Best Management Practices to Protect Groundwater at Hine's Emerald Dragonfly Larval Sites in Door County, Wisconsin

Final Report
February 1, 2013

COOPERATIVE AGREEMENT
No. F12AC00153
BETWEEN THE
U.S. FISH AND WILDLIFE SERVICE
AND THE RIDGES SANCTUARY

Submitted by:

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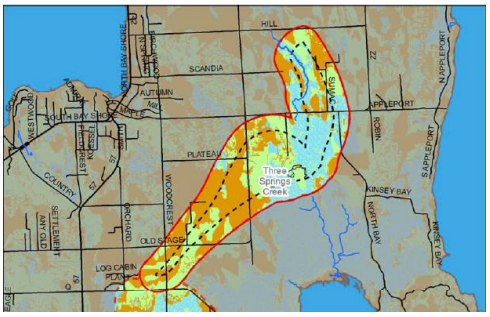
**Photo on cover from The Ridges Sanctuary photo archive*

Introduction

The largest population of federally endangered Hine's emerald dragonfly (HED) exists in Door County due to the extensive coastal wetland habitat on the Peninsula. The HED have a relationship to groundwater sources, as they need calcium-rich, spring-fed wetland for larval development. Protecting existing habitat locations as well as the quality of groundwater supplying these sites is essential for the dragonfly's survival and recovery.

In 2008, the groundwater contribution areas (GCAs) of HED larval wetlands in Door County were delineated the Wisconsin Geological and Natural History Survey (Cobb and Bradbury 2008). The maps produced from this project are instrumental resources for the community. Now with the knowledge of locations of the GCAs and their importance to the protection of groundwater for the HED, best management practices (BMPs) need to be identified for landowners and local government to reconsider Door County activities and potential land use impacts. Providing this information through outreach has the potential to instill a sense of stewardship in the public and encourage landowners and local decision-makers to take an active role in protection of endangered resources.



Map of the Three Springs Creek GCA. *Cobb and Bradbury 2008.* View the HED GCAs on the Door County web map: http://map.co.door.wi.us/map/

The Ridges Sanctuary, Wisconsin's oldest member-based nature preserve and first land trust has some of the best and most extensive HED habitat. Similarly, many other rare species also call The Ridges home, giving rise to the Wisconsin Department of Natural Resources (WDNR) claim that The Ridges is the "most biologically diverse landscape in Wisconsin". Consistent with The Ridges' mission to promote awareness of biodiversity and the importance of protecting rare and threatened species, The Ridges started planning for a new educational interpretive center.

In cooperation with local businesses, The Ridges Sanctuary developed a simple fire ring and drip line to place under fish boils to prevent contamination of the soil and groundwater.

In 2012 during negotiations to purchase the adjacent Sandpiper Restaurant property for the new building site, an environmental investigation of the site revealed that a portion of the kerosene used to fuel fires for fish boils did not burn off and seeped into the ground. Fish boils have been an iconic Door County meal and activity for over 100 years. Kerosene is used to create a flashover for guest appeal. The tradition is a large tourist attraction. On this particular site, the environmental investigation determined that 25 years of fish boils had contaminated 800 tons of soil.

This newly discovered contamination issue compelled The Ridges to start a campaign to build more awareness on how best to protect Door County's groundwater. By mitigating contamination and restoring healthy soils and native vegetation at the new building site, managing storm water using retention and infiltration devices, and working with the community on groundwater protection throughout the watershed, The Ridges will become a model for groundwater protection in the Midwest. The HED BMP project was an opportunity that matched The Ridges' goals and addressed a need for outreach to protect the Hine's emerald critical habitat. This report lays the framework for further outreach to be conducted to satisfy HED BMP project deliverables and The Ridges Sanctuary outreach programs.

Thanks to the volunteers and professionals for their time and assistance in laying the framework for this project. Also, many thanks to the project technical committee for their guidance and collaboration. Committee member agencies include:

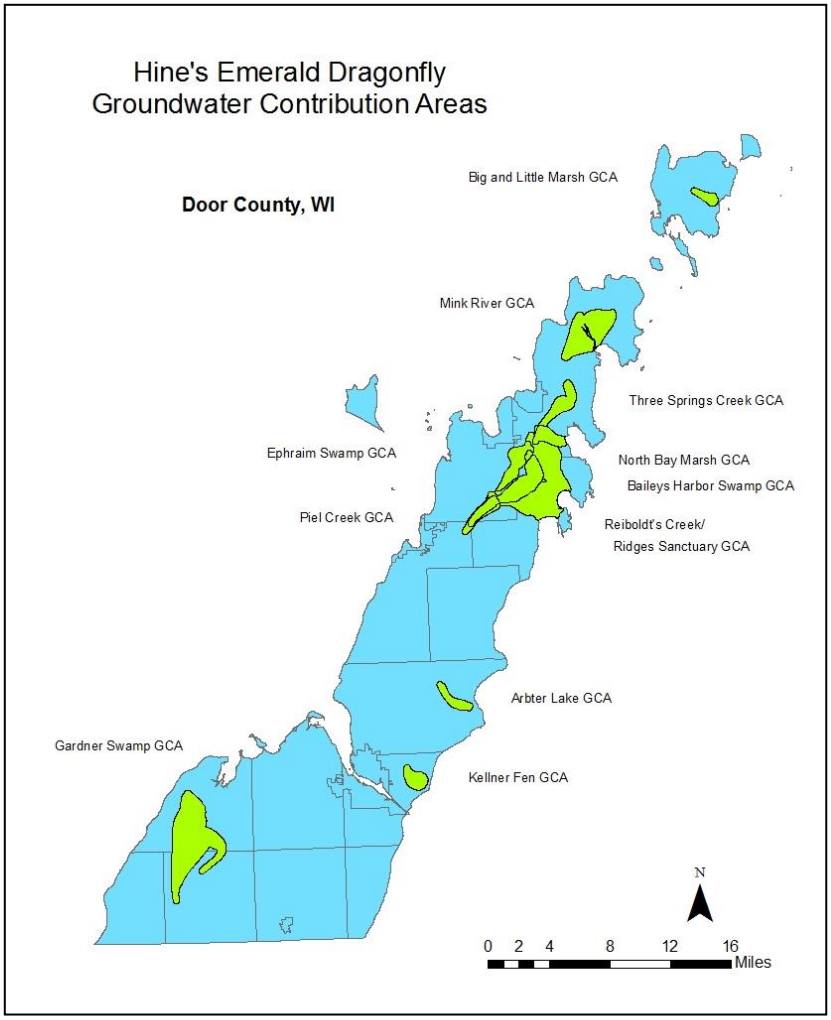
- U.S. Fish and Wildlife Service (USFWS)
- Door County Soil and Water Conservation Department (DCSWCD)
- Wisconsin Department of Natural Resources (WDNR)
- The Nature Conservancy (TNC)
- Door County Planning and Zoning Department (DC Planning)
- Wisconsin Geological and Natural History Survey, University of Wisconsin-Extension (UWEX)
- The Ridges Sanctuary (TRS)

This project serves as a proactive and preventative means to protecting the HED. Protecting the groundwater that supports HED wetlands sites is a Priority 1 task identified in the HED Recovery Plan (USFWS 2001). The project also addresses the following recovery tasks:

- Task No. 1.1.4 Long term watershed and habitat protection
- Task No. 5.1. Encourage private landowners to conserve HEDs
- Task No. 5.2 Inform local and county governments of HED goals; and
- Task No. 5.3 Develop outreach material on HED life history and conservation.

This project was funded by a 2012 Great Lakes Restoration Initiative grant.

Hine's Emerald Dragonfly Life History



The HED (*Somatochlora hineana*) became federally listed as endangered on January 26th, 1995, and is the only dragonfly to be protected under the Federal Endangered Species Act (USFWS 2007). The larvae of the HED require a calcium-rich wetland habitat underlain with dolomite bedrock and sustained water quality. Fragmentation of habitat, destruction of wetland sites, changes in hydrology, and degradation of water quality are causes for the species rarity and loss (USFWS 2001).

Historically the species was found in Ohio, Indiana, and Alabama but now believed to be extirpated from these states (USFWS 2001). Known populations are currently found in Wisconsin, Illinois, Michigan, and Missouri, and the province of Ontario, Canada.

HED in Door County, Wisconsin

The first HED identified in Door County was collected in 1987 in the Mink

River watershed by WDNR Biologist William Smith (Vogt and Cashatt 1990). Several of Door County's Lake Michigan tributaries and coastal wetlands provide the calcium-rich groundwater that enables the HED to flourish in these habitats. Although populations existing in Illinois and Missouri are the most genetically diverse, populations found in Door County, Wisconsin are the largest and have more protected larval habitat (Vogt and Cashatt 1990, 1992; WDNR 1993). Currently there are 11 federally designated critical habitat areas in Door County (USFWS 2007, 2010).

Life Cycle

The life cycle of the HED spans four to five years, with most of this time spent as aquatic larvae. A female lays about 500 eggs in rivulets, small streams connected to seeps, or in small ponds and swales (USFWS 2007). Eggs overwinter in the mud and hatch the following spring coinciding with increased water temperature.

Adult male HED. *Photo by Dan Jackson*

Adults

During a two to six week period as adults, HEDs feed, establishes territories, mate and the females oviposit (lay eggs) (Mierzwa et al. 1995b; Corbet 1962). In the northern range, which includes Wisconsin, adults emerge in late June (this varies depending on temperature and precipitation) and the flight season will last until late August (Mierzwa et al. 1995a, Vogt and Cashatt 1994). Adult male HEDs patrol territories and both sexes forage along narrow corridors, like streams, swales, and tree-bordered roads (Lukes 1993). Distinctive characteristics of adult HED include bright emerald green eyes and large body size, having a length of 60-65 mm (2.4- 2.6 inches) and wing span of 90-95 mm (3.5 -3.7 inches) (USFWS 2007). HED are easily distinguished from other adults in the genus *Somatochlora* by two cream-colored lateral stripes on thorax, distinctive clasping appendages at the end of the abdomen in males, and a distinctive vulvar lamina in females (Williamson 1931).

One, two, three and four year old HED larvae. *Photo by Dan Soluk*

Larvae

Larvae spend four to five years in an aquatic environment during which they molt through four instar stages (Soluk et al 1996, 1998a). They are sit-and-wait predators, feeding on smaller aquatic insect larvae at night (Soluk et al 2000, Johnson 1991). HED larvae take refuge from drought and to overwinter in burrows of the red devil crayfish (*Cambarus diogenes*) (Door County HED workshop 2000; Pintor and Soluk 2006).

Habitat Requirements

To thrive, HED need cool, shallow, slow moving, and mineral rich groundwater-fed wetland habitat (Door County HED workshop 2000). The plant communities associated with this kind of ecosystem may vary, but can include sedge meadows, fens, and wetland with calcareous springs (Door County HED workshop 2000). Occasionally, wetlands are subject to drought for a few weeks in summer but maintain a relatively steady water temperature due to groundwater influence (Door County HED workshop 2000). Adults utilize fields, meadows and forested edges near larval habitat. These corridors provide space for forage, protection, perching and roosting.

Door County provides a highly suitable habitat for HEDs because the seeps and springs associated with the dolomite/dolostone bedrock leaches calcium rich groundwater into wetlands that sustain larvae. However, the karst bedrock is highly fractured and much of it is covered with thin soil. These structural conditions provide ready access to pollutants that can quickly make their way through bedrock to surface springs, contaminating wetland habitat (see 2. Hydrology of Door County below).

Hydrology of the Door Peninsula

The Door Peninsula rests on layers of dolomite rock first formed as sediment within the warm, shallow Silurian sea between 428 and 444 million years ago. Rain and snow-melt water erode the fractured and soluble bedrock made up primarily of calcium magnesium carbonate, forming enlarged fissures and other karst features (Surface Water Inventory of Door County 2000). Characteristics of the bedrock are occasionally visible on the surface of the land as sinkholes, cave openings, swallets, closed depressions, fracture traces, crevices, springs, seeps, and exposed dolomite pavement (refer to Appendix A). These features can act as direct conduits to groundwater sources.

Springs at Three Springs Nature Preserve (HED critical habitat).

In many parts of Door County, glaciation over the last ice age removed much of the material above the bedrock surface. Today, soils are very shallow; 22% of the soil on the Peninsula is less than 18 inches deep, and 17% is between 18 to 46 inches deep (Surface Water Inventory of Door County 2000). Highly fractured bedrock and thin soils can be the equation for significant groundwater contamination.

Door County's natural history, exposure of the Niagara Escarpment, and proximity to Green Bay and Lake Michigan combine to form small but incredibly unique ecosystems including ridge-swale complexes, coastal wetlands, dunes, estuaries, and embayment lakes. Inhabiting these areas are 30 Wisconsin State threatened or endangered plants, and nine animals. In addition to the HED, species with Federal protection include the piping plover (*Charadrius melodus*), dwarf lake iris (*Iris lacustris*), and Pitcher's thistle (or dune thistle, *Cirsium pitcheri*).

Groundwater; A Shared Resource

Knowledge of the "Swiss cheese" bedrock and the wealth of biodiversity that exists in Door County should encourage the evaluation of existing land uses, maintenance, and management that may degrade the quality of our local resources and the upper Lake Michigan basin (Surface Water Inventory of Door County 2000). On the peninsula, the Silurian aquifer supplies groundwater as drinking water and to local ecosystems. A shared resource should be of concern to the public not only for health and human safety and preservation of natural resources, but also to support an important tourism based economy.

Guidelines or best management practices (BMPs) coupled with outreach are needed to protect groundwater sources discharging to wetlands with HED breeding sites and other sensitive habitats. Public awareness, education, and voluntary implementation of BMPs can avoid or minimize groundwater contamination and changes to the natural infiltration processes.

Field Work

The information used in developing the maps showing karst features in the GCAs, was obtained from the Door County Soil and Water Conservation Department (DCSWCD). DCSWCD houses extensive data on previously documented types and locations of karst features throughout Door County (refer to "Maps" below and Appendix A).

Engineered surface water hydrologic connections (e.g., culverts, channels, and ditches) can influence water quality by facilitating erosion and conveying pollution during storm events and spring melt. Other than data of culvert locations within The Ridges Sanctuary watershed and minimal non-digitized information of culverts along county highways maintained by the Door County Highway Department, a comprehensive record of culvert locations and conditions in Door County is lacking.

Unmapped hydrologic connections were field checked as a part of the HED BMP project. With the help of volunteers, The Ridges Sanctuary partnered with the WDNR and TNC in a road-stream crossing inventory. Although designed to assess culvert function and barriers to fish passage, the survey protocol was modified to identify undocumented culvert locations to establish a database within to HED GCAs. This was an opportunity for citizen scientists to utilize technological tools in the field and observe ecosystem connectivity to assess watershed health. Over 320 hours of volunteer and staff time was spent in the field identifying culvert locations documenting man-made surface water channels. Utilizing volunteer efforts aided in educating the public about watersheds and water quality.

The survey results indicated that culvert locations did not have much significance when plotted with the GCAs using Geographic Information Systems (GIS). Because the GCAs are generally more inland areas of the county, culvert function may be for drainage systems during spring melt. Culverts may convey some surface flow from one area to another before infiltration in the GCAs, but their overall significance to large scale impacts on groundwater in the GCAs is questionable. Also, the data on all culvert locations is incomplete and therefore conclusions on the scale of their impact in the GCAs cannot be determined.

Culvert impact may have some relevancy in affecting HED wetland habitat in facilitating flow through HED critical habitat areas. A map of the culvert locations in the Reiboldts Creek and Ridges Sanctuary HED GCA (including critical habitat) can be found in Appendix C.

Maps

Four sets of maps were developed for the HED BMP project and are included in this report. The maps show the HED GCAs developed by Cobb and Bradbury (2008) and include data representing potential, natural, man-made, and land use activity influences. Project maps consist of the following:

- HED GCAs with Karst Features and Closed Depression Capture Zones (Appendix A)
- HED GCAs among Watersheds and Subwatersheds (Appendix B)
- Culvert Locations in HED GCAs (Appendix C)
- Land Uses in HED GCAs (Appendix D)

Notes:

- *Groundwater contribution area data is from Cobb and Bradbury (2008). Read the report and view the GCA maps with groundwater recharge potential: www.ridgessanctuary.org/aboutus/preservation/HED/cobbandbradbury2008*
- *All maps were created by Marne Kaeske, using 2011 orthogonal photos, color, 1 foot pixel resolution; Pictometry International Corp.*
- *All maps are scaled in miles. 1 mile = 1.609 kilometers*

Framework Used to Develop BMPs and Design Outreach Approach

Guidance from HED BMP Technical Committee

To discuss potential threats and areas of interest meetings were conducted with the HED BMP technical committee to gather information, identify gaps within existing regulatory programs, discuss opportunities within community interest, and target audiences for outreach purposes.

Review of Existing Regulations and Programs

Some examples of state regulations that apply to land use, resources, and protections in the Door County HED GCAs are:

- Runoff Management under NR 151 identifies standards for non-agricultural activities generating runoff pollution.
- Wisconsin's Shoreland Protection Program, NR 115, regulates the zoning to reduce impacts along lakes streams, and wetlands.
- Door County is a sensitive area identified under NR 812, *Well Construction and Pump Instillation*. Most private wells in Door county have casing requirements of 170 feet deep to provide protection for the drinking water in the fractured dolomite.

Concern over the historical occurrence of water contamination in Door County has led to the development of governmental rules to protect water quality. Examples of such rules are noted below:

- Chapter 21of the Door County Sanitation Code sets minimum standards for criteria including design, instillation, inspection and management of Private Onsite Wastewater Treatment Systems (POWTS).
- The DCSWCD has established criteria for urban storm water runoff control design. *Construction Site Erosion Control and Post Construction Storm water Policy Procedure* is consistent with NR 151, but intended to protect runoff conditions affecting or magnified by karst features.
- The DCSWCD enforces Chapter 23, *Agriculture Performance Standards and Animal Waste Storage Ordinance*, to promote public health and safety.
- Setbacks to shorelines, wetlands, rock holes, and escarpment are sited in Chapter 5, the *Natural Features* protection requirements chapter of the Door County Zoning Ordinance.

Identifying Current Land Use

The top land uses within each HED GCAs directed selection of BMPs to include in this project. For further information on HED GCA landscapes and land use percentages refer to Appendix E. Maps of land use distribution in each HED GCA can be found in Appendix D.

Communicating Community Interest

Initial communications with town boards, planning commissions and special interest groups to communicate interest and to build relationships during project planning is reflected in the included BMPs. Likewise, some BMPs included within are also based on partnership opportunities with special interest groups for support and reach more people. Comprehensive plans developed by each town provided guidance for assessing community interest within the HED GCAs and likelihood of BMP incorporation. Smart Growth plan objectives consistent with the BMPs, previous community accomplishments satisfying HED BMPs, and identification of local stakeholders are discussed in *Land Use and Community Information for Door County HED GCAs* (Appendix E).

BMPs Identified to Protect Groundwater in the HED GCAs

Eliminate Pesticide and Synthetic Fertilizer Usage on Residential Lawns, Public Spaces and Recreational Fields

Pesticides are commonly used to control weeds and bugs in crop fields, orchards, and golf courses. Pesticides are also available to private landowners to support lush green and manicured lawns. However, these uses are not regulated and unknown amounts and types of pesticides may be used in "weed and feed" mixes and applied by hired companies in "seasonal treatments."

Make your lawn *Safe to Play*.

With Door County's shallow soils, pesticides and synthetic fertilizers applied to lawns can quickly be carried into the groundwater and drinking water sources. In addition, these substances can be harmful to the health of children, pets and wildlife through exposure in the environment.

How to:

- Plant a mixture of grass seed to develop a diverse lawn. Include species that prefer cooler conditions for spring and fall, and some preferring dry hot conditions. Make seed selection to address impacts from foot traffic tolerance to sun and shade conditions.
- Mow high. Set your blade to 2.5" or 3"above the ground. Taller grass has healthier roots. This will result in thicker turf that is more resistant to drought.
- Let it lie. Grass clippings are local, organic, and free fertilizers.
- Consider alternatives to traditional "lawns" (e.g., artistic, organic or edible yards). Reduce your lawn burden and expand your garden.
- Many Door County landscapers offer organic and pesticide-free fertilizers. Inquire about alternative services.

For more information, check out *Safe Lawns in Door County*, a local special interest resource: www.doorpropertyowners.org/safe-lawns-in-door-county

Maintain Private Onsite Wastewater Treatment Systems (POWTS)

GCA locations for HED habitat generally include rural lands where POWTS are the norm for handling waste water. Door County requires POWTS inspections every three years. However, maintenance and awareness can prolong the life and function of POWTS.

Septic failure or flooded drain fields result in smelly and costly messes. Furthermore, they can spread disease and contaminate well and groundwater. Maintenance and upkeep will protect your water and wallet.

How to:

- Check or clean the effluent filter one to three times a year.
- If you are in the market for a new POWTS, consider keeping it small. Smaller systems will have potentially smaller problems and cost less to maintain.
- Reduce waste water volume: fix plumbing leaks and consider up-grading to water saving toilets or wash machines.
- Don't hook up garbage disposals to mound or in-ground systems; food particles can plug the filters and clog the drainfield.
- Protect the drain field from damage to pipes: keep it clear of driving paths, and large tree roots.
- Watch for early warning signs: water pooling at your ankles in the shower, you sense an occasional sewage smell, or soggy soil above drain field.
- Be aware and get your flushes worth!

Learn the ins and outs of your POWTS:
http://learningstore.uwex.edu/Assets/pdfs/B3583.pdf

Peil Sanitation, Baileys Harbor, WI

Protect Exposed Bedrock

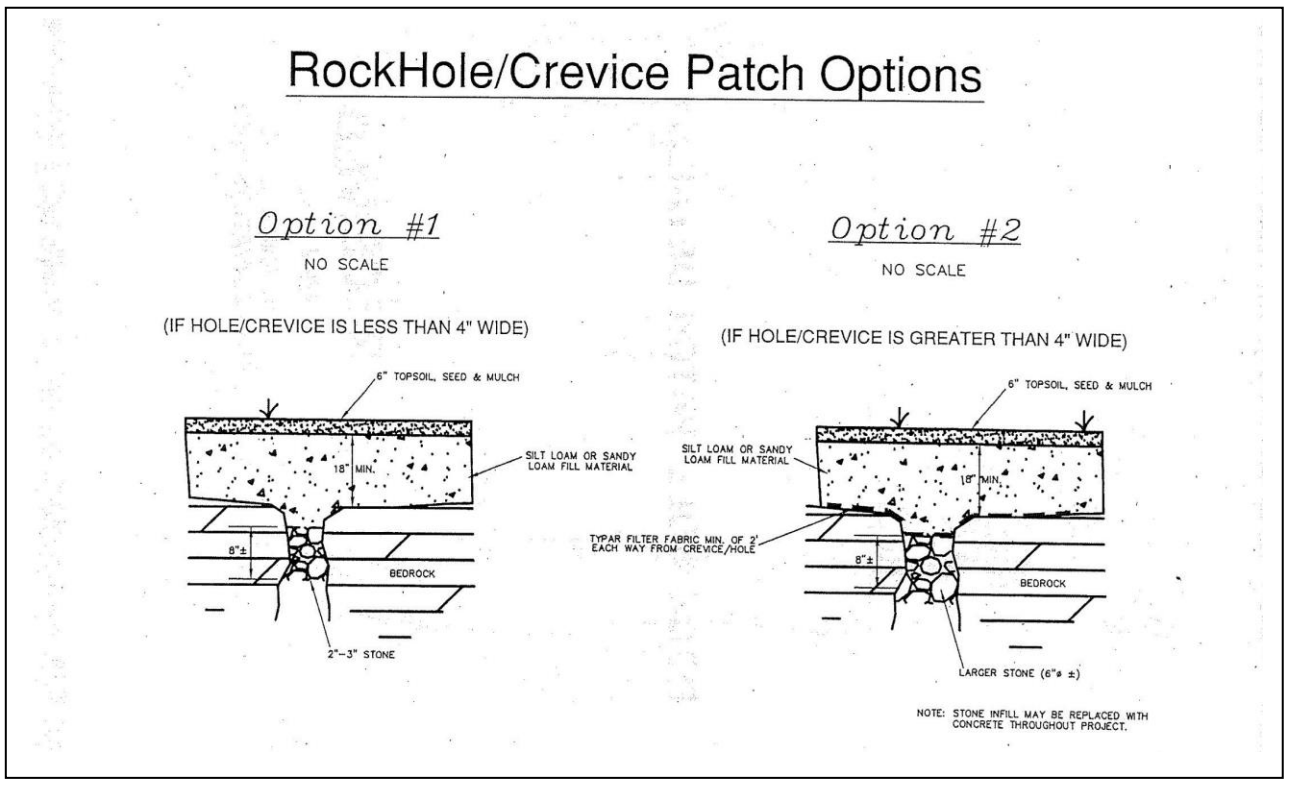
In parts of Door County the bedrock is highly fractured and covered with little soil. Karst features like cracks, fissures and sinkholes are direct conduits to groundwater. They provide access for pollutants to reach our well water and HED habitat.

Areas adjacent to exposed bedrock and closed depressions (low spots in the terrain, usually lying over cracked bedrock) should be treated as riparian (shoreline) areas around surface waters. Activities such as (but not limited to) tilling, spraying, grazing, manure spreading or development have the potential to negatively impact groundwater resources.

Sinkholes can be stabilized to minimize erosion and groundwater contamination. *Photo by DCSWCD*

How to:

- Clean out sinkholes historically used as dump sites.
- Setback activities like pasturing, development or landscaping 75 feet from karst features.
- Establish buffer areas over 75 feet wide surrounding karst features to filter any water entering bedrock by planting native vegetation.
- To avoid potential exposed karst feature enlargement, use DCSWCD's patching options (below or view online at: www.ridgessanctuary.org/aboutus/preservation/HED/SWCDrockholepatchoptions).
- Be a community model! Contact The Ridges Sanctuary if you are interested in assistance with cleaning out, patching, or creating a buffer around sinkholes on your property.



Properly Dispose of Pharmaceuticals and Hazardous Waste

Door County hosts a Household Hazardous Waste Collection Program. *Photo by Door County HHW recycling program*

In the past, the public was advised to flush unused prescription drugs down the toilet. Likewise, dumping old gas/oil mixes into a fallow field was a common practice. However waste that doesn't break down organically can persist in the environment. Cleaning solvents, petroleum products, mercury-containing equipment, hormones and antibiotics are all examples of pollutants that have been found to enter the ground and surface watersheds.

Door County citizens should be concerned about the environmental health of the larger Lake Michigan basin, impacts to the local fishery, and the contents of their drinking water. Extra precautions should be taken to make sure hazardous waste makes an appropriate exit.

How to:

- Don't flush pharmaceuticals down the toilet; take them to the Door County Sheriff's Office.
- Don't put household hazardous waste in the trash; take them to a "Door County Household Hazardous Waste Collection".
- Capture excess kerosene used in fish boils to prevent it from contaminating nearby soils and filtering into the groundwater.

Find when, where and how to drop your old and unused pharmaceuticals:
http://doorcountysheriff.homestead.com/files/Press_Release_Prescription_Drug_Drop_Off.pdf
Check the Door County "Events" page to find the next Household Hazardous Waste Drop-Off:
http://www.co.door.wi.gov/events.asp?locid=137

Follow Manure Application Standards

Nutrients cannot be incorporated into frozen soil; spring rains and snow melt can cause runoff into waterways.

Applying manure to agricultural fields is a cost effective and sustainable practice. It is a beneficial fertilizer with many agricultural and economic advantages.

However, there are environmental concerns with manure runoff entering local surface waters. Phosphorus nutrient loading leached from fertilizers adds to *Cladophora* (algae) blooms on Lake Michigan shorelines. Likewise, nitrogen can escape into the groundwater as nitrate which can cause health problems for humans if ingested at high levels. Given the potential to cause harm to our surface and groundwater, it is prudent for Door County citizens to adhere to manure land application standards.

How to:

- Manure and organic by-products should not be applied on frozen or snow covered grounds.
- Manure and organic by-products shall not be applied within 75 feet of surface water.
- Manure and organic by-products shall not be applied within 75 feet of exposed bedrock.
- Manure and organic by-products shall not be applied unless incorporated within 72 hours.

Learn more about the benefits and precautions of manure as a soil amendment:
http://learningstore.uwex.edu/Assets/pdfs/A3392.pdf

Develop and Implement a Storm Water Management Plan to Control Erosion on Construction Sites

During construction top soil is removed. Heavy rains can erode the bare soil and carry it away with any near-by pollutants. Developing and implementing storm water management plans that include the use of building pads can alleviate the threat of contaminating surrounding surface and groundwater.

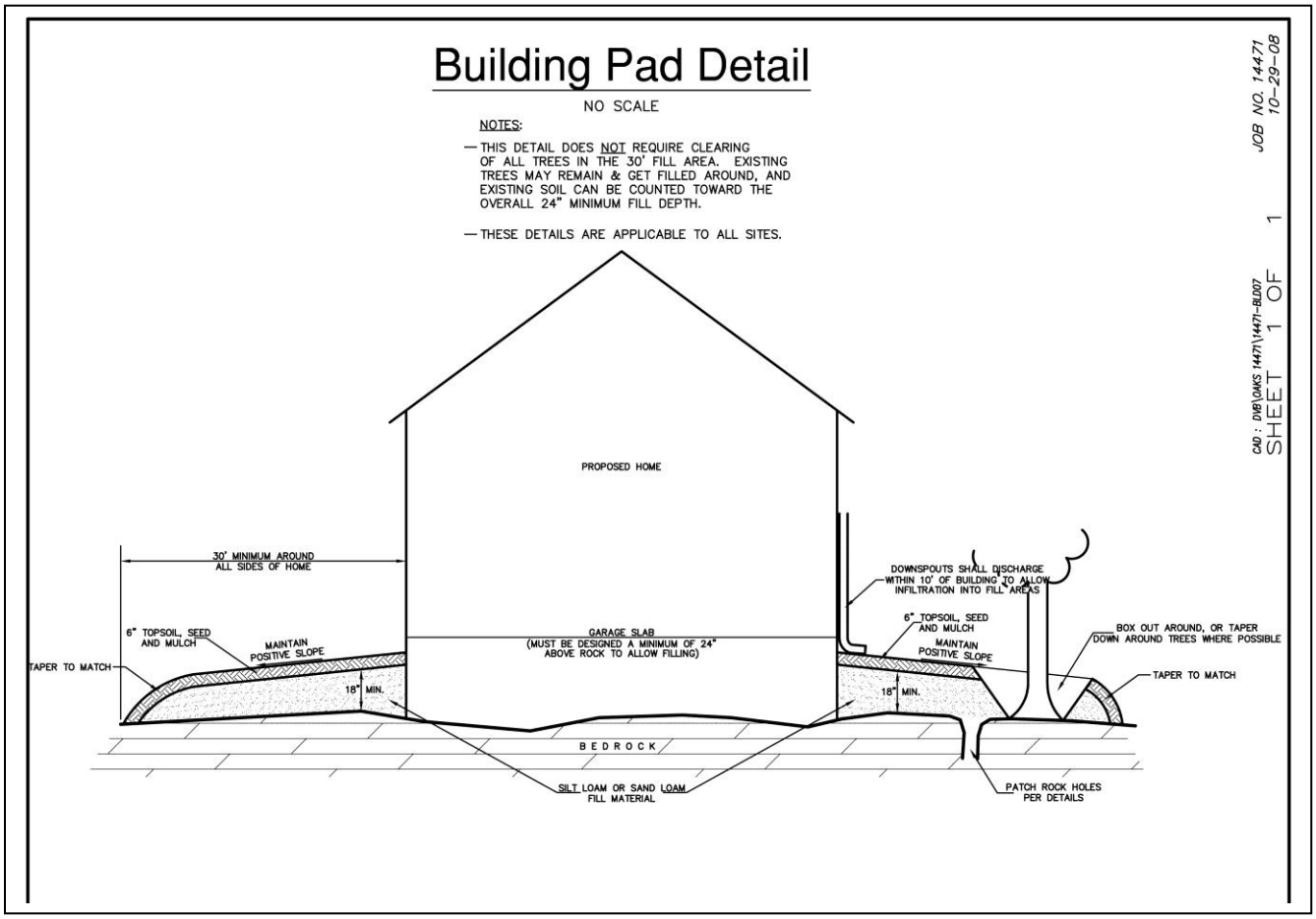
A storm water management plan is required by the WDNR if land disturbance is over one acre in size. Having a storm water management plan on *any size* project is a preventative measure that will help protect ground and surface waters.

Building pads that filter storm water blend into the landscape after construction, as green space or heavy mulch cover. *Photo by DCSWCD*

How to:

- Implement erosion and stabilization or sediment control practices consistent with WDNR storm water construction technical standards: http://dnr.wi.gov/topic/Stormwater/standards/const_standards.html

- Use DCSWCD's construction pad design for your project (below or view online at: www.ridgessanctuary.org/aboutus/preservation/HED/SWCDbuildingpaddetail).



Install Storm Water Infiltration Systems to Mitigate Impervious Surface Runoff

Impervious surfaces can facilitate the movement of a considerable amount of water during storm event and displace pollutants with it. This water can change natural infiltration regimes, degrade the quality of shoreline beaches, create mosquito breeding habitat, or erode top soils. Simple, low maintenance retention and infiltration devices can mitigate the negative impacts of storm water.

Storm water mitigation systems can also fit into existing landscaping and work in tandem with the artistic design of your yard or business.

Bioswales are planned for storm water mitigation at The Ridges Sanctuary's new interpretive center (dark green areas).

How to:

- Establish a low-maintenance rain garden with native vegetation to infiltrate storm water from downspouts or in low areas.
- Install French drains (or a sub-drain) to infiltrate storm water or convey storm water away (underground) from building foundations.
- Install vegetated swales to convey and enhance storm water infiltration around larger impervious areas like parking lots.

Learn design criteria, standards and specifications for storm water infiltration systems:

WDNR Storm Water Technical Standards
http://dnr.wi.gov/topic/Stormwater/standards/postconst_standards.html

UWEX Rain Garden Manual
http://clean-water.uwex.edu/pubs/pdf/rgmanual.pdf

Vegetated Infiltration Swale
http://dnr.wi.gov/topic/Stormwater/documents/Interim_Infiltration_Swale_1005.pdf


French drains convey rain water from rooftop gutters into the ground.

Promote Conservation Practices to Support Increasing Environmental Awareness and Demand for Green Tourism

Door County's strong tourist economy offers an opportunity to educate our visitors on protecting water resources and endangered species such as the HED. Our green space and scenic water frontage are some of the main reasons tourists visit the Peninsula. Demonstrating that local businesses are taking steps to conserve water and safeguard its quality will persuade patrons to do the same and encourage their return. In fact, many visitors plan their vacations around leaving little or no foot print and seek out *Travel Green* certified Door County businesses.

Encourage visitors to consider the impacts of daily actions.

How to:

- Urge guests to reuse towels and sheets to conserve laundry water.
- Obtain *Travel Green* certification for your business and highlight your water conservation and wastewater management efforts: http://www.travelwisconsin.com/wisconsin/Travel-Green
- Offer information on Door County groundwater and the HED in rooms and visitor information centers.

Learn what simple reading material is available for visitors:

Protect the Water You Drink
http://map.co.door.wi.us/swcd/DoorCoKarst%20(2).pdf

Groundwater and the Hine's Emerald Dragonfly in Door County
http://map.co.door.wi.us/swcd/HED-fly/GW_Hines%20brochure%20.pdf

Protecting Groundwater in Door County
www.ridgessanctuary.org/aboutus/preservation/HED/HEDBMPbrochure

Look for the *Travel Green Wisconsin* logo at participating Door County businesses. *WI Dept. of Tourism*

Protect Groundwater from the Impacts of Development with Conservation Easements

Washington Island landowners discuss conservation easements with Terrie Cooper (Door County Land Trust).

Reserving natural space from development is an important tool in land and resource protection. Door County's rural and green space plays a role in expressing our cultural heritage and supports numerous economic and ecological factors.

Conservation organizations and governmental bodies like The Ridges Sanctuary, Door County Land Trust (DCLT), Door County Parks, TNC, WDNR, and local governments are instrumental in reducing our local footprint now and forever. The DCLT can assist landowners in erecting easements on private property.

How to:

- Work with the DCLT to develop a conservation easement for your land. Landowners retain ownership while future development is permanently restricted. Information on the DCLT can be obtained from: http://www.doorcountylandtrust.org

- Consider donating your land for natural resource protection. Door County conservation organizations and local government bodies will accept donations of land that possess high quality value such as habitat supporting the HED.

Use Door County *Greenprint* to Guide Development in Protection of Areas Crucial for HED Recovery

Door County Greenprint is a virtual resource (found on the web) that combines scientific data with conservation goals which can assist local policy makers in strategic planning and guide local development businesses in protecting natural resources. It is a program utilizing a framework to identify locations of highest concern for environmental protection.

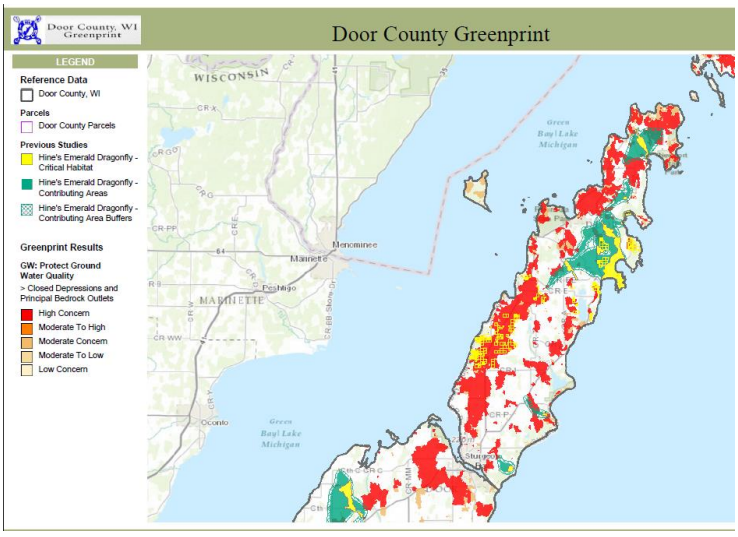
The software and modeling process was developed by the national non-profit conservation organization *The Trust for Public Land*. "Greenprinting" is used in over 50 locations across the United States but the *Door County Greenprint* project was the first in Wisconsin. The goals, weight and overlay data regarding resource sensitivity is designed by a technical committee of local natural resource managers, making it a program specific to land use in Door County.

Protection of the HED groundwater contribution areas (GCA) have been added to the *Door County Greenprint* as an overlay under "Previous Studies". Using *Door County Greenprint* can assist with planning development in a manner that protects the HED and the groundwater resources crucial to maintaining its wetland habitat.

How to:

- Learn how to use *Door County Greenprint* in the self-guided training tool.
- Use *Door County Greenprint* to identify steps in building process (e.g., permits needed if in areas of concern).

Plan development and land use while protecting sensitive Door County resources:
http://tplgis.org/DoorCounty_Greenprint/



Use *Door County Greenprint* to guide development while protecting groundwater.

A Groundwater Protection Zoning Overlay Model Ordinance

The locations supplying groundwater to HED larval wetlands were delineated by Cobb and Bradbury (2008). The maps produced from the project are instrumental in conveying the opportunity for residents and local governments to protect endangered resources.

A groundwater protection zoning overlay model ordinance is included in Appendix F. The model ordinance is a resource for local governments to use as a regulatory measure to help protect the HED and the groundwater essential for its survival.

Notes:

- *Enforcement is not included within the model ordinance and is left to the discretion of the town to designate.*
- *For those towns without county zoning, this ordinance may be adopted as a "Groundwater Protection Ordinance".*

Voluntary Implementation of BMPs

This report presents an initial set of BMPs that will be promoted through education and outreach to landowners, local governments, special interest groups and stakeholders. The BMPs presented here are resources for the Door County community to be stewards in protection of local endangered resources.

Although the BMPs are targeted for proactive and preventative protection of groundwater in the almost 23,000 acres of HED GCAs, they can be applied anywhere in Door County. Protection of the groundwater in the GCAs will help insure that the wetlands that the HED depend on are maintained as high quality wetlands. As a shared resource, protection of groundwater also protects drinking water sources and the overall water quality of the surrounding Lake Michigan basin.

Due to the voluntary nature and purpose of the project, BMP implementation will be based on land use and is ultimately dependent on landowner or business interest. As an example, GCAs including a large number of residential homes might consider adopting additional in-home water conservation practices and more awareness and diligence of septic system maintenance.

Parties interested in implementing BMPs are encouraged to contact The Ridges Sanctuary for further guidance and resources. The HED BMP project objectives fulfilled by The Ridges Sanctuary and will continue to be a focus of The Ridges *Landowner Stewardship* outreach program. The Ridges Sanctuary will continue to educate the importance of groundwater protection in Door County through a new educational interpretive center that is currently under development.

Guidance and Assistance from Resource Agencies, Organizations, and Volunteers

Many partnering organizations were instrumental in the development of this project. Various discussions, meetings, phone calls and e-mails were coordinated with individuals to obtain information and guidance in planning throughout the project period. The Ridges Sanctuary wishes to acknowledge the following individuals for their efforts and support on behalf of the HED and assistance in this project:

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Dick Weidman, UWEX (retired)
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  http://map.co.door.wi.us/map/
- Groundwater Protection Model Ordinance Resources
  http://water.epa.gov/polwaste/nps/mol7.cfm#groundwater
- SafeLawns (National umbrella)
  http://www.safelawns.org
- Safe Lawns in Door County (Local special interest group)
  http://www.doorpropertyowners.org/safe-lawns-in-door-county
- The Ridges Sanctuary
  http://www.ridgessanctuary.org
- Storm Water Construction Technical Standards
  http://dnr.wi.gov/topic/Stormwater/standards/const_standards.html

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Outreach Materials

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