DEPARTMENT OF NATURAL RESOURCES

Technical Criteria for Identifying Calcareous Fens in Minnesota

Developed by the Minnesota DNR Calcareous Fen Technical Team

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Introduction

Calcareous fens are a rare and legally protected wetland type and Native Plant Community (NPC), sustained by calcium-rich groundwater supporting a diverse assemblage of hydrophytic plants. This document is the technical criteria currently used by the Minnesota Department of Natural Resources (DNR) for identifying calcareous fens under Minnesota Statutes 103G.223 and associated Minnesota Rules Chapter 8420.0935. This document specifically addresses Minnesota Administrative Rule 8420.0935 Subpart 2.

This is the third revision of technical criteria by the Calcareous Fen Technical Team since its initial release in 1995 (DNR 1995, DNR 2005, DNR 2016). The technical criteria outlined in this document are minimum values used for identifying calcareous fens in Minnesota for listing in the state register and should not be used for evaluating the condition of a calcareous fen.

In addition to these criteria, the DNR also uses The Native Plant Community (NPC) classification system to map and assess the conditions of calcareous fens in Minnesota (Asseng 2011). The NPC system was developed to provide a framework and common language to survey and improve the management of vegetation, identify research needs, and promote the study and appreciation of native vegetation in Minnesota. Under the NPC system, calcareous fens are identified as Prairie Extremely Rich Fens and Northern Extremely Rich Fens (Aaseng 2011). The most recent Prairie Extremely Rich Fen Condition Ranking Guidelines were developed in 2018 and are used to determine the quality of a calcareous fen (DNR 2018a).

For a complete list of specific field methods refer to Minnesota Department of Natural Resources Calcareous Fen Field Assessment Procedures (DNR 2018). DNR continues to collect and analyze data on calcareous fens and similar communities, which may lead to future revisions of the technical criteria.

Calcareous fens identified by DNR are listed in the State Register and is available at: Listed Fens - Identification List of Known Calcareous Fens

Technical Criteria Definition

Calcareous fens possess diagnostic characteristics of hydrology, soils, water chemistry and vegetation. These specific characteristics, or technical criteria, are essential for identification and listing purposes. All four categories must be met for an area to meet these technical criteria for identifying calcareous fens in Minnesota.

Hydrology Criterion

An area meets the hydrology technical criterion when the site has stable, upwelling groundwater sufficient to maintain saturation for the development of an organic soil (peat). The fen's landscape position (i.e. along a beach ridge, or a river valley) along with saturated organic soils (peat), precipitation of carbonates (tufa), and measured upward gradient of hydraulic head indicate upwelling groundwater. Other indicators may include the occurrence of springs, seeps or peat domes. Indicators can be assessed remotely, prior to field visits, by evaluating geologic cross sections and groundwater levels in nearby wells.

Soils Criterion

An area meets the soils technical criterion when the soils are characterized as predominantly organic (e.g., peat) formed by decomposition of organic material under saturated, anoxic conditions. Organic soils often extend downward from the surface to at least 20 cm (8 inches). Presence of calcium carbonate deposits or tufa is frequently associated with calcareous fens and found in the soil profile.

Water Chemistry Criterion

An area meets the water chemistry criterion if the water sampled from the rooting zone within the calcareous fen has the following: a pH of 6.7 or more; calcium of 30 mg/l mg/L (as $CaCO_3$) or more; alkalinity of 1.65 meq/l or more; and specific conductance of 500 µS/cm or more. Spring or marl pools within the fen are also acceptable sampling locations.

Water Chemistry Assumption

If an area meets the vegetative criterion, it is assumed to meet the water chemistry technical criterion when there is a positive acid test on soil or tufa. A positive acid test is any reaction when a 1 molar solution of Hydrochloric acid is dropped on to a sample and observed (USDA 2017).

If an area meets the vegetative criteria, but an acid test cannot be performed or is inconclusive, the additional parameters of pH, specific conductance, alkalinity and calcium concentration will need to be measured. Samples must be tested or collected as outlined in the field procedures (DNR 2018).

Vegetation Criterion

An area meets the vegetation technical criterion when it scores more than 50 points using the regionalized vascular plant indicators by summing the species found within a wetland community (Figure 1, Table 1).

Communities with indicator plant scores of 30 to 49 are eligible to be listed as calcareous fens if they also meet calcareous fen soil, hydrology, and water chemistry criteria. These sites should include a rationale for why the calcareous fen does not meet the vegetation criteria. The boundary lines represented in Figure 1 are not static

and are expected to have soft boundaries. Professional judgment near regional boundaries is required to select the region that best captures the calcareous fen community. The regionalized list of vascular plant indicator species for calcareous fens, developed in 1995, was revised in 2025 based on a review of vegetation plot data (DNR 2025).

Prior to 2024, the DNR had a list of bryophyte indicator species for calcareous fens that was used to meet the vegetation criterion for listing calcareous fens on the State Register. Bryophytes will no longer be used to meet the vegetation criterion. A list of bryophytes can be found in the previous version of DNR's tech criteria (DNR 2016). Bryophytes can be used when evaluating the ecological condition or health of the fen community according to the DNR Calcareous Fen Field Procedures (DNR 2018b).

Table 1. Regionalized list of Vascular plant indicators used to identify fens in Minnesota. The south and north regions are outlined in Figure 1. Professional judgment may be required to select the region if the area is close to a boundary. A dash indicates a species that is not expected to occur in that region; in the unlikely case that it does occur, it will receive the score from the alternate region (DNR 2025).

Scientific Name	Common Name	South Region	North Region
Agalinis paupercula	small-flower false foxglove	5	5
Berula erecta	cut-leaf water parsnip	5	-
Betula pumila	bog birch	10	0
Bromus ciliatus	fringed brome	5	0
Bidens trichosperma	crowned beggarticks	5	0
Cardamine bulbosa	spring cress	5	0
Carex aquatilis	water sedge	0	5
Carex interior	inland sedge	5	5
Carex limosa	mud sedge	-	5
Carex livida	livid sedge	-	1
Carex prairea	prairie sedge	15	10
Carex sterilis	sterile sedge	25	20
Carex viridula	little green sedge	-	15
Cladium mariscoides	smooth sawgrass	25	20
Dasiphora fruticosa	shrubby cinquefoil	20	1
Eleocharis quinqueflora	few-flowered spikerush	10	10
Eleocharis rostellata	beaked spikerush	25	25
Equisetum variegata	variegated scouring-rush	-	1
Eriophorum angustifolium	tall cottongrass	15	1
Fimbristylis puberula	hairy fimbry	25	25
Gentianopsis virgata	lesser fringed gentian	25	10
Liparis loeselii	Loesel's twayblade	15	1
Lobelia kalmii	Kalm's lobelia	25	5
Muhlenbergia glomerata	spike muhly	1	0
Oxypolis rigidior	cowbane	10	-
Parnassia glauca	American grass of Parnassus	25	15
Parnassia palustris	marsh grass of Parnassus	-	5
Primula mistassinica	Mistassini primrose	-	25
Rhynchospora capillacea	needle beaksedge	25	25
Salix candida	sage-leaved willow	15	1
Salix serissima	autumn willow	10	0
Schoenoplectus pungens	three-square bulrush	15	15
Scleria verticillata	whorled nutrush	25	25
Symphyotrichum boreale	northern bog aster	10	0
Triantha glutinosa	sticky false Asphodel	25	10
Trichophorum cespitosum	tufted bulrush	25	20
Triglochin maritima	seaside arrowgrass	20	5
Triglochin palustris	marsh arrowgrass	25	25
Valeriana edulis	edible valerian	15	-

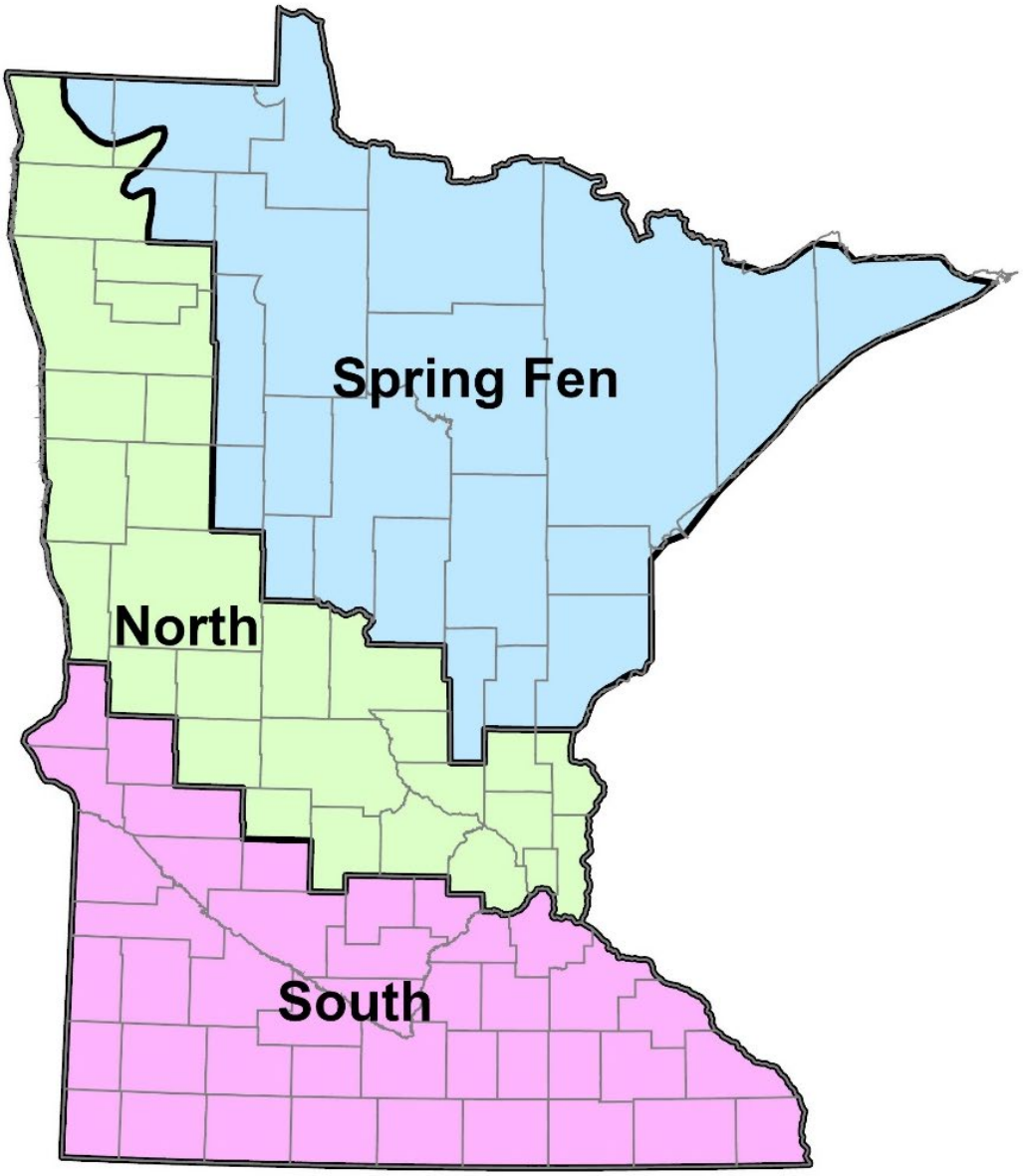

Figure 1. Regions for use with the calcareous fen vegetation criterion. Professional judgment near regional boundaries is required to select the region that best captures the calcareous fen community. The Spring Fen (Northern Extremely Rich Fen) boundary needs further refinement and study.

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Glossary

Alkaline - Natural waters and soils having a pH greater than 7.

Alkalinity - The capacity of solutes in a solution to neutralize acid. In natural waters in Minnesota, bicarbonate is the primary species representing alkalinity.

Circumneutral - nearly neutral soil or water: having a pH between 6.5 and 7.5

Marl – Material is composed dominantly of calcium carbonate precipitated from groundwater in fens it is a muck or mud with a white hue. Will effervesce with a one molar hydrochloric acid solution.

Peat – Soil composed of dominantly organic material

Peat dome - A dome formation composed of peat, caused by upwelling of groundwater under pressure to create mounds that can be meters higher that the surrounding peat surface.

Specific conductance – the measure of how well sample water can conduct electrical current. at 25^{o}C

Tufa - A porous mineral deposit composed of calcium carbonate and formed by precipitation from water

Appendix A Minnesota Regulations

The following are current references to Minnesota Statutes and Rules. For any possible updates, the Minnesota Revisor of Statutes maintains currently accurate listings at The Office of the Revisor of Statutes.

State Statue

103G.223 CALCAREOUS FENS.

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.

History: 1991 c 354 art 6 s 9; 2004 c 221 s 43

State Rule

8420.0935 STANDARDS AND CRITERIA FOR IDENTIFICATION, PROTECTION, AND MANAGEMENT OF CALCAREOUS FENS.

Subpart 1. Purpose.

The purpose of this part is to provide minimum standards and criteria for identifying, protecting, and managing calcareous fens as authorized by Minnesota Statutes, section 103G.223. Calcareous fens, as identified by the commissioner, must not be impacted or otherwise altered or degraded, wholly or partially, by any action, unless the commissioner, under an approved management plan, decides some alteration is necessary. The exemptions under part 8420.0420 and the sequencing provisions under part 8420.0520 do not apply to calcareous fens.

SUBP. 2. IDENTIFYING CALCAREOUS FENS.

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.

SUBP. 3. PROCEDURES TO LIST CALCAREOUS FENS.

A. The commissioner must investigate wetlands to determine if the wetland is properly identified as a calcareous fen.

B. The commissioner must, by written order published in the State Register, maintain a current list of known calcareous fens in the state and their location.
C. The commissioner must provide an updated list of calcareous fens to the board for further distribution.

SUBP. 4. MANAGEMENT PLANS.

Calcareous fens must not be impacted or otherwise altered or degraded except as provided for in a management plan approved by the commissioner. The commissioner must provide technical assistance to landowners or project sponsors in the development of management plans.

SUBP. 5. RESTORATION.

The commissioner may approve management plans to restore or upgrade a previously damaged calcareous fen.

SUBP. 6. APPEALS.

A. A landowner or project proposer may challenge the commissioner's determination that a wetland is a calcareous fen or the commissioner's calcareous fen management plan by requesting a hearing. The hearing shall be conducted in the same manner as water permit hearings under Minnesota Statutes, chapter 103G.
B. The determination that a wetland is a calcareous fen may be appealed at any time by requesting a hearing. For a decision under a management plan, the hearing must be requested within 30 days after the notice of the commissioner's decision was mailed to the project proposer; otherwise the decision becomes final and may not be challenged by the project proposer.
C. Appeal of the commissioner's decision after the hearing must be done in the manner provided for appeals from contested case decisions under Minnesota Statutes, chapter 14.

SUBP. 7. ENFORCEMENT PROCEDURES.

ENFORCEMENT PROCEDURES FOR CALCAREOUS FENS MUST BE CONDUCTED CONSISTENT WITH MINNESOTA STATUTES, SECTIONS 103G.141 AND 103G.2372, EXCEPT THAT NECESSARY RESTORATION OR REPLACEMENT ACTIVITIES, IF REQUIRED, MUST BE DETERMINED BY THE COMMISSIONER, IN CONSULTATION WITH THE LOCAL SOIL AND WATER CONSERVATION DISTRICT.

STATUTORY AUTHORITY: MS S 103G.2242

HISTORY: 34 SR 145