resource restoration work.

Option to consider:

c. Authorize WCA LGU to provide in CWPMP for replacement credit for other water resource benefits including improvements with respect to flow conditions, habitat, pollutant generation and pollutant transport.

RECOMMENDATION #7: Coordinate USACE Section 404 jurisdiction with a watershed-based CWPMP or other implementing framework.

Funding for this project was provided by the Minnesota Environment and Natural Resources Trust Fund as recommended by the Legislative-Citizen Commission on Minnesota Resources (LCCMR).

Findings: A conflicting federal regulatory framework can preclude CWPMP outcomes. The USACE's reserved regulatory prerogative under Section 404 of the Clean Water Act can undermine the benefits of a CWPMP by reducing the CWPMP's ability to deliver more certainty in permitting time and outcome. The alternatives analysis requirement under Section 404 adds to CWPMP cost concerns and undermines certainty in permitting time and outcome that are important benefits of a watershed-wide approach.

Recommended actions:

a. (Non-legislative) Further BWSR coordination with USACE to align Section 404 permitting with CWPMPs, including: (i) readier USACE use of programmatic permits, (ii) USACE consideration of "sector-specific" programmatic permits for drainage system maintenance, and (iii) consistent standards and procedures for fee-in-lieu programs.

Options to consider:

b. Enhance tools and resources for WCA LGU and land use authority to collaborate in developing and implementing CWPMP.

c. Direct and facilitate DNR pursuit of delegated Section 404 authority (with BWSR and Department of Agriculture cooperation per §103G.127) for CWPMP areas.

d. Coordinate Minnesota Pollution Control Agency §401review with CWPMP.

RECOMMENDATION #8: Integrate MnDOT right-of-way, other state-managed lands and local road authority activities within a CWPMP framework.

Findings: State agencies may affect higher-valued wetlands or disrupt protected corridors contrary to CWPMP goals. Local road impacts in higher-valued resource areas will be subject to CWPMP disincentives but replacement activity may be outside of plan area and not contribute to desired CWPMP outcomes.

Options to consider:

a. Provide that WCA provision naming state agency as LGU for state-managed lands may be qualified within a CWPMP area by (i) constraints on replacement wetland location as feasible and (ii) authority of LGU to require fee in lieu of replacement outside of CWPMP area.

b. Provide that road replacement under WCA may be qualified within a CWPMP area by (i) constraints on replacement wetland location as feasible and (ii) authority of LGU to require fee in lieu of replacement outside of CWPMP area.

RECOMMENDATION #9: Foster reliability of CWPMP outcomes through coordination of local land use authority and wetland regulatory authority.

Funding for this project was provided by the Minnesota Environment and Natural Resources Trust Fund as recommended by the Legislative-Citizen Commission on Minnesota Resources (LCCMR).

Findings: The local land use authority may regulate wetland impacts under local ordinances and inconsistently with the CWPMP framework. The identity of the WCA LGU may shift after CWPMP investment has been completed, and a new LGU may not be committed to the CWPMP framework and expectations created. Property owner collaboration in a CWPMP framework rests on the reliability of created expectations. Early coordination enhances commitment to framework over intended duration of CWPMP implementation.

Options to consider:

a. State in Minnesota Statutes §103G.2243 that CWPMP rule preempts inconsistent wetland regulation by local land use authority.

b. Affirm authority and enhance capacity for local land use authorities to use area-based rather than site-based approaches to planning and development regulation.

c. *Allow metro area land use authorities to revise comprehensive land use plans under CWPMP framework without Metropolitan Council approval, consistent with broader density parameters set by Council.*

Funding for this project was provided by the Minnesota Environment and Natural Resources Trust Fund as recommended by the Legislative-Citizen Commission on Minnesota Resources (LCCMR).

APPENDIX A

DRAFT LEGISLATION TO IMPLEMENT RECOMMENDATIONS

RECOMMENDATION #1: Provide drainage authorities with more tools and resources for watershed-based planning.

Findings: Watershed-based management and regulation may require a significant up-front investment in engineering and scientific study. The cost of such study may not be justifiable in traditional terms to the landowners in the drainage system, particularly if the outcome is not known. If the risk of bearing the cost falls only on the drainage petitioner, and if benefits of the approach are not fully captured by benefitted lands, disincentives to use the approach are created.

Recommended actions:

a. Enact incentives for drainage systems to be included in watershed-based plans through coordination of existing comprehensive plan, local water management plan, watershed management plan and Total Maximum Daily Load implementation plan processes; provide for BWSR performance-based grants (including from Legacy Funds) and a coordination process to eliminate duplication; include incentives for counties to use existing authority to transfer this responsibility to watershed districts where locally preferred and feasible.

103B.101 BOARD OF WATER AND SOIL RESOURCES.

Subdivision 14. **Local water management coordination.**

The Board of Water and Soil Resources, by resolution, may adopt policies or orders that allow a comprehensive plan, local water management plan, watershed management plan or total maximum daily load implementation plan adopted and approved according to this chapter and chapters 103C, 103D, and 114D to serve as substitutes for one another. To the extent practical, the board shall incorporate a watershed approach and promote the inclusion of public drainage systems in such plans. The board shall work with local government stakeholders to foster mutual understanding and develop recommendations for local water management and related state water management policy and programs. The board may convene informal working groups or work teams to develop information, education, and recommendations.

103B.3369 LOCAL WATER RESOURCES PROTECTION AND MANAGEMENT PROGRAM.

Subdivision 5. **Financial assistance**.

Funding for this project was provided by the Minnesota Environment and Natural Resources Trust Fund as recommended by the Legislative-Citizen Commission on Minnesota Resources (LCCMR).

A base grant may be awarded to a county that provides a match utilizing a water implementation tax or other local source. A water implementation tax that a county intends to use as a match to the base grant must be levied at a rate determined by the board. ~~The minimum amount of the water implementation tax shall be a tax rate times the adjusted net tax capacity of the county for the preceding year. The rate shall be the rate, rounded to the nearest .001 of a percent, that, when applied to the adjusted net tax capacity for all counties, raises the amount of $1,500,000. The base grant will be in an amount equal to $37,500 less the amount raised by the local match. If the amount necessary to implement the local water plan for the county is less than $37,500, the amount of the base grant shall be the amount that, when added to the match amount, equals the amount required to implement the plan. For counties where the tax rate generates an amount equal to or greater than $18,750, the base grant shall be in an amount equal to $18,750.~~ The board may award performance-based grants to local units of government that are responsible for implementing elements of applicable portions of watershed management plans or local water management plans adopted and approved according to this chapter or chapter 103C or 103D. The board may award performance-based grants to local units of government to carry out total maximum daily load (TMDL) implementation plans as defined in section 114D.15 if the board has reviewed and approved the TMDL implementation plan, as requested by a local unit of government, according to the procedures for approving comprehensive plans, watershed management plans, or local water management plans in this chapter or chapter 103C or 103D. The board may award performance-based grants to drainage authorities to complete watershed-based plans for public drainage systems, and to facilitate the transfer, pursuant to section 103D.335, subd. 15, to a watershed district of all joint county or county drainage systems within the watershed district, together with the right to repair, maintain, and improve them.

b. Enact specific statutory authority in Minnesota Statutes chapter 103D for watershed districts and chapter 103B for counties to provide drainage authorities watershed and subwatershed ad valorem levy and utility charge authorities for the purpose of watershed-based drainage system planning where not otherwise funded by water planning process of chapter 103B. Clarify that the Minnesota Statutes §103B.311 county water planning process must specifically include drainage systems.

103B.311 COUNTY WATER PLANNING AND MANAGEMENT.

Subdivision 1.**County duties.**

Each county is encouraged to develop and implement a local water management plan. Each county that develops and implements a plan has the duty and authority to:

(1) prepare and adopt a local water management plan that meets the requirements of this section through section 103B.315;

(2) review water and related land resources plans and official controls submitted by local units of government to assure consistency with the local water management plan; and

(3) exercise any and all powers necessary to assure implementation of local water management plans.

Funding for this project was provided by the Minnesota Environment and Natural Resources Trust Fund as recommended by the Legislative-Citizen Commission on Minnesota Resources (LCCMR).

Subdivision 4.**Water plan requirements.**

(a) A local water management plan must:

(1) cover the entire area within a county;

(2) address water problems in the context of watershed units and groundwater systems;

(3) be based upon principles of sound hydrologic management of water, effective environmental protection, and efficient management;

(3a) identify public drainage systems, including existing dams and control structures within those systems, and assess their effect on the hydrologic and hydraulic characteristics of the watershed units in which they are situated, including impacts on water quality, water volumes transported and flooding;

(4) be consistent with local water management plans prepared by counties and watershed management organizations wholly or partially within a single watershed unit or groundwater system; and

(5) the local water management plan must specify the period covered by the local water management plan and must extend at least five years but no more than ten years from the date the board approves the local water management plan. Local water management plans that contain revision dates inconsistent with this section must comply with that date, provided it is not more than ten years beyond the date of board approval. A two-year extension of the revision date of a local water management plan may be granted by the board, provided no projects are ordered or commenced during the period of the extension.

(b) Existing water and related land resources plans, including plans related to agricultural land preservation programs developed pursuant to chapter 40A, must be fully utilized in preparing the local water management plan. Duplication of the existing plans is not required.

103B.325 CONSISTENCY OF LOCAL PLANS AND CONTROLS WITH THE LOCAL WATER MANAGEMENT PLAN.

Subdivision 1.**Requirement.**

Local units of government other than watershed districts and watershed-based organizations formed for the joint exercise of powers under section 471.59 shall amend existing water and related land resources plans and official controls as necessary to conform them to the applicable, approved local water management plan following the procedures in this section.

Subdivision 3.**Revision and implementation.**

Funding for this project was provided by the Minnesota Environment and Natural Resources Trust Fund as recommended by the Legislative-Citizen Commission on Minnesota Resources (LCCMR).

Local units of government other than watershed districts and watershed-based organizations formed for the joint exercise of powers under section 471.59 shall revise existing plans and official controls to conform them to the recommendations of the county board and shall initiate implementation of the revised plans and controls within 180 days after receiving the recommendations of the county board, or 180 days after resolution of an appeal, whichever is later.

103B.335 TAX LEVY AUTHORITY.

Subdivision 1.**Local water planning and management.**

(a) The governing body of any county~~, municipality, or township~~ may levy a tax in an amount required to implement sections 103B.301 to 103B.355.

(b) The governing body of any county may establish a special taxing district in the same manner as set forth in 103B.331, subdivision 4, to pay the cost to prepare a local water management plan under 103B.311 and implement watershed-based elements of that plan.

(c) The governing body of any county may establish a water management district or districts in any territory within the county not within the boundaries of a watershed district, if provided for by the local water management plan, for the purpose of collecting revenues and paying the costs of projects implemented under watershed-based elements of a local water management plan. The plan shall describe with particularity the territory or the area to be included in the water management district, the amount of the necessary charges, the methods used to determine charges, the basis for determining that the charges are just and equitable, and the length of time the water management district will remain in force. The water management district may be dissolved by the procedure prescribed for the establishment of the water management district. Ten days prior to a hearing or decision on projects implemented under this section, the county shall provide notice to the city or town within the affected area. The city or town receiving notice shall submit to the governing body concerns relating to project implementation. The governing body shall consider the concerns of the city or town in its decision on the project.

103D.905 FUNDS OF WATERSHED DISTRICT.

Subdivision 9.**Project tax levy.**

(a) In addition to other tax levies provided in this section or in any other law, a watershed district may levy a tax:

(1) to pay the costs of projects undertaken by the watershed district which are to be funded, in whole or in part, with the proceeds of grants or construction or implementation loans under sections 103F.701 to 103F.761;

Funding for this project was provided by the Minnesota Environment and Natural Resources Trust Fund as recommended by the Legislative-Citizen Commission on Minnesota Resources (LCCMR).

(2) to pay the principal of, or premium or administrative surcharge, if any, and interest on, the bonds and notes issued by the watershed district pursuant to section 103F.725; or

(3) to repay the construction or implementation loans under sections 103F.701 to 103F.761.

Taxes levied with respect to payment of bonds and notes shall comply with section 475.61.

(b) A watershed district may levy a tax for payment of costs incurred in preparing a watershed management plan under section 103D.401 and implementing projects in that plan.

(c) A watershed district may establish a special taxing district to pay the cost to prepare a watershed management plan under 103D.401 and to implement watershed-based elements of that plan. The county auditor must be notified of a new special taxing district by July 1 in order to be effective for taxes payable in the following year.

c. Specify in Minnesota Statutes chapter 103E that cost of multipurpose watershed-based planning is not to be borne solely by benefitted properties in drainage system.

103E.011 DRAINAGE AUTHORITY POWERS.

Subdivision 1.**Generally.**

The drainage authority may make orders to:

(1) construct and maintain drainage systems;

(2) deepen, widen, straighten, or change the channel or bed of a natural waterway that is part of the drainage system or is located at the outlet of a drainage system;

(3) extend a drainage system into or through a municipality for a suitable outlet; ~~and~~

(4) construct necessary dikes, dams, and control structures and power appliances, pumps, and pumping machinery as provided by law; and

(5) prepare and adopt watershed-based plans for drainage systems, including an assessment of drainage system impacts on water quality, volume, and flooding, as well as prioritized projects to address such impacts while preserving essential drainage capacity, provided that the cost of preparing such plans shall not be paid solely by assessments based on the benefits of the drainage system.

Funding for this project was provided by the Minnesota Environment and Natural Resources Trust Fund as recommended by the Legislative-Citizen Commission on Minnesota Resources (LCCMR).

d. Provide statutory confirmation in Minnesota Statutes §103E.011, subdivision 5, that such watershed-based planning activities of drainage authority are eligible for external sources of grant funding.

103E.011 DRAINAGE AUTHORITY POWERS.

Subdivision 5.**Use of external sources of funding.**

Notwithstanding other provisions of this chapter, a drainage authority may accept and use funds from sources other than, or in addition to, those derived from assessments based on the benefits of the drainage system for the purposes of watershed-based planning for the drainage system, wetland preservation or restoration, or creation of water quality improvements or flood control. The sources of funding authorized under this subdivision may also be used outside the benefited area but must be within the watershed of the drainage system.

e. Require that watershed-based plans for drainage systems assess drainage system impacts on water quality, volume and flooding and include prioritized projects to address the same while preserving essential drainage capacity.

(See also recommended action 1.c, above, for statutory revision to effect recommended action 1.e.)

103D.401 WATERSHED MANAGEMENT PLAN.

Subdivision 1.**Contents.**

(a) The managers must adopt a watershed management plan for any or all of the purposes for which a watershed district may be established. The watershed management plan must give a narrative description of existing water and water-related problems within the watershed district, possible solutions to the problems, and the general objectives of the watershed district. The plan must identify public drainage systems and assess their effect on the hydrologic and hydraulic characteristics of the watershed units in which they are situated, including impacts on water quality, water volumes transported and flooding. The watershed management plan must also conform closely with watershed management plan guidelines as adopted and amended from time to time by the Board of Water and Soil Resources.

(b) The watershed management plan may include a separate section on proposed projects. If the watershed district is within the metropolitan area, the separate section of proposed projects or petitions for projects to be undertaken according to the watershed

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management plan is a comprehensive plan of the watershed district for purposes of review by the Metropolitan Council under section 473.165.

RECOMMENDATION #2: Provide drainage authorities with more tools and resources to implement projects with integrated drainage, flood control, conservation and water quality benefits.

Findings: A drainage authority must be able to allocate implementation costs of multipurpose watershed-based management fairly. Watershed districts can use an ad valorem levy or a stormwater utility to fund these needs, but where a county is the drainage authority and there is no watershed district, funding optionsmay be more constrained. The absence of an appropriate funding mechanism may impose costs in a way that creates a disincentive to act or in a way that creates stakeholder opposition to a watershed-based approach. As a result, a drainage authority seeking to implement a watershed-based approach to projects with multiple benefits may be hampered in its access to timely and equitable implementation funding.

Recommended actions:

a. **Establish ad valorem levy authority for watershed districts (in chapter 103D) and counties (in chapter 103B) to help pay for outcomes of watershed-based management plans.**

b. **Establish subwatershed ad valorem levy authority for watershed districts/counties (chapters 103D/103B) to pay for subwatershed-wide outcomes of watershed-based management plans; codify subwatershed units as special taxing districts (Minnesota Statutes §275.066).**

c. **Establish stormwater utility charge authority for watershed-based system management by counties (chapter 103B) where no watershed district exists to serve as the drainage authority.**

(In addition to the following, see recommended action 1.b, above, for statutory revisions to effect recommended actions 2.a, 2.b and 2.c.)

275.066 SPECIAL TAXING DISTRICTS; DEFINITION.

For the purposes of property taxation and property tax state aids, the term "special taxing districts" includes the following entities:

(1) watershed districts under chapter 103D;

(2) sanitary districts under sections 115.18 to 115.37;

(3) regional sanitary sewer districts under sections 115.61 to 115.67;

(4) regional public library districts under section 134.201;

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(5) park districts under chapter 398;

(6) regional railroad authorities under chapter 398A;

(7) hospital districts under sections 447.31 to 447.38;

(8) St. Cloud Metropolitan Transit Commission under sections 458A.01 to 458A.15;

(9) Duluth Transit Authority under sections 458A.21 to 458A.37;

(10) regional development commissions under sections 462.381 to 462.398;

(11) housing and redevelopment authorities under sections 469.001 to 469.047;

(12) port authorities under sections 469.048 to 469.068;

(13) economic development authorities under sections 469.090 to 469.1081;

(14) Metropolitan Council under sections 473.123 to 473.549;

(15) Metropolitan Airports Commission under sections 473.601 to 473.680;

(16) Metropolitan Mosquito Control Commission under sections 473.701 to 473.716;

(17) Morrison County Rural Development Financing Authority under Laws 1982, chapter 437, section 1;

(18) Croft Historical Park District under Laws 1984, chapter 502, article 13, section 6;

(19) East Lake County Medical Clinic District under Laws 1989, chapter 211, sections 1 to 6;

(20) Floodwood Area Ambulance District under Laws 1993, chapter 375, article 5, section 39;

(21) Middle Mississippi River Watershed Management Organization under sections 103B.211 and 103B.241;

(22) emergency medical services special taxing districts under section 144F.01;

(23) a county levying under the authority of section 103B.241, 103B.245, or 103B.251;

(24) Southern St. Louis County Special Taxing District; Chris Jensen Nursing Home under Laws 2003, First Special Session chapter 21, article 4, section 12;

(25) an airport authority created under section 360.0426; ~~and~~

(26) any other political subdivision of the state of Minnesota, excluding counties, school districts, cities, and towns, that has the power to adopt and certify a property tax levy to the county auditor, as determined by the commissioner of revenue; and

Funding for this project was provided by the Minnesota Environment and Natural Resources Trust Fund as recommended by the Legislative-Citizen Commission on Minnesota Resources (LCCMR).

(27) any special taxing district created to prepare and implement a local water management plan or watershed management plan under section 103B.231, 103B.311 or 103D.401.

d. Create process in Minnesota Statutes chapter 103E to move all or part of a drainage system repair to a utility-based charge system under drainage authority control.

103E.725 COST OF REPAIR.

(a) All fees and costs incurred for proceedings relating to the repair of a drainage system, including inspections, engineering, viewing, and publications, are costs of the repair and must be assessed against the property and entities benefited.

(b) Notwithstanding any other provision of this chapter, the drainage authority may pay for costs of repair by imposition of just and equitable charges and, if a watershed district, may certify charges to the counties with territory within the drainage system for collection by the counties.

(c) Charges may be fixed on the basis of:

(1) drainage benefits conferred;

(2) use of system conveyance capacity;

(3) contribution to repair cost or frequency by virtue of sediment contributed;

(4) contribution to increasing or decreasing environmental compliance costs; or

(4) any other equitable basis including any combination of clauses (1) to (4).

(d) When charges have been appropriated to the repair cost, no charge shall be deemed unreasonable by virtue of the fact that the repair work to be financed has not been commenced or completed, if proceedings for it are taken with reasonable dispatch and the work, when completed, may be expected to have a value reasonably commensurate with the charges.

RECOMMENDATION #3: Better integrate effects on wetlands and water quality into drainage authority decisions about drainage system work.

Findings: Under the drainage code, drainage authority decisions require a quantitative weighing of benefits and costs to property owners but only general consideration of "public benefits," a term that itself is ill-defined in the law. Decisions that best reconcile public interests in drainage and in wetland/water quality protection are served by better integration of those interests in the decisionmaking process. However, public benefits and costs from wetland and water quality impacts are difficult to measure and quantify, and a requirement to do so would be premature.

Funding for this project was provided by the Minnesota Environment and Natural Resources Trust Fund as recommended by the Legislative-Citizen Commission on Minnesota Resources (LCCMR).

Recommended actions:

a. Require that engineer's reports for drainage projects and repairs under Minnesota Statutes §§103E.245, 103E.285, 103E.705 and 103E.715 evaluate impacts of proposed work on wetlands, flow conditions, and pollutant transport and means of reducing impacts consistent with drainage system requirements.

103E.245 PRELIMINARY SURVEY AND PRELIMINARY SURVEY REPORT.

Subdivision 2.**Limitation of survey.**

The engineer shall restrict the preliminary survey to the drainage area described in the petition, except that to secure an outlet the engineer may run levels necessary to determine the distance for the proper fall of the water and to evaluate the impact of the proposed drainage project on the environmental and land use criteria in section 103E.015, subdivision 1. The drainage authority may have other areas surveyed after:

(1) giving notice by mail of a hearing to survey additional areas, to be held at least ten days after the notice is mailed, to the petitioners and persons liable on the petitioners' bond;

(2) holding the hearing;

(3) obtaining consent of the persons liable on the petitioners' bond; and

(4) ordering the additional area surveyed by the engineer.

Subdivision 4.**Preliminary survey report.**

The engineer shall report the proposed drainage project plan or recommend a different practical plan. The report must give sufficient information, in detail, to inform the drainage authority on issues related to feasibility, and show changes necessary to make the proposed plan practicable and feasible including extensions, laterals, and other work. If the engineer finds the proposed drainage project in the petition is feasible and complies with the environmental and land use criteria in section 103E.015, subdivision 1, the engineer shall include in the preliminary survey report a preliminary plan of the drainage project showing the proposed ditches, tile, laterals, and other improvements, the outlet of the project, the watershed of the drainage project or system, and the property likely to be affected and its known owners. The plan must show:

(1) the elevation of the outlet and the controlling elevations of the property likely to be affected referenced to standard sea level datum, if practical;

(2) the probable size and character of the ditches and laterals necessary to make the plan practicable and feasible;

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(3) the character of the outlet and whether it is sufficient;

(4) the probable cost of the drains and improvements shown on the plan;

(5) all other information and data necessary to disclose the practicability, necessity, and feasibility of the proposed drainage project;

(6) consideration of the drainage project under the environmental and land use criteria in section 103E.015, subdivision 1, including impacts of proposed work on wetlands, flow conditions, and pollutant transport in sufficient detail to evaluate these impacts as far downgradient as they are reasonably discernable and to advise the drainage authority of means of reducing the impacts consistent with the conveyance needs of the drainage system; and

(7) other information as ordered by the drainage authority.

103E.285 DETAILED SURVEY REPORT.

Subdivision 10.**Other information on practicability and necessity of drainage project.**

Other data and information to inform the drainage authority of the practicability and necessity of the proposed drainage project must be made available including a comprehensive examination and the recommendation by the engineer regarding the environmental and land use criteria in section 103E.015, subdivision 1, including impacts of proposed work on wetlands, flow conditions, and pollutant transport in sufficient detail to evaluate these impacts as far downgradient as they are reasonably discernable and to advise the drainage authority of means of reducing the impacts consistent with the conveyance needs of the drainage system.

103E.705 REPAIR PROCEDURE.

Subdivision 3.**Drainage inspection report.**

For each drainage system that the board designates and requires the drainage inspector to examine, the drainage inspector shall make a drainage inspection report in writing to the board after examining a drainage system, designating portions that need repair or maintenance of the permanent strips of perennial vegetation and the location and nature of the repair or maintenance. The board shall consider the drainage inspection report at its next meeting and may repair all or any part of the drainage system as provided under this chapter after due consideration of public benefits and costs pursuant to section 103E.015, subdivision 2. The permanent strips of perennial vegetation must be maintained in compliance with section 103E.021.

Funding for this project was provided by the Minnesota Environment and Natural Resources Trust Fund as recommended by the Legislative-Citizen Commission on Minnesota Resources (LCCMR).

103E.715 PROCEDURE FOR REPAIR BY PETITION.

Subdivision 2.**Engineer's repair report.**

If the drainage authority determines that the drainage system needs repair, the drainage authority shall appoint an engineer to examine the drainage system and make a repair report. The report must show the necessary repairs, the estimated cost of the repairs, and all details, plans, and specifications necessary to prepare and award a contract for the repairs. The report also will include an assessment of public benefits and costs pursuant to section 103E.015, subdivision 2, at a level of detail corresponding to the scope of the repair and sufficient to advise the drainage authority of means of reducing public costs consistent with the conveyance needs of the drainage system. The drainage authority may give notice and order a hearing on the petition before appointing the engineer.

Subdivision 4.**Hearing on repair report.**

(a) The drainage authority shall make findings and order the repair to be made if it finds the repair justified after due consideration of public benefits and costs pursuant to section 103E.015, subdivision 2, and:

(1) it determines from the repair report and the evidence presented that the repairs recommended are necessary for the best interests of the affected property owners; or

(2) the repair petition is signed by the owners of at least 26 percent of the property area affected by and assessed for the original construction of the drainage system, and it determines that the drainage system is in need of repair so that it no longer serves its original purpose and the cost of the repair will not exceed the total benefits determined in the original drainage system proceeding.

(b) The order must direct the auditor and the chair of the board or, for a joint county drainage system, the auditors of the affected counties to proceed and prepare and award a contract for the repair of the drainage system. The contract must be for the repair described in the repair report and as determined necessary by the drainage authority, and be prepared in the manner provided in this chapter for the original drainage system construction.

b. Clarify that Minnesota Statutes §103E.015, subdivision 2, directing the drainage authority to consider "public utility, benefit or welfare," applies to drainage system repair.

103E.015 CONSIDERATIONS BEFORE DRAINAGE WORK IS DONE.

Funding for this project was provided by the Minnesota Environment and Natural Resources Trust Fund as recommended by the Legislative-Citizen Commission on Minnesota Resources (LCCMR).

Subdivision 2.**Determining public utility, benefit, or welfare.**

In any proceeding to establish a drainage project, in determining the scope of any repair, or in the construction of or other work affecting a public drainage system under any law, the drainage authority or other authority having jurisdiction over the proceeding must give proper consideration to conservation of soil, water, forests, wild animals, and related natural resources, and to other public benefits and costs, together with other material matters as provided by law in determining whether the project will be of public utility, benefit, or welfare.

c. Refine the definition of "public benefit" in Minnesota Statutes §103E.005 to include public values of wetlands, downgradient water quality, protection of natural geomorphology, downgradient channel stability, and protection of public infrastructure. Include a definition of "public cost" to refer to the loss of public benefit.

103E.005 DEFINITIONS.

Subdivision 24a. **Public cost**.

"Public cost" refers to a loss of public benefit and includes but is not limited to an act or thing that degrades public values of wetlands, water quality, channel stability, natural channel geomorphology or public infrastructure.

Subdivision 27.**Public welfare or public benefit.**

"Public welfare" or "public benefit" includes an act or thing that tends to improve or benefit the general public, either as a whole or as to any particular community or part, including works contemplated by this chapter that drain or protect roads from overflow, protect property from overflow, or reclaim and render property suitable for cultivation that is normally wet and needing drainage or subject to overflow; and works that enhance public values of wetlands, water quality and channel stability and protect natural geomorphology and public infrastructure.

d. (Non-legislative) Foster work to further the understanding of drainage system impacts on wetlands, flow conditions and pollutant transport, and to further the means quantify and value those impacts cost-effectively.

(No legislative text.)

Funding for this project was provided by the Minnesota Environment and Natural Resources Trust Fund as recommended by the Legislative-Citizen Commission on Minnesota Resources (LCCMR).

RECOMMENDATION #4: Provide drainage authorities with more clarity in legal authority to address drainage system alignment, grade, cross section, and hydraulic capacity of bridges and culverts for multipurpose design of drainage system establishment, improvement, or repair.

Findings: Watershed-based approaches to drainage system projects, repairs and retrofits tend to involve multiple design characteristics and challenges. Under the drainage law, the extent of permissible localized impacts to drainage efficiency from realignment or reconfiguration is uncertain. Often records are insufficient to establish "official" alignment, dimensions and grade of drainage systems established many years ago. Without official alignment, dimensions and grade to serve as a baseline, evaluating proposed realignment or reconfiguration for actual and legal impacts is problematic. Field investigation to establish official alignment and grade is expensive and can be inconclusive.

Recommended actions:

a. Amend consolidation statute (§103E.801) to establish process to "officially designate" drainage system after investigation.

103E.801 CONSOLIDATION OR DIVISION OF DRAINAGE SYSTEMS.

Subdivision 1a. **Authority to designate alignment and cross-section**.

If after diligent inquiry a drainage authority finds that records establishing alignment and cross-section of a public drainage system as constructed and thereafter legally modified are incomplete, it may by order designate an alignment and cross-section that it finds to be most reasonably supported by existing records and evidence. The drainage authority's designation may provide for hydraulic continuity from points of terminus to the system outlet and may make a finding of continuous channel right-of-way adequate for that purpose. This designation will not interrupt prescriptive occupation.

Subdivision 2.**Initiation of action.**

The consolidation,-division or designation may be initiated by the drainage authority on its own motion or by any party interested in or affected by the drainage system filing a petition. If the system is under the jurisdiction of a drainage authority, the petition must be filed with the auditor. If the system is under the jurisdiction of a watershed board, the petition must be filed with the secretary of the board.

Subdivision 3.**Hearing.**

(a) When a drainage authority or watershed board directs by resolution or a petition is filed, the drainage authority in consultation with the auditor or secretary shall set a time

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and location for a hearing. The auditor or secretary shall give notice by publication to all persons interested in the drainage system.

(b) The drainage authority may consolidate or divide drainage systems, by order, if it determines that the division of one system into two or more separate systems, the consolidation of two or more systems, the transfer of part of one system to another, or the attachment of a previously abandoned part of a system to another system:

(1) is consistent with the redetermination of the benefited areas of the drainage system;

(2) would provide for the efficient administration of the drainage system; and

(3) would be fair and equitable.

(c) An order to consolidate or divide drainage systems does not release property from a drainage lien or assessment filed for costs incurred on account of a drainage system before the date of the order.

(d) A final drainage authority order designating the alignment and cross-section of a public drainage system constitutes the official system profile. A finding of system right-of-way in such an order is a defense to a trespass claim and will be given due weight in any subsequent court proceeding to establish the existence or nature of a property encumbrance.

b. Amend realignment/impoundment/repair statutes (§§103E.227, 103E.701) to define range of permissible impacts on hydraulic efficiency (general or localized) when implementing statutes.

103E.227 IMPOUNDING, REROUTING, AND DIVERTING DRAINAGE SYSTEM WATERS.

Subdivision 1.**Petition.**

(a) To conserve and make more adequate use of our water resources or to incorporate wetland or water quality enhancing elements as authorized by Minnesota Statutes §103E.011, subdivision 5, a person, public or municipal corporation, governmental subdivision, the state or a department or agency of the state, the commissioner of natural resources, and the United States or any of its agencies, may petition to impound, reroute, or divert drainage system waters for beneficial use.

(b) If the drainage system is under the jurisdiction of a county drainage authority, the petition must be filed with the auditor of the county. If the drainage system is under the jurisdiction of a joint county drainage authority, the petition must be filed with the county having the largest area of property in the drainage system, where the primary drainage system records are kept, and a copy of the petition must be submitted to the auditor of

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each of the other counties participating in the joint county drainage authority. If the system is under the jurisdiction of a watershed district, the petition must be filed with the secretary of the district. The auditor of an affected county or the secretary of a watershed district must make a copy of the petition available to the public.

(c) The petition must contain the location of the installation, concept plans for the proposed project, and a map that identifies the areas likely to be affected by the project.

(d) The petition shall identify the sources of funds to be used to secure the necessary land rights and to construct the project and the amount and rationale for any drainage system funds requested.

(e) The petitioner or drainage authority must also acquire a public waters work permit or a water use permit from the commissioner of natural resources if required under chapter 103G.

Subdivision 3.**Procedure to establish project.**

(a) After receiving the petition and bond, if required, the drainage authority must appoint an engineer to investigate the effect of the proposed installation and file a report of findings.

(b) After filing of the engineer's report, notice must be given and a public hearing held as provided in section 103E.261.

(c) If at the hearing it appears from the engineer's report and other evidence presented that the project will be of a public or private benefit and that it will not substantially impair the utility of the drainage system or substantially deprive an affected land owner of its benefit without that land owner's consent, the drainage authority shall make an order modifying the drainage system, to include the amount, if any, of drainage system funds approved for the project at the discretion of the drainage authority, and issue an order authorizing the project.

103E.701 REPAIRS.

Subdivision 1.**Definition.**

The term "repair," as used in this section, means to restore all or a part of a drainage system as nearly as practicable to the same condition as originally constructed and subsequently improved, including resloping of ditches and leveling of waste banks if necessary to prevent further deterioration, realignment to original construction if necessary to restore the effectiveness of the drainage system, and routine operations that may be required to remove obstructions and maintain the efficiency of the drainage system. "Repair" also includes:

(1) incidental straightening of a tile system resulting from the tile-laying technology used to replace tiles;

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(2) replacement of tiles with the next larger size that is readily available, if the original size is not readily available; and

(3) incorporation within a drainage system of a measure to limit the wetland or water quality impacts of the repair, provided that any increase in hydraulic efficiency from the measure is local and insubstantial.

Subdivision 6.**Wetland restoration and water quality protection.**

Repair of a drainage system may include the preservation, restoration, or enhancement of wetlands; wetland replacement under section 103G.222; the realignment of a drainage system to prevent drainage of a wetland; and the incorporation of measures to reduce channel erosion and otherwise reduce pollutant transport within the channel and receiving waters.

c. Provide for mechanisms to allocate costs of technical work for system redesignation and realignment proceedings in same manner as indicated in Recommendations #1 and #2, above.

(See Recommended Actions 1 and 2 for statutory language to effect Recommended Action 4.c.)

d. Clarify that a drainage authority may direct that the engineer's report include multiple purposes in design of a drainage project or repair, so long as these purposes are consistent with the applicable watershed-based management plan and approved by the drainage authority.

103E.011 DRAINAGE AUTHORITY POWERS.

Subdivision 5.**Incorporation of wetland and water quality protection; Use of external sources of funding.**

A drainage authority may incorporate into public drainage systems measures to reduce the wetland and water quality impacts of such systems as identified in the engineer's report or as otherwise specified in an adopted watershed-based plan of a watershed district or county. Notwithstanding other provisions of this chapter, a drainage authority may accept and use funds from sources other than, or in addition to, those derived from assessments based on the benefits of the drainage system for the purposes of wetland preservation or restoration or creation of water quality improvements or flood control. The funding authorized under this subdivision may be used outside the benefited area but within the watershed of the drainage system.

Funding for this project was provided by the Minnesota Environment and Natural Resources Trust Fund as recommended by the Legislative-Citizen Commission on Minnesota Resources (LCCMR).

RECOMMENDATION #5: Extend to public waters wetlands the authority to establish a locally based wetland framework under a CWPMP.

***Findings*:** Technical evaluation and planning can integrate WCA and public water wetlands, but WCA LGU has no authority to manage and regulate public waters in accordance with CWPMP except through case-by-case DNR waiver of jurisdiction. Landowner benefits in the form of expectations/certainty are undermined by preservation of full DNR regulatory prerogative. Benefits of clear, efficient process are undermined by ambiguous Minnesota Statutes §103E.701 language concerning DNR approval of repair. Drainage authority ability to fairly allocate management costs is complicated by uncertainty over the statutory cost to protect public water wetlands affected by drainage system (e.g., §103G.225).

a. Clarify DNR authority under Minnesota Statutes §§103G.2243 and 103G.245 to (i) programmatically waive jurisdiction to WCA LGU under CWPMPs and (ii) establish a parallel CWPMP framework by agreement with the LGU.

103G.2243 LOCAL COMPREHENSIVE WETLAND PROTECTION AND MANAGEMENT PLANS.

Subdivision 2.**Plan contents.**

A comprehensive wetland protection and management plan may:

….

(5) incorporate the terms of a general permit issued by the commissioner governing work in public waters within the plan area .

103G.245 WORK IN PUBLIC WATERS.

Subdivision 3.**Permit application.**

Application for a public waters work permit must be in writing to the commissioner on forms prescribed by the commissioner. The commissioner may issue a state general permit to a governmental subdivision or to the general public for classes of activities having minimal impact upon public waters under which more than one project may be conducted under a single permit. Activities conducted within the framework of a comprehensive wetland protection and management plan approved by the Board pursuant to Minnesota Statutes §103G.2243 may constitute a class of activities for the purpose of this subdivision.

Funding for this project was provided by the Minnesota Environment and Natural Resources Trust Fund as recommended by the Legislative-Citizen Commission on Minnesota Resources (LCCMR).

b. Establish an efficient administrative process with record review under Minnesota Statutes §103E.701 to involve DNR in determination of repair depth when public waters may be affected.

103E.701 REPAIRS.

Subdivision 2.**Repairs affecting public waters.**

Before a repair is ordered, the drainage authority must notify the commissioner if the repair may affect public waters. If the commissioner disagrees with the repair depth or cross-section, the engineer, a representative appointed by the director, and a soil and water conservation district technician must jointly determine the repair depth and cross-section using soil borings, field surveys, and other available data or appropriate methods. This determination shall define the limit of the repair unless within 30 days of receipt the drainage authority or commissioner initiates a contested case proceeding under sections 14.57 to 14.66. In such a proceeding, the administrative law judge shall decide permitted repair depth on the basis of a preponderance of the evidence but shall give substantial weight to the determination. The report of the administrative law judge constitutes a final decision in the case, as provided in section 14.62, subdivision 4. Costs for determining the repair depth beyond the initial meeting of the representatives and for the administrative proceeding must be shared equally by the drainage system and the commissioner. The determined repair depth must be recommended to the drainage authority. The drainage authority may accept the joint recommendation and proceed with the repair.

c. Revisit Minnesota Statutes §103G.225 and related statutes for clear legislative articulation of when the public shall bear the cost to protect public waters against the impacts of lawful drainage work.

(Statutory language is not offered here, as this recommendation requires a legislative policy decision concerning how the cost to protect public waters from impacts of drainage system work should be allocated as between the drainage system and the public.)

RECOMMENDATION #6: Create replacement alternatives within a CWPMP for a landowner causing wetland impact who may not have a high-valued replacement option on site.

Findings: A CWPMP will incorporate incentives to replacement wetlands within particular areas of the watershed to enhance overall wetland value. As a result, certain landowners may be situated with access to higher-valued restoration options and others may not. CWPMP potential is diminished if a landowner is forced to a lower-valued replacement option.

Recommended actions:

Funding for this project was provided by the Minnesota Environment and Natural Resources Trust Fund as recommended by the Legislative-Citizen Commission on Minnesota Resources (LCCMR).

a. State authority in Minnesota Statutes §103G.2243 for WCA LGU to establish and manage own watershed-based wetland replacement bank under CWPMP.

103G.2243 LOCAL COMPREHENSIVE WETLAND PROTECTION AND MANAGEMENT PLANS.

Subdivision 2.**Plan contents.**

A comprehensive wetland protection and management plan may:

(1) provide for classification of wetlands in the plan area based on:

(i) an inventory of wetlands in the plan area;

(ii) an assessment of the wetland functions listed in section 103B.3355, using a methodology chosen by the Technical Evaluation Panel from one of the methodologies established or approved by the board under that section; and

(iii) the resulting public values;

(2) vary application of the sequencing standards in section 103G.222, subdivision 1, paragraph (b), for projects based on the classification and criteria set forth in the plan;

(3) vary the replacement standards of section 103G.222, subdivision 1, paragraphs (f) and (g), based on the classification and criteria set forth in the plan, for specific wetland impacts provided there is no net loss of public values within the area subject to the plan, and so long as:

(i) in a 50 to 80 percent area, a minimum acreage requirement of one acre of replaced wetland for each acre of drained or filled wetland requiring replacement is met within the area subject to the plan; and

(ii) in a less than 50 percent area, a minimum acreage requirement of two acres of replaced wetland for each acre of drained or filled wetland requiring replacement is met within the area subject to the plan, except that replacement for the amount above a 1:1 ratio can be accomplished as described in section 103G.2242, subdivision 12; ~~and~~

(4) in a greater than 80 percent area, allow replacement credit, based on the classification and criteria set forth in the plan, for any project that increases the public value of wetlands, including activities on adjacent upland acres; and

(5) establish a bank for replacement credits generated and to be applied within the plan area and administered by the local government unit under terms specified in the plan.

Funding for this project was provided by the Minnesota Environment and Natural Resources Trust Fund as recommended by the Legislative-Citizen Commission on Minnesota Resources (LCCMR).

b. Affirm in Minnesota Statutes §103G.2243 that a WCA LGU, notwithstanding land use law concerning exactions, may: (i) collect fees in lieu of replacement provided fees are used to create or purchase replacement credits meeting CWPMP requirements; and (ii) require as condition of replacement plan approval that a property owner dedicate an easement allowing public resource restoration work.

103G.2243 LOCAL COMPREHENSIVE WETLAND PROTECTION AND MANAGEMENT PLANS.

Subdivision 2.**Plan contents.**

A comprehensive wetland protection and management plan may:

(1) provide for classification of wetlands in the plan area based on:

(i) an inventory of wetlands in the plan area;

(ii) an assessment of the wetland functions listed in section 103B.3355, using a methodology chosen by the Technical Evaluation Panel from one of the methodologies established or approved by the board under that section; and

(iii) the resulting public values;

(2) vary application of the sequencing standards in section 103G.222, subdivision 1, paragraph (b), for projects based on the classification and criteria set forth in the plan;

(3) vary the replacement standards of section 103G.222, subdivision 1, paragraphs (f) and (g), based on the classification and criteria set forth in the plan, for specific wetland impacts provided there is no net loss of public values within the area subject to the plan, and so long as:

(i) in a 50 to 80 percent area, a minimum acreage requirement of one acre of replaced wetland for each acre of drained or filled wetland requiring replacement is met within the area subject to the plan; and

(ii) in a less than 50 percent area, a minimum acreage requirement of two acres of replaced wetland for each acre of drained or filled wetland requiring replacement is met within the area subject to the plan, except that replacement for the amount above a 1:1 ratio can be accomplished as described in section 103G.2242, subdivision 12; and

(4) in a greater than 80 percent area, allow replacement credit, based on the classification and criteria set forth in the plan, for any project that increases the public value of wetlands, including activities on adjacent upland acres;

Funding for this project was provided by the Minnesota Environment and Natural Resources Trust Fund as recommended by the Legislative-Citizen Commission on Minnesota Resources (LCCMR).

(5) provide that a fee may be paid to the local government unit in lieu of replacement under terms providing for the fee to be used to increase wetland values within the plan area and to reasonably reflect the cost of replacing the wetland values being lost; and

(6) require as a condition of replacement plan approval that a property owner dedicate the right to manage hydrologic and vegetative conditions within priority wetland and associated upland areas; there must be an essential nexus between the dedication and the public purpose sought to be achieved by the dedication and the burden of the dedication must bear a rough proportionality to the need created by the proposed activity.

RECOMMENDATION #7: Coordinate USACE Section 404 jurisdiction with a watershed-based CWPMP or other implementing framework.

Findings: A conflicting federal regulatory framework can preclude CWPMP outcomes. The USACE's reserved regulatory prerogative under Section 404 of the Clean Water Act can undermine the benefits of a CWPMP by reducing the CWPMP's ability to deliver more certainty in permitting time and outcome. The alternatives analysis requirement under Section 404 adds to CWPMP cost concerns and undermines certainty in permitting time and outcome that are important benefits of a watershed-wide approach.

Recommended actions:

a. (Non-legislative) Further BWSR coordination with USACE to align Section 404 permitting with CWPMPs, including: (i) readier USACE use of programmatic permits, (ii) USACE consideration of "sector-specific" programmatic permits for drainage system maintenance, and (iii) consistent standards and procedures for fee-in-lieu programs.

(No statutory change.)

RECOMMENDATION #8: Integrate MnDOT right-of-way, other state-managed lands and local road authority activities within a CWPMP framework.

Findings: State agencies may affect higher-valued wetlands or disrupt protected corridors contrary to CWPMP goals. Local road impacts in higher-valued resource areas will be subject to CWPMP disincentives but replacement activity may be outside of plan area and not contribute to desired CWPMP outcomes.

(No statutory change.)

RECOMMENDATION #9: Foster reliability of CWPMP outcomes through coordination of local land use authority and wetland regulatory authority.

Funding for this project was provided by the Minnesota Environment and Natural Resources Trust Fund as recommended by the Legislative-Citizen Commission on Minnesota Resources (LCCMR).

Findings: The local land use authority may regulate wetland impacts under local ordinances and inconsistently with the CWPMP framework. The identity of the WCA LGU may shift after CWPMP investment has been completed, and a new LGU may not be committed to the CWPMP framework and expectations created. Property owner collaboration in a CWPMP framework rests on the reliability of created expectations. Early coordination enhances commitment to framework over intended duration of CWPMP implementation.

(No statutory change.)

Funding for this project was provided by the Minnesota Environment and Natural Resources Trust Fund
as recommended by the Legislative-Citizen Commission on Minnesota Resources (LCCMR).

APPENDIX B

TECHNICAL INFORMATION – HOUSTON ENGINEERING

Funding for this project was provided by the Minnesota Environment and Natural Resources Trust Fund
as recommended by the Legislative-Citizen Commission on Minnesota Resources (LCCMR).

MEMO

(External Correspondence)

HoustonEngineering Inc.

To: Louis Smith, Smith Partners

From: Greg Bowles, P.E.
Nancy Stowe, P.E.

Date: June 23, 2011

Cc: File Project No. 117261-001

Subject: Scenario A - Wetland Restoration Hydrologic and Nutrient Removal Analysis

Introduction

Agricultural land owners in the Red River Valley have experienced ongoing flooding problems that jeopardize agricultural production, building sites and cause temporary flooding of roadways during larger storm events. Feasible methods of flood control are being considered which will provide future flood protection, as well as benefit to habitat. Scenario A is a hypothetical scenario that was created to investigate how a drainage system might be modified to provide flood control and environmental benefits through wetland restoration. It seems important to note that the function of a drainage system is the drainage of land for agricultural production. Drainage systems can of course also provide some flood control benefit, but normally the open channel of a drainage system is design to convey a much smaller (usually less than 10-year and often less) runoff event than an open channel designed for flood control purposes (usually a 100-year event). Field surface drainage is designed for event smaller conveyance.

The purpose of this analysis is to estimate the hydrologic and nutrient removal benefits of a hypothetical wetland restoration area constructed as a component of a "fictitious" or idealized public drainage system. Several assumptions were necessary to define the watershed and for sizing the wetland restoration area. Agricultural areas typically have ditch drainage systems, and one method of creating a wetland restoration area is to construct an impoundment across the ditch system (i.e., on channel rather than off-channel). For the purposes of analyzing Scenario A, the impoundment was assumed to be on-channel and create a wetland restoration surface area of 75 acres that has an average normal pool depth of 2 feet and an additional bounce of 1 foot resulting from runoff from the 10-year, 24-hour return period event. The wetland restoration is further assumed to be designed with 225 acres of upland buffer corresponding to a 3:1 upland area to wetland area ratio. The drainage area to the wetland restoration area is assumed to be 1,875 acres (3 sq. mi.) corresponding to a 25:1 drainage area to wetland area ratio.

Methodology

Hydrologic models for existing and for proposed conditions (after the wetland restoration) were completed for the 2-year (2.20 inches), 10-year (3.40 inches) and the 100-year (5.00 inches), 24 hour storm events using a HydroCAD model. The model was created assuming the runoff from the entire 1,875 acre drainage area flows to the restored wetland area via sheet flow, shallow concentrated flow, and channelized flow through a ditch system. The slope of the terrain within this drainage area is assumed to be very flat and have a slope of 2 feet per mile. This terrain slope was used in calculating a time of concentration of 543 minutes which was used in

the existing and proposed model. Soil within the Red River Valley is assumed to be type B soil for agricultural lands and type C soil for the upland buffer area surrounding the wetland restoration area. The entire 1,875 acre existing watershed was modeled with a curve number (CN) of 78 (row crop, straight row, good, HGC B). The proposed watershed was modeled with a composite CN of 78 which included 1,500 acres using a CN of 78 (row crop, straight row, good, HGC B), 225 acres using a CN of 71 (meadow, non-grazed, HGC C) and 75 acres using CN of 98 (water surface). The wetland restoration impoundment was designed as a two stage 70-foot long weir (first stage) to allow for a bounce of one foot for the 10-year, 24 hour storm event, and a 200-foot long weir (second stage) to allow for a bounce of 1.4 feet in the 100-year, 24 hour storm event. This bounce criteria of one foot for the 10-year, 24 hour storm event is commonly used by Ducks Unlimited in their wetland restoration designs. Modeling analysis assumed the normal water elevation of the wetland restoration area is the same elevation as the outlet elevation of the impoundment and that there is free discharge downstream. If the scenario included a downstream channel that controlled the flow, the peak runoff rate reduction would be less than the modeled results. The hydrologic model results of existing and proposed conditions are shown in **Table 1**.

Pollutant loading and removal for the hypothetical watershed and restored wetland was performed using version 3.4 of the P8 model – Program for Predicting Polluting Particle Passage thru Pits, Puddles, & Ponds (http://wwalker.net/p8). It was used to estimate the total suspended sediment (TSS), total phosphorus (TP), and total kjeldahl nitrogen (TKN) components of the long-term mass balance.

In order to understand the long-term variability in pollutant loading in the watershed, a 50-year (1961 to 2010) model simulation was carried out. The P8 model requires user input relative to local precipitation and temperature, watershed characteristics, water quality parameters, and treatment device geometry. Hourly precipitation and daily temperature data were obtained at the Minneapolis-St. Paul airport, as it has sufficient data to perform long-term model simulations since the percent of the load removed is primarily of interest. As in the HydroCAD model, the impervious fraction in the watershed was assumed zero, and a CN of 78 was applied. The wetland was assumed to provide 150 AF of permanent pool and 75 AF of flood pool and have a 70-foot long weir as an outlet. The wetland was modeled as a pond in the P8 model and assigned a particle removal scale factor of 3 to account for the effects of vegetation on particle removal rates. Since the wetland was modeled as an on-channel pond, there was no pollutant removal assumed for the upland buffer area.

The simulated weighted average annual pollutant loads, as well as the removal occurring in the hypothetical restored wetland, as predicted by the P8 model, are shown in **Table 2.**

Results

Peak existing and proposed runoff rates for the 2-, 10- and 100-year, 24 hour storm events are shown below.

Table 1 – HydroCAD Modeling Results for Scenario A

Storm Event	Existing Peak Runoff Rates Before Wetland Restoration	Proposed Peak Runoff Rates after Wetland Restoration	Peak Runoff Rate Reduction (%)
2-YR Runoff Event (cfs)	99	63	36%
10-YR Runoff Event (cfs)	246	179	27%
100-YR Runoff Event (cfs)	483	433	10%

Model assumptions:

- Drainage area of 1,875 acres
- Type B soils in agricultural area and type C soil within the wetland buffer area
- CN value = 78 for row crop (straight, good), 71 for meadow (non-grazed), 98 for restoration water surface
- Time of Concentration = 543 minutes (65 min. sheet flow, 250 min. shallow concentrated flow and 228 min. channel flow)
- Slope of terrain is flat (2'/mile)
- Wetland restoration pool has surface area of 75 acres, live storage of 1' and dead storage of 2'.
- Wetland restoration outlet is a two stage outlet with a width of 70 feet and 200 feet. The outlet is sized for a 1' bounce at the 100-year, 24 hour storm event and a 1.4' bounce at the 100-year event.
- Normal water elevation of the wetland restoration area is the same elevation as the outlet elevation of the impoundment.

The results indicate the wetland restoration area will create a peak runoff reduction of 36% for the 2-year, 27% for the 10-year, and 10% for the 100-year, 24 hour storm events. The results also indicate that the wetland restoration area will not change the peak flood volume for this particular scenario. The percentage reductions have not been converted to stage and the change in the area inundated. Therefore an estimate of the area protected by adding storage is not possible.

Table 2 - P8 Modeling Results for Scenario A (based on 50-year period of record)

	Loading Before Wetland Restoration Treatment (lbs/yr)	Loading After Wetland Restoration Treatment (lbs/yr)	Removal (lbs/yr)	Removal Percent (%)
Total Suspended Solids (TSS)	168,294	65,345	102,949	61%
Total Phosphorus (TP)	523	353	170	32%

Total Nitrogen (TKN)	2,331	1,669	662	28%

Model assumptions:

- Drainage area of 1,875 acres
- Minneapolis-St. Paul precipitation records
- No impervious area
- Weir discharge coefficient - 2.66
- Particle Removal Factor = 3 (recommended for vegetation)
- Otherwise P8 defaults

APPENDIX C

TECHNICAL INFORMATION – I & S GROUP

Funding for this project was provided by the Minnesota Environment and Natural Resources Trust Fund as recommended by the Legislative-Citizen Commission on Minnesota Resources (LCCMR).

INTRODUCTION

Green Meadows County Ditch No. 43 (***"Ditch 43"***) is located within Green Meadows County near the City of Greenstown and generally flows from south to northeast eventually draining into the Old Corncob River. The contributing watershed to Ditch 43 contains primarily of agricultural land usage and also drains most of the City of Greenstown. Ditch 43 was originally constructed in 1919 and has undergone improvements as recently as 1975. Additional improvements to Ditch 43 are currently under construction and will provide increased conveyance and water quality benefits through the use of grass buffers lining the ditch, two stage ditch, and two (2) detention ponds. These improvements are outlined in ***Figure 1***.

This analysis details the anticipated pollutant removals for three contaminants as a result of the improvements to Ditch 43. Namely, the pollutants studied are Total Suspended Solids (***"TSS"***), Total Phosphorus (***"TP"***), and Total Nitrogen (***"TN"***).

METHODOLOGY

Based on data obtained from the Nation Urban Runoff Program, existing agricultural pollutant loading was determined for TSS, TP, and TN. From an article titled "Pollution From Urban Storm Water Infiltration", existing urban concentrations for TSS, TP, and TN were determined for urban runoff. These values are empirical and represent only an estimation of typical values given the source of the runoff.

Because the treatment practices are deemed either a storm water pond or vegetative filter, the Minnesota Stormwater Manual was referenced to determine the expected percent removal of TSS, TP, and TN for these particular treatments. From these percent removals, an anticipated treated pollutant concentration was determined and the annual pollutant removal was calculated accordingly.

Due to the nature of the data collected from the National Urban Runoff Program, the only contributing factor to the amount of pollutant generated from the adjoining land use was the number of acres treated by the particular BMP; i.e. existing/future flows generated via modeling were unnecessary to compute the annual pollutant removal. Using this data, the annual pollutant removals for the Surge Pond, Two Stage Ditch, and Grass Buffers were calculated.

The estimated urban runoff concentrations determined from "Pollution From Urban Storm Water Infiltration" was provided in a format which necessitated hydrologic and hydraulic modeling. As such, two (2) 6-month storm events were simulated and an annual volume of water passing through the City Pond was obtained and used to compute the annual pollutant removal by the City Pond.

The theoretical Total Maximum Daily Limit (***"TMDL"***) that could be imposed on the system at the downstream end of the future ditch was determined utilizing two (2) 6-month storm events and the existing/treated pollutant concentrations. The flows and concentrations were routed throughout the treatment system and the resulting pollutant concentrations were established at the downstream end of the project. This result represents the lowest TMDL that could be imposed before additional treatment practices would need to be implemented.

ENVIRONMENTAL OUTPUTS

For the described treatment practices, TSS, TP, and TN removals were estimated given the anticipated annual rainfall. These removals were determined for the City Pond, Surge Pond, Two Stage Ditch, and Grass Buffer treatments.

City Pond

The City Pond ultimately treats most of the storm water runoff generated by the City of Greenstown. Approximately 295 acres of land characterized as urban and producing 12 ac-ft annual rainfall runoff drains into this basin. Based on empirical data, it is estimated that the storm water runoff entering the pond possesses a TSS concentration 65 mg/L, TP concentration 0.350 mg/L, and TN concentration 2.0 mg/L. Upon treatment of the storm water, it is anticipated that the TSS, TP, and TN concentrations will be reduced to 10 mg/L, 0.175 mg/L, and 1.4 mg/L, respectively, as outlined in ***Table 1***. The subsequent annual removal of pollutants by the City Pond is 1775 lbs. TSS, 5.7 lbs. TP, and 19.4 lbs. TN, as described in ***Table 2***.

Surge Pond

The Surge Pond treats storm water runoff generated by the portion of the watershed south of the Surge Pond. Included in this runoff are the previously treated flows from the City Pond. In determination of the contaminant removal, the flows treated by the City Pond were not included. Approximately 1395 acres of land classified as agriculture and producing 95 ac-ft annual rainfall runoff empties into the Surge Pond. It is estimated that the storm water runoff entering this pond possesses a TSS concentration 8.5 lbs/ac-yr, TP concentration 0.035 lbs/ac-yr, and TN concentration 14 lbs/ac-yr. Upon treatment of the storm water, it is anticipated that the TSS, TP, and TN concentrations will be reduced to 1.3 lbs/ac-yr, 0.018 lbs/ac-yr, and 9.8 lbs/ac-yr, respectively, as outlined in ***Table 1***. The subsequent annual removal of pollutants by the Surge Pond is 10,045 lbs. TSS, 23.7 lbs. TP, and 5,860 lbs. TN, as described in ***Table 2***.

Two Stage Ditch

The Two Stage Ditch treats storm water runoff generated by the portion of the watershed generally within the center of the catchment. Included in this runoff are the previously treated flows from the City Pond and Surge Pond. As was the case previously, the determination of the contaminant removal neglected the flows treated by the City Pond and Surge Pond. Approximately 260 acres of additional land classified as agriculture and producing 60 ac-ft annual rainfall runoff empties into the Surge Pond. It is estimated that the storm water runoff entering this portion of the ditch possesses a TSS concentration 8.5 lbs/ac-yr, TP concentration 0.035 lbs/ac-yr, and TN concentration 14 lbs/ac-yr. Upon treatment of the storm water, it is anticipated that the TSS, TP, and TN concentrations will be reduced to 1.3 lbs/ac-yr, 0.018 lbs/ac-yr, and 9.8 lbs/ac-yr, respectively, as outlined in ***Table 1***. The subsequent annual removal of pollutants by the Two Stage Ditch is 1,880 lbs. TSS, 4.5 lbs. TP, and 1,095 lbs. TN, as described in ***Table 2***.

Grass Buffers

The Grass Buffers treat storm water runoff generated by the portion of the watershed generally at the downstream portion of the catchment. Included in this runoff are the previously treated flows from the City Pond, Surge Pond, and Two Stage Ditch. The determination of the contaminant removal neglected the flows previously treated by other methods. Approximately 330 acres of additional land classified as agriculture and producing 2,250 ac-ft annual rainfall runoff passes through the portion of Ditch 43 containing Grass Buffers. Important to note, because the Grass Buffers are only capable of treating overland flow, a vast majority of the runoff generated in this area goes untreated. This is due to much of the runoff being captured by field drainage tile and routed to Ditch 43 without treatment. As such, only 300 feet of the portion of land adjacent to Ditch 43 extending out from the ditch was included as part of the treated calculation. It is estimated that the storm water runoff entering this portion of the ditch possesses a TSS concentration 8.5 lbs/ac-yr, TP concentration 0.035 lbs/ac-yr, and TN concentration 14 lbs/ac-yr. Upon treatment of the storm water, it is anticipated that the TSS, TP, and TN concentrations will be reduced to 1.9 lbs/ac-yr, 0.018 lbs/ac-yr, and 9.1 lbs/ac-yr, respectively, as outlined in ***Table 1***. The subsequent annual removal of pollutants by the Grass Buffers is 345 lbs. TSS, 0.9 lbs. TP, and 255 lbs. TN, as described in ***Table 2***.

TOTAL MAXIMUM DAILY LIMITS

The system of storm water treatments utilized throughout the drainage ditch results in TSS, TP, and TN concentrations of 20 mg/L, 0.154 mg/L, and 1.73 mg/L, respectively, before the confluence with the Old Corncob River. In the event that a TMDL were imposed on this waterway, the treated water emerging from the pond and grass buffer treatment system will not exceed the TMDL provided the following:

- TSS TMDL ≥ 20mg/L

- TP TMDL ≥ 0.154 mg/L
- TN TMDL ≥1.73 mg/L

If a TMDL was imposed for a particular pollutant below the concentrations listed, additional treatment measures would need to be implemented to ensure compliance.

FIGURE 1. GREEN MEADOWS COUNTY DITCH NO. 43 IMPROVEMENTS

GREEN MEADOWS COUNTY, MINNESOTA

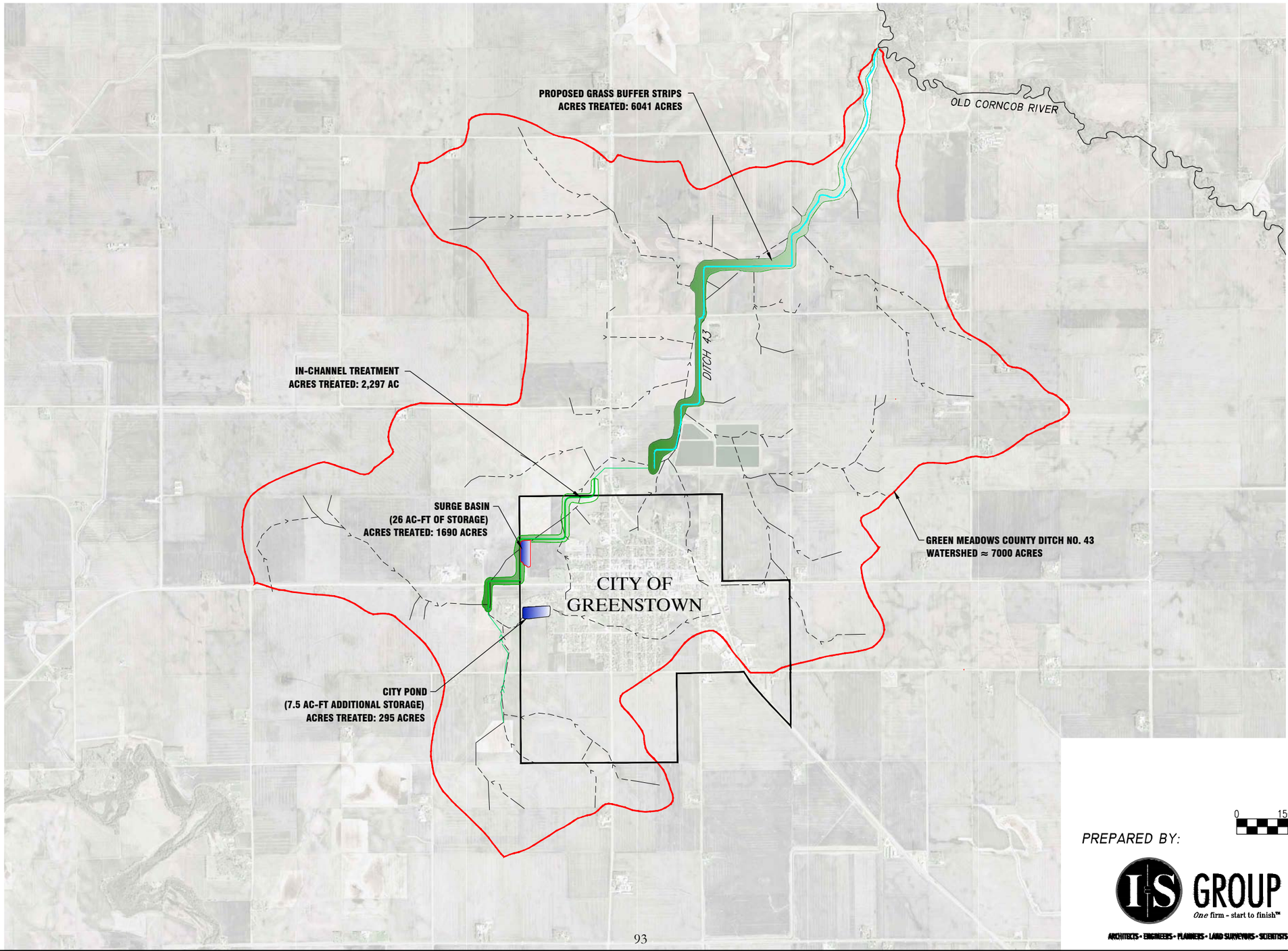

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TABLE 1
GREEN MEADOWS COUNTY DITCH NO. 43
ESTIMATED WATER QUALITY POLLUTANT CONCENTRATIONS BEFORE/AFTER TREATMENT

Pollutant Concentration Summary						
Treatment*	**Total Suspended Solids Concentration Before Treatment (lbs/ac-yr)**	**Total Suspended Solids Concentration After Treatment (lbs/ac-yr)**	**Total Phosphorus Concentration Before Treatment (lbs/ac-yr)**	**Total Phosphorus Concentration After Treatment (lbs/ac-yr)**	**Total Nitrogen Concentration Before Treatment (lbs/ac-yr)**	**Total Nitrogen Concentration After Treatment (lbs/ac-yr)**
City Pond**	65**	10**	0.35**	0.175**	2.0**	1.4**
Surge Pond***	8.5	1.3	0.035	0.018	14.0	9.8
Two Stage Ditch***	8.5	1.3	0.035	0.018	14.0	9.8
Grass Buffers***	8.5	1.9	0.035	0.018	14.0	9.1

*Treatment removal efficiency based on the Minnesota Stormwater Manual.

**Existing pollutant concentrations based on research by Mikkelsen et al. published in 1994.
Pollutant removal derived from the volume of water produced by two simulated six-month rainfall events.
Concentrations listed in mg/L.

***Existing pollutant concentrations based on data collected as part of the National Urban Runoff Program.

TABLE 2
GREEN MEADOWS COUNTY DITCH NO. 43
ESTIMATED WATER QUALITY POLLUTANT REMOVAL PER YEAR

Pollutant Removal Summary					
Treatment*	**Watershed Area (ac.)**	**Total Flow Treated (ac-ft)**	**Estimated Total Suspended Solids Removal (lb.)**	**Estimated Total Phosphorus Removal (lb.)**	**Estimated Total Nitrogen Removal (lb.)**
City Pond**	295	12	1,775	5.7	19.4
Surge Pond***	1,395	95	10,045	23.7	5,860
Two Stage Ditch***	260	60	1,880	4.5	1,095
Grass Buffers***	330	2,250	345	0.9	255

*Treatment removal efficiency based on the Minnesota Stormwater Manual.

**Existing pollutant concentrations based on research by Mikkelsen et al. published in 1994.

Pollutant removal derived from the volume of water produced by two simulated six-month rainfall events.

***Existing pollutant concentrations based on data collected as part of the National Urban Runoff Program.

APPENDIX D

ECONOMIC ANALYSIS

June 29, 2011
To: Louis Smith, Smith Partners
From: Steven J. Taff

Assessing the total economic value of drainage improvement projects

My task was to think through a relatively transparent and practical procedure to assign total economic values to the agronomic and environment services affected by a given drainage improvement project—Scenarios A and B in the LCCMR project. To an economist, "total economic value" is the sum of monetized changes in all service flows. This is in contrast to "market value," which captures only that money value of actual transactions. Total economic value is one way economists attempt to capture the cost of "externalities," those effects of an action that aren't considered by economic actors (acting under a strict financial calculus) in their decisions.

To properly estimate total economic value, we require valuations for both market and the extra-market impacts of an action. The former is usually simpler, because there exists both a history of market prices and an apparatus for deciding upon "proper" market prices for many activities. In the case of drainage improvements, the Engineering Report and the Viewers' Report (available only for Scenario B) both assign economic values to the market effects of the proposed improvement, using techniques accepted in both professional and judicial circles.

To estimate the value of non-marketed effects, such as changes in water quality or in wildlife habitat, economists have developed a range of tools that can elicit peoples' implicit valuations about these changes. This presupposes, however, that we have at hand a complete set of measures of the physical changes in the environment: how much more water pollution, how much less habitat. These physical measures are not commonly obtained in engineering or viewers' reports. Consequently, for the present effort, we asked the engineers to estimate these numbers.

A drainage project, by its nature, is expected to change both the timing and volume of water flows through the system by changing the retention capacity of various lands through the system.

In Scenario A, the water quality improvement measures include a large retention basin, part of which will be restored to wetland, and a two-stage ditch structure in the upper reaches of the watershed. In Scenario B, the improvement measures consist of increasing the size of the receiving ditch and, simultaneously, retarding the rate of flow by installing intervening surge ponds. In addition, Scenario B calls for increasing the size of buffer areas along the ditch.

Funding for this project was provided by the Minnesota Environment and Natural Resources Trust Fund as recommended by the Legislative-Citizen Commission on Minnesota Resources (LCCMR).

In both scenarios, the retention basin/ponds can be thought of as a change in land use—modeled here as a change from cropland to wetland or grassland. The two-stage ditch, by its design, also results in land use changes by reducing cropland and increasing buffer strips and the bench of the ditch itself. The retention basin/ponds, in retarding the flow of water, are expected to have certain pollution reduction effects, notably in the removal of Nitrogen, Phosphorus, and suspended solids from the system. The buffer areas in Scenario B, by intercepting overland flows, will also reduce these pollutants to some extent. All land use changes will have carbon sequestration impacts.

In the attached models, I work through all these calculations for Scenarios A and B independently, making use of the engineering reports (for both) and the viewers' report for the latter, as well as project advisory team members' suggestions. The result is a complete set of measured physical changes in each system: water flow, pollutant levels, land use changes, and crop production (which is covered in acquisition costs).

In each scenario, I calculate the magnitude distribution of total costs and benefits of the proposed drainage system improvements without and with "water quality improvements," which term I use as shorthand for all changes in environmental services.

To assign dollar values to each of the services, I make use of existing literature on the economics of environmental services and of on-going research in these areas. None of my work creates "new numbers;" rather, it arrays dispersed information in a framework that can be used to assess drainage improvement projects from a perspective wider than is traditional.

I calculate the change in total economic value (for the agronomic and environmental services measured here) of adding water quality improvement measures to a drainage project already proposed. This way, we can compare the costs of these additional measures to their benefits. Not all environmental services are measured here, so the total benefits I estimate are not complete: they could be lower but would likely be higher than that I report, if we were to obtain physical measures of additional environmental services (in a subsequent effort).

Differences between the two arrays are thus the costs and benefits of the water quality improvements themselves.

Assumptions:

Many of the elements in the spreadsheet are self-evident, and specific items are commented. Here are a few that are common to both scenarios:

Project Life: 25 years (consistent with that implicit in Viewers' Report for Scenario B and applied also to Scenario A)

Discount/Interest rate: 5% (consistent with that assumed in the Viewers' Report for Scenario B and applied also to Scenario A). Used in annualizing one-time capital costs. As is customary in

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these reports, all values are in current (2010) dollars. Because inflation is assumed to affect all activities equally over time, it does not have to be explicitly modeled.

Drainage improvements: Project engineers say that drainage improvements without water quality improvements stuff would be "more expensive". I assume 10% more than the amount shown in the Engineering Report for both scenarios. These costs are allocated to the benefitted owners in the system. I treat all local governments as system owners, because benefits are assigned to them in the Viewers' Report.

Drainage repairs: This expenditure is what is needed to keep the system going at its *original* (pre-improvement) design level. These costs are paid by all owners in the system.

Upper watershed storage basins (Scenario B only): I assume that none of the proposed drainage or water quality improvements affect the pollution dispersion capacity of the city's wastewater treatment plant.

Viewers' Report

While I show a summary of the Viewers' Report for Scenario B (both for the Improvements and for the associated Redetermination) for reference, the current version of the model does not make use of most of these numbers. Scenario A does not have a viewers' report. Only the overall benefits estimated with and without the water quality improvements enter into our final calculations. Ron Ringquist, advisory group member, estimates a 5-10% increase in benefits for the WITH situation, because the water quality improvements increase drainage efficiency at upper end of the system. I assume this increase is 10% for both scenarios.

Environmental services

Houston and I&S provide estimates of changes in Phosphorus, suspended solids, Nitrogen, and land cover for the addition of the water quality improvements to their respective drainage plans. I converted their estimates to standard international weights, because the economic values for unit changes of these environmental services are generally in such units. I credit all estimated changes to the water quality improvement portion of the projects.

The Houston report estimates changes in peak flow for Scenario A, but we lack a ready total economic value estimate for changes in this parameter. Instead, for Scenario A, I estimate the economic value of the reduction in flood damages, based on a very approximate value of flood damages associated with a 100-year event in that watershed. I assume that the wetland restoration portion of the retention basin will qualify as "wetlands" and that the entire basin will provide carbon sequestration benefits because of land use change. Wetland habitat values are already captured in the wetland value.

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The I&S report estimates changes in peak flow and peak elevation for Scenario B, we do not have to put a dollar value on them because the project is designed to have identical flow and elevation values with and without the water quality improvements. I assume that both surge ponds will qualify as "wetlands" and that both the ponds and the buffer areas will provide carbon sequestration benefits because of land use change. The buffer areas will also provide habitat benefits. Wetland habitat values are already captured in the wetland value.

Unit value of environmental services

I make use of existing unit values, localized to southern or western Minnesota where possible. Although these numbers are known to be widely variable, but I report only point estimates here. The spreadsheet permits subsequent users to enter different values, if known/asserted.

Phosphorus: In forthcoming work by Pennington and Dalzell (pers. comm.), Phosphorus reductions are estimated to be "worth" $274/kg. This number is probably the most uncertain of all of those used in the present report, but it is similar to that used in Kovacs et al.

Suspended sediments: Hanson and Ribaudo suggests $6-7/ton of avoided sediment in water bodies in this area.

Carbon sequestration: I use $62/Mg, the 33% level for the distribution of avoided carbon release through land use change from Tol.

Nitrogen: In forthcoming work by Pennington and Dalzell (pers. Comm.), Nitrogen reductions from changing crop land to grass land are estimated to be $2/kg. This is similar, on average, to that used in Kovacs et al.

Wetlands: I use Brander et al. fresh water marsh median value, adjusted to 2010 dollars.

Habitat: I use the average cost (in 2010 dollars) of Minnesota DNR Scientific and Natural Area purchase costs, from Kovacs et al.

Value of environmental series from water quality improvements

Each of the changes in physical flows estimated by the engineers are multiplied by the unit values discussed above to give estimated annual economic value of the changes in the flow of environmental services created by the water quality improvement additions to the drainage project. In Scenario A, Phosphorus and flood damage reduction are the largest environmental service values. In Scenario B, Nitrogen and Phosphorus values are dominant.

Distribution of costs

Funding for this project was provided by the Minnesota Environment and Natural Resources Trust Fund as recommended by the Legislative-Citizen Commission on Minnesota Resources (LCCMR).

This section of the model summarizes and annualizes the initial cost arrays, breaking them down into two classes of payers: system owners (which class includes local governments) and the broader public. In Scenario B nearly all the costs are to be paid by system owners, while in Scenario A the State is a major financial participant. These costs—and measured drainage and environmental benefits—could have been broken down into a finer mesh of recipients (such as lake owners, hunters, taxpayers, etc.), but such detail was beyond the scope of this project.

Annual change from water quality improvement

Here I simply group all calculated *annual* costs and benefits from adding the water quality improvements to the drainage project. For Scenario B, the system owners pay $13,750 (including the cost reduction in the drainage project itself) and non-local public entities pay $2,700. Everyone, including system owners, gains $12,404 in increased environmental services. For Scenario A, the values are $1,925 *less* for system owners, $42,975 for non-local entities, and $53,915 for environmental services.

Recommendations

To add information to the drainage authority's decision context, the State might consider requiring a few additional elements to the engineering report. These could be made consistent and routine by standardizing some of the numbers and procedures to be used.

I further suggest that all engineering reports, in addition to the current practice of estimating changed peak levels and flows at the outlet, be required also to calculate changes in pollutants (Nitrogen, Phosphorus, and suspended solids) and a change matrix in land use (X acres from crop to grass, Y acres from grass to ponds, etc.). The specific calculation protocols could be developed through a statewide body such as the Drainage Work Group, which is already in operation. The result would be similar to the attached spreadsheet table Environmental Services, described above.

At the same time, the State should develop, through the Drainage Work Group, a "standard environmental service unit value" schedule similar to that used in the attached spreadsheet, adjusted for regional conditions.

The Engineer's specific project estimated environmental services changes could then be combined with the official State unit values for the locality to come up with a total economic value for environmental services provided by the proposed project. This number would then be available to the drainage authority and to the State in the consideration of drainage system improvement proposals.

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as recommended by the Legislative-Citizen Commission on Minnesota Resources (LCCMR).

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Funding for this project was provided by the Minnesota Environment and Natural Resources Trust Fund as recommended by the Legislative-Citizen Commission on Minnesota Resources (LCCMR).

Scenario A

watershed size	38,400
all prices in 2010 dollars	
project life	25
discount rate	0.05

Engineer's report

drainage without conservation measures

	improvement owners	non-government system owners	city	county	township	total system owners	lakeshore owners	lake users	state	public total	TOTAL
drainage repairs						-				-	-
road crossing improvements				190,000		190,000				-	190,000
drainage improvements	1,265,000					1,265,000				-	1,265,000
retention area easements						-				-	-
wetland restoration extra cost						-				-	-
upland restoration extra cost						-				-	-
two-stage ditch sections						-				-	-
TOTAL	1,265,000	-	-	190,000	-	1,455,000	-	-	-	-	1,455,000
annual payment	63,250	-	-	9,500	-	72,750	-	-	-	-	72,750

drainage with conservation measures

	improvement owners	non-government system owners	city	county	township	total system owners	lakeshore owners	lake users	state	public total	TOTAL
drainage repairs						-				-	-
road crossing improvements				171,000		171,000				-	171,000
drainage improvements	1,150,000					1,150,000				-	1,150,000
retention area easements	78,000					78,000			702,000	702,000	780,000
wetland restoration extra cost	9,000					9,000			81,000	81,000	90,000
upland restoration extra cost	4,500					4,500			40,500	40,500	45,000
two-stage ditch sections	4,000					4,000			36,000	36,000	40,000
TOTAL	1,245,500	-	-	171,000	-	1,416,500	-	-	859,500	859,500	2,276,000
annual payment	62,275	-	-	8,550	-	70,825	-	-	42,975	42,975	113,800

Environmental services

		quantity of environmental service (at outlet)		
		drainage without conservation measures	drainage with conservation measures	change from without to with (calculated)
TMDL	Phosphorus (kg/yr)	230.5	155.9	75
	suspended solids (t/yr)	81.2	31.5	50
non TMDL	Carbon sequestration (Mg/yr)	-	77	77
	Nitrogen (kg/yr)	1,026.8	735.9	291
	wetlands (acres)	-	75.0	75
	habitat (acres)	-	225.0	225
non-environment externality	peak flow (cfs)	483.0	433.0	50.0

Unit value of environmental services

TMDL	Phosphorus $/kg	274
	suspended solids $/ton	7
non TMDL	Carbon sequestration $/Mg	62
	Nitrogen $/kg	2
	wetlands $/acre/yr	61
	habitat $/acre/yr	20
non-environment externality	peak flow $/cfs	

pennington crop to prairie

mean SS $/a/y	5.42	mean P $/a/y	71.7
mean SS t/a/y	0.828	mean P kg/a/y	0.262
SS $/t	6.5	P $/kg	273.7
mean C $/a/y	15.8	mean N $/a/y	
mean C Mg/a/y	0.256	mean N kg/a/y	
C $/t	61.7	N $/kg	#DIV/0!

Value of environmental services from conservation measures

		change from without to with conservation measures
TMDL	Phosphorus	20,400
	suspended solids	326
non TMDL	Carbon sequestration	4,740
	Nitrogen	570
	wetlands	4,573
	habitat	4,556
non-environment externality	flood damamge	18,750
TOTAL		53,915

single-event flood damage	187,500
percent reduction in peak flow	0.1

	drainage without conservation measures			drainage with conservation measures			changed without to with conservation measures		
Annual expenditures	**owners**	**public**	**TOTAL**	**owners**	**public**	**TOTAL**	**owners**	**public**	**TOTAL**
drainage repairs	-	-	-	-	-	-	-	-	-
road crossing improvements	9,500	-	9,500	8,550	-	8,550	(950)	-	(950)
drainage improvements	63,250	-	63,250	57,500	-	57,500	(5,750)	-	(5,750)
retention area easements	-	-	-	3,900	35,100	39,000	3,900	35,100	39,000
wetland restoration extra cost	-	-	-	450	4,050	4,500	450	4,050	4,500
upland restoration extra cost	-	-	-	225	2,025	2,250	225	2,025	2,250
two-stage ditch sections	-	-	-	200	1,800	2,000	200	1,800	2,000
TOTAL EXPENDITURES	72,750	-	72,750	70,825	42,975	113,800	(1,925)	42,975	41,050

annual change from conservation measures	
drainage improvement costs to system owners	(6,700)
cost of water quality improvements to system owners	4,775
cost of water quality improvements to non-local public entities	42,975
environmental services	53,915

Scenario B

all prices in 2010 dollars	
project life	25
discount rate	0.05

Engineer's report

drainage without water quality improvements

	drainage improvement owners	non-government system owners	city	county	township	total system owners	lakeshore owners	lake users	state	public total	TOTAL
drainage repairs		575,000				575,000				-	575,000
road crossing improvements				190,000		190,000				-	190,000
drainage improvements	231,000					231,000				-	231,000
upper watershed storage basins						-				-	-
two-stage ditch sections						-				-	-
in-channel sediment storage						-				-	-
native grass buffers--open ditch						-				-	-
TOTAL	231,000	575,000	-	190,000	-	996,000	-	-	-	-	996,000
annual payment	11,550	28,750	-	9,500	-	49,800	-	-	-	-	49,800

drainage with water quality improvements

	drainage improvement owners	all system owners	city	county	township	total system owners	lakeshore owners	lake users	state	public total	TOTAL
drainage repairs		575,000				575,000				-	575,000
road crossing improvements				190,000		190,000				-	190,000
drainage improvements	210,000					210,000				-	210,000
upper watershed storage basins	25,000		125,000	100,000		250,000				-	250,000
two-stage ditch sections	4,000			36,000		40,000				-	40,000
in-channel sediment storage	3,000					3,000			27,000	27,000	30,000
native grass buffers--open ditch	3,000					3,000			27,000	27,000	30,000
TOTAL	245,000	575,000	125,000	326,000	-	1,271,000	-	-	54,000	54,000	1,325,000
annual payment	12,250	28,750	6,250	16,300	-	63,550	-	-	2,700	2,700	66,250

Viewers report

Improvement	"market impact"	improvement rate	"benefit value"	acres/feet	"potential benefits"	"gross benefits"	system average efficiency rate	"net benefits to landowners"	
township								904	
city									
county								419	
state								1,638	
road benefits								2,961	
city									
a	2,480.0	0.6	1,488.00	100	248,000	148,800	0.17	25,198	0.17
b	2,100.0	0.85	1,785.00	167	350,700	298,095	0.17	50,481	
c	815.0	0.9	733.50	1,087	885,905	797,315	0.17	135,020	
d	375.0	0.9	337.50	361	135,375	121,838	0.17	20,632	
e (tile)	1.5	0.9	1.35	3,450	5,175	4,658	0.17	789	
land benefits								232,121	

total benefits from drainage improvements	235,082
total benefits from drainage improvements with conservation measures	258,590

Redetermination	"market impact"	improvement rate	"benefit value"	acres/feet	"potential benefits"	"gross benefits"	system average efficiency rate	"net benefits to landowners"	
township								20,113	
city									
county								54,660	
state								66,504	
road benefits								141,277	
city					1,285,000	858,000	0.79	678,544	
a	2,480.0	0.6	1,488.00	215	533,200	319,920	0.79	253,007	0.79
b	2,100.0	0.85	1,785.00	511	1,073,100	912,135	0.79	721,356	
c	815.0	0.9	733.50	3,366	2,743,290	2,468,961	0.79	1,952,562	
d	375.0	0.9	337.50	881	330,375	297,338	0.79	235,147	
e (tile)	1.5	0.9	1.35	118,900	178,350	160,515	0.79	126,942	
land benefits								3,967,558	
total benefits FROM REPAIRS								4,108,835	

Environmental services

		quantity of environmental service (at outlet)			
		drainage without conservation measures	drainage with conservation measures	change from without to with (calculated)	change from without to with (I&S)
TMDL	Phosphorus (kg/yr)			16	16
	suspended solids (t/yr)			7	7
non TMDL	Carbon sequestration (Mg/yr)			9	
	Nitrogen (kg/yr)			3,279	3,279
	wetlands (acres)			7.0	7.0
	habitat (acres)			29.9	29.9
non-environment externality	peak flow (cfs)	747.0	747.0	-	
	peak elevation (feet)	986.3	986.3	-	

Unit value of environmental services

TMDL	Phosphorus $/kg	274
	suspended solids $/ton	7
	Carbon sequestration $/Mg	62
non TMDL	Nitrogen $/kg	2
	wetlands $/acre/yr	61
	habitat $/acre/yr	20
non-environment externality	peak flow $/cfs/yr	
	peak elevation $/ft/yr	

pennington crop to prairie

mean SS $/a/y	5.42	mean P $/a/y	71.7
mean SS t/a/y	0.828	mean P kg/a/y	0.262
SS $/t	6.5	P $/kg	273.7

mean C $/a/y	15.8	mean N $/a/y	
mean C Mg/a/y	0.256	mean N kg/a/y	
C $/t	61.7	N $/kg	#DIV/0!

Value of environmental services from water quality improvements

		change from without to with conservation measures
TMDL	Phosphorus	4,320
	suspended solids	46
	Carbon sequestration	582
non TMDL	Nitrogen	6,427
	wetlands	424
	habitat	605
non-environment externality	peak flow	-
	peak elevation	-
TOTAL		12,404

	drainage without conservation measures			drainage with conservation measures			changed without to with conservation measures		
Annual expenditures	**owners**	**public**	**TOTAL**	**owners**	**public**	**TOTAL**	**owners**	**public**	**TOTAL**
drainage repairs	28,750	-	28,750	28,750	-	28,750	-	-	-
road crossing improvements	9,500	-	9,500	9,500	-	9,500	-	-	-
drainage improvements	11,550	-	11,550	10,500	-	10,500	(1,050)	-	(1,050)
upper watershed storage basins	-	-	-	12,500	-	12,500	12,500	-	12,500
two-stage ditch sections	-	-	-	2,000	-	2,000	2,000	-	2,000
in-channel sediment storage	-	-	-	150	1,350	1,500	150	1,350	1,500
native grass buffers--open ditch	-	-	-	150	1,350	1,500	150	1,350	1,500
TOTAL EXPENDITURES	49,800	-	49,800	63,550	2,700	66,250	13,750	2,700	16,450

annual change from water quality improvement	
drainage improvement costs to system owners	(1,050)
drainage improvement benefits to system owners	1,175
net cost of water quality improvements to system owners	14,800
cost of water quality improvements to non-local public entities	2,700
environmental services	12,404

APPENDIX E

STUDY ADVISORY COMMITTEE

Name	Affiliation
Ray Bohn	Minnesota Association of Watershed Districts
Gary Botzek	Minnesota Conservation Federation
Mark Dittrich	Minnesota Department of Agriculture
Les Everett	University of Minnesota Water Resources Center
Warren Formo	Minnesota Agriculture Water Resources Coalition
Annalee Garletz	Minnesota Association of Counties
Ron Harnack	Red River Watershed Management Board
Al Kean	Minnesota Board of Water and Soil Resources
Rick Moore	MSU-Mankato Water Resources Center
Lance Ness	Minnesota Fish & Wildlife Legislative Alliance
Ron Ringquist	Minnesota Viewers Association
Doug Thomas	Comfort Lake Forest Lake Watershed District
Henry Van Offelen	Minnesota Center for Environmental Advocacy

Meeting	Date	Agenda
1	12-14-09	Problem Statement; Critical Issues Identification
2	7-21-10	Legal Review; Critical Issues Analysis
3	9-9-10	Scenario A Development
4	10-14-10	Scenario B, Scenario C Development
5	11-30-10	Scenario B Development; Scenario C Policy Issues
6	2-18-11	Scenario C, Analysis
7	3-31-11	Scenario B, Preliminary Economic Analysis
8	5-6-11	Scenario B, Economic Analysis; Scenario A
9	5-26-11	Draft Recommendations

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