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☞ **These materials were grouped together.**
For January 5, 2006 Cadott hearing?

(FORM UPDATED: 08/11/2010)

WISCONSIN STATE LEGISLATURE ...
PUBLIC HEARING - COMMITTEE RECORDS

2005-06

(session year)

Senate Select

(Assembly, Senate or Joint)

Committee on ... DNR (SSC-DNRRR)

COMMITTEE NOTICES ...

- Committee Reports ... **CR**
- Executive Sessions ... **ES**
- Public Hearings ... **PH**

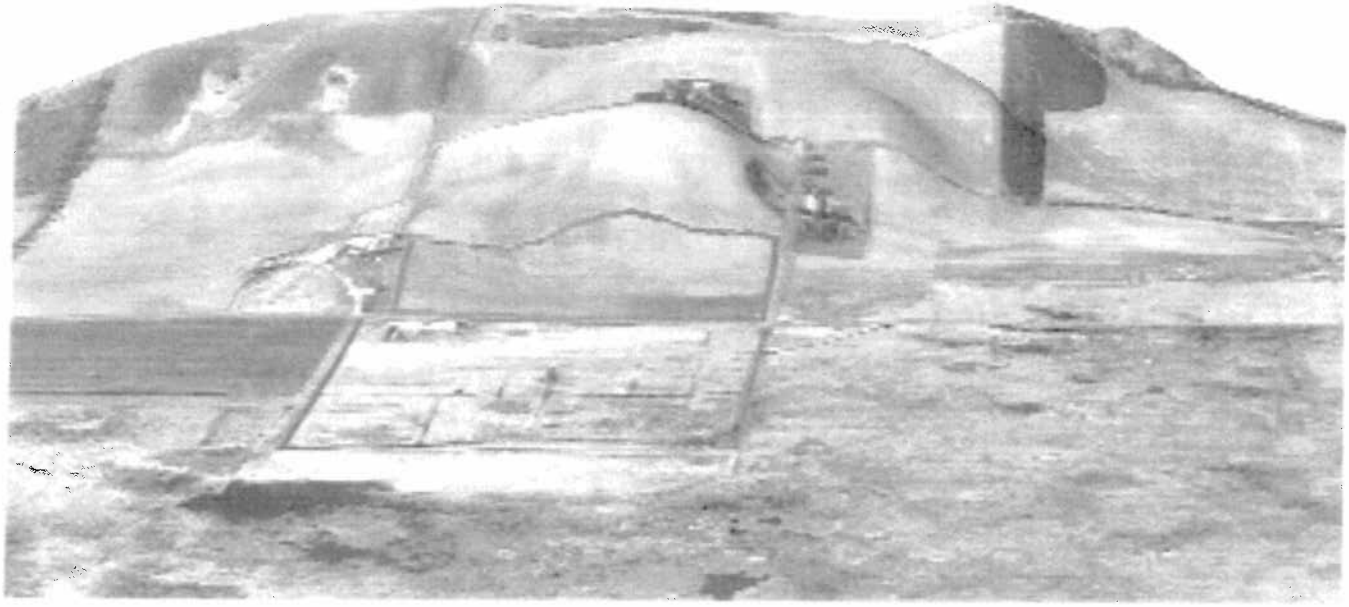
INFORMATION COLLECTED BY COMMITTEE FOR AND AGAINST PROPOSAL

- Appointments ... **Appt** (w/Record of Comm. Proceedings)
- Clearinghouse Rules ... **CRule** (w/Record of Comm. Proceedings)
- Hearing Records ... bills and resolutions (w/Record of Comm. Proceedings)
  (**ab** = Assembly Bill) (**ar** = Assembly Resolution) (**ajr** = Assembly Joint Resolution)
  (**sb** = Senate Bill) (**sr** = Senate Resolution) (**sjr** = Senate Joint Resolution)
- Miscellaneous ... **Misc**

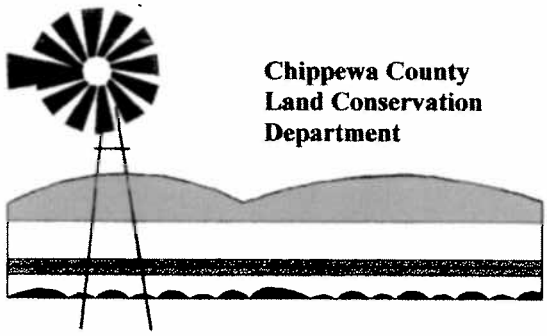
* Contents organized for archiving by: Mike Barman (LRB) (July/2012)

CHIPPEWA COUNTY WETLAND COMPENSATORY MITIGATION BANK

Original Prospectus
Plus
Appendage Containing Hydrological Analysis



Cadott Hearing



Chippewa County
Land Conservation
Department

March 2005

TABLE OF CONTENTS

Section I

September 2, 2004

Pat Trochlell - Wisconsin Department of Natural Resources
P.O. Box 7921
101 South Webster Street
Madison, WI 53707

Dear Ms. Trochlell,

Please consider this cover letter and the attached information as a Prospectus for a Wetland Compensatory Mitigation Bank (Bank). We understand this information formally initiates your involvement as the lead agency.

The Chippewa County Highway Department intends to sponsor a Bank, in Chippewa County within the Lower Chippewa River Watershed. The Chippewa County Land Conservation Department has worked closely with the Highway Department on site selection, preliminary design considerations, and land acquisition. The Departments will continue to work together throughout the establishment of the bank and long-term monitoring and maintenance.

We propose a project that will use proven techniques to achieve permanent, "in-kind" restoration of approximately 54 acres of prior-converted and degraded wetlands that are currently in agricultural use. The County will acquire the real estate in fee simple. The attached information shows several factors leading to the selection of the site including the following:

(1) Physical characteristics that support the likelihood of successful restoration to historical wetland function.
(2) Geographic proximity to existing conservancy areas (i.e. WDNR Wildlife Area)
(3) Close proximity to an appreciable amount of anticipated wetland taking by future roadwork.

County staff conducted two pre-proposal conferences on-site with local WDNR staff. Dan Koich, Water Management Specialist, evaluated the site on May 18 and June 2, 2004. John Dunn, Senior Wildlife Biologist evaluated the site on June 2, 2004. Both Koich and Dunn advised the site has good restoration potential.

The most pivotal factor in the success of our proposal is real estate acquisition. The window of opportunity to acquire the subject real estate is narrow. The County cannot purchase the real estate without formal notification that the site will likely comply with your Agency's guidelines for wetland compensatory mitigation. We would like to assist your agency and the other members of the Mitigation Bank Review Team (MBRT), in any way, to expedite their inter-agency site meeting.

Please find extra copies of this letter and the attached information for review by you and other members of the MBRT. If it's not too much trouble, please distribute the information and schedule an MBRT meeting at your earliest convenience. Please advise as to when your team will evaluate the site and if there is any way we can assist in facilitating the activity.

If it would be possible to schedule the on-site meeting between September 21- 23, I would be happy to acquire parking and admission passes for the 2004 Wisconsin Farm Technology Days so members of your team could make contact with their respective booths.

We look forward to working with you to create an outstanding wetland compensatory mitigation bank. If you have any questions or concerns, please contact Mike at (715) 726-7921.

Sincerely,

Michael E. Dahlby
Private Lands Conservation Specialist
Chippewa County Land Conservation Department

Richard L. Kern P.E.
Project Manager
Chippewa County Highway Department

Enclosures

Section I. Bank Prospectus: Chippewa County Wetland Compensatory Mitigation Bank

Submitted pursuant to "Guidelines For Wetland Compensatory Mitigation In Wisconsin", Chapter 10. Process for Establishing a Bank. Step 1.

Identification of Bank Sponsor & Purpose Of The Bank

The Chippewa County Highway Department will be the sponsor of the Wetland Compensatory Mitigation Bank. The Chippewa County Land Conservation Department will provide project site selection, land acquisition services, subsurface soil investigations and analysis, topographical surveying, restoration design, construction project layout, construction management, and long–term monitoring.

Highway Department Contact:	Richard L. Kern, P.E. 801 E. Grand Ave Chippewa Falls, WI 54729	Office: (715) 738-2610 Cell: (715) 559-3591 Email: Rkern@co.chippewa.wi.us
Land Department Contact:	Michael E. Dahlby 711 N. Bridge Street Chippewa Falls, WI 54729	Office: (715) 726-7921 Email: mdahlby@co.chippewa.wi.us

The purpose of this proposal to establish a compensatory wetland mitigation bank is to compensate for the unavoidable adverse impacts on wetlands that occur as a result of roadwork and remain after all appropriate and practicable avoidance and minimization has been achieved.

The Bank will primarily be used by the Chippewa County Highway Department. The bank may potentially be open to Towns, Villages, and Cities.

In the past, the Chippewa County Highway Department and Town governments within Chippewa County have had difficulty meeting statutory requirements for wetland mitigation. Few mitigation banks exist other than those sponsored by the Wisconsin Department of Transportation (DOT). Many highway projects are not performed for the DOT and do not qualify to purchase credit from a DOT mitigation bank. There are no privately held wetland compensatory mitigation banks within the Chippewa County Compensation Search Area. Few mitigation options exist for local projects that do not have readily available on-site mitigation opportunity.

For the reason set forth above, the proposed Bank will work well for local municipalities. It will also benefit the local resource base. Chippewa County records indicate that most wetland takings in the county are less than one acre. Experience shows that it is impractical to acquire, restore, monitor and maintain many small, mitigated wetlands. The approach of this proposal is to focus County resources and expertise on one, large site with good potential for restoration of wetland values similar to the takings.

Identification Of Experts To be Involved In The Design Of The Bank's Compensation Site

The Chippewa County Highway and Land Conservation Departments will work together to establish the wetland compensatory wetland mitigation bank and ensure it's long-term performance. Richard Kern, P.E, will manage Highway Department work. Michael E. Dahlby, David B. Nashold, P.E., and Gregory D. Borczick, P.E will provide the Land Conservation Department's services. Information as to the background and credentials of each are contained within next three pages.

Michael E. Dahlby

Private Lands Conservation Specialist

Chippewa County Land Conservation Department
711 N. Bridge Street
Chippewa Falls, WI 54729
mdahlby@co.chippewa.wi.us
(715) 726-7921

Position Summary

Employed with the Chippewa County Land Conservation Department since April 2001. Primary responsibilities include, but are not limited to:

- Management of the County's Conservation Reserve Enhancement Program
- Management of County conservation easement projects with private landowners
- Wetland identification, delineation, and consultation with private landowners

Education

Bachelor of Science Degree University of Wisconsin-Stevens Point May 1995

- Major: **Watershed Management**
- Minor: **Soil Science**
- Graduate: 25 **graduate-level** credit hours at UWSP in **geomorphology, groundwater geochemistry, soils, geographical information systems, and independent studies in surface water quality.**

Advanced Coursework

Wetland Characteristics & Classification	UW- Stevens Point	Spring 1994
Basic Wetland Delineation	UW-La Crosse Continuing Education/ Extension et al	August 2001
Advanced Wetland Delineation	UW-La Crosse Continuing Education/ Extension et al	August 2001
Basic Plant Identification	UW-La Crosse Continuing Education/ Extension et al	June 2002
Soil & Site Evaluation Training	Chippewa Valley Technical College	December 2001

Wetland - Related Program Experience

Drafted "Working Agreement For Wetland Delineation Services – Between Chippewa County Zoning Department and Chippewa County Land Conservation Department, October 2001". Performed 28 formal wetland investigations pursuant to working agreement, since October 2001. Investigations include preliminary review of resource inventory data, on-site delineation of subject wetland boundaries following 1987 USCOE Protocol, using real-time differential GPS to map wetland boundaries, and preparing formal wetland investigation reports.

Involved with 14 Wetland Restoration Projects totaling approximately 300 acres of restored wetlands.

GREGORY D. BORZICK, P.E.
Project Manager

Chippewa County
Land Conservation Department

Mr. Borzick joined the Chippewa County Land Conservation Department in March, 2000. Prior to joining the Land Conservation Department, Mr. Borzick had two years experience working with MSA Professional Services in Baraboo, WI, two years experience working with the Winnebago and Fond du Lac County Land Conservation Departments and one year of experience working for the Department of Natural Resources. He is responsible for soil investigations, survey, design, plan review, and construction management of water resource related projects including wetland mitigation and urban and rural stormwater runoff management. Mr. Borzick is also responsible for the design and construction management of public works projects including recreational trails, boat launches and road drainage.

Related Projects

Wetland Mitigation

Responsibilities included conducting field evaluations to determine site suitability, reviewing surface water and groundwater contribution to wetlands, proposing mitigation areas for wetlands lost through construction, designing wetland mitigation projects, and providing construction management oversight of wetland mitigation projects. Projects include:

Walmart Distribution Center, Tomah, WI
Irvine Park, Chippewa Falls, WI

Stormwater Management

Responsibilities included conducting field evaluations, performing hydraulic and hydrologic calculations, designing stormwater management systems, preparing stormwater management reports, providing construction management oversight, and review of other professional engineer stormwater management plans and designs. Projects include:

Manitowish Waters	Town of Baraboo
Village of Lake Delton	Town of LaFayette
Village of Mount Horeb	Town of Wheaton
City of Baraboo	Town of Eagle Pt.

Registrations

Registered Professional Engineer, WI, 2002

Education

Master of Science, Civil Engineering – Water Resources Emphasis, Michigan Technological University, 1998
Bachelor of Science, Environmental Engineering, Michigan Technological University, 1998
Bachelor of Science, Water Resource Management - Watershed Management Option, minor in Soil and Waste Management, University of Wisconsin-Stevens Point, 1991

Credentials

Wetland Restoration Planning & Design
Natural Resource Conservation Service, 2001
Storm Sewer System Design
University of Wisconsin-Madison, 2000
Stormwater Detention Basin Design
University of Wisconsin-Madison, 1998
Wisconsin Association of Land Conservation Employees, Member

David B. Nashold, P.E.

Environmental Engineer / Program Manager

Chippewa County Land Conservation Department
711 N. Bridge Street
Chippewa Falls, WI 54729
dnashold@co.chippewa.wi.us
(715) 726-7920

Position Summary

Employed with the Chippewa County Land Conservation Department since February 1989. Primary responsibilities include, but are not limited to:

- Management of the County's Environmental Engineering Program
- Management of County Non-Metallic Mine Reclamation Program
- Management of Engineering Activities Related To County Waste Storage Ordinance

Education

Bachelor of Science	University of Wisconsin-Madison	**Agricultural Engineering**	May 1986
Master of Science	University of Wisconsin-Madison	**Agricultural Engineering**	Dec. 1989

Professional Registration Certification

Wisconsin Professional Engineer (since 1992) License # 28360
USDA – NRCS/ Wis. DATCP Job Approval / Job Certification

Related Project Experience

More than 18 years of experience in soil & water conservation engineering and urban storm water management. Types of specific activities include but are not limited to:
Engineering Field Survey (topographic and soil characteristics)

- General erosion control,
- Manure storage facility design, construction, and abandonment
- Comprehensive Barnyard runoff management system design and installation,
- Small dam design and installation,
- Stream bank protection system design and installation
- Wetland restoration design and installation.

Location of Proposed Wetland Compensatory Mitigation Bank

The proposed Bank is located near the urbanizing areas of south-central Chippewa County, where many wetland takings occur. The site is located within the SW ¼ of the SW ¼ of Section 16; and the NW ¼ of the NW ¼ of Section 21 of Township 28 North, Range 8 West, Chippewa County, Wisconsin. Approximately twenty-nine (29) percent of the project is located within the Village of Lake Hallie. The remainder of the project is in the Town of Hallie. Map 1 shows that the site is within the Lower Chippewa River Basin. The area lies within the WDNR West Central Region.

One factor that makes the proposed site exceptional for use as a public wetland restoration project is its location. Map 2 shows that the site (outlined in red) is adjacent land owned by the Wisconsin Department of Natural Resources (DNR). The site is also adjacent approximately 85 acres of privately owned land that is protected by a perpetual conservation easement. The area outlined in blue is permanently enrolled in the Conservation Reserve Enhancement Program (CREP) and a DNR Nonpoint Source Pollution Abatement Easement protects the area outlined in light green. The DNR easement is open to public use.

To travel to the site: Exit Highway 124 within the Village of Lake Hallie and proceed East on 40th Ave. The site is located approximately 2.0 miles east of Hwy 124 at the intersection of 40th Ave. and 152nd Street.

General Description Of Current Ownership And Land-Use

The proposed wetland compensatory mitigation bank site is currently in private ownership and is used for agricultural production. The last deed of record gave ownership of the real estate to Cherrier Bros Inc, approximately 50 years ago. Cherrier Bros, Inc was a family run farming business that has since dissolved, but the Cherrier family continues to rent out the land for agriculture. The site has primarily been used for grain production and grazing of cattle.

The physical characteristics of the proposed site make it ideal for wetland restoration. Map 3 uses a portion of the Lake Wissota 1:24000 USGS Quadrangle to illustrate that the site (outlined in red) is located along a transition from a large wetland complex to steeply sloped uplands. This landscape positioning is further illustrated in Map 4, which also shows main and lateral drainage ditches within the NW ¼ of the NW ¼ of Section 21. Much of the SW ¼ of the SW ¼ of Section 16 historically contained depress ional wetlands that have been converted to non wetland by surface drains.

The majority of the site (outlined in red) contains hydric soil. Map 5 shows the three soil units (outlined in brown) that occupy the site. Chetek sandy loam occupies the slopes on the north side of the site. The lowest portions of the property contain Minocqua loam (hydric). The transition area contains a Warman Variant sandy loam (hydric inclusions).

The site (outlined in red) receives diffuse surface runoff and channelized flow from a relatively large watershed. Map 6 shows that approximately 1690 acres (outlined in blue) drain through the site.

General Description of Anticipated Design Concept For Wetland Restoration at The Proposed Compensation Site.

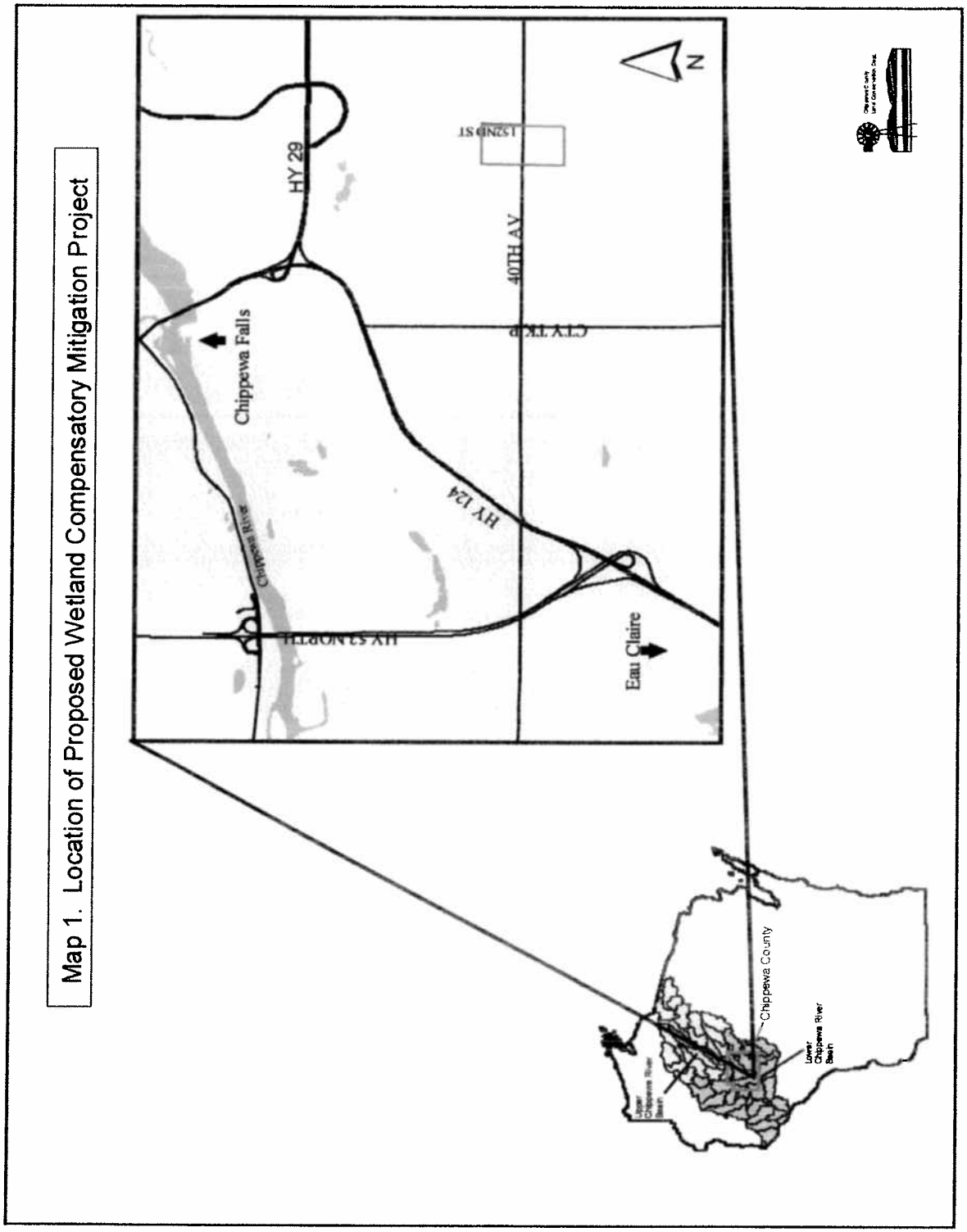
The County will acquire the real estate in fee simple. Deed restrictions will be placed on the real estate to provide that the site will be permanently dedicated to use a wetland conservancy. Public access will be allowed, but only to the extent that there is no negative ecological impact.

County staff conducted two pre-proposal conferences on-site with Western Region DNR staff. Dan Koich, Water Management Specialist, evaluated the site on May 18 and June 2, 2004. John Dunn, Senior Wildlife Biologist evaluated the site on June 2, 2004. Both Koich and Dunn advised the site has good restoration potential.

The proposed project will restore a combination of wetland types proportionate with the types typically taken. Map 7 illustrates the conceptual design. We intend to restore the site to a diverse complex consisting of approximately 6 acres of upland buffer, 10 acres of Deep marsh, and 15 acres of shallow marsh. The balance will consist of sedge meadow. Every effort will be made to maximize "In-Kind" restoration that relies on self-operative technologies (i.e. no mechanical control structures). Review of aerial photography archives indicates the restoration will be consistent with the wetland types that historically occupied the site.

Sediment will be removed from several depressions and embankments will be used to restore original morphology and hydrology to the "North Restoration Area". The "Upland Buffer Zone" will be planted to a mixture of native grasses, forbs, and legumes of local genotype. Hydrophytic vegetation will be reintroduced to best match the restored conditions.

A series of ditch plugs will be used throughout the "South Restoration Area" to restore the original hydrology and plant community. Past grading has degraded several wetland areas within the northwest portion of the "South Restoration Area". These areas may be re-graded to best match the historical topography. The existing farm buildings will be removed.



Section I Maps

Map 2. Geographic Proximity Of Proposed Wetland Compensatory Mitigation Bank Site

1 0 1 Miles

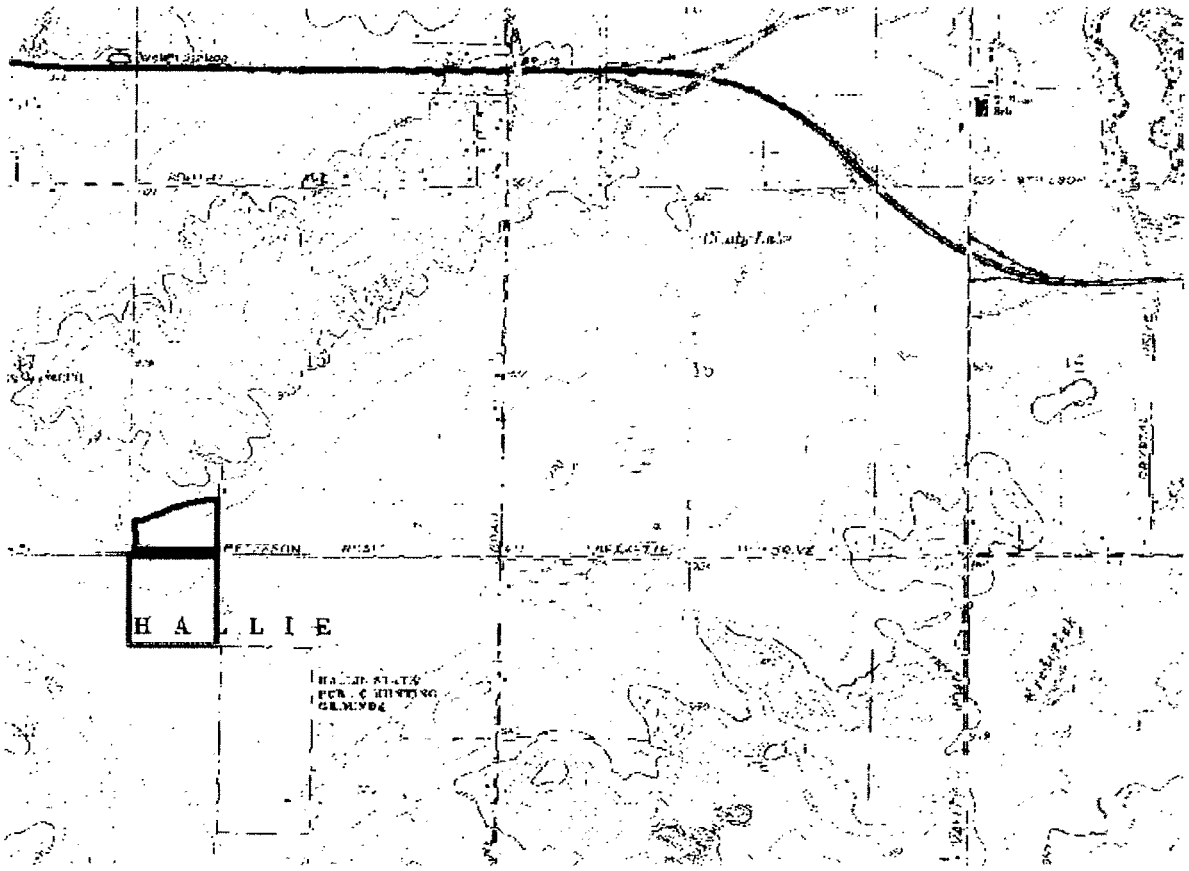
N

Proposed Site
WI DNR Land Holding
CREP Conservation Easement
NPS Conservation Easement

Chippewa County Land Conservation Dept

August 2004

Map 3. Portion of the Lake Wissota 1:24,000 USGS Quadrangle



NOT TO SCALE

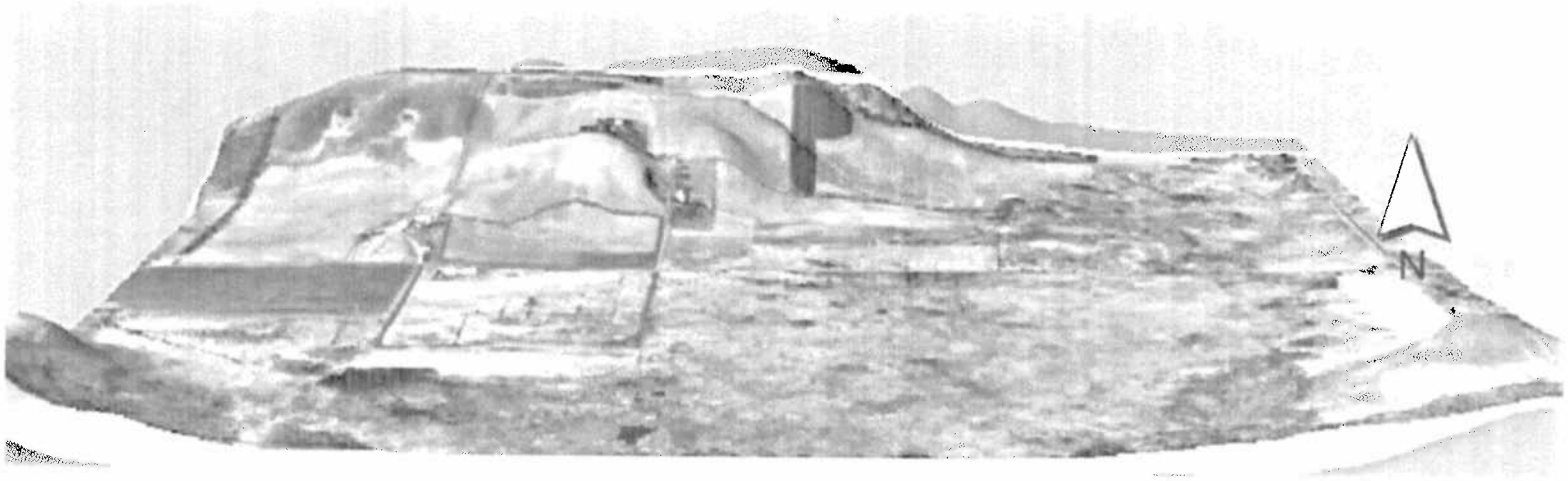
N

Proposed Site

Chippewa County
Land Conservation Dept.

August 2004

Map 4. Landscape Position Of Proposed Wetland Compensatory Mitigation Bank Site



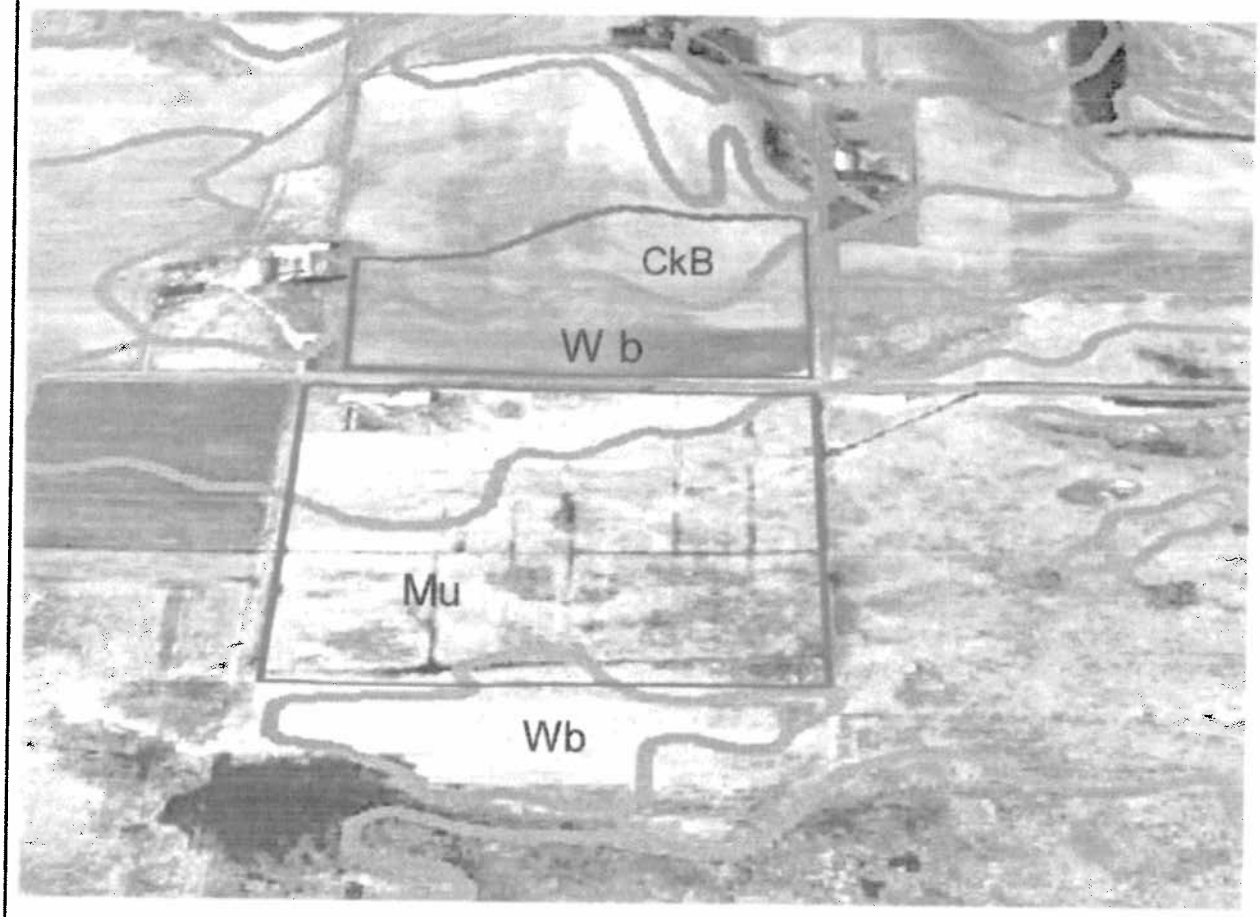
NOT TO SCALE

Proposed Site

Chippewa County
Land Conservation Dept.

August 2004

Map 5. Soil Units Within Proposed Wetland Compensatory Mitigation Bank Site



NOT TO SCALE

Proposed Site

Soil Units

N

CkB = Chetek Sandy Loam (12% of Site)
Mu = Minoqua Loam (Hydric) (49% of Site)
Wb = Warman Variant Sandy Loam (Hydric Inclusions) (39% of Site)

Chippewa County
Land Conservation Dept.

August 2004

Map 6. Surface Watershed Influencing Proposed Wetland Compensatory Mitigation Bank Site

1 0 1 Miles

N

Approximate Watershed Area (approx. 1690 acres)

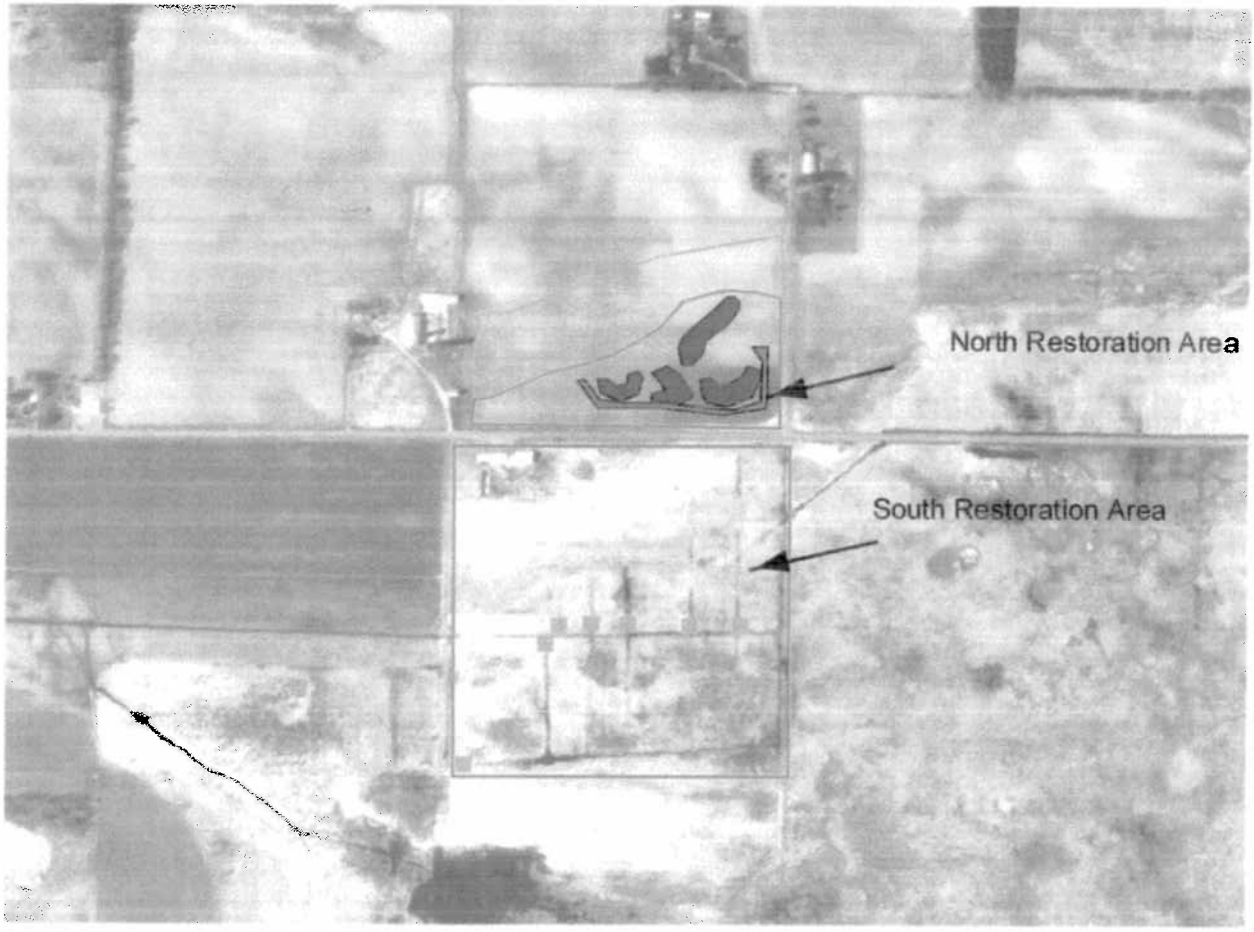
Proposed Site

20' Contour Interval From Lake Wissota 1:24000 USGS Quad

Chippewa County
Land Conservation Dept.

August 2004

Map 7. Preliminary Design Concept For Proposed Wetland Compensatory Mitigation Bank Site



1000 0 1000 2000 Feet

N

Preliminary Estimate of Restoration Area
- Restored Wetland (approx. 47 acres)
- Upland Filter / Nesting Area (approx. 7 acres)
- Approximate Location of Low Berm (s)
- Approximate Location of Restored Depressions
- Potential Ditch Plugs

Chippewa County
Land Conservation Dept.

August 2004

Reason for Appendage

To supplement the original bank prospectus with information generated on the September 22, 2004 **Mitigation Bank** Review Team site visit and subsequent analysis by Chippewa County Land Conservation Department.

Introduction

Chapter NR350. Wetland Compensatory Mitigation of Wisconsin Administrative Code establishes standards for development, monitoring, and long-term maintenance of wetland compensatory mitigation projects that are approved by the Department of Natural Resources; and establishes procedures and standards for the establishment and maintenance of mitigation banks. State policy is further articulated in "Guidelines for Wetland Compensatory Mitigation in Wisconsin", a document developed by the Wisconsin Department of Natural Resources dated February 2002.

Both the code and policy guidelines define degraded wetland, enhancement, and functional values as follows:

Degraded wetland: wetland subjected to deleterious activities such as drainage, grazing, cultivation, increased stormwater input, and partial filling, to the extent that natural wetland characteristics are severely compromised and where wetland function is substantially reduced.

Enhancement: activities conducted in existing wetlands that increase one or more wetland functions.

Functional values: the physical, chemical, and biological processes or attributes that occur in a wetland system and how society finds certain functions beneficial as listed in s. NR103.03(1) and listed below.

- Storm and flood water storage and retention and the moderation of water level fluctuation extremes;
- Hydrologic functions including the maintenance of dry season streamflow, the discharge of groundwater to a wetland, the recharge of groundwater from a wetland to another area and the flow of groundwater through a wetland;
- Filtration or storage of sediments, nutrients, or toxic substances that would otherwise impact the quality of other waters of the state;
- Shoreline protection against erosion through the dissipation of wave energy and water velocity and anchoring of sediments;
- Habitat for aquatic organisms.....;
- Habitat for resident and transient wildlife species.....; and
- Recreational, cultural, educational, scientific and natural aesthetic values and uses.

Both the code and policy allow several techniques for establishing credit at a compensation site. The techniques are:

- Restoration
- Enhancement
- Creation
- Minimum Upland Buffer
- Ecological Enhancement in adjacent Uplands
- Preservation of Fully Functioning Wetlands under demonstratable threat.

As shown above, State policy recognizes that wetlands have many functions. The functions are a product of all components of the wetland ecosystem. Many wetland functions are carried out in all seasons and are independent of plant activity. Chippewa County proposes a site for use as a wetland compensatory mitigation bank site that has been drastically degraded from its reported pre-settlement condition. At present, the site is made up mostly of degraded wetland or complete conversion to non-wetland. A relatively small portion of the site consists of wetland that has experienced less recent disturbance and appears to have regained wetland function.

The main premise of our proposed project is that historical manipulation (i.e. deforestation, hydrologic manipulation, and intensive agricultural land use) has disrupted the wetland ecosystem, resulting in significant loss of wetland functional value. According to the original land survey records of the U.S. General Land office (see Appendage Map I), much of the

site was an internally drained Tamarac Swamp (no surface water outlet; outlet = groundwater recharge, evaporation, and evapotranspiration). We believe the Tamarac Swamp was most likely fringed by less conspicuous wetland types (i.e. sedge meadow – wet prairie) that were not recognized by the early surveyors. It would appear that the current vegetation is significantly different from it's original composition. Impacts of the historical degradation include:

- Downstream flooding
- Reduction in on-site sediment trapping and biofiltration of nutrients or other toxic substances
- Disturbed plant community
- Loss of habitat for native aquatic and terrestrial plants and animals
- Loss of recreational, cultural, educational, scientific and natural aesthetic values and uses

The site is currently subject to continuous row cropping, unrestricted mowing, and intermittent cattle grazing. Because portions of the site watershed are urbanizing, we assume storm water input to the site will increase over time. Significant recreational, cultural, educational, scientific and natural aesthetic values have been lost.

The county proposes to restore farmed wetlands and areas previously converted to non-wetland, enhance degraded wetlands, ecologically enhance the adjacent upland, and preserve areas that currently provide important wetland functional value. The site will be owned by the County and will be open to the public for educational purposes, quiet enjoyment, and low-impact use. The basis for our proposal is that hydrologic site manipulation is the most immediately reversible factor contributing to the degradation and loss of wetland function.

There is strong local support for the proposed project. A local conservation organization is currently in negotiations to purchase the adjacent property lying south and east of the site. The Organization will donate the acquired real estate to the Wisconsin DNR. Focusing wetland mitigation efforts in close proximity to other large-scale conservation projects makes good use of limited public funds. This drastically increases the social value of the proposed wetland compensatory mitigation bank.

Since the September 22, 2004 site visit by the Mitigation Bank Review Team, the Chippewa County Land Conservation Department has further analyzed site conditions to support our proposal and estimate potential compensatory mitigation credits.

Objectives of Analysis:

Objective #1: ***To evaluate the potential for positive manipulation of the surface hydrology of the proposed site; and***
Objective #2: ***To evaluate the impact of the existing ditch system on the subsurface hydrology of the site.***

Site Information

According to the Wisconsin Department of Administration, Chippewa County was the 3rd fastest growing county during the time period from April 2000 – January 2004. The trend is expected to continue. Prospectus Maps 1 and 2 show the proximity of the proposed project site to the City of Chippewa Falls, the Village of Lake Hallie, and Highways 29 and 53. Because of this proximity to services and transportation corridors, the site watershed contains some of the most rapidly urbanizing area in Chippewa County. Most of the urbanization occurs on land that was previously used for agriculture. The importance of the proposed project, as a perpetual natural area, will increase with urbanization of the watershed.

According to the Wisconsin Natural Heritage Inventory (see Appendage Map II), the project area lies within two (2) square miles that have known occurrences of rare species and/or natural communities.

The physical characteristics of the proposed site make it well-suited for wetland restoration and perpetual protection. Prospectus Map 3 uses a portion of the Lake Wissota 1:24000 USGS Quadrangle to illustrate that the site (outlined in red) is located along a transition from a large wetland complex to steeply sloped uplands. This landscape positioning is further illustrated in Prospectus Map 4, which also shows main and lateral drainage ditches within the NW ¼ of the NW ¼ of Section 21. Both the SW ¼ of the SW ¼ of Section 16 and the NW ¼ of the NW ¼ of Section 21, historically contained depressional wetlands that have been converted to non wetland by cut/fill or excavation of surface drains.

The site has a relatively large watershed. Prospectus Map 6 shows the total watershed area of approximately 1690 acres (outlined in blue). Appendage Map III sows the site receives direct runoff from approximately 52 acres (direct watershed).

At present surface discharge from the north restoration area is "short-circuited" westward via the road ditch on the north side of 40th Avenue. As part of the proposed project, a culvert would be installed under 40th Avenue that would increase the hydrologic connection between the north and south restoration areas to more closely resemble pre-settlement runoff patterns.

Appendage Map IV shows that the direct watershed is intensively used. Eighty-three (83) percent of the area is used for intensive cash-grain row crop agriculture, twelve (12) percent is residential, and three (3) percent is degraded wetland. We anticipate conversion of agricultural land to residential. At present, the ability of the site to attenuate the non-point source pollution (inorganic fertilizers, herbicides & pesticides, and sediment) and surface runoff that results from the intensive land use is significantly compromised as a result of the artificial drainage network.

The majority of the site contains soil that formed hydric. Prospectus Map 5 shows the three soil units that occupy the site and Appendage Map V shows the hydrologic soil classification. Chetek sandy loam occupies the slopes on the north side of the site. The lowest portions of the property contain Minocqua loam (hydric). The transition area contains a Warman Variant sandy loam (hydric inclusions). The hydrologic soil classification of Minocqua is B/D. The HSG of the other two soils is B, however, hydric inclusions within the Warman Variant function as B/D. It is important to note that the HSG B/D designation of the Mu soil demonstrates that the soil survey recognizes the effects of drainage relative to the hydrology of the soils. Typically, HSG B applies where drainage has been installed within hydric soils. Conversely, HSG D applies where no drainage exists. Appendage Map VI shows the approximate extent of soils that we believe have been converted to non-hydric.

Methods

Several Federal agencies have developed a handbook "Hydrology Tools for Wetland Determination", which describes a series of analytic approaches to determining the long-term hydrology of a site. The WRP Technical Note HY-DE-4.1, January 1998, titled 'Methods to Determine the Hydrology of Potential Wetland Sites' summarizes the handbook. According to the technical note, estimates of runoff volumes and scope and effect equations are useful methods of evaluating the potential of wetland restoration sites. Using two or more of the methods increases the accuracy of the evaluation.

Design Concept – Tentative Construction Activities:

Appendage Map VII shows the preliminary design concept for the proposed wetland compensatory mitigation bank project. The primary goal of the project is to restore site hydrology to the most natural extent possible. We anticipate that restored hydrology will create more natural plant communities and soil moisture conditions. To accomplish this goal, we prescribe re-creation of historical depressional areas, re-directing artificial surface drainage from the "North Restoration Area", removal of cattle facilities, ditch plugs, and re-introduction of native plant species.

The target land cover for the "North Restoration Area" includes approximately 7 acres of ecologically enhanced upland. All upland will be planted to a mixture of native grasses, forbs, and legumes consistent with the USDA-NRCS Agronomy Technical Note V. We intend to reshape the area so surface runoff is no longer "short-circuited" westward via the road ditch, but rather directed south into the "South Restoration Area". Depending on the results of engineering site survey, a low berm with a stable outlet designed according to USDA-NRCS Technical Specifications may be used in the design. Natural regeneration of hydrophytic vegetation (i.e. a sedge meadow community) within the restored wetland area will be monitored and augmented with plantings if necessary.

A culvert will be installed under 40th Avenue to direct outflow from the "north restoration area" to the "south restoration area". Depressional areas will be restored throughout the northern and western portions of the "south restoration area". Ouflow from the culvert will be spread across the portion of the south restoration area containing restored depressions. The depressions will have a bottom elevation above the water table (in the unsaturated soil zone) and will be available for intermittent storage of surface runoff and floodwater. When depressions are filled to capacity, water will move as sheet flow, southward toward the main channel.

Water entering the "south restoration area" via the main channel will remain in the channel and essentially flow through the site as is currently occurring. Lateral ditches, however, will be plugged according to USDA-NRCS Technical specifications. Approximately 15 acres, lying south of the main ditch will be preserved as is.

The barn and cattle feedlot that is situated within the northeast portion of the "South Restoration Area" will be removed from the site. All areas disturbed by excavation, and other areas where appropriate, will be planted to a mixture of native plant species per recommendation by local WDNR Wildlife Biologist.

Objective #1: Estimating Time of Concentration, Peak Discharge Rates, and Surface Runoff Volume:
Time of concentration, peak runoff rates, and surface runoff volumes were calculated in order to determine the site's ability to assimilate and infiltrate runoff, attenuate peak flow rates, recharge the local groundwater, supply local stream baseflow, and perform other wetland functions.

More specifically, the time of concentration calculations were used to determine the ability of the site to assimilate runoff. Peak runoff rates were used to determine the ability of the site to attenuate peak flows. Runoff volume estimates were used to determine the ability of the site to infiltrate surface runoff. Collectively, these three parameters provide the information necessary to determine the sites impact on local hydrology and the effectiveness of proposed restoration activities.

Time of concentration, peak runoff rates, and surface runoff volumes were calculated using techniques developed by the Soil Conservation Service (SCS), now the Natural Resource Conservation Service. Specifically, runoff volumes were calculated using HydroCAD, a computer aided design tool that incorporates SCS Technical Release 20 (TR-20) and SCS Technical Release 55 (TR-55). Time of concentration, peak runoff rates, and surface runoff volumes were modeled under pre- and post-restoration conditions. Appendage Map VIII illustrates the pre and post restoration conditions.

Soil Hydrologic Considerations For Modeling
The existing ditches and surface drainage features serve a drainage function; therefore, the pre-restoration calculations used hydrologic soil group designation B for the entire site. Similarly, assuming that the existing drainage ditches were plugged during restoration, the post-restoration calculations used hydrologic soil group designation D for the Mu soils and B for the Wb soils. We expect that an appreciable portion of the Wb will have the post restoration function of hydrologic soil group D, but used hydrologic soil group B for conservative results.

Runoff Curve Numbers
The runoff curve number (RCN) used for the calculations varied under pre- and post-restoration conditions. The variation can be attributed to the change in HSG designation from B to D as well as the change in land cover from agriculture to wetland and upland buffer. It is important to note that the RCN for wetlands varies seasonally between 40 and 100. Higher runoff curve numbers indicate higher runoff. An RCN of 40 is representative of conditions when the wetland is actively absorbing runoff and an RCN of 100 is representative of conditions when all storage volume in the wetland is occupied.

Time of Concentration
The time of concentration (T_c) used for the calculations varied under pre- and post-restoration conditions. The variation can be attributed to the change in land cover from agriculture to wetland and upland buffer and the effect of plugging ditches. It is important to note that the shallow concentrated flow surface description provided by TR-20/TR-55/HydroCAD does not provide for wetland surfaces. A surface of "woodland" was selected to approximate the Manning's "n" value used to calculate average velocity and ultimately T_c.

It is important to note that the proposed project includes the restoration of depressional areas. The role of these depressional areas in routing runoff was not included in the hydrological analysis. It is reasonable to assume, that restoring depressional areas will decrease peak discharge, increase Tc, and generally improve wetland performance above the predictions described herein.

Storm Event
The hydrologic analysis used a 1 year, 24 hour rainfall event to model the pre- and post-restoration conditions. While recognizing that the average year is composed primarily of smaller events, the 1 year event was selected as a representative storm to demonstrate the hydrological effects of the wetland restoration project. It can be assumed that proportionately similar hydrological effects will be realized for both smaller and larger rainfall events.

Drainage Areas
Appendage Map VIII identifies the drainage areas used for the pre- and post restoration calculations. The pre-restoration area was modeled as having two separate surface outlets; (1) a 57 acre area north of 40th Avenue draining to the 40th Avenue road ditch and then flowing off-site to the west and; (2) a 53 acre drainage area south of 40th Avenue draining to the main drainage ditch that outlets to the west.

Appendage Map VIII also shows that the 57 acres were divided into 40 acres (labeled A1) and 17 acres (labeled A2). A1 represents the drainage area outside the project boundary and the A2 represents the drainage area planned as the "north restoration area". The two areas are individually identified in order to demonstrate the hydrological impact of restoration under post-restoration conditions.

The existing land cover of the 52 acres south of 40th Avenue is a combination of a vacant feedlot and barn, actively harvested marsh hay, and shrub swamp. The 52 acres south of 40th Avenue were divided into 20 acres (labeled B1), 19 acres (labeled B2), and 13 acres (labeled B3). B1 is actively managed for harvest of marsh hay and also contains a feedlot and barn that are currently vacant and will be removed as part of the project. B1 is planned for wetland restoration. B2 consists primarily of shrub swamp with a monotypic stand of reed canary grass on the western edge. Most of B2 is planned for preservation/ protection against unrestricted cattle access. B3 is a combination of abandoned farm field and shrub swamp. B3 is outside of the project boundary.

Appendage Map VIII also shows the post-restoration drainage area. The post-restoration condition combines the north and south restorations and their respective watersheds. This combination will be accomplished by adding a culvert under 40th Avenue that will convey surface runoff from the north restoration area to the south restoration area. The net result is one outlet serving the entire area.

Note:
The HydroCAD Calculation Sheets showing the specific data used as inputs to determine pre- and post-restoration hydrologic conditions are available upon request. Results of the hydrologic modeling are presented and discussed in the section titled "Results and Conclusions".

Objective #2: Estimating Subsurface Effects of Drainage Network:
Two scenarios were evaluated for impact on subsurface hydrology:

1. Existing Drainage (with current system of drainage ditches)
2. Drainage after Wetland Restoration (with all ditches but the main plugged)

The van Schilfgaarde Equation is a non-steady state water table draw down equation. The equation was used to evaluate the soil saturation in its current drainage condition and as projected following implementation of the proposed wetland restoration project. The equation was used to model the effects of the main ditch as well as the laterals.

The following excerpt is from "Scope and Effect Equations for Evaluating the Removal of Soil Saturation for Wetland Hydrology Determination", USDA - National Sedimentation Laboratory and Wetland Science Institute.

> The **van Schilfgaarde equation** was developed for non-steady state conditions with the assumption that rainfall is not occurring during water table drawdown. This equation evaluates saturation depth based on time (t), soil drainable porosity (f) and hydraulic conductivity (K). The use of effective depth (d_e) in place of actual depth may be used but requires an iteration process to solve the equation (performed by the program). The van Schilfgaarde equation is meant to be applied with no standing water above the [ditch bottom](s) and where rainfall is sporadic (moist subhumid to arid climates) rather than constant (humid and superhumid climates).
>
> The NRCS uses a modified version of the van Schilfgaarde equation in which the drainable porosity is replaced with an adjusted drainable porosity, which accounts for the water storage (s) by surface roughness. If surface roughness is ignored (s=0), the equation is identical to the original van Schilfgaarde equation.
>
> van Schilfgaarde equation
>
> $$S = \sqrt{\frac{9K\,t\,d_e}{f\left[\ln m_e(2d_e + m) - \ln m(2d_e + m_e)\right]}}$$
>
> The equation is first used with "a" in place of "de" to determine an estimated spacing S'.
>
> The equation variables are:
>
> S = drain spacing, ft
> K = hydraulic conductivity, ft/day (program takes in/hr and converts to correct units)
> d_e = equivalent depth from drainage feature to impermeable layer, ft
> m = height of water table above the center of the drain at midplane after time t, ft

m_0= initial height of water table above the center of the drain at t=0, ft
t = time for water table to drop from m_0 to m, days
a = depth from free water surface in drainage feature to impermeable layer, ft
f' = drainable porosity adjusted for surface roughness, dimensionless (i.e. ft/ft), = $f + (s/(m_0-m)$
f = drainable porosity of the water conducting soil, dimensionless
s = water trapped on the surface by soil roughness, ft, s=0.0083 ft (0.1 in) would be typical

Wisconsin NRCS engineering staff developed a spreadsheet for solving the van Schilfgaarde equation. This spreadsheet was used for these analyses.

Variables and Assumptions Used in Performing van Schilfgaarde Analysis on Proposed Restoration Site

Site Data:
Soil mapping unit; ***Mu, Minocqua loam***
Depth to impermeable layer; ***h= 4.5 feet***
Depth to water level in ditch; ***d=2.0 feet***

Variables Used To Solve Equation:
S = drain spacing, ft; ***the average ditch spacing for the lateral ditches was used, use 175 feet***
K = hydraulic conductivity, ft/day; ***the NRCS Wisconsin spreadsheet computes a composite value based on soil permeability characteristics***
d_e = equivalent depth from drainage feature to impermeable layer, ft; ***value computed by the spreadsheet from the h and the channel geometry***
m = height of water table above the center of the drain at midplane after time t, ft; ***value computed by the spreadsheet from the m_0 and c***
m_0= initial height of water table above the center of the drain at t=0, ft; ***0.5 ft (based on site investigation)***
t = time for water table to drop from m_0 to m, days; ***used 14 days to per recommendation from literature***
a = depth from free water surface in drainage feature to impermeable layer, ft; ***=(h-d)***
f' = drainable porosity adjusted for surface roughness, dimensionless (i.e. ft/ft); = **$f + (s/(m_0-m)$; *computed as shown***
f = drainable porosity of the water conducting soil, dimensionless, ***spreadsheet used 0.0844 based on soil mapping unit***
s = water trapped on the surface by soil roughness, ft; ***default value=0.1 in***

Results

Objective #1: Estimating Time of Concentration, Peak Discharge Rates, and Surface Runoff Volume:

Table 1. summarizes the results of the pre- and post-restoration hydrologic modeling of the proposed project.

Table XXX: Results of Hydrologic Analysis for 1 Year, 24 Hour Rainfall

Sub-Watershed	Land Cover		Area (acres)	Runoff Curve Number		Time of Concentration T_c (mins)		Peak Discharge Q_{peak} (cfs)		Volume of Runoff (ac-ft)		Comments
	Pre	Post		Pre	Post	Pre	Post	Pre	Post	Pre	Post	
A1	Agriculture	Agriculture	40	76	76	15.2	15.2	24.3	1.1	2.6	0.6	Outside project boundary
A2	Agriculture	Wetland	17	78	47	13.8	23.8					Proposed wetland restoration and upland buffer
B1	Marsh Hay	Wetland	20	58	49	35.4	34.1	0.2		0.1		Proposed wetland restoration
B2	Brush	Wetland	19	56	40	12.3	80.0	0.2	0.1	0.1	0.05	Preserve threatened wetland
B3	Brush	Brush	13	56	70	36.9	36.9					Outside project boundary

This hydrologic analysis indicates that restoring and enhancing the proposed wetland site, re-connecting the north and south restoration areas, plugging ditches, and restoring depressional areas will result in a significant increase in the time of concentration, decrease the peak runoff rates, and decrease the runoff volumes within the proposed restoration site.

The most dramatic hydrological improvement from pre- to post-restoration occurred with the Q_{peak} for subwatersheds A1-A3. As summarized in Table 1, the Q_{peak} for subwatersheds A1 and A2 decreased from 24.3 cfs to 1.1cfs. This decrease can be attributed to two factors; (1) The change in land cover from agriculture to wetland and buffer, as illustrated by the decrease in pre- to post-restoration RCN value, and; (2) The connection and conveyance of runoff from the north restoration area to the south restoration area through the proposed culvert and the resulting increase in T_c.

A second hydrologic improvement is the decrease in runoff volume. Table 1 shows, the total volume of runoff decreased from a pre-restoration volume of 2.8 ac-ft to a post-restoration volume of 0.65 ac-ft. This nearly 75% reduction can be attributed to change in land cover from agriculture to wetland and buffer, and the increase in T_c resulting from ditch plugging and increased surface roughness.

It is important to note, again, that the proposed project includes the restoration of depressional areas. The role of these depressional areas in routing runoff was not included in the hydrological analysis, nor were they given a hydrologic soil group designation of D. It is reasonable to assume, that restoring depressional areas will decrease peak discharge, increase Tc, and generally improve wetland performance above the predictions described herein.

Objective # 2: Estimating Subsurface Effects of Drainage Network:

The designation of B/D as the hydrologic soil group for the Mu soil indicates effective artificial site drainage. The effects of the artificial drainage network were confirmed through modeling that utilized the USDA-NRCS recommended - van Schilfgaarde equation. The estimated zone of influence of the laterals and main ditch is as shown on Appendage Map IX. The drainage network is not effective enough to completely convert the entire zone of influence to non-wetland, but it does significantly dewater the area and degrade the areas functional value as a wetland.

According to the modeling, the ditch network exports 5.4 acre feet of water over a 14-day period with no rainfall, and beginning with water ponded to a depth of 0.5 feet over the entire zone of influence. After 14 days, the soil at the midpoint between the laterals is drained to a depth of approximately 22.5 inches below the land surface. We estimate that plugging the lateral ditches will return soil saturation levels to the average natural depth reported in the Chippewa County Soil Survey for this soil unit (water table at the ground surface with some capability to pond water).

The current proposal does not include plugging the main ditch. Therefore, we used the van Schlifgaarde equation to delineate that portion of the post -restoration site that will continue to be impacted (drained) by the main ditch. The main ditch is approximately the same depth (and hence lateral effect) as the lateral ditches.

Conclusion

The analysis presented herein shows that historical degradation to the site hydrology can be reversed. We can expect to achieve a successful wetland restoration. At present, portions of the site do have remnant wetland hydrology and plant communities; however, the site is likely providing minimal wetland functional value. We believe that more natural hydrology and permanent protection of the site will restore and enhance the sites wetland functional value.

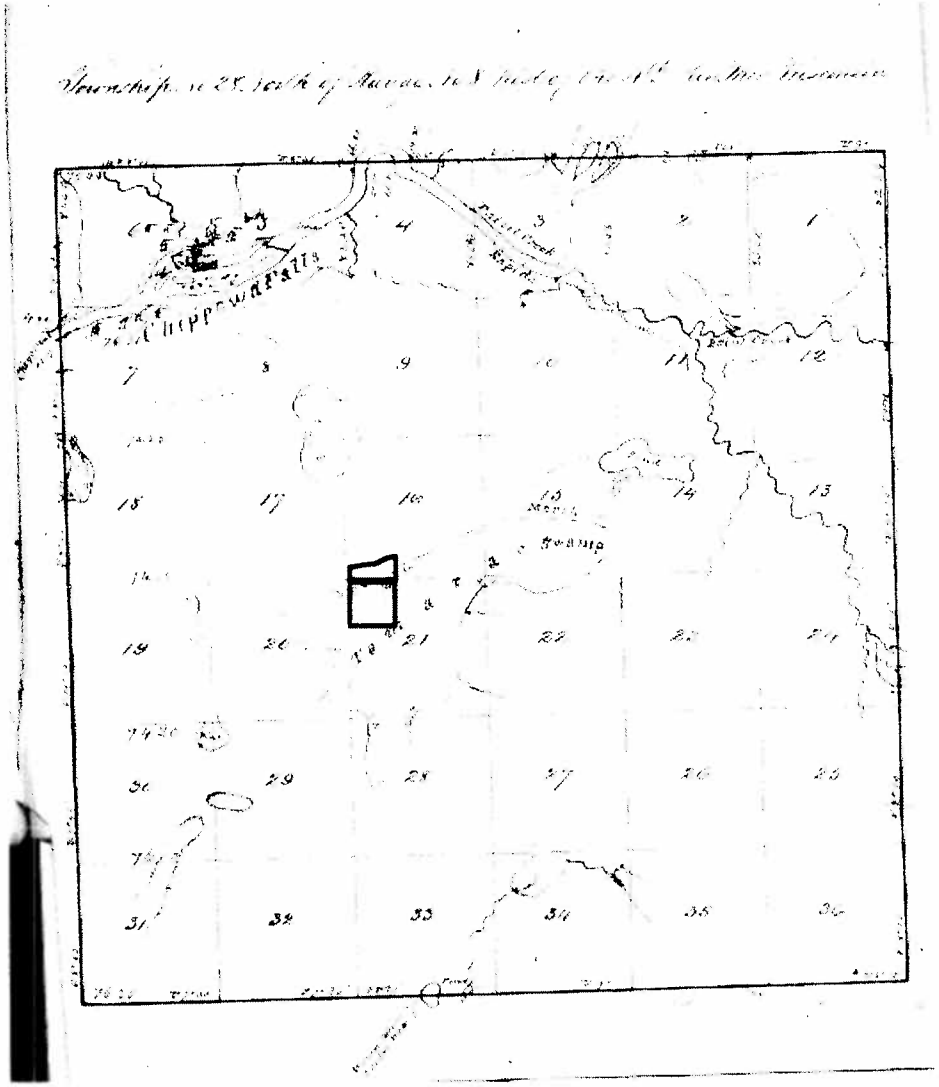
Appendage Map X shows the proposed restoration techniques classified according to "Guidelines for Wetland Compensatory Mitigation in Wisconsin". The publication also describes an example credit calculation. Following the example credit calculation, we were able to estimate that the proposed project would yield approximately 32.75 mitigation credits. Table 2 lists the results of the credit estimate.

Table 2: Credit Estimate for Proposed Chippewa County Wetland Compensatory Mitigation Bank

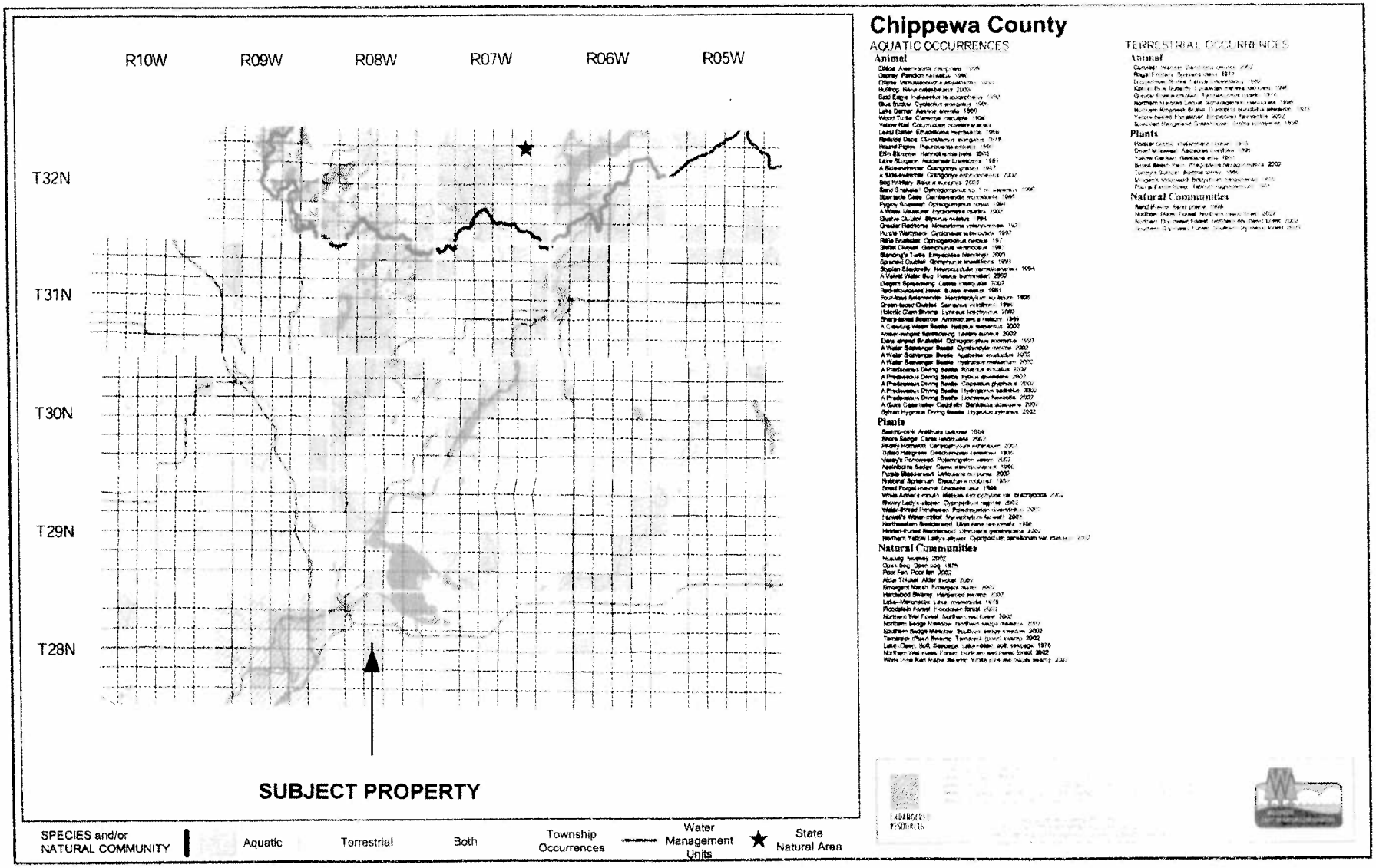
Activity / Technique	Acres	Crediting	Credit Acres
Restoration of historic wetland area w/enhancement of severely degraded areas that still meet wetland definition	29	1.0 : 1.0	29.0
Ecological enhancement in Adjacent Uplands	7	0.25 : 1.0	1.75
Preservation of Fully Functioning Wetlands	15	0.125 :1.0	1.875
No credit area	5.0	0	0
Total	**56**		**32.625**

Appendage Map I. Government Survey Map & Notes

Section II MAPS



Appendage Map II. WDNR Natural Heritage Inventory Map for Chippewa County



Appendage Map III. Site Watershed: Total & Direct Contributing Areas

LEGEND

- Proposed Site
- Direct Contributing Area: Approx. 109 Acres
- Total Contributing Area: Approx.1693 Acres

N

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Land Conservation Dept.

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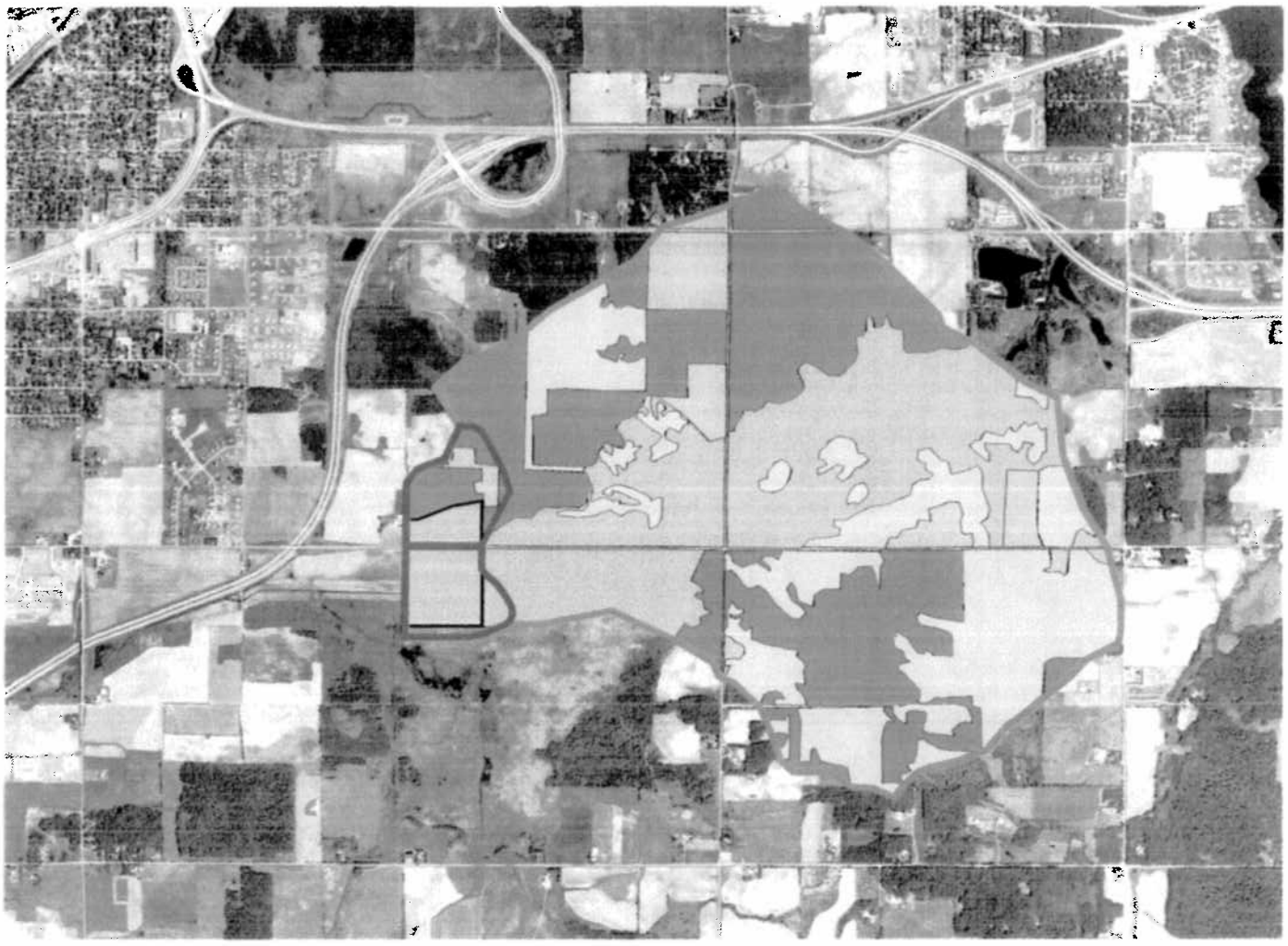
Appendage Map IV. Total Watershed Land Use



Proposed Restoration Areas

Direct Watershed

Total Watershed

Land Use

Agricultural	= 577.5 acres
Forested	= 458.3 acres
Residential	= 112.5 acres
Wetland	= 468.9 acres

N

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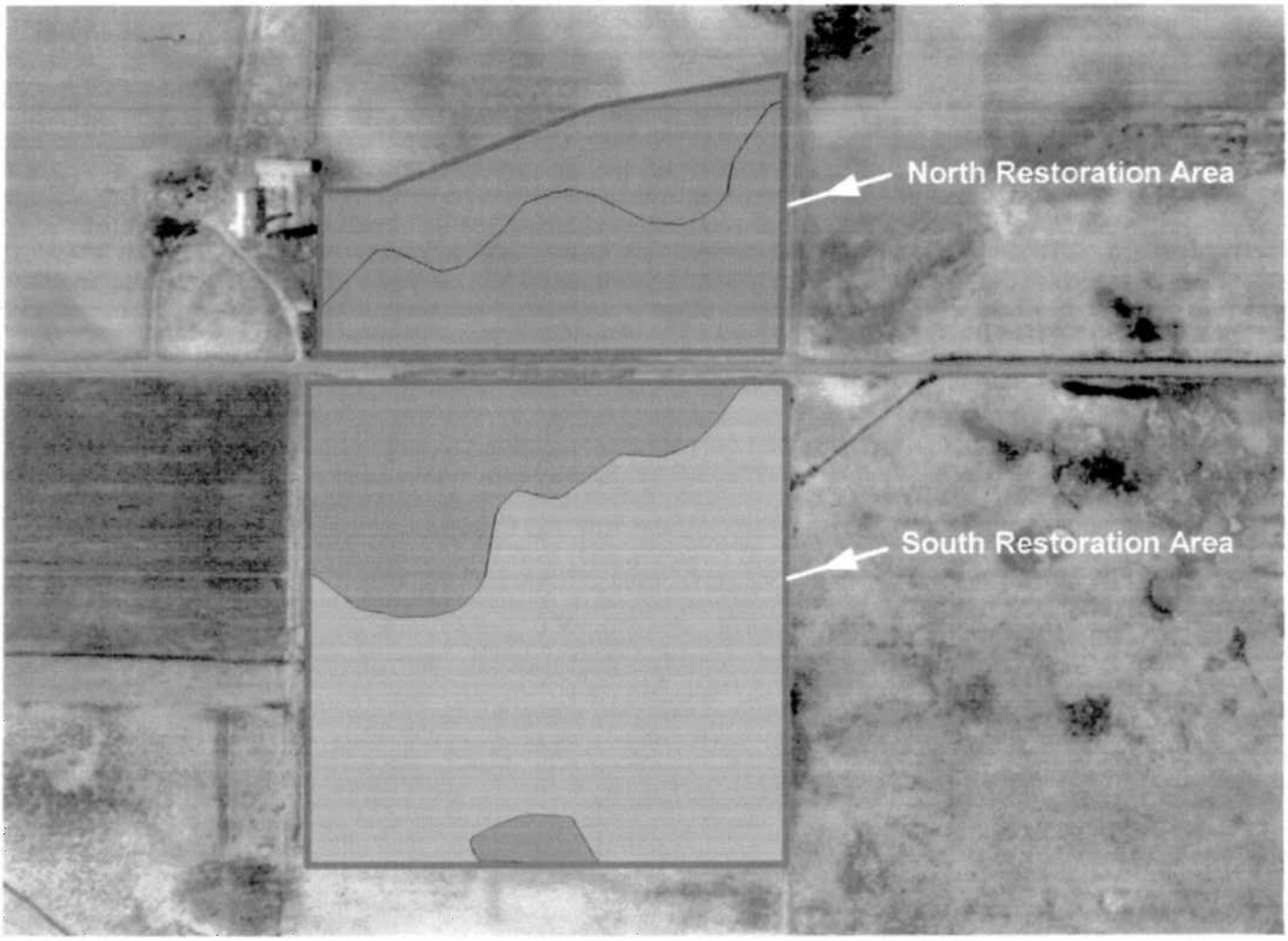
Appendage Map V. Site Soils & Hydrologic Soil Group Classification



600 0 600 1200 Feet

Proposed Restoration Areas

N

Hydrologic Soil Groups

B — Soils having a moderate infiltration rate when thoroughly wet. They consist chiefly of moderately deep well drained soils that have moderately fine to moderately course texture. These soils have a moderate rate of water transmission.

B/D — A soil that has been manipulated to behave as a B, but originally was a group D. Group D soils have a very slow infilitration rate and high runoff potential when thoroughly wet. Consisting chiefly of clays, these soils have a very slow rate of water transmission.

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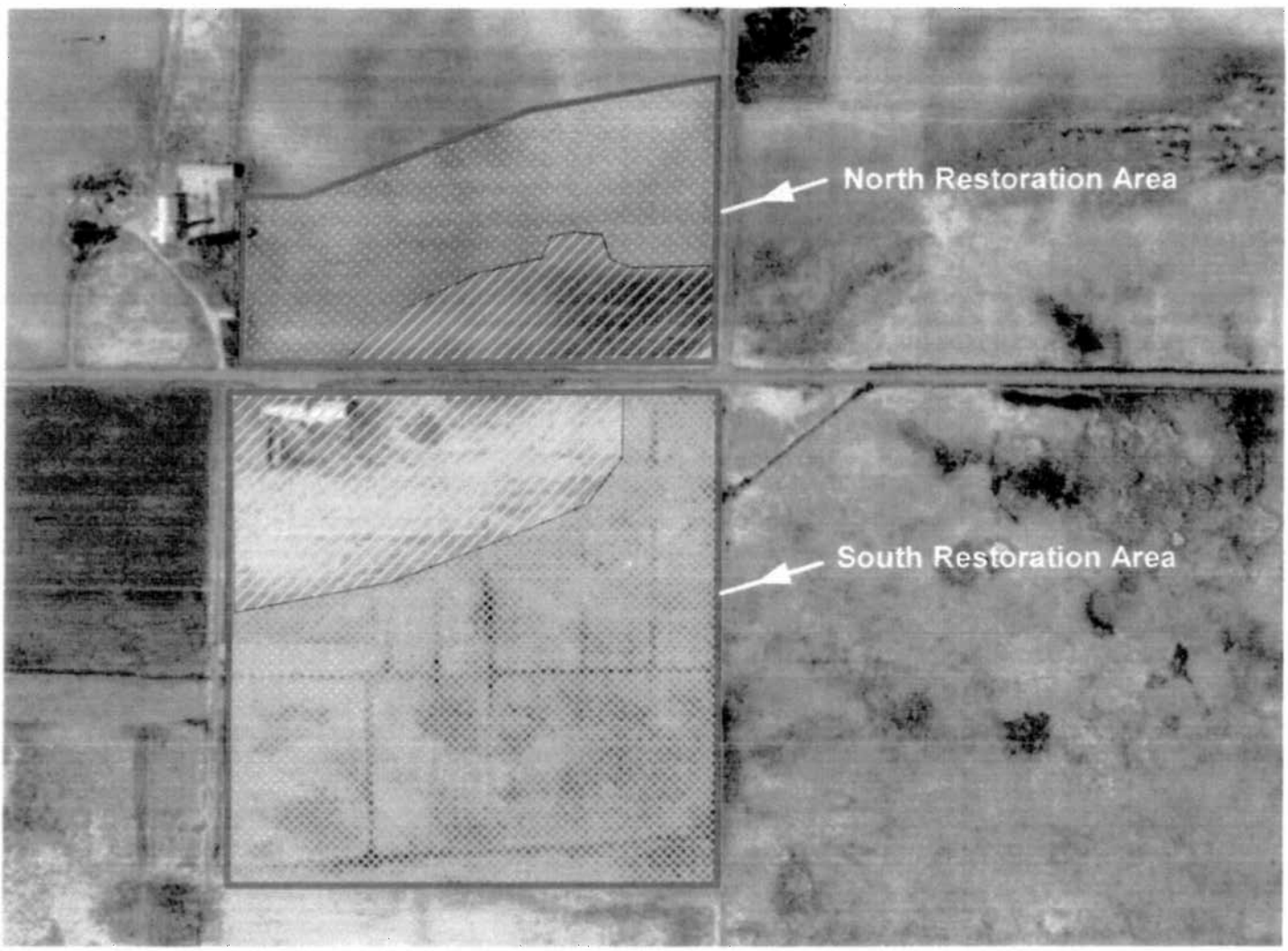
Appendage Map VI. Estimated Extent of Soils Converted to Non-Hydric



500 0 500 1000 1500 Feet

Proposed Restoration Areas

Soils

Converted to Non-Hydric

Converted to Non -Hydric

Non-Hydric

Hydric

N

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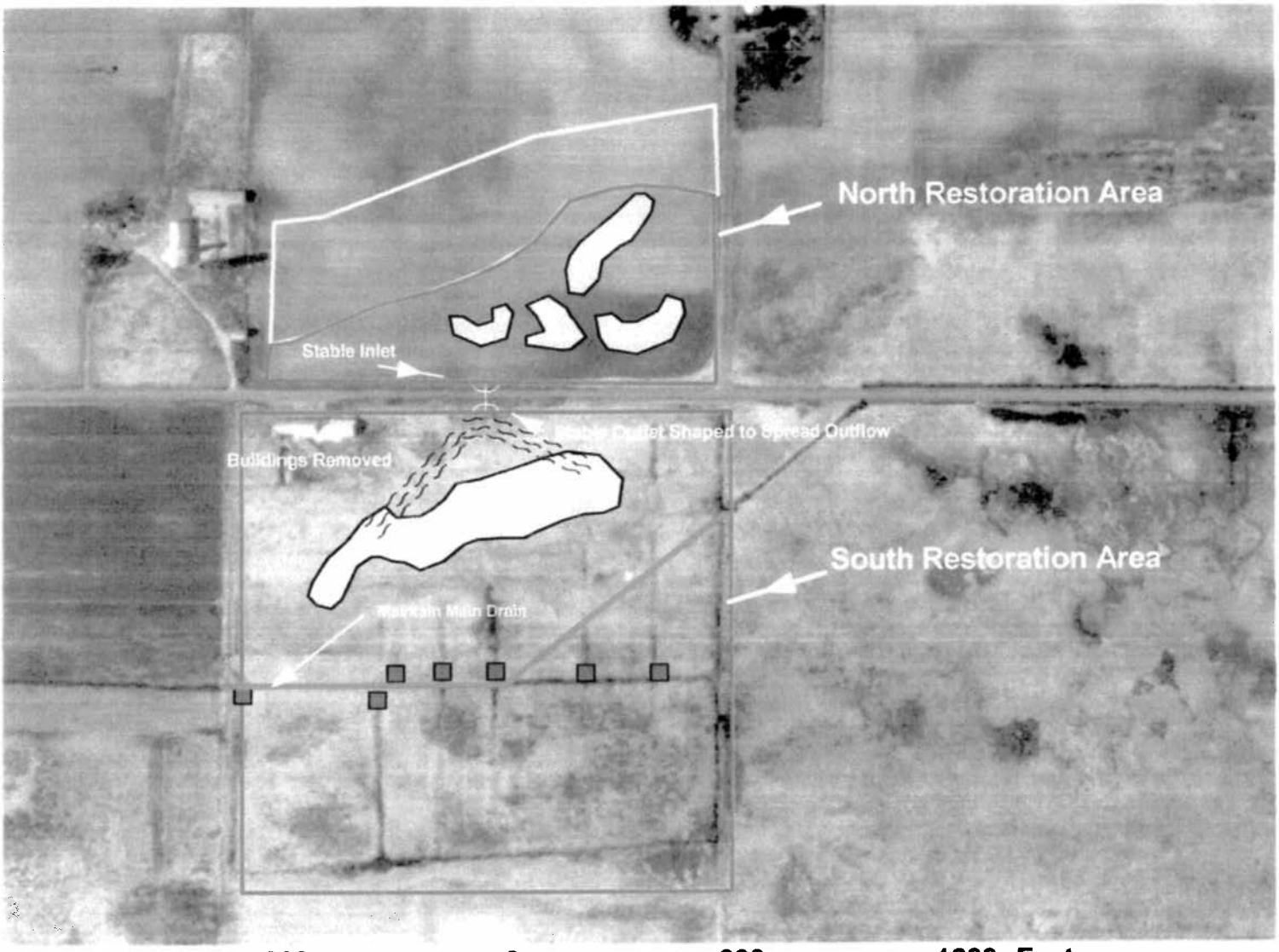
Appendage Map VII. Revised Preliminary Design Concept



600 0 600 1200 Feet

N

Main drain
Proposed Culvert
Approx. Location of Restored Depressions
Potential Ditch Plugs
Preliminary Estimate of Restoration Area
Upland Filter / Nesting Area (approx. 7 acres)
Restored Wetland (approx. 47 acres)

Chippewa County
Land Conservation Dept.

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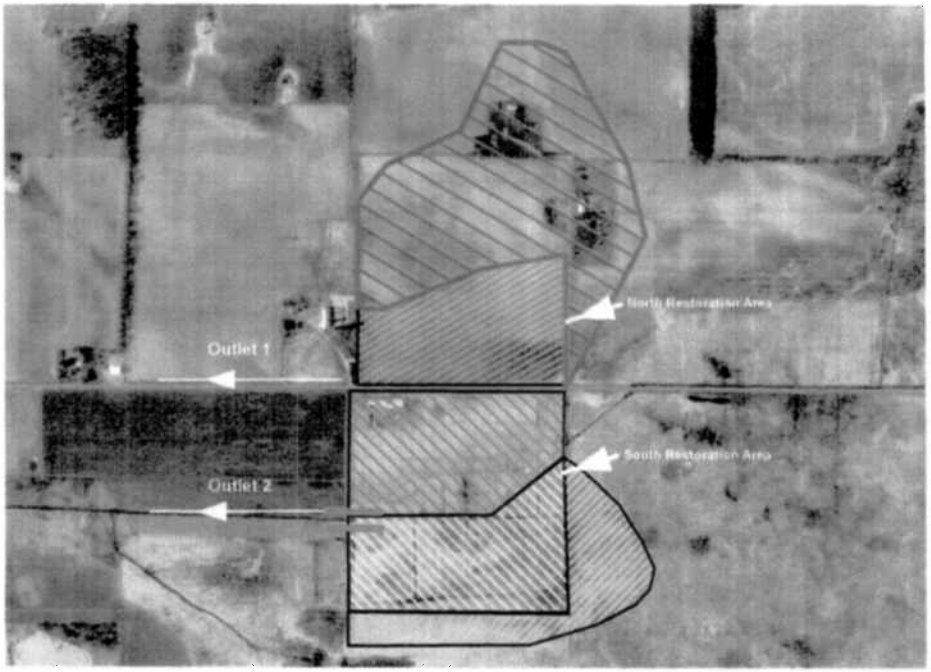
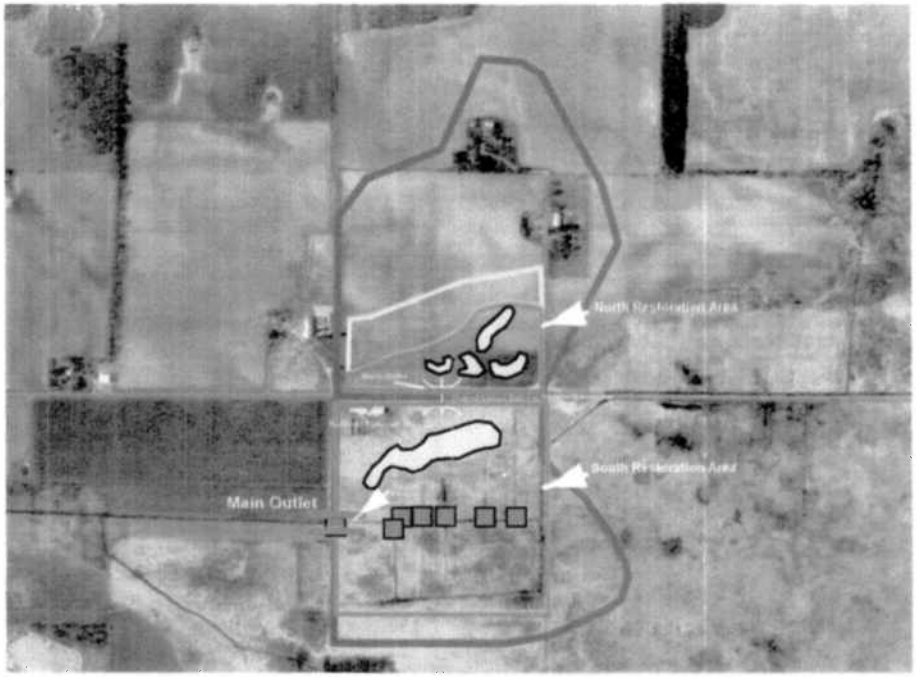
Appendage Map VIII. Pre- and Post-Restoration Watershed Characteristics

Pre-Construction



Post Construction



A1 = 40 acres

A2 = 17 acres

A3 = 20 acres

A4 = 19 acres

A5 = 13 acres

N

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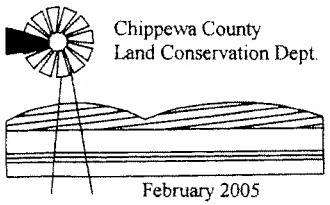

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Direct Watershed

Proposed Culvert

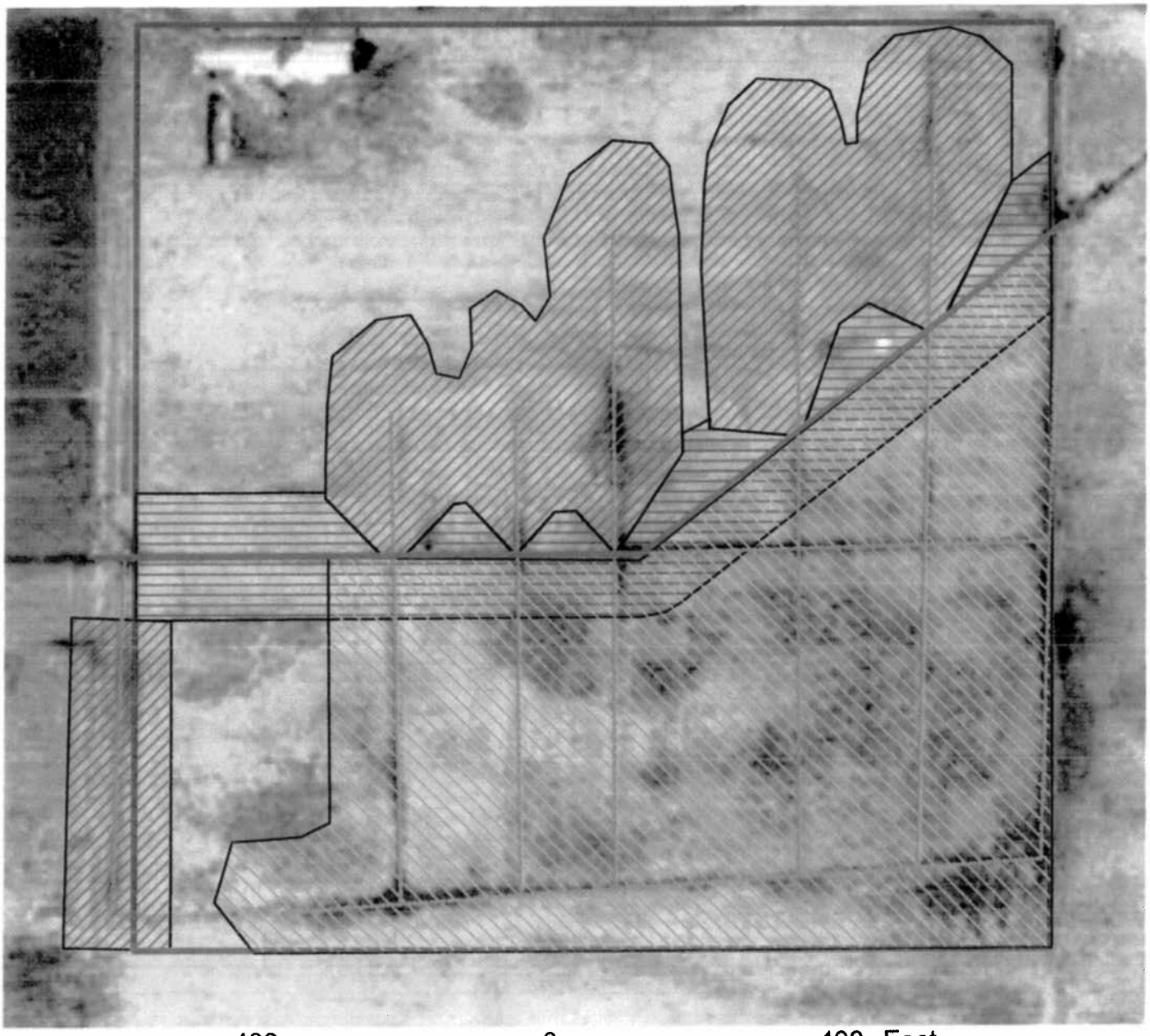
Potential Ditch Plugs

Preliminary Estimate of Restoration Area

Upland Filter / Nesting Area (approx. 7 acres)

Restored Wetland (approx. 47 acres)

Appendage Map IX. Aerial Extent of the Subsurface Influence of Existing Drain Network



400 0 400 Feet

N

Proposed Restoration Area
Zone of Drawdown, to be Restored
Effect of Main Drain
Functioning Preserved Wetland
Defined Laterals
Main drain

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Appendage Map X. Anticipated As-Built Land Classification for Credit Calculation

Proposed Restoration Areas

Restoration with Minimal Enhancement

Preservation of Fully Functioning Wetlands

Upland Buffer (Native Grass)

N

TECHNIQUE	Anticipated Credit ACRES	CREDIT
Ecological Enhancement in Adjacent Uplands	7	1.75
Restoration with Minimal Enhancement	29	29
Preservation of Fully Functioning Wetlands	15	1.875
TOTAL	51	32.625

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Land Conservation Dept.

February 2005

Appendix

CHERRIER BROS. WETLAND RESTORATION

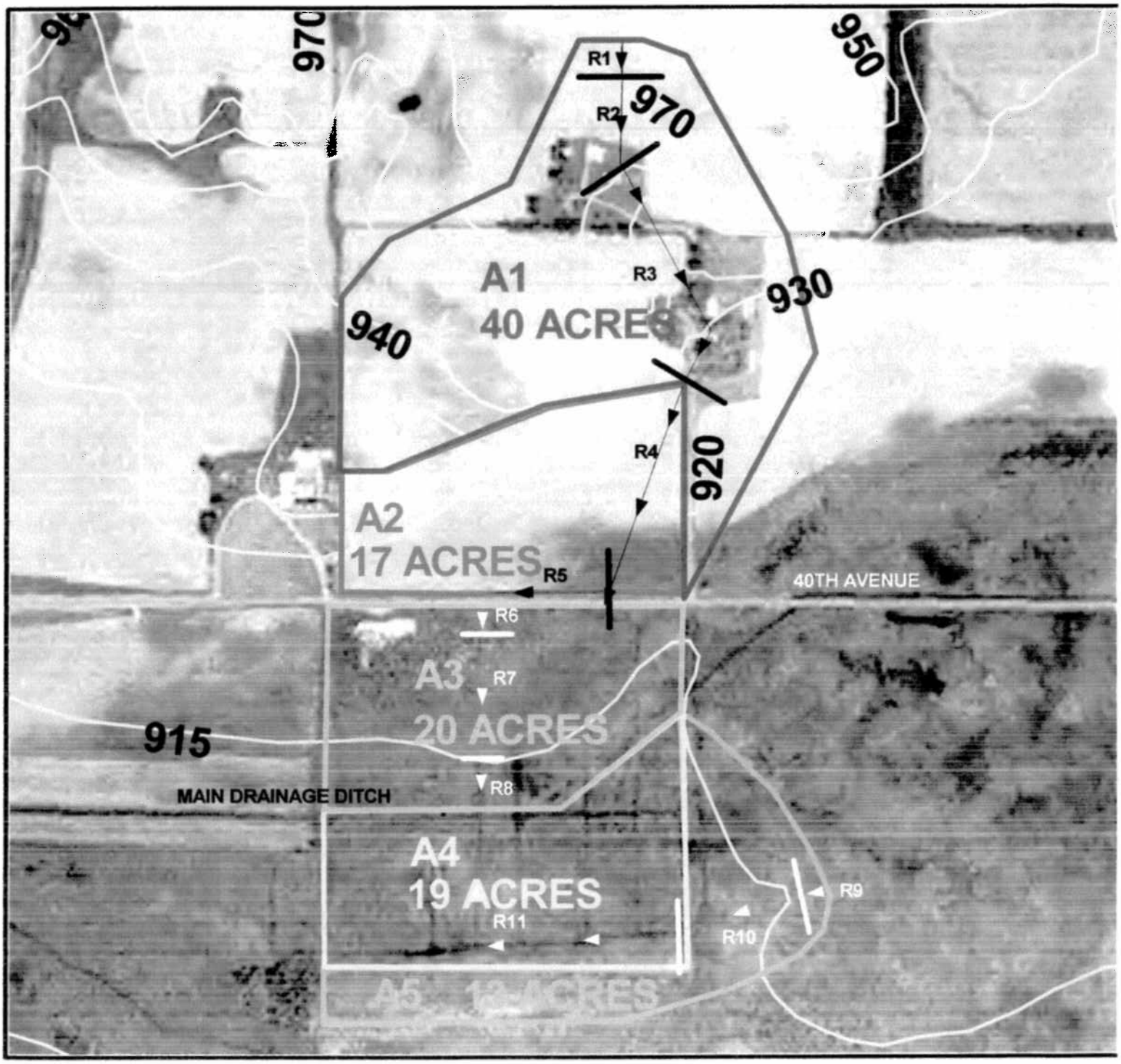
HYDROLOGIC CALCULATIONS
PRE-RESTORATION CONDITIONS

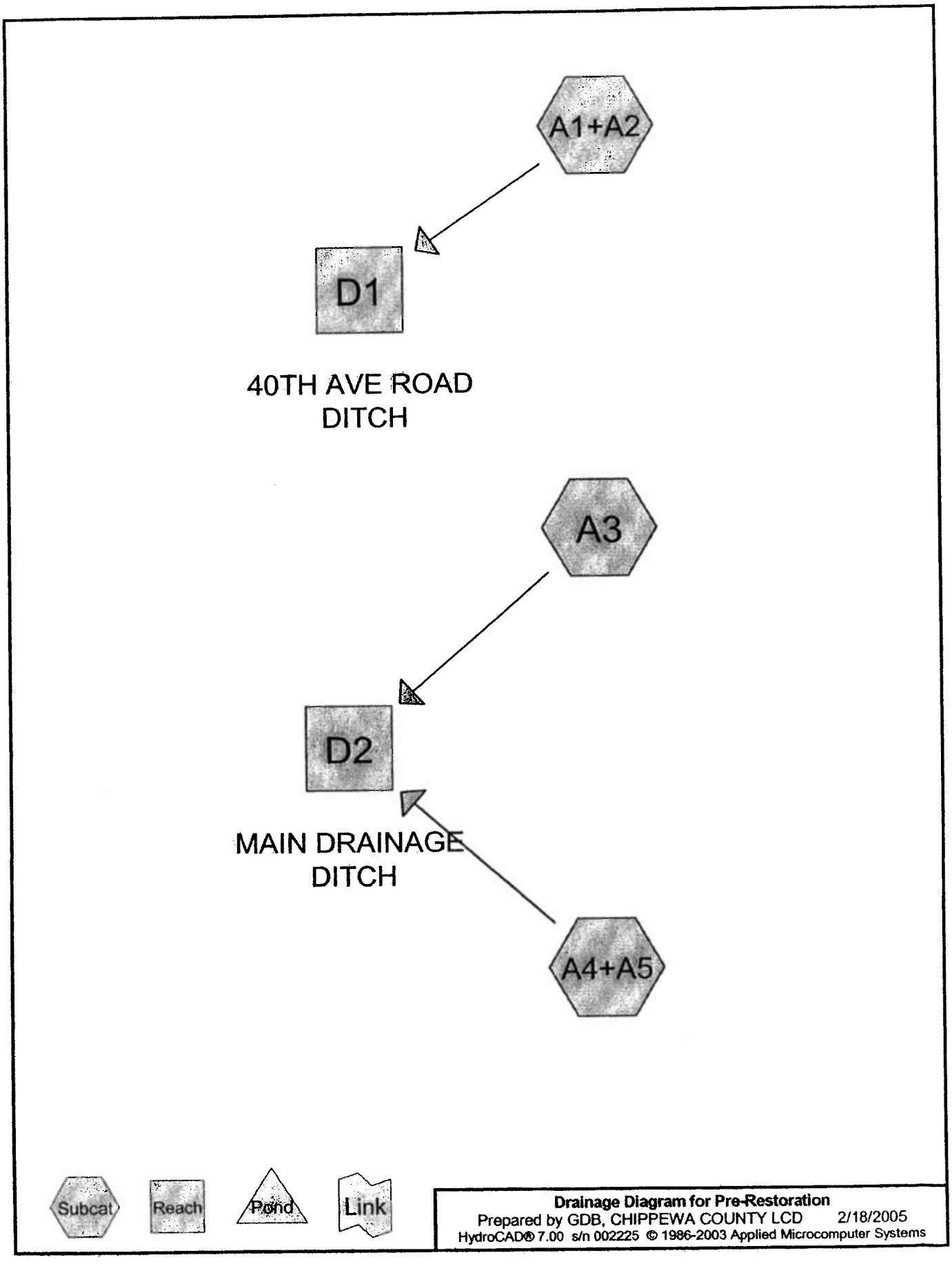
PREPARED BY:

CHIPPEWA COUNTY LAND CONSERVATION DEPARTMENT

FEBRUARY 21, 2005

CHERRIER WATERSHED DELINEATION
PRE-RESTORATION




A1+A2
D1
40TH AVE ROAD
DITCH
A3
D2
MAIN DRAINAGE
DITCH
A4+A5
Subcat
Reach
Pond
Link
Drainage Diagram for Pre-Restoration
Prepared by GDB, CHIPPEWA COUNTY LCD 2/18/2005
HydroCAD® 7.00 s/n 002225 © 1986-2003 Applied Microcomputer Systems

PRE-RESTORATION CONDITIONS NORTH OF 40TH AVENUE

Time span=5.00-30.00 hrs, dt=0.05 hrs, 501 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment A1+A2: Runoff Area=56.400 ac Runoff Depth=0.56"
Flow Length=2,525' Tc=29.0 min CN=77 Runoff=24.29 cfs 2.630 af

Reach D1: 40TH AVE ROAD DITCH Inflow=24.29 cfs 2.630 af
Outflow=24.29 cfs 2.630 af

Total Runoff Area = 56.400 ac Runoff Volume = 2.630 af Average Runoff Depth = 0.56"

Subcatchment A1+A2:

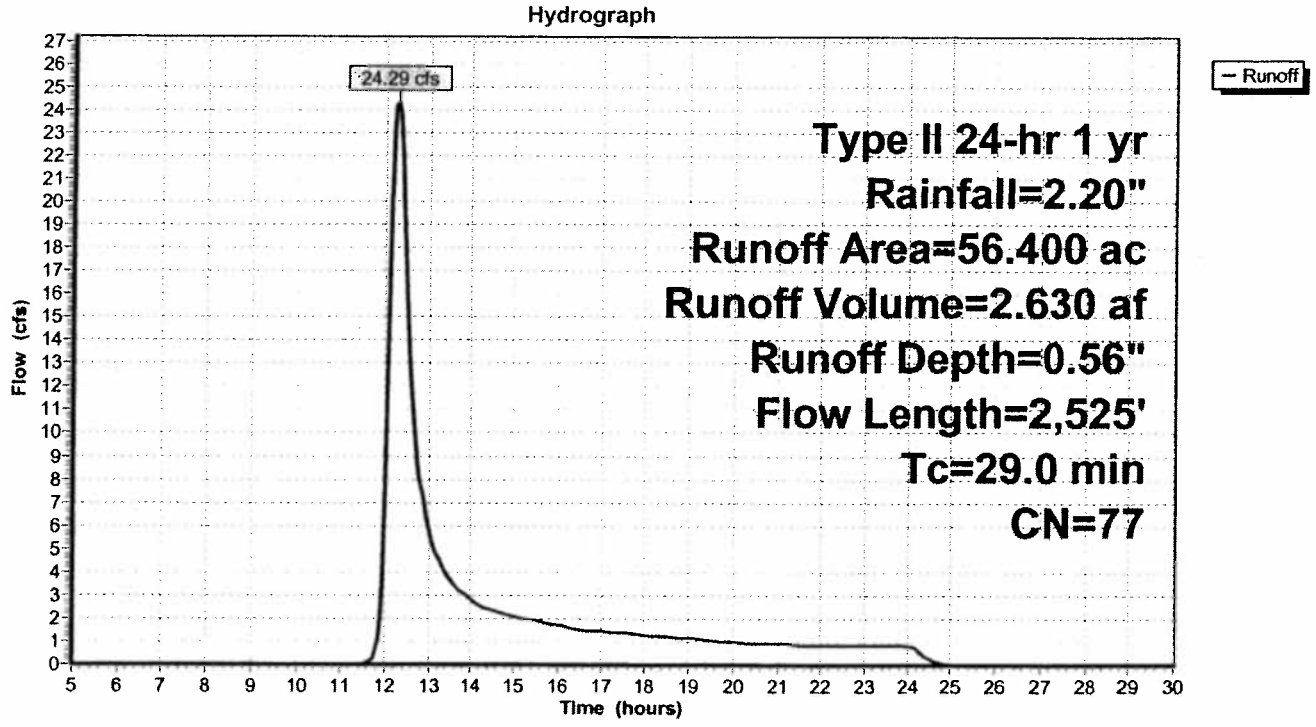
Runoff = 24.29 cfs @ 12.27 hrs, Volume= 2.630 af, Depth= 0.56"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 1 yr Rainfall=2.20"

Area (ac)	CN	Description
39.700	76	Agriculture
16.700	78	Agriculture
56.400	77	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.4	100	0.0300	0.4		**Sheet Flow, R1** Cultivated: Residue<=20% n= 0.060 P2= 2.70"
3.5	325	0.0300	1.6		**Shallow Concentrated Flow, R2** Cultivated Straight Rows Kv= 9.0 fps
7.3	850	0.0460	1.9		**Shallow Concentrated Flow, R3** Cultivated Straight Rows Kv= 9.0 fps
12.5	800	0.0140	1.1		**Shallow Concentrated Flow, R4** Cultivated Straight Rows Kv= 9.0 fps
1.3	450	0.0050	6.0	143.52	**Channel Flow, R5 (Road Ditch)** Area= 24.0 sf Perim= 12.6' r= 1.90' n= 0.027
29.0	2,525	Total			

Subcatchment A1+A2:

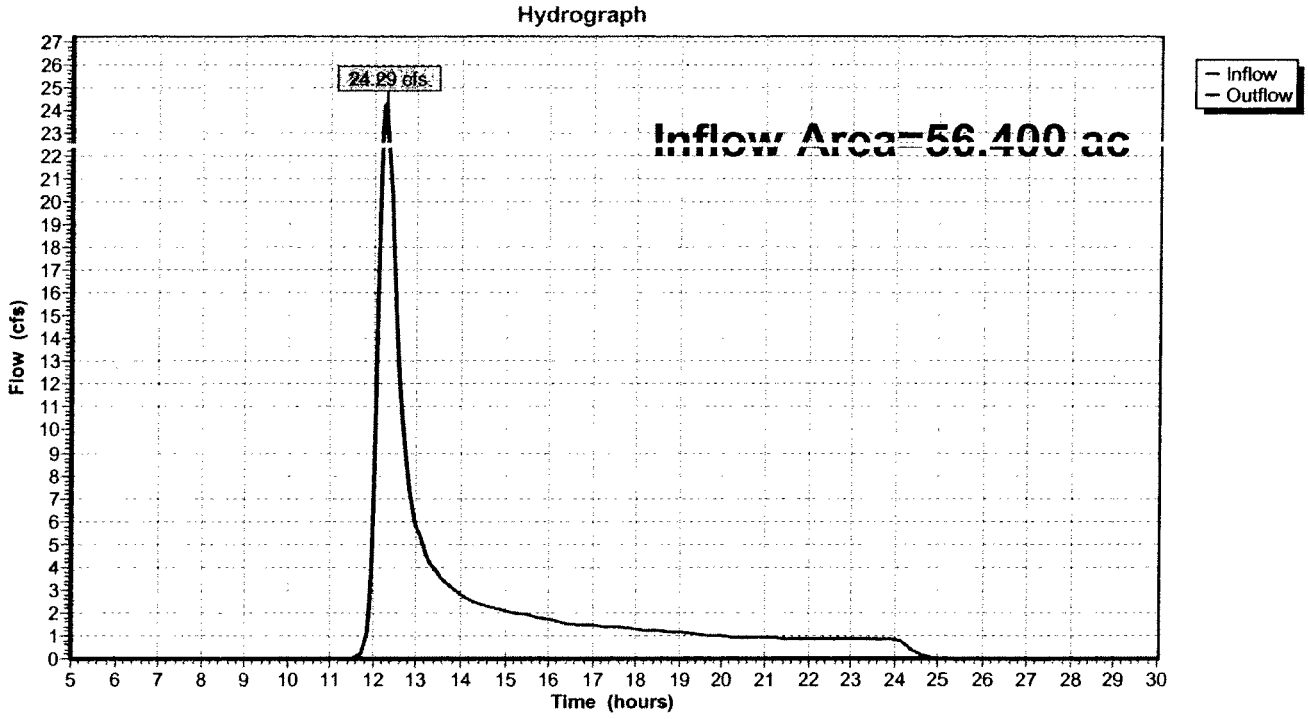


Reach D1: 40TH AVE ROAD DITCH

Inflow Area = 56.400 ac, Inflow Depth = 0.56" for 1 yr event
Inflow = 24.29 cfs @ 12.27 hrs, Volume= 2.630 af
Outflow = 24.29 cfs @ 12.27 hrs, Volume= 2.630 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs

Reach D1: 40TH AVE ROAD DITCH



PRE-RESTORATION CONDITIONS SOUTH OF 40TH AVENUE

Time span=5.00-30.00 hrs, dt=0.05 hrs, 501 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment A3: Runoff Area=19.700 ac Runoff Depth=0.07"
Flow Length=725' Tc=35.4 min CN=58 Runoff=0.18 cfs 0.116 af

Subcatchment A4+A5: Runoff Area=31.900 ac Runoff Depth=0.05"
Flow Length=1,700' Tc=49.2 min CN=56 Runoff=0.16 cfs 0.124 af

Reach D2: MAIN DRAINAGE DITCH Inflow=0.31 cfs 0.240 af
Outflow=0.31 cfs 0.240 af

Total Runoff Area = 51.600 ac Runoff Volume = 0.240 af Average Runoff Depth = 0.06"

Subcatchment A3:

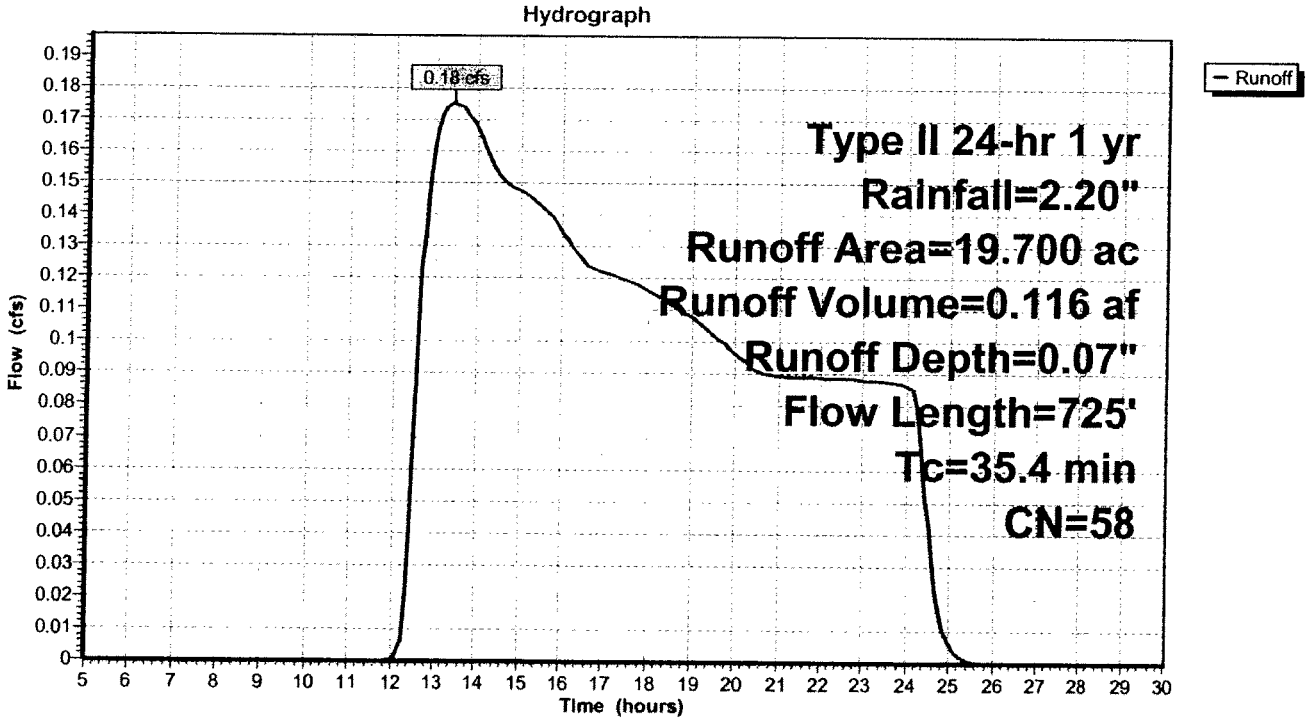
Runoff = 0.18 cfs @ 13.41 hrs, Volume= 0.116 af, Depth= 0.07"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 1 yr Rainfall=2.20"

Area (ac)	CN	Description
19.700	58	Meadow, non-grazed, HSG B

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
27.0	100	0.0050	0.1		**Sheet Flow, R6** Grass: Dense n= 0.240 P2= 2.70"
7.1	450	0.0050	1.1		**Shallow Concentrated Flow, R7** Grassed Waterway Kv= 15.0 fps
1.3	175	0.0050	2.3	9.16	**Channel Flow, R8 (Existing Drainage Lateral)** Area= 4.0 sf Perim= 6.0' r= 0.67' n= 0.035
35.4	725	Total			

Subcatchment A3:



Subcatchment A4+A5:

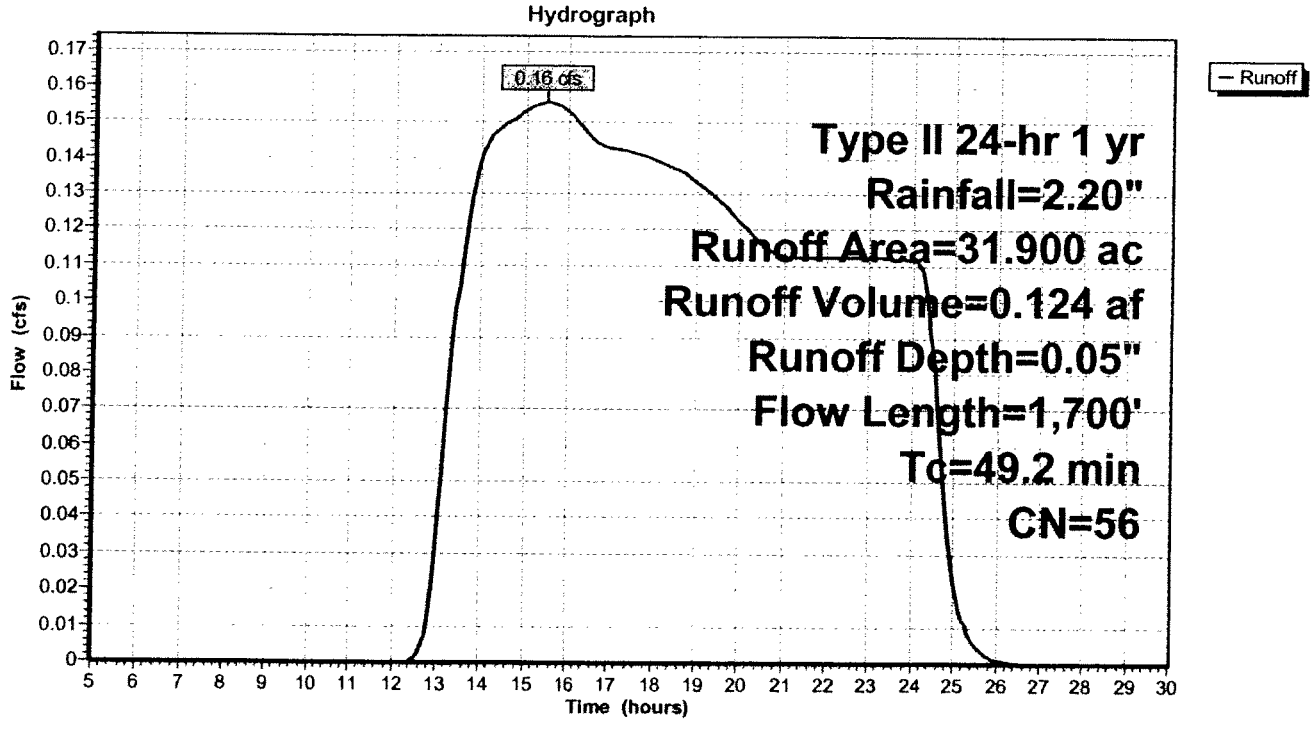
Runoff = 0.16 cfs @ 15.49 hrs, Volume= 0.124 af, Depth= 0.05"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 1 yr Rainfall=2.20"

Area (ac)	CN	Description
18.500	56	Brush, Fair, HSG B
13.400	56	Brush, Fair, HSG B
31.900	56	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.2	100	0.0025	0.2		**Sheet Flow, R9** Fallow n= 0.050 P2= 2.70"
26.7	400	0.0025	0.3		**Shallow Concentrated Flow, R10** Woodland Kv= 5.0 fps
12.3	1,200	0.0025	1.6	6.48	**Channel Flow, R11 (Existing Drainage Lateral)** Area= 4.0 sf Perim= 6.0' r= 0.67' n= 0.035
49.2	1,700	Total			

Subcatchment A4+A5:

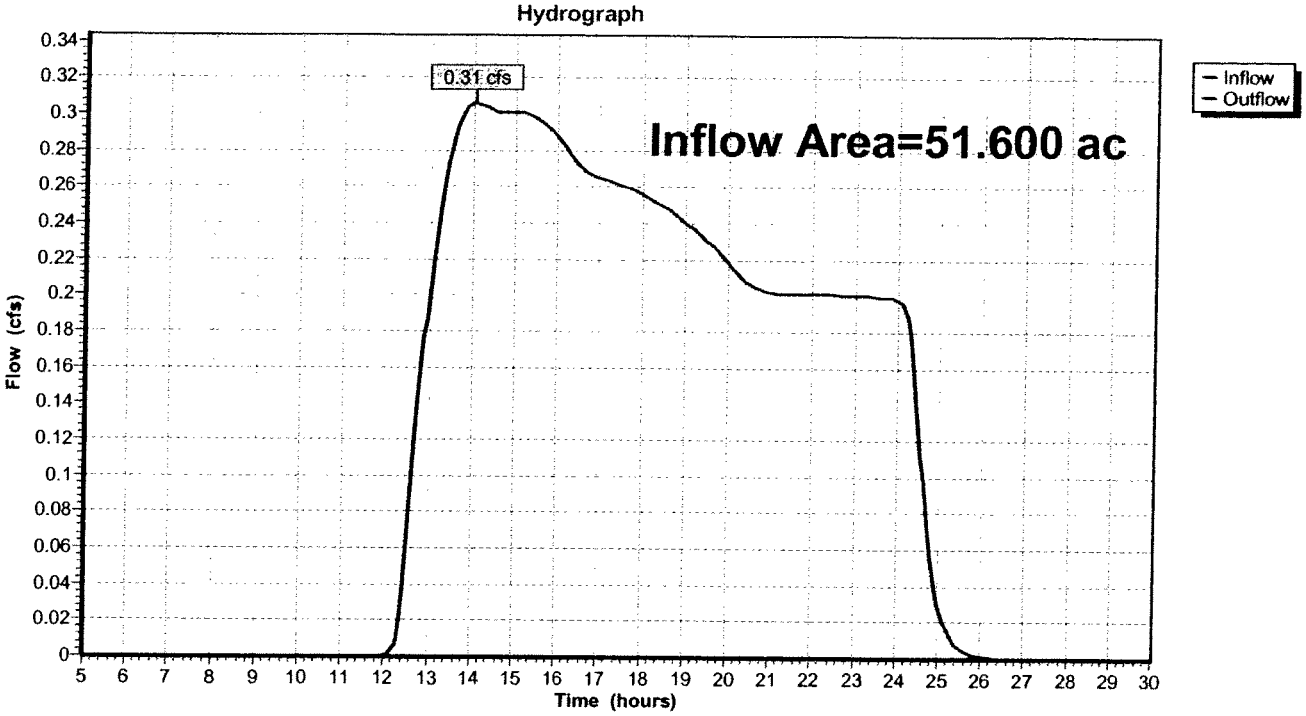


Reach D2: MAIN DRAINAGE DITCH

Inflow Area = 51.600 ac, Inflow Depth = 0.06" for 1 yr event
Inflow = 0.31 cfs @ 14.07 hrs, Volume= 0.240 af
Outflow = 0.31 cfs @ 14.07 hrs, Volume= 0.240 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs

Reach D2: MAIN DRAINAGE DITCH



CHERRIER BROS.
WETLAND RESTORATION

HYDROLOGIC CALCULATIONS
POST-RESTORATION CONDITIONS

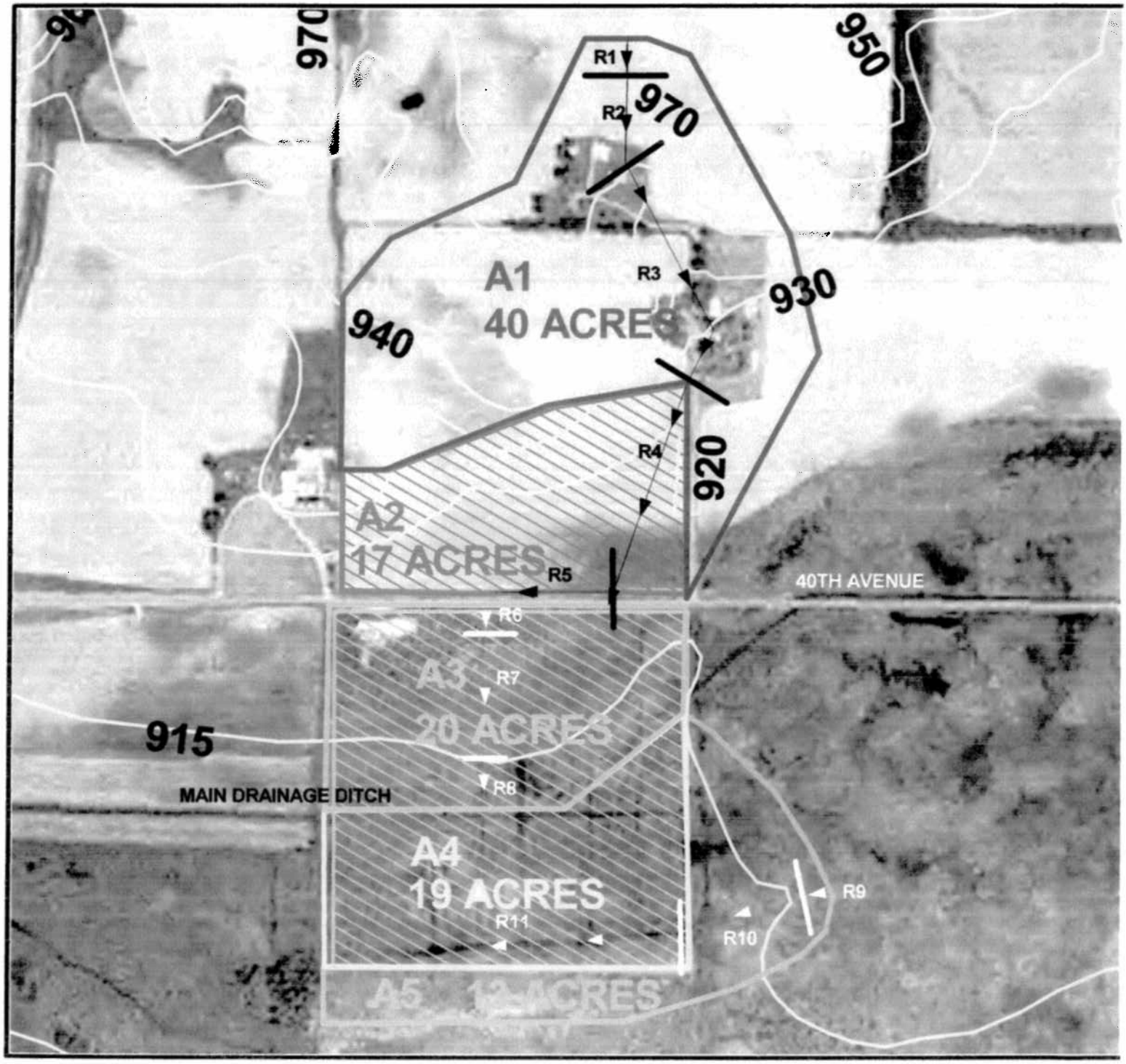
PREPARED BY:

CHIPPEWA COUNTY LAND CONSERVATION DEPARTMENT

FEBRUARY 21, 2005

POST-RESTORATION CONDITIONS NORTH AND SOUTH OF 40TH AVENUE

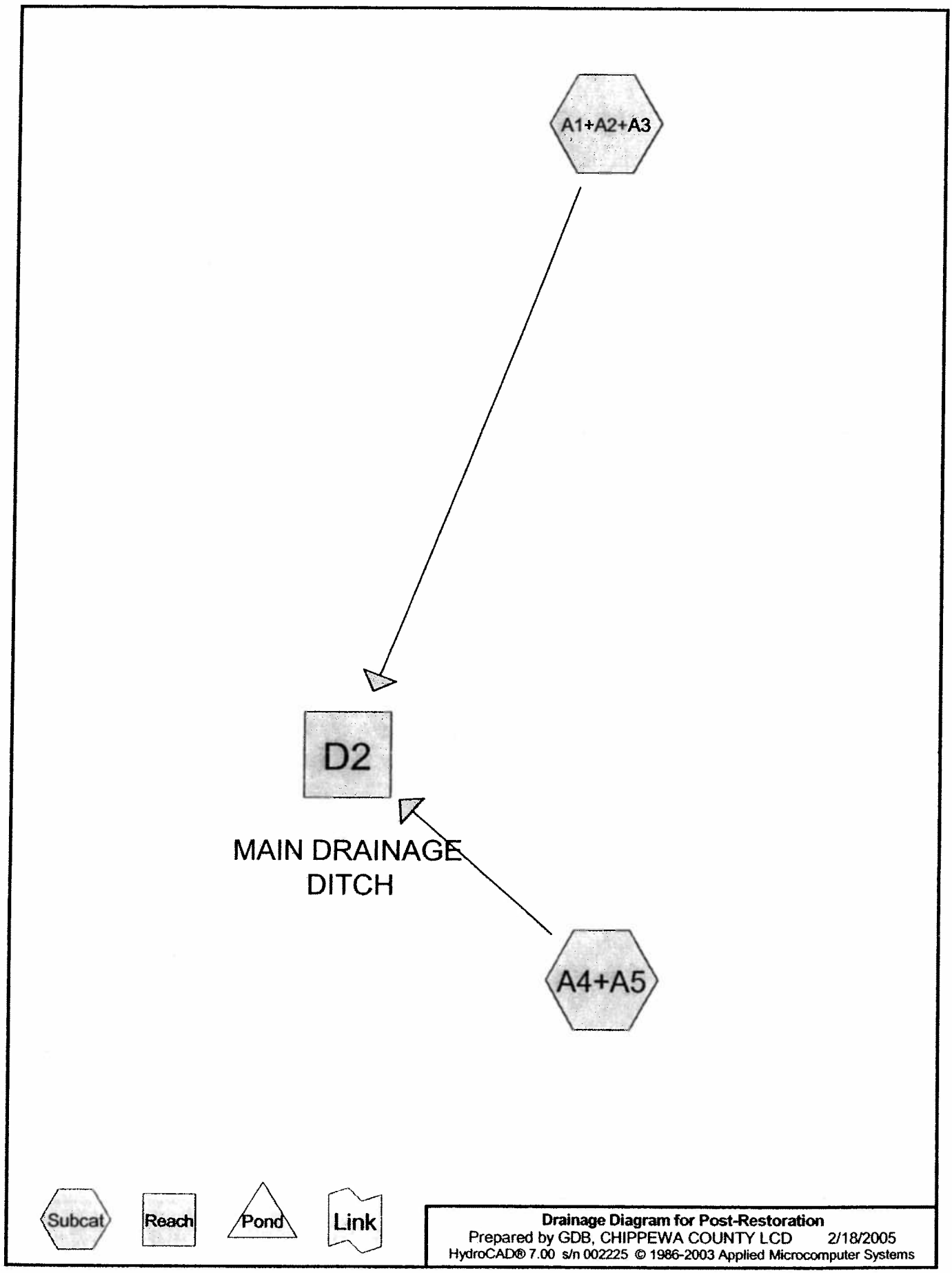
CHERRIER WATERSHED DELINEATION
POST RESTORATION



A1
A2
A3
A4
A5
Contour Lines
N Restoration Area
S Restoration Area

600 0 600 1200 Feet

N



Drainage Diagram for Post-Restoration
Prepared by GDB, CHIPPEWA COUNTY LCD 2/18/2005
HydroCAD® 7.00 s/n 002225 © 1986-2003 Applied Microcomputer Systems

Time span=5.00-30.00 hrs, dt=0.05 hrs, 501 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment A1+A2+A3: Runoff Area=76.100 ac Runoff Depth=0.10"
Flow Length=3,250' Tc=73.1 min CN=60 Runoff=1.07 cfs 0.632 af

Subcatchment A4+A5: Runoff Area=31.900 ac Runoff Depth=0.02"
Flow Length=1,700' Tc=116.9 min CN=53 Runoff=0.07 cfs 0.052 af

Reach D2: MAIN DRAINAGE DITCH Inflow=1.07 cfs 0.684 af
Outflow=1.07 cfs 0.684 af

Total Runoff Area = 108.000 ac Runoff Volume = 0.684 af Average Runoff Depth = 0.08"

Subcatchment A1+A2+A3:

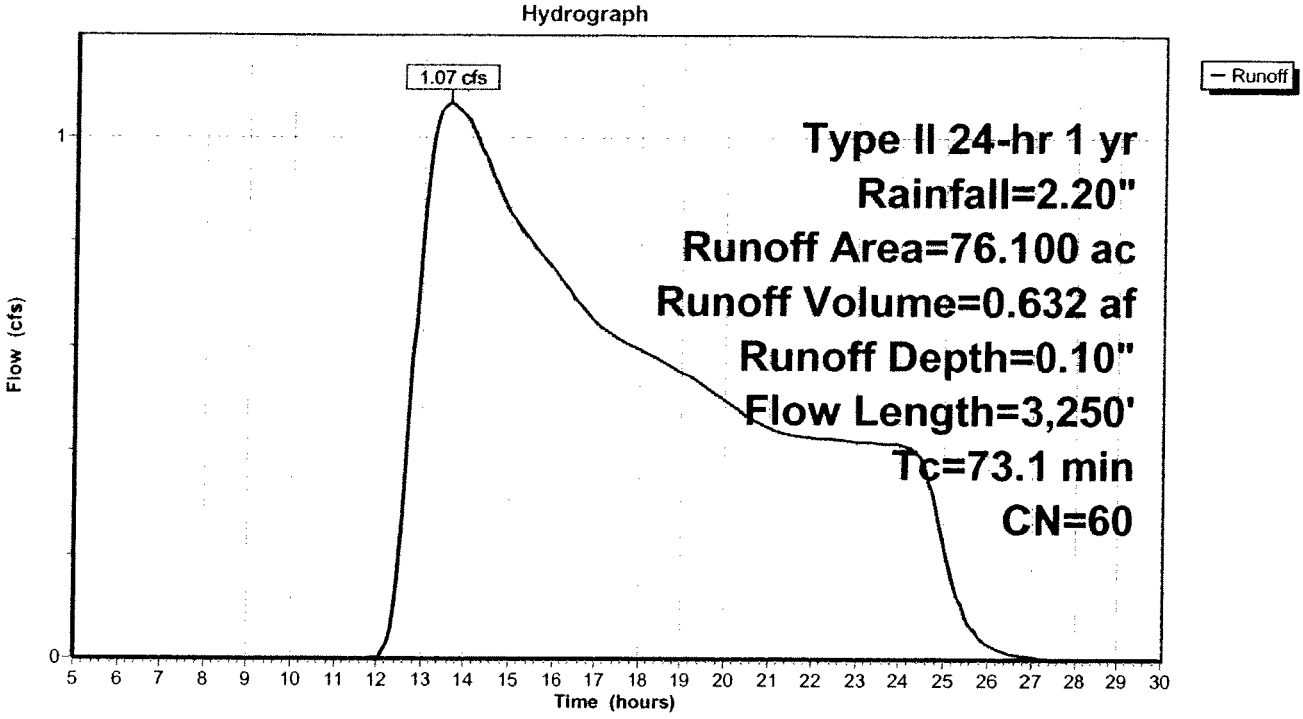
Runoff = 1.07 cfs @ 13.60 hrs, Volume= 0.632 af, Depth= 0.10"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 1 yr Rainfall=2.20"

Area (ac)	CN	Description
39.700	76	Agriculture
16.700	47	Restored Wetland and Buffer
19.700	40	Restored Wetland
76.100	60	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.4	100	0.0300	0.4		**Sheet Flow, R1**
					Cultivated: Residue<=20% n= 0.060 P2= 2.70"
3.5	325	0.0300	1.6		**Shallow Concentrated Flow, R2**
					Cultivated Straight Rows Kv= 9.0 fps
7.3	850	0.0460	1.9		**Shallow Concentrated Flow, R3**
					Cultivated Straight Rows Kv= 9.0 fps
22.5	800	0.0140	0.6		**Shallow Concentrated Flow, R4**
					Woodland Kv= 5.0 fps
1.3	450	0.0050	6.0	143.52	**Channel Flow, R5 (Road Ditch)**
					Area= 24.0 sf Perim= 12.6' r= 1.90' n= 0.027
4.7	100	0.0050	0.4		**Shallow Concentrated Flow, R6 (Spread to break channel flow)**
					Woodland Kv= 5.0 fps
21.2	450	0.0050	0.4		**Shallow Concentrated Flow, R7**
					Woodland Kv= 5.0 fps
8.2	175	0.0050	0.4		**Shallow Concentrated Flow, R8**
					Woodland Kv= 5.0 fps
73.1	3,250	Total			

Subcatchment A1+A2+A3:



Subcatchment A4+A5:

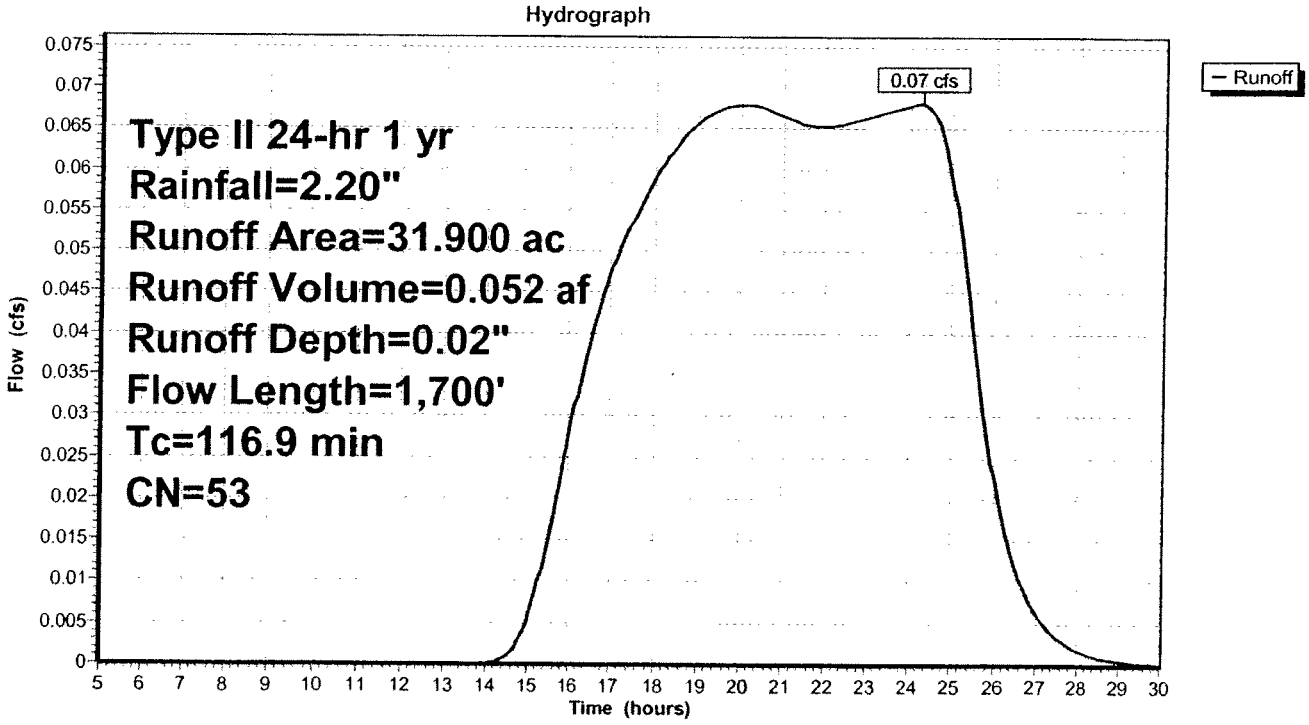
Runoff = 0.07 cfs @ 24.26 hrs, Volume= 0.052 af, Depth= 0.02"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 1 yr Rainfall=2.20"

Area (ac)	CN	Description
18.500	40	Wetland (typical)
13.400	70	Brush (fair)
31.900	53	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.2	100	0.0025	0.2		**Sheet Flow, R9** Fallow n= 0.050 P2= 2.70"
26.7	400	0.0025	0.3		**Shallow Concentrated Flow, R10** Woodland Kv= 5.0 fps
80.0	1,200	0.0025	0.3		**Shallow Concentrated Flow, R11** Woodland Kv= 5.0 fps
116.9	1,700	Total			

Subcatchment A4+A5:



Reach D2: MAIN DRAINAGE DITCH

Inflow Area = 108.000 ac, Inflow Depth = 0.08" for 1 yr event
Inflow = 1.07 cfs @ 13.60 hrs, Volume= 0.684 af
Outflow = 1.07 cfs @ 13.60 hrs, Volume= 0.684 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs

Reach D2: MAIN DRAINAGE DITCH