Calcareous Fens

What, Where, Why, How?

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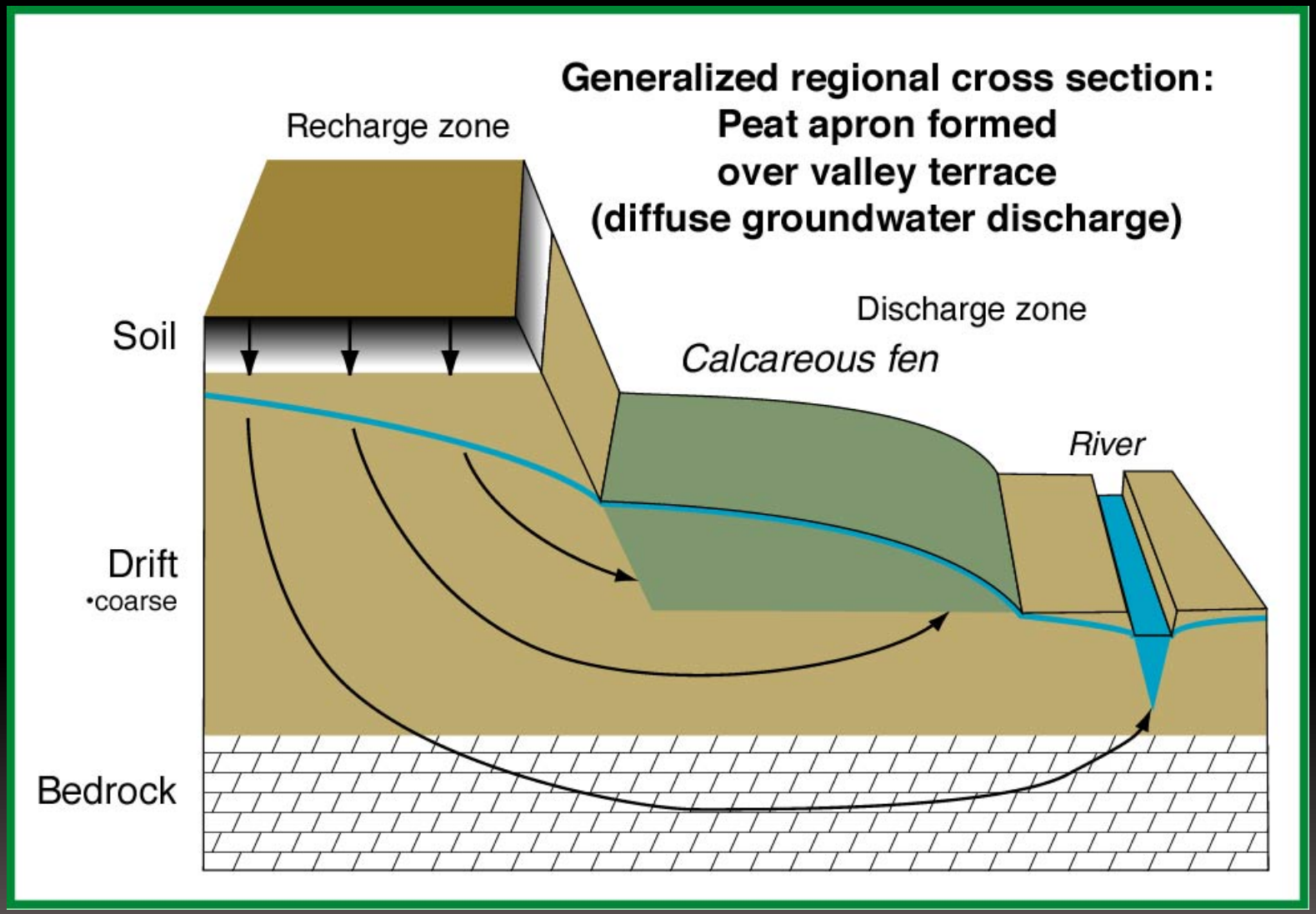
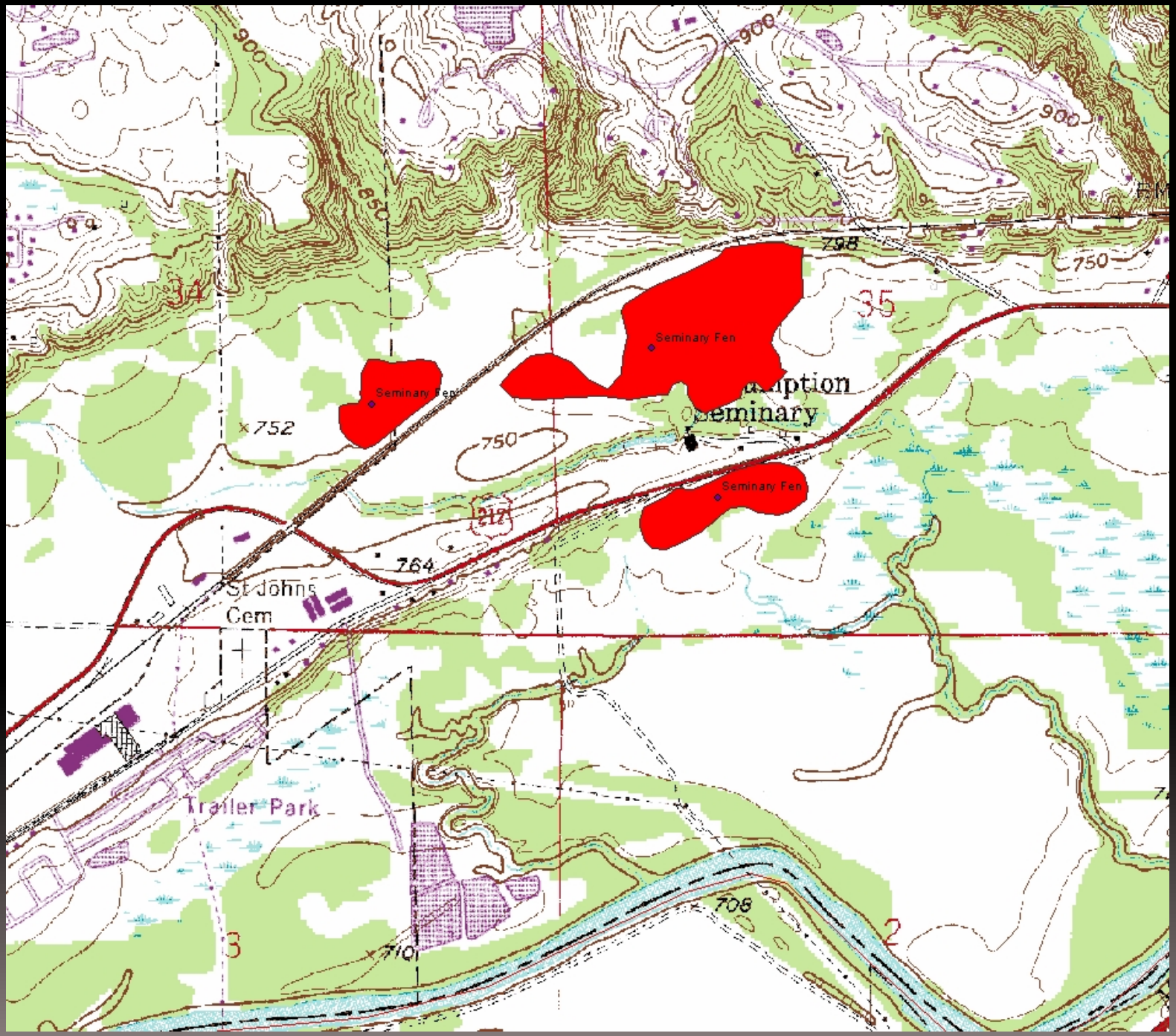
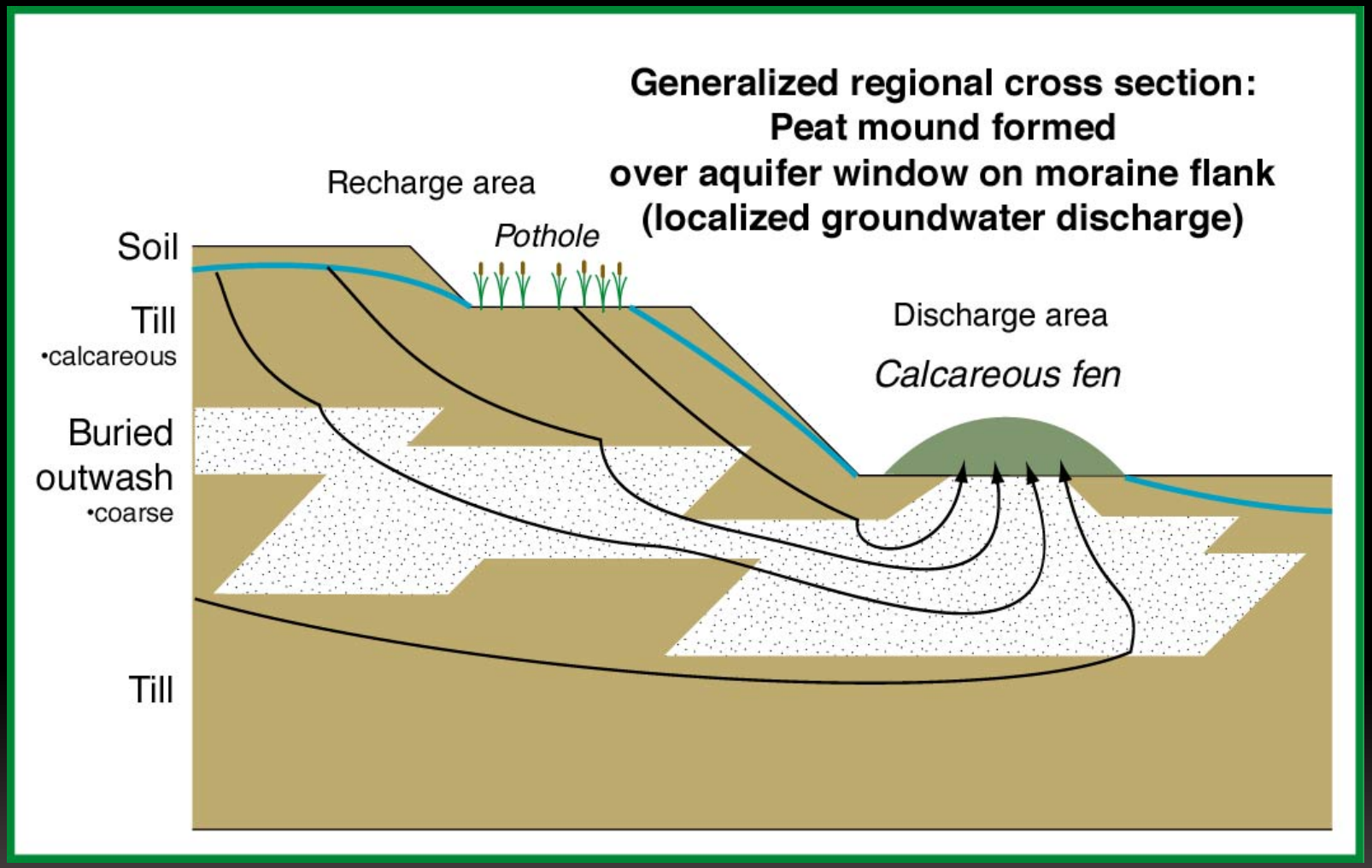
Minn. Department of Natural Resources
Ecological and Water Resources Div.

"A calcareous fen is a peat-accumulating wetland dominated by distinct groundwater inflows having specific chemical characteristics. The water is characterized as circumneutral to alkaline, with high concentrations of calcium and low dissolved oxygen content. The chemistry provides an environment for specific and often rare hydrophytic plants."

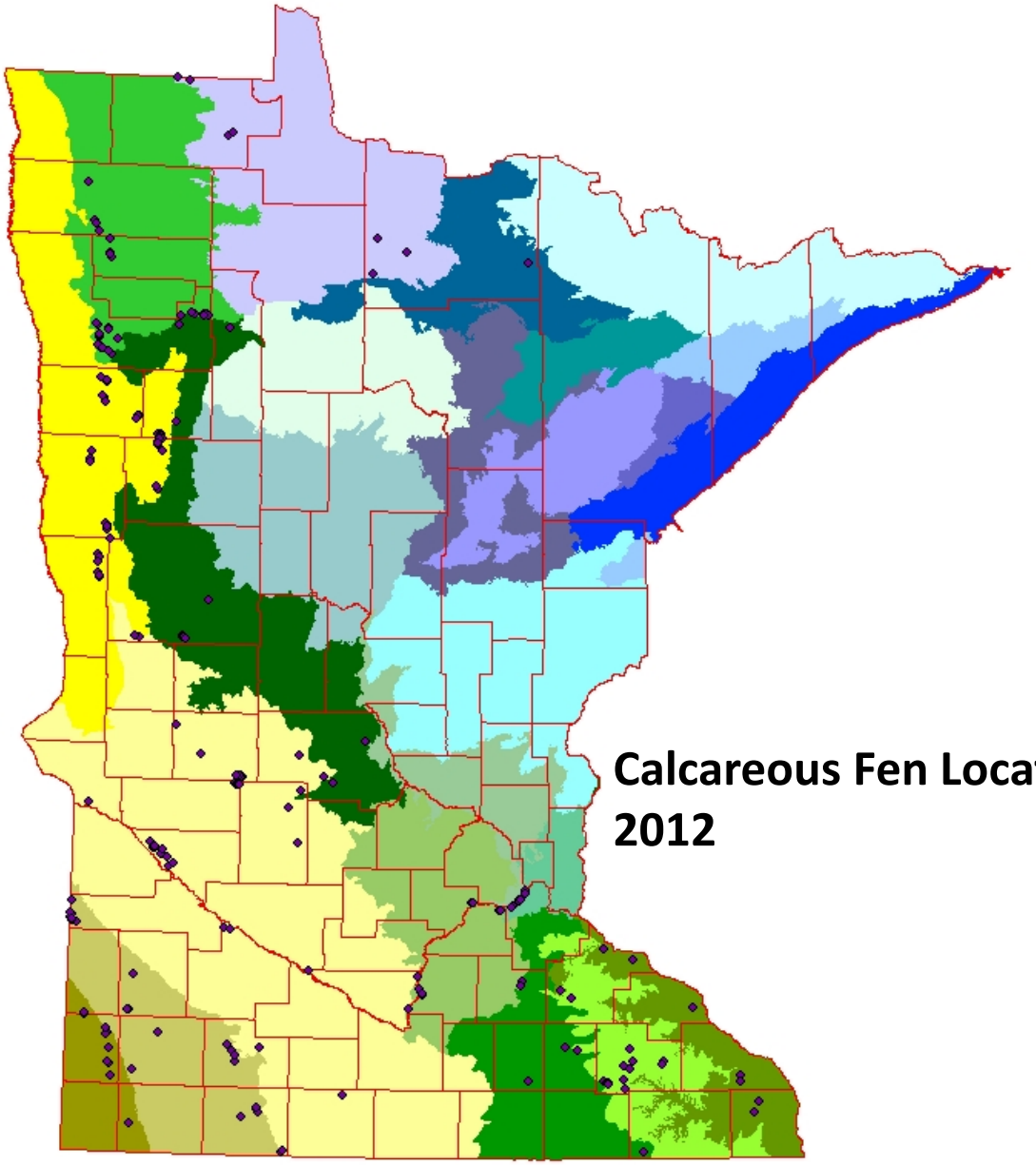
- Minn. Rules Ch. 8420.0935, Subp. 2


Generalized regional cross section:
Peat apron formed
over valley terrace
(diffuse groundwater discharge)
Recharge zone
Discharge zone
Calcareous fen
River
Soil
Drift
•coarse
Bedrock


900
850
798
750
34
35
Seminary Fen
Seminary Fen
Seminary Fen
752
750
764
St Johns
Cem
Trailer Park
708
710
3
2


Generalized regional cross section:
Peat mound formed
over aquifer window on moraine flank
(localized groundwater discharge)
Recharge area
Pothole
Discharge area
Calcareous fen
Soil
Till
•calcareous
Buried
outwash
•coarse
Till

Ordway Prairie Calcareous Fen



Calcareous Fen Locations 2012

Gully 30 Calcareous Fen – Polk Co.

Dover 7 Calcareous Fen – Olmsted Co.

Calcareous Fen Characteristics

“. . .peat-accumulating. . .”

“. . .distinct groundwater inflows. . .”

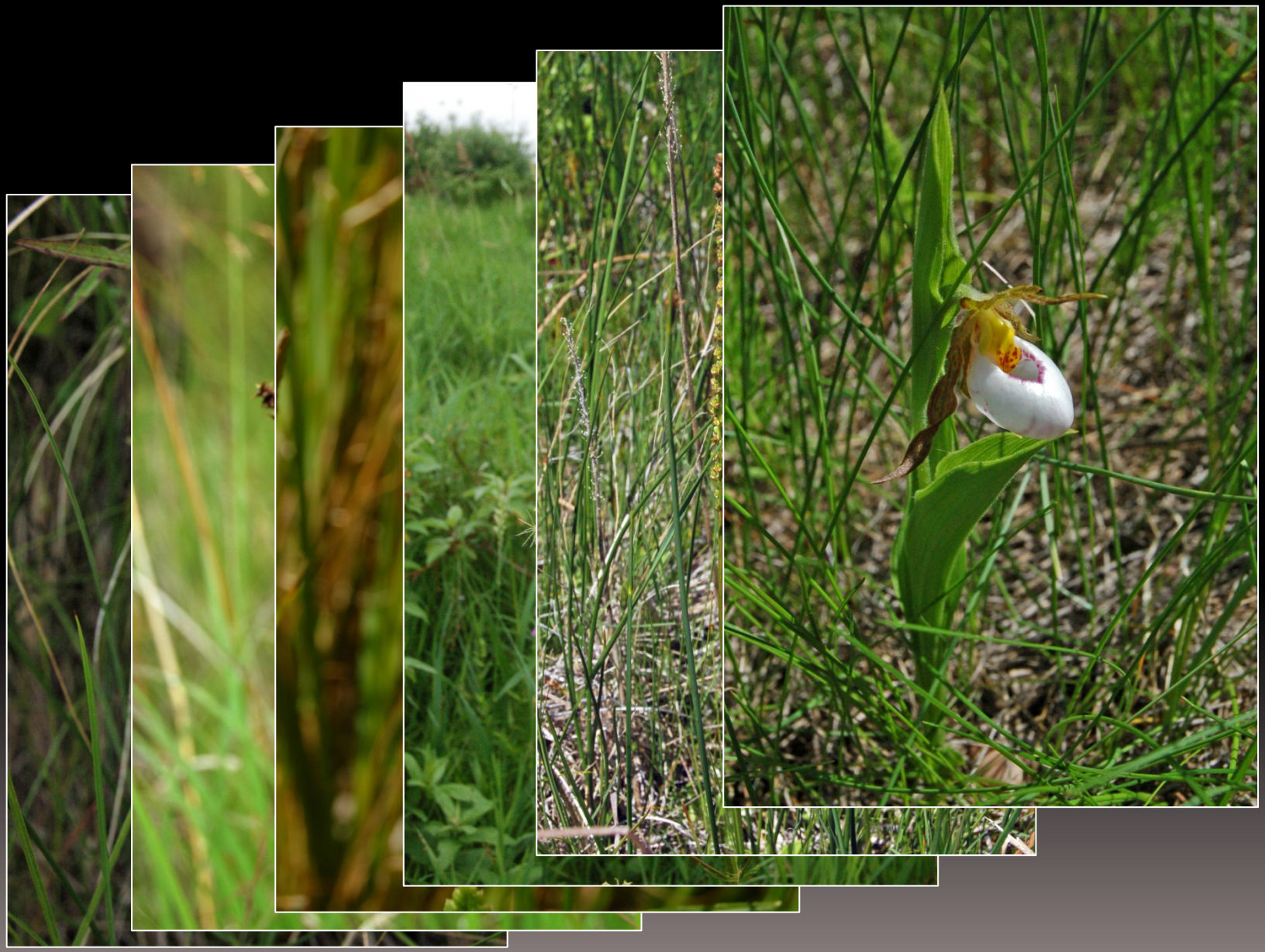
“. . .distinct groundwater inflows. . .”

“. . .specific chemical characteristics. . .”

– $CaCO_3(s) + CO_2 + H_2O$ <==> $Ca^{2+} + 2HCO3^-$

“. . .specific chemical characteristics. . .”

“. . .rare hydrophytic plants. . .”

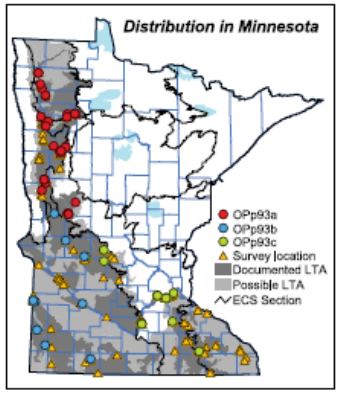


Prairie Extremely Rich Fen

Open graminoid-dominated fens on permanently saturated peat sustained by mineral-rich groundwater discharge, with little influence from surface water inputs. Typically present on sloping sites; peat is sometimes mounded or domed. Small pools and sparsely vegetated marly peat areas are commonly present.

Vegetation Structure & Composition

Description is based on summary of vegetation data from 78 plots (relevés) and moss data from 33 bryophyte plots. (Documented locations without plot data are shown on the distribution map as survey locations.)



- **Moss** cover is variable, composed only of brown mosses with *Sphagnum* absent. Characteristic species are *Bryum pseudotriquetrum*, *Campylium stellatum*, *Drepanocladus aduncus*, and *Limprichtia cossonii*. *Limprichtia cossonii* is more common in northern and western Minnesota; the other three species are common throughout the state. The liverwort *Aneura pinguis* is also characteristic, occurring throughout the range of OPp93.
- **Graminoid** cover is patchy to continuous (50–100%), with sedges at least as important as grasses. Of the most distinctive species, prairie sedge *(Carex prairea)* is important throughout the range of OPp93; sterile sedge *(C. sterilis)* is typically a major component except in the far southwest; tufted bulrush *(Scirpus cespitosus)* is fairly common from central Minnesota northward; and hair-like beak rush *(Rhynchospora capillacea)* is often abundant (except in southeastern Minnesota), especially on the margins of marly pools. Two important species shared with wet prairies but absent from other meadow and fen communities are mat muhly grass *(Muhlenbergia richardsonis)* and big bluestem *(Andropogon gerardii)*, although the latter is rare south of the Minnesota River valley. Other typically important species are more widely shared with other wetland classes, including clustered muhly grass *(Muhlenbergia glomerata)*, narrow reed grass *(Calamagrostis stricta)*, tussock sedge *(Carex stricta)*, aquatic sedge *(C. aquatilis)*, and hard-stemmed bulrush *(Scirpus acutus)*.
- **Forb** cover is usually sparse (5–25%). Among the more common distinctive species are American grass-of-Parnassus *(Parnassia glauca)*, Kalm's lobelia *(Lobelia kalmii)*, seaside arrowgrass *(Triglochin maritima)*, marsh arrowgrass *(T. palustris)*, and lesser fringed gentian *(Gentianopsis procera)*. Wet-meadow species common in OPp93 are spotted Joe pye weed *(Eupatorium maculatum)*, common boneset *(Eupatorium perfoliatum)*, and swamp thistle *(Cirsium muticum)*. Several wet-prairie species are common in OPp93, including flat-topped aster *(Aster umbellatus)*, swamp lousewort *(Pedicularis lanceolata)*, northern bedstraw *(Galium boreale)*, Riddell's goldenrod *(Solidago riddellii)*, Virginia mountain mint *(Pycnanthemum virginianum)*, prairie loosestrife *(Lysimachia quadriflora)*, and golden alexanders *(Zizia aurea)*. Other wet-prairie species such as tall meadow-rue *(Thalictrum dasycarpum)*, northern plains blazing star *(Liatris ligulistylis)*, and yellow stargrass *(Hypoxis hirsuta)* are often present at low densities.
- **Shrub layer** is absent to sparse (0–25% cover). Red-osier dogwood *(Cornus sericea)* is often present. Bog birch *(Betula pumila)* is often fairly common, except in southwestern Minnesota, and sage-leaved willow *(Salix candida)* is typically present. Shrubby cinquefoil *(Potentilla fruticosa)* is often common in northwestern Minnesota, although rare to absent elsewhere.

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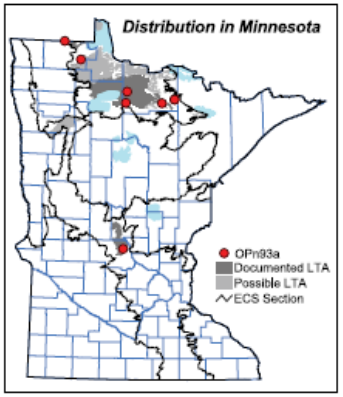
OPn93

Northern Extremely Rich Fen

Open peatlands dominated by fine-leaved graminoids scattered in channels of standing water. Present in areas of calcium-rich groundwater discharge in large patterned peatlands.

Vegetation Structure & Composition

Description is based on summary of vascular plant data from 8 plots (relevés).



- **Moss layer** is dominated by brown mosses such as *Scorpidium scorpoides*.
- **Graminoid layer** is characterized by fine-leaved graminoids such as candle-lantern sedge *(Carex limosa)*, tufted bulrush *(Scirpus cespitosus)*, twig rush *(Cladium mariscoides)*, and fen wiregrass sedge *(Carex lasiocarpa)* scattered in channels of standing water.
- **Forb layer** is sparse, usually with < 25% cover. Pitcher plant *(Sarracenia purpurea)*, buckbean *(Menyanthes trifoliata)*, and intermediate bladderwort *(Utricularia intermedia)* are typically present, with seaside arrowgrass *(Triglochin maritima)* common.
- **Shrub** cover is sparse (< 5%), with bog birch *(Betula pumila)* typically present and shrubby cinquefoil *(Potentilla fruticosa)* occasional.
- **Tree layer** is sparse (< 5% cover), with scattered stunted white cedar typically present and tamarack common.
- **Notes:** High Ca^{++} concentrations in groundwater discharge create conditions favorable for calciophilic species such as tufted bulrush *(Scirpus cespitosus)*, Kalm's lobelia *(Lobelia kalmii)*, grass-of-Parnassus *(Parnassia* spp.), and rare species such as twig rush *(Cladium mariscoides)*, sterile sedge *(Carex sterilis)*, hair-like beak rush *(Rhynchospora capillacea)*, marsh arrowgrass *(Triglochin palustris)*, and beaked spikerush *(Eleocharis rostellata)*.

Landscape Setting & Soils

OPn93 is rare, occurring mainly in large patterned peatlands in the MOP that have an interconnecting network of nonforested channels draining through conifer swamp forests. OPn93 has also been documented in a few smaller peatlands in areas of calcareous glacial till south and west of the MOP. Substrate is deep peat (> 15in [40cm]). Calcium carbonate precipitates are common, forming marl in pools.

Natural History

OPn93 develops in areas where highly calcareous groundwater is discharged from underlying calcareous mineral soil and forced through peat by artesian pressure. Water in OPn93 is characterized by high pH (> 7.0) and high Ca^{++} concentrations, providing conditions favorable for calciophilic species. Cold water temperatures, low dissolved oxygen content, and high water levels likely minimize competition from species that dominate fen areas lacking significant calcareous groundwater discharge. The unique hydrological conditions of sites where OPn93 occurs are very rare.

Similar Native Plant Community Classes

- **OPp93 Prairie Extremely Rich Fen**

OPp93 and OPn93 are both calcareous fens and have similar hydrology and water chemistry. OPp93 occurs within the prairie region of Minnesota and has prairie species that are absent from OPn93. Conversely, OPn93 has a number of species from the

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Minn. Statute 103G.223

"Calcareous fens, as identified by the commissioner by written order published in the State Register, may not be filled, drained, or otherwise degraded, wholly or partially, by any activity, unless the commissioner, under an approved management plan, decides some alteration is necessary. Identifications made by the commissioner are not subject to the rulemaking provisions of chapter 14 and section 14.386 does not apply."

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- Contract audits
- Prepayment investigations
- Enhanced edit structures for claims processing

Proposal Content

Responders are encouraged to:

1. Provide information on additional technologies, services, and/or activities that could enhance the state's payment integrity
2. Identify successful applications of their products and/or services in other state Medicaid programs
3. Identify potentials for enhanced federal match for procurement of identified products
4. Identify procurement strategies that minimize state costs
5. Identify the potential for contingency payment plans that are consistent with CMS regulations

Please submit six (6) paper copies of your response. **Please limit responses to ten (10) pages of documentation.** DHS will request additional information, if necessary.

Submit responses to:

Department of Human Services
Gina Kiser, Project Coordinator
444 Lafayette Road N.
St. Paul, MN 55155-3849

All information must be received no later than close of business on **April 8, 2005.**

This is not a bid. No contract will result from this solicitation.

All materials submitted become the property of the State of Minnesota, Department of Human Services. Materials shall not be returned to the responder.

This RFI is being issued to gather information that may identify potential enhancements to Minnesota's program integrity efforts. No decision has been made as to whether or not the State will offer demonstration opportunities. The State reserves the right to determine if we move forward with a Request for Proposal.

All costs incurred in responding to this RFI will be borne by the responder.

Fax and e-mail responses will not be considered.

Department of Natural Resources

Identification of Known Calcareous Fens Order No. 05-001

Pursuant to the provisions of *Minnesota Statutes*, section 103G.223, the following described lands contain calcareous fens as defined in *Minnesota Rules*, part 8420.1020.

Additional sites may be added to this list as new calcareous fens are discovered and existing sites may be removed from the list if it is determined that the wetland no longer meets the definition of a calcareous fen. Revisions to the list will be published in the *State Register*. The current list will also be posted on the DNR's web site at:

http://files.dnr.state.mn.us/publications/waters/Calcareous_Fen_List.pdf

County Calcareous Fen Site Name	Fen IDNo.	Located in: Township	Range	Section(s)
Becker				
Spring Creek WMA South	28184	T142N	R42W	SWNE12
Spring Creek WMA South	28183	T142N	R42W	NWSE13
Spring Creek WMA South	251	T142N	R42W	NENE13
White Earth 5	19104	T142N	R41W	NW05
White Earth 1	19181	T142N	R41W	NE06
Waubun WMA	28221	T142N	R42W	NENE01
Anderson WPA	28540	T139N	R42W	NWNE01
Big Stone				
Stony Run	19784	T121N	R45W	ESENE19
Carver				

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DRAFT (7-11-12)

Technical Criteria for Identifying Calcareous Fens in Minnesota

Minnesota Department of Natural Resources
Division of Ecological and Water Resources
[Date]

Waubun WMA Calcareous Fen in Mahnomen County (Erika Rowe photo)

Calcareous Fen Technical Criteria

- Hydrology:

" . . . stable, typically upwelling groundwater inflows sufficient to maintain saturation for the development of a histosol or a histic epipedon soil."

Calcareous Fen Technical Criteria

- Soils

". . . characterized by the presence of either a histosol or a histic epipedon. Calcium carbonate precipitates, such as tufa deposits, may frequently be associated with calcareous fens and high carbonate content in this case is not indicative of a mineral soil."

Calcareous Fen Technical Criteria

- Water Chemistry

". . . pH of 6.7 or more; calcium of 30 mg/l or more; alkalinity of 1.65 meq/l or more; and, specific conductance of 500 µS/cm or more."

Calcareous Fen Technical Criteria

- Vegetation

". . . under normal circumstances, the area has a natural community index value of 50 or more by summing the appropriate regional index values of the vascular plant plus the bryophyte calcareous fen indicator species. Where both bryophyte and vascular plant data are available and the site's latitude is greater than 47 degrees, the natural community index value must exceed 80."

Table 14: Regionalized List of 29 Vascular Plant Indicators to Identify Calcareous Fens in Minnesota

Species	NW	MN valley	SE	SW
Aster borealis	1	5	5	5
Berula pusila	-	5	5	-
Betula pumila	1	5	5	-
Bidens coronata	-	5	5	-
Bromus ciliatus	1	5	5	-
Cardamine bulbosa	5	5	5	5
Carex aquatilis	1	5	25	25
Carex hystericina	1	5	5	25
Carex interior	1	5	5	5
Carex prairea	25	25	25	25
Carex sterilis	25	25	25	25
Cladium mariscoides	5	25	-	-
Eleocharis rostellata	25	25	-	-
Eriophorum angustifolium	1	1	5	5
Gentianopsis procera	1	5	25	25
Liparis loeselii	1	5	5	5
Lobelia kalmii	1	25	25	25
Oxypolis rigidior	-	5	5	-
Parnassia glauca	5	25	25	25
Potentilla fruticosa	1	25	25	-
Primula mistassinica	25	-	-	-
Rhynchospora capillacea	25	25	25	25
Salix candida	5	5	5	-
Scirpus cespitosus	5	25	25	-
Scleria verticillata	25	25	25	25
Tofieldia glutinosa	5	25	-	-
Triglochin maritima	1	25	25	25
Triglochin palustris	25	25	25	25
Valeriana edulus	-	5	5	-

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Chester 24 Calcareous Fen Management Plan

Pipeline Anomaly Repair

Prepared for
Enbridge Energy Company

February 17, 2011
FINAL

ENBRIDGE™

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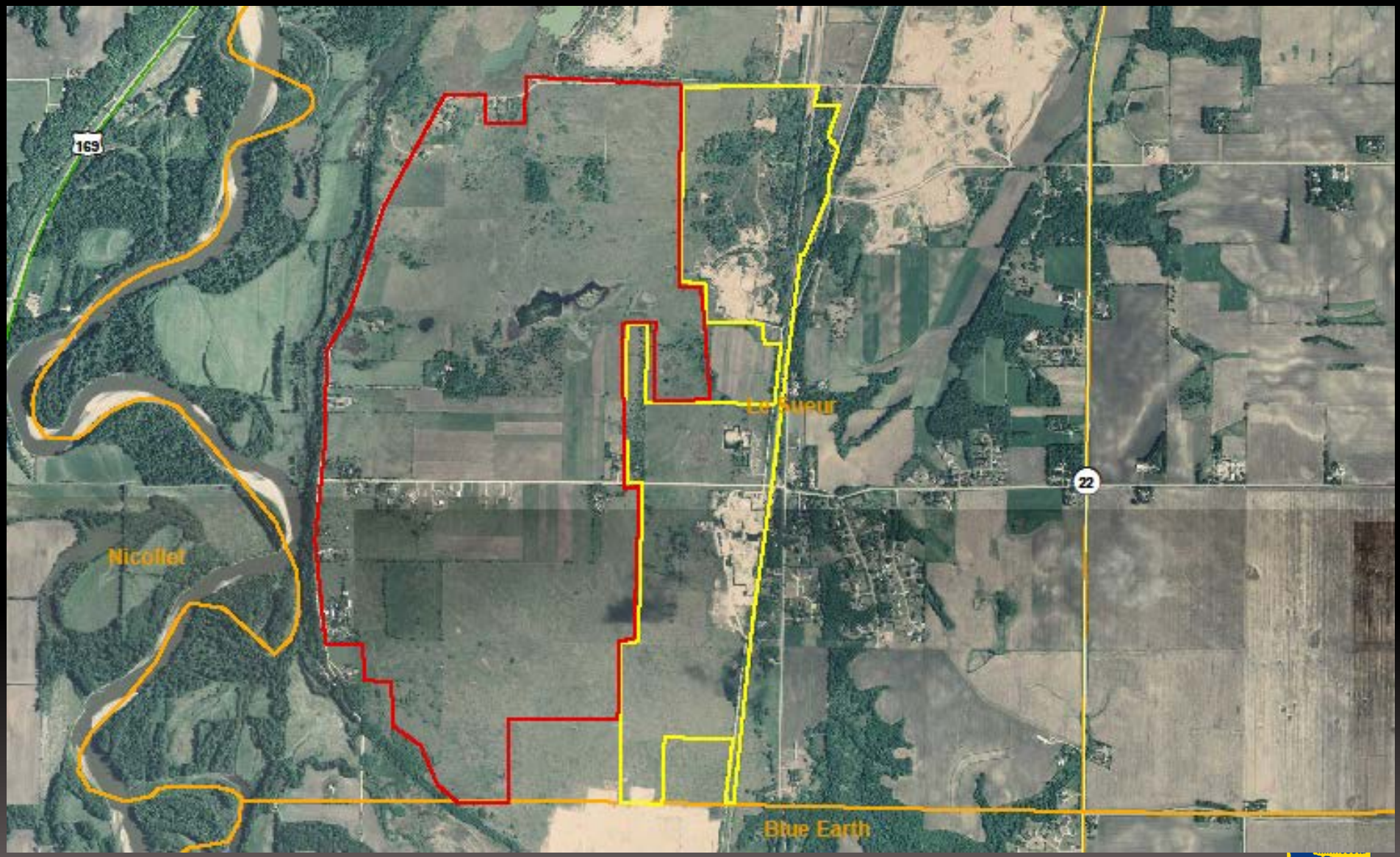

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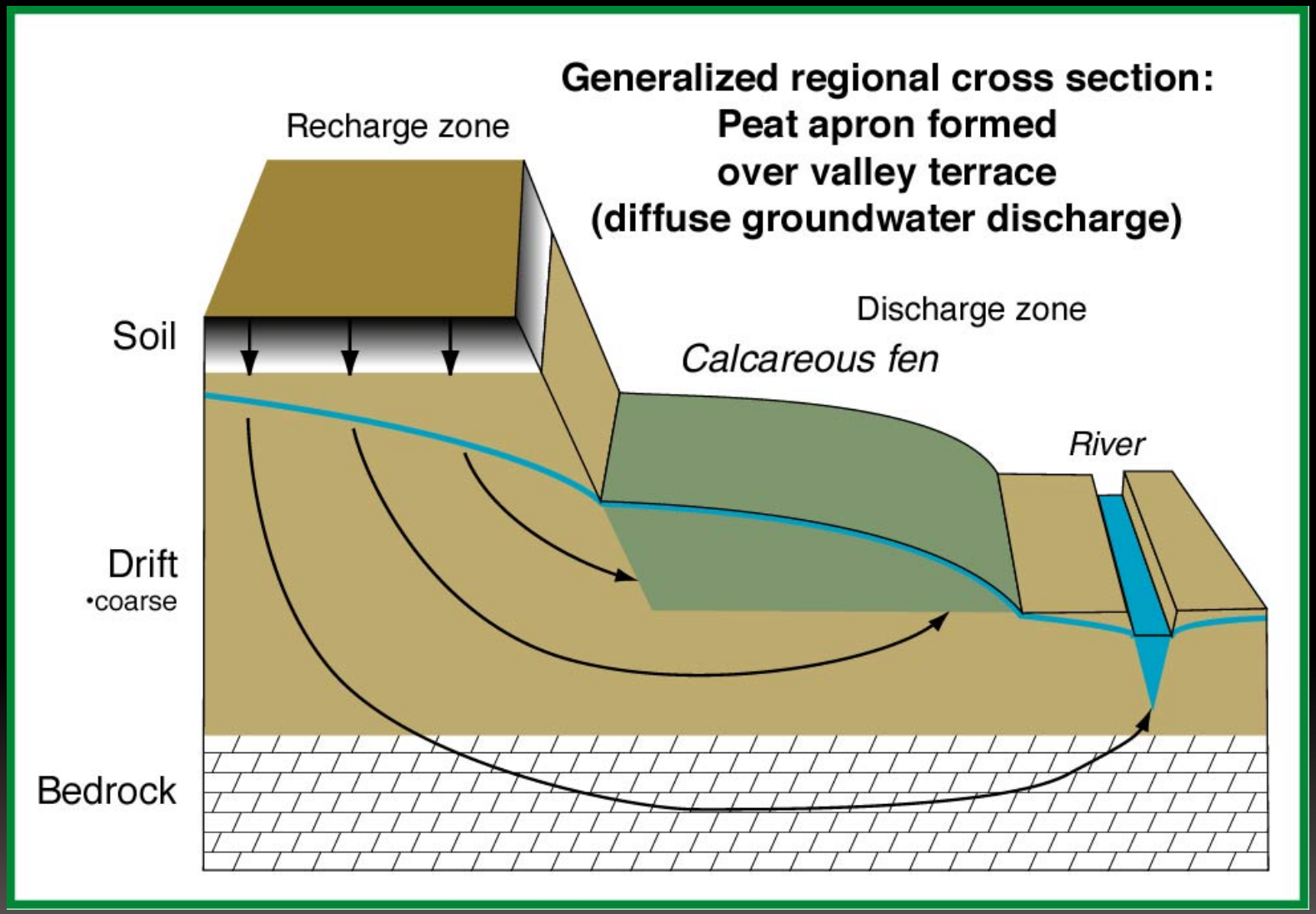
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Bedrock

Wetland Type 2 - Calcareous Fen: Minnesota DNR - Windows Internet Explorer

http://www.dnr.state.mn.us/wetlands/type2_calcareous_fen.html

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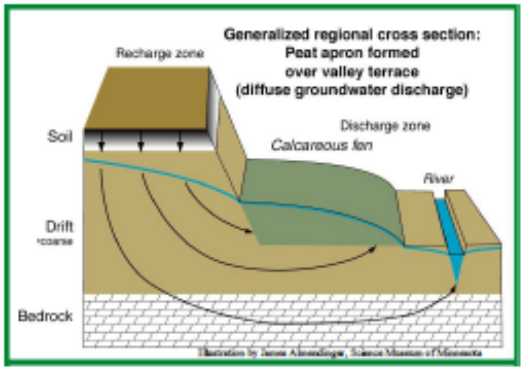
Type 2 - Calcareous Fen

Calcareous fens are a rare and distinctive category of Type 2 wetlands. They are characterized by non-acidic peat soil and dependent on a constant supply of cold, oxygen-poor groundwater rich in calcium and magnesium bicarbonates. This calcium-rich environment supports a plant community dominated by "calciphiles", or calcium-loving species, several of which are state-listed as endangered, threatened or special concern.

Calcareous fen in Otter Tail County

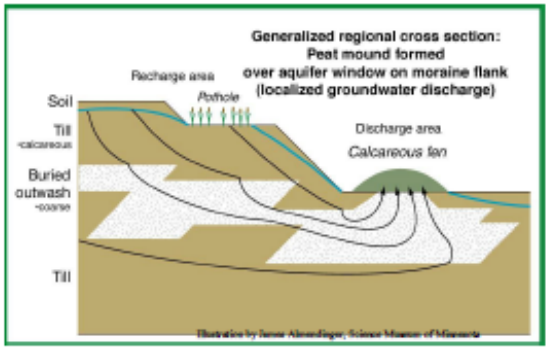
- **Soil:** Non-acidic, sedge-derived peat; saturated or nearly saturated during most of the growing season
- **Hydrology:** Constant, upwelling groundwater; waterlogged within at least a few inches of the surface with scattered small pools and rivulets
- **Vegetation:** Grasses, sedges, rushes, shrubs, various broad-leaved

WHAT IS A CALCAREOUS SEEPAGE FEN?



Calcareous fens are rare and distinctive wetlands characterized by a substrate of non-acidic peat and dependent on a constant supply of cold, oxygen-poor groundwater rich in calcium and magnesium bicarbonates. This calcium-rich environment supports a plant community dominated by "calciphiles," or calcium-loving species. These fens typically occur on slight slopes where upwelling water eventually drains away and where surface water inputs are minimal. Sometimes they occur as domes of peat that grow to the height of the hydraulic head. These settings create an unusual wetland regime where the substrate is almost always saturated to the surface, but flooding is rare and brief. Shallow pools of water in which marl precipitates are typically present surrounded by low, tussocky, grass- and sedge-dominated vegetation. The substrate is springy or quaking underfoot. The figures above and below illustrate the geologic features and groundwater flows that lead to the formation of calcareous seepage fens.

HOW RARE ARE CALCAREOUS SEEPAGE FENS?



Calcareous seepage fens are one of the rarest natural communities in the United States. These fens have been reported from 10 states, mostly in the Midwest. Approximately 200 are known in Minnesota, most of which are only a few acres in extent. They are concentrated at the bases of terrace escarpments in river valleys in southeastern Minnesota, on the sides of morainal hills and valley sideslopes in southern and west-central Minnesota, and on the downslope side of beach ridges in the Glacial Lake Agassiz basin in the northwest. There are also a few in northern Minnesota where upwelling groundwater reaches the surface within large, more acidic peatlands.

Questions?