Leech Lake River Watershed Landscape Stewardship Plan

Appendix

Aitkin SWCD

Cass County Environmental Services

Hubbard SWCD

Leech Lake Division of Resource Management

Northern Waters Land Trust



BOARD OF WATER AND SOIL RESOURCES



Table of Contents

Project Partners	3
Leech Lake River LSP Planning Team	.3
Staff Supporting the Leech Lake River LSP Development	.3
Bibliography	5
Leech Lake River Resource Inventory (HUC 8)	7
Geography	.8
Forest Cover and Composition1	10
Lakes and Streams1	۱5
Forest and Watershed Disturbance1	۲7
Protection1	۱9
Conservation Priorities2	22
Population and Development Growth2	25
Other2	26
Subwatershed Analyses (HUC 10)2	8
Subwatershed No. 1 Steamboat River (HUC 701010201)	32
Subwatershed No. 2 Kabekona River (HUC 701010202)	37
Subwatershed No. 3 Woman Lake (HUC 701010203)4	12
Subwatershed No. 4 Boy River (HUC 701010204)4	17
Subwatershed No. 5 Leech Lake (HUC 701010205)5	52
Subwatershed No. 6 Leech River (HUC 701010206)5	57
Ecological Pathway to Sustainable Forest Management6	3

This page intentionally left blank

Project Partners

This section provides an overview of the people involved with the development of the Leech Lake River Landscape Stewardship Plan.

Leech Lake River LSP Planning Team

The Leech Lake River Landscape Stewardship Plan development involved several people representing different interests. The following list includes planning tam members arraigned alphabetically by last name. In addition to those on this list, there were many others who supported the effort in various ways.

Team Member	Organization
Mitch Lundeen	Aitkin SWCD
John Ringle	Cass County Environmental Services
Kelly Condiff	Cass County Environmental Services
Julie Kinsley	Hubbard SWCD
Steve Mortensen	Leech Lake Division of Resource Management
Chris Pence	Board of Water and Soil Resources
Mike Bates	MN DNR Forestry
Kathy DonCarlos	Northern Waters Land Trust

Staff Supporting the Leech Lake River LSP Development

Board of Water and Soil Resources

- Lindberg Ekola, Forest Stewardship Planning Coordinator
- Dan Steward, Watershed/Private Forest Management Program Coordinator

Independent Contractors

- David Henkel-Johnson, plan writer
- Mitch Brinks, GIS support

This page intentionally left blank

Bibliography

This section lists documents referenced in the Leech Lake River Landscape Stewardship Plan or otherwise used in its development.

Arnold, C. L., & Gibbons, C. J. (1996). *Impervious Surface Coverage: The Emergence of a Key Environmental Indicator*. Journal of the American Planning Association, 62(2), 243–258. doi: 10.1080/01944369608975688

Brown, Terry; Meysembourg, Paul; Host, George E. (2013). *Geospatial Modeling of Native Plant Communities of Minnesota's Laurentian Mixed Forest*. Natural Resources Research Institute, University of Minnesota Duluth. Retrieved from <u>https://data.nrri.umn.edu/data/dataset/nemnpnpc</u>.

Host, G. (2018). *Potential Native Plant Communities of Minnesota's Eastern Broadleaf Forest*. Natural Resources Research Institute, University of Minnesota Duluth. Retrieved from <u>https://data.nrri.umn.edu/data/dataset/npc-ebf-lmf</u>

Jacobson, Peter; Cross, Timothy; Dustin, Donna; Duval, Michael. (2017). *A Fish Habitat Conservation Framework for Minnesota Lakes*, Fisheries, 41:6, 302-317. Retrieved from https://www.researchgate.net/publication/303745823 A Fish Habitat Conservation Framework for Minnesota Lakes.

Minnesota Department of Natural Resources. (2010). *Identification of Priority Forests for the Minnesota Forests for the Future Program*. St. Paul, MN.

Minnesota Forest Resource Council (2017). *North Central Landscape Forest Resources Plan*. Minnesota Forest Resource Council, St. Paul, Minnesota. Retrieved from <u>https://mn.gov/frc/docs/NC_Landscape_Plan.pdf</u>

Minnesota Pollution Control Agency. (2017). *Leech Lake River Watershed Restoration and Protection Strategy Report.* Retrieved from <u>https://www.pca.state.mn.us/water/watersheds/leech-lake-river</u>

USDA Forest Service, Northeastern Area State and Private Forestry. (2009). *Forest, Water and People: Drinking water supply and forest lands in Minnesota*.

Verry, E.S. (2016). *The Hydrology of Minor Watersheds*. Ellen River Partners, Inc. Grand Rapids, Minnesota.

This page intentionally left blank

Leech Lake River Resource Inventory (HUC 8)

The purpose of this section is to provide major watershed-scale (HUC 8) geographic data as a reference for the Leech Lake River Landscape Stewardship Plan. Included in this section are maps regarding forest management topics for the Leech Lake River Major Watershed.



Figure 1. Location of the Leech Lake River Major Watershed.

Geography





Figure 3. Elevation.





Figure 4. Ecological subsections.





Forest Cover and Composition



Figure 6. Historic vegetation cover, Marschner.

Figure 7. Historic vegetation class, MnDOT (VegMod).



Figure 8. Land cover, 2013.









Figure 10. Potential native plant community systems.





Figure 12. Change in red oak abundance.



Figure 13. Change in white pine abundance.



Figure 14. Potential white pine recovery areas.



Lakes and Streams



Figure 15. Lakes of phosphorus sensitivity significance.

Figure 16. Lakes of biological significance.





Figure 17. Wild rice, cisco refuge, and trout lakes.

Figure 18. Designated trout streams and tributaries.



Forest and Watershed Disturbance



Figure 19. Forest disturbance areas by year.

Figure 20. Forest disturbance levels by minor watershed (HUC 14).





Figure 21. Average annual forest disturbance levels by minor watershed.

Figure 22. Disturbed land cover by catchment (DNR level 8).



Protection





Figure 24. Public and tribal land ownership.





Figure 25. Subwatershed (HUC 10) protection levels.

Figure 26. Minor watershed (HUC 14) protection levels.





Figure 27. Parcels with the potential to protect.

Figure 28. Protection/restoration classifications.



Conservation Priorities



Figure 29. Lessard-Sams Outdoor Heritage Council priorities.

Figure 30. DNR Wildlife Action Network rankings.





Figure 31. DNR Forests for the Future composite scores.

Figure 32. DNR Forests for the Future composite scores by minor watershed (HUC 14).





Figure 33. Minnesota Biological Survey (DNR) sites of biological significance.

Population and Development Growth



Figure 34. Population change, 2000-2010.

Figure 35. Development increases since 2002.



Other





Figure 37. Current forest stewardship plan areas.







This page intentionally left blank

Subwatershed Analyses (HUC 10)

Developing water resource protection strategies within a watershed context is a logical, scientific approach because it acknowledges what landowners have known for years: that upstream activities affect those downstream. The question becomes at what scale is appropriate? Watersheds are classified at many scales, from region and basin scales down to smaller watershed and sub-watersheds, including minor watersheds and catchments. The Leech Lake River Major Watershed is divided into 6 smaller or "sub" watershed units (HUC10 scale) as shown in the map below. Within each of these HUC10 sub-watersheds, are 7 to 20 minor watersheds, which are on average are 11,440 acres (17.9 sq. miles). Although major watersheds can be analyzed and modeled, it is difficult to implement since they typically cross municipal, county, and/or state boundaries.



The minor watershed is a sub-watershed unit of the HUC12 unit, which is a sub-watershed of the HUC10 unit. "The character of the minor watersheds drives the character of larger watersheds" (Sandy Verry, 2016). Implementation is also easier since many minor watersheds are within a single jurisdiction, focused on one or two primary surface water resources, and strategies can be better targeted and designed for optimal success and cost efficiencies. Each of the 75 minor watersheds are unique in their amount of protection, quality forest and water resources, and risk factors. These minor watersheds are highlighted in the following sections, which are organized by the HUC10 subwatershed unit. These HUC10 subwatersheds are summarized in the table below and on the following pages:

Subwatershed Characteristics

Below is a summary of the subwatershed and forest characteristics of the Leech Lake River Major Watershed by subwatershed (HUC10):

# of minor	٩	7	9	20	20	10	
wshds		/				10	
% upland forest cover	48%	60%	46%	50%	36%	39%	
% protected	39%	68%	70%	83%	88%	90%	
Land use disturbance	24%	13%	9%	10%	7%	11%	
# of lakes	12	14	162	126	126	30	
Avg. lake size	223	325	155	146	914	267	
Geomorphology	Till plain	Till plain / moraine sediments	Moraine sediments / outwash	Till plain / moraine sediments / peat / outwash	Till plain / moraine sediments	Till plain / moraine sediments / peat / outwash	
Primary land cover	Open lands / deciduous forest	Open lands / deciduous forest	Open water / deciduous forest	Open water / deciduous forest / wetlands	en water / eciduous forest / vetlands		
Lake or stream based	Stream	Lake / stream	Lake	Lake / stream	Lake	Stream	
Quality	Jality Surface water S (trout streams), fo forest/habitat		Surface water, forests/habitat	Surface water, forests/habitat	Surface water, forests/habitat	Surface water, forests/habitat	
Risks	Ag: animal Ag: animal development		Development, declining WQ	Development, declining WQ, impairment	Development	Development	
Avg. land lalue (20+ acre, private lands)	\$1,645	\$1,544	\$2,798	\$2,267	\$2,503	\$1,473	
Acres needed for protection goal	8,316	5,443	5,523	0	0	0	
Cost to achieve protection goal	\$9,359,863	\$5,961,239	\$8,127,185	\$0	\$0	\$0	
Avg. RAQ score	2.2	3.1	4.4	5.3	4.8	4.6	

Table 1. Subwatershed characteristics and indices of quality and risk.

Table 2. Composite Forests for the Future (FFF) scores and potential native plant communities.

Name	FFF score (composite mean)	Fire-Dependent		Mesic Hardwood		Acid & F Rich Pe	orested atland	Floodplain & Wet Forest		Open wetlar Open Peat Mear	ıds (Marsh, land, Wet dow)	
Steamboat River	95.8	16,320	19%	48,018		56%	6,397	7%	9,251	11%	2,514	3%
Kabekona River	102.4	17,370	22%	43,365		56%	5,655	7%	5,037	7%	1,203	2%
Woman Lake	97.9	30,826	30%	32,836		31%	7,937	8%	4,308	4%	4,723	5%
Boy River	102.4	27,868	19%	54,012		36%	22,156	15%	18,857	13%	10,083	7%
Leech Lake	100.4	67,086	20%	91,767		28%	27,411	8%	29,675	9%	5,918	2%
Leech River	91.9	19,212	18%	26,528		24%	23,110	21%	37,675	35%	23	0%
Total (or avg for FFF)	99.1	178.683	21%	296.526		35%	92.666	11%	104.804	12%	24,463	3%

Lake Characteristics

Below is a summary of the lake characteristics of the Leech Lake River Major Watershed by subwatershed (HUC10). More information on the lakes will be detailed in the individual subwatershed sections to follow.



Figure 39. Lake size distribution.

Table 3. Priority	and at-risk	lake estimates.
-------------------	-------------	-----------------

	Lakes sensiti	of phosp vity signi	horous ficance	Lake of biodiversity significance			Lake water quality trends			Outstanding water resources			
Name	High	Higher	Highest	Moderate	High	Outstanding	Improving	Declining	Stable	Cisco/ tullibee	Trout	Priority wild rice	Priority shallow
Steamboat River		2		2		3			2			3	2
Kabekona River	3		3			2	1		1	1	1	4	2
Woman Lake	9	9	17	3	6	11	12	3	13	4	2	15	6
Boy River	4	8	9	2	3	12	5	3	7	2		26	15
Leech Lake	9	7	8	4	3	5	2		7	4	1	12	9
Leech River	2		2			5			1			7	8
Totals	27	26	39	11	12	38	20	6	31	11	4	67	42

Subwatershed No. 1 Steamboat River (HUC 701010201)

Description

The Steamboat River Subwatershed drains 134 square miles of Hubbard, Cass, and Beltrami counties and is the headwaters to the Leech Lake River Major Watershed. It is roughly shaped like a rectangle and located in the northwestern corner of the major watershed, which is south of the city of Bemidji. The land cover is primarily forests with some wetlands and agriculture. The headwaters to the Steam River Subwatershed are in the western and northwestern parts of the subwatershed, and the outlet is in the southeast corner where the Steamboat River flows into Leech Lake.

Figure 40. Elevation.



Geography

The Steamboat River Subwatershed is largely covered by level to rolling till plains formed by the formed by the Koochiching Lobe glacier. The river corridors are lower in elevation than the surrounding landscape and coincide with sandy outwash deposits.





Past, Current, and Potential Future Forest Conditions

The historical vegetation of the Steamboat River Subwatershed was estimated to be a mix of northern hardwoods, oak, aspen, jack pine, red pine, and white pine in the uplands, and conifer swamps in the lowlands. In the uplands the deciduous species were generally found on the till plains while the coniferous species were on the outwash deposits. Today the forest remains somewhat intact, although it is more fragmented compared to the other subwatersheds of the Leech Lake River Major Watershed. The current forest composition is primarily in the aspen/birch forest type group.

Estimates of the potential native plant communities (NPCs) indicate that most of the upland area has the potential to support mesic hardwood NPCs, although some areas may also support fire-dependent NPCs. The lowland areas may support either wet forest or forested rich peatland NPCs.



Figure 42. Historic vegetation cover, Marschner.

Figure 43. Land cover, 2013.





Figure 44. Potential native plant communities.

Water Resources Summary

The Steamboat River Subwatershed is largely a stream-based watershed with relatively few lakes. It is home to the Steamboat River as its name implies, as well as other rivers such as the Necktie River and Bungoshine Creek. Of the lakes with available water quality data, 2 have stable water quality and 1 is impaired by nutrients. This subwatershed also has 3 lakes of outstanding biodiversity significance, as well as 3 priority wild rice lakes and 2 priority shallow lakes. Additionally, the Steamboat River Subwatershed contains 62 miles of streams, including 17 miles of trout streams, none of which are impaired.



Figure 45. Water quality trends.

Note: Since this map has been developed, the water quality trend in Steamboat Lake has changed to 'no trend'.

Protection Status

39% of the Steamboat River Subwatershed is currently protected, mostly by county-owned lands and wetlands. In this subwatershed protection generally increases as you move south. To reach the subwatershed protection goal of 49% an additional 8,316 acres need to be protected at an estimated cost of \$9,359,863. Fortunately, over 37,000 acres have the potential to protect, although the Leech Lake River Landscape Stewardship Committee recommends prioritizing protection efforts along the trout streams and minor watershed #'s 8006, 8015, and 8016.



Figure 46. Protected lands.

Figure 47. Minor watershed protection levels.



Subwatershed No. 2 Kabekona River (HUC 701010202)

Description

The Kabekona River Subwatershed is a tributary watershed to the Leech Lake Subwatershed and drains 121 square miles of Hubbard and Cass counties. It is located to the west of Leech Lake and its overall shape is about as wide and it is tall. The Kabekona River Subwatershed is heavily forested with some wetlands and minor amounts of agriculture in the northeastern quarter of the subwatershed. The headwaters to the Kabekona River is in the subwatershed's northwestern corner, and from there it flows southeast and eventually meets with Leech Lake.

Figure 48. Elevation.



Geography

The southwestern half of the Kabekona River Subwatershed is an end moraine characterized by steep rugged terrain. The rest of the subwatershed is level to rolling till plains and sandy outwash deposits in the areas around the large lakes and along the Kabekona River corridor.





Past, Current, and Potential Future Forest Conditions

The historical vegetation of the Kabekona River Subwatershed was estimated to be dominated by conifers, particularly red pine, jack pine, and white pine in the uplands and conifer swamps in the lowlands. Aspen and northern hardwood forests were also present and more likely to occur on the till plain deposits. Today the forest remains largely intact, although some fragmentation is occurring around the town of Laporte. The current forest composition is primarily in the aspen/birch forest type group, although some scattered stands of pine are present as well as spruce/fir forests in the lowlands.

Estimates of the potential native plant communities (NPCs) indicate that most of the upland area has the potential to support mesic hardwood NPCs, although the outwash deposits may support fire-dependent NPCs. The lowland areas may support either wet forest or forested rich peatland NPCs.



Figure 50. Historic vegetation cover, Marschner.

Figure 51. Land cover, 2013.



Figure 52. Potential native plant communities.



Water Resources Summary

The Kabekona River Subwatershed is home to the Kabekona River as its name implies, as well as several smaller streams and lakes. Of the lakes with available water quality data, 1 has improving water quality and 1 is stable. This subwatershed also has 2 lakes of outstanding biodiversity significance, as well as 1 cisco refuge lake, 1 trout lake, 4 priority wild rice lakes and 2 priority shallow lakes. Additionally, the Stanchfield Creek Subwatershed contains 41 miles of streams, including 30 miles of trout streams, 16 miles of which are impaired by E-coli.



Figure 53. Water quality trends.

Protection Status

68% of the Kabekona River Subwatershed is currently protected, mostly by county-owned lands and the Paul Bunyan State Forest. To reach the subwatershed protection goal of 75% an additional 5,443 acres need to be protected at an estimated cost of \$5,961,239. Fortunately, over 16,000 acres have the potential to protect, although the Leech Lake River Landscape Stewardship Committee recommends prioritizing protection efforts along the Kabekona River and minor watershed #'s 8007, 8014, 8016, 8020.



Figure 54. Protected lands.

Figure 55. Minor watershed protection levels.



Subwatershed No. 3 Woman Lake (HUC 701010203)

Description

The Woman Lake Subwatershed drains 163 square miles of Cass and Hubbard counties and is the headwaters to the Boy River. It is located along the southern border of the Leech Lake River Major Watershed and it has a rectangular shape that is about three times as wide (east to west) and it is tall (north to south). The dominant land cover in the Woman Lake Subwatershed is forest along with wetlands and open water. The headwaters are located in the western end of the subwatershed, and the subwatershed's outlet is where the Boy River flows out of Girl Lake in the subwatershed's northeastern corner.

Geography

Almost the entire Woman Lake Subwatershed is a landscape characterized by steep irregularly shaped slopes with many closed depressions. Approximately half of the landscape is covered by an end moraine, and the other half by outwash deposits.

Figure 56. Elevation.







Past, Current, and Potential Future Forest Conditions

The historical vegetation of the Woman River Subwatershed was estimated to be dominated by conifers, particularly red pine and white pine in the uplands and conifer swamps in the lowlands. Northern hardwood forests were also present and more likely to occur in the center of the subwatershed where the surrounding lakes provided protection from fire. Today the forest remains largely intact, although some fragmentation is occurring around the center of the subwatershed where agriculture, roads, and development is more common. The current forest composition is primarily in the aspen/birch forest type group, although smaller stands of northern hardwoods are spread throughout the subwatershed along with occasional stands of pine.

Estimates of the potential native plant communities (NPCs) indicate that the upland area has the potential to support a mix of mesic hardwood and fire-dependent NPCs. The lowland areas may support acid peatland, wet meadow, or wet forest NPCs.



Figure 58. Historic vegetation cover, Marschner.

Figure 59. Land cover, 2013.



Figure 60. Potential native plant communities.



Water Resources Summary

The Woman Lake Subwatershed is home to Woman Lake as its name implies, as well as an abundance of other lakes both small and large. Of the lakes with available water quality data, 12 are improving, 3 are declining, and 13 are stable/no trend. This subwatershed also has 2 lakes of outstanding biodiversity significance, as well as 1 cisco refuge lake, 1 trout lake, 4 priority wild rice lakes and 2 priority shallow lakes. Additionally, the Woman Lake Subwatershed contains 34 miles of streams, none of which are impaired.





Note: Since this map has been developed, the water quality trend in Ten Mile Lake, Widow Lake, Man Lake, Baby Lake, Girl Lake, and Big Deep Lake has changed to 'no trend' or 'stable'. Webb Lake has changed to 'improving'.

Protection Status

70% of the Woman Lake Subwatershed is currently protected, mostly by public waters and the Chippewa National Forest. To reach the subwatershed protection goal of 75% an additional 5,523 acres need to be protected at an estimated cost of \$8,127,185. Fortunately, nearly 18,000 acres have the potential to protect, although the Leech Lake River Landscape Stewardship Committee recommends prioritizing protection efforts on minor watershed #'s 8056, 8058, 8059, 8060, and 8065.



Figure 62. Protected lands.

Figure 63. Minor watershed protection levels.



Subwatershed No. 4 Boy River (HUC 701010204)

Description

The Boy River Subwatershed drains 232 square miles of Cass County and receives water from the Woman Lake Subwatershed. It is in the southeast corner of the Leech Lake River Major Watershed and its landcover is primarily forests and wetlands. The inlet to the Boy River Subwatershed is by the town of Longville, and from there the Boy River flows north and its outlet is in the northwestern corner of the subwatershed where the Boy River meets Leech Lake.

Geography

The Boy River Subwatershed has a mixture of landforms including end moraines, till plains, outwash plains, and lake plains. Most of the subwatershed is characterized by rolling to steep topography, although the area to the north of Boy Lake is a nearly level glacial lake basin (Aitkin) formed by melt waters of the Des Moines Lobe glacier.

Figure 64. Elevation.







Past, Current, and Potential Future Forest Conditions

The historical vegetation in the uplands of the Boy River Subwatershed was estimated to be a mix of coniferous and deciduous forests, mainly red pine, white pine, and northern hardwoods. The lowlands were mostly conifer swamps, which were particularly abundant in the northern part of the subwatershed. Today the forest remains largely intact, and the composition is primarily in the aspen/birch forest type group with spruce/fir forest in the lowlands.

Estimates of the potential native plant communities (NPCs) indicate that the majority of the upland area has the potential to support mesic hardwood NPCs, although fire-dependent NPCs have more potential in the portion of the subwatershed covered by the Itasca Moraine LTA. The lowland areas may support wet forest, acid peatland, forested rich peatland, or wet meadow NPCs. Wet meadow NPCs have noticeably more potential than the other lowland NPCs in the southern third of the subwatershed.



Figure 66. Historic vegetation cover, Marschner.

Figure 67. Land cover, 2013.





Figure 68. Potential native plant communities.

Water Resources Summary

The Boy River Subwatershed is home to the Boy River as its name implies, as well as an abundance of lakes both small and large. Of the lakes with available water quality data, 5 are improving, 3 are declining, and 7 are stable/no trend. This subwatershed also has 15 lakes of high or outstanding biodiversity significance, as well as 2 cisco refuge lakes, 26 priority wild rice lakes and 15 priority shallow lakes. Additionally, the Boy River Subwatershed contains 67 miles of streams, 4 miles of which are impaired by invertebrate bioassessments.





Note: Since this map has been developed, the water quality trend in Swift Lake has changed to 'no trend'. The main basin of Long Lake has changed to 'decreasing'.

Protection Status

83% of the Boy River Subwatershed is currently protected, mostly by county-owned lands and the Chippewa National Forest. This exceeds the subwatershed protection goal of 75%, and therefore the Boy River Subwatershed is a low priority for forest land protection.





Figure 71. Minor watershed protection levels.



Subwatershed No. 5 Leech Lake (HUC 701010205)

Description

The Leech Lake Subwatershed is located near the center of the Leech Lake River Major Watershed where it covers 520 square miles of Cass, Hubbard, and Beltrami counties, making it the largest subwatershed in the major watershed. It also receives water from the Steamboat, Kabekona, and Boy rivers. The Leech Lake Subwatershed's defining feature is Leech Lake, which is among the most famous fishing lakes in Minnesota and the largest lake in the major watershed. The land cover in this subwatershed is largely undisturbed and split between forest cover, open water, and wetlands. The outlet to the Leech Lake Subwatershed is the Leech Lake River, which begins as an outflow from a northeastern bay of Leech Lake.

Geography

In the Leech Lake Subwatershed the area to the south of Leech Lake is in the Itasca Moraine, which is characterized by steep irregularly shaped slopes with many closed depressions. The area to the north of Leech Lake is characterized by level to rolling till plains formed by the Koochiching Lobe glacier, while near the eastern border is a nearly level glacial lake basin.

Figure 72. Elevation.







Past, Current, and Potential Future Forest Conditions

The historical vegetation in the uplands of the Leech Lake Subwatershed was estimated to be primarily coniferous forests, except on the till plain deposits to the north of the lake which were dominated by deciduous forests. The most common coniferous forest types were red and jack pine, and common deciduous forest types included northern hardwoods and aspen. Conifer swamps covered most of the lowland areas, which were particularly abundant to the east and northeast of Leech Lake. Today the forest remains largely intact with minor fragmentation near the communities that surround the lake. The current forest composition is primarily in the aspen/birch forest type group with some scattered stands of northern hardwoods and pine stands to the north of Leech Lake. The forested lowlands areas are generally in the spruce/fir forest type group.

Estimates of the potential native plant communities (NPCs) indicate that the upland area has the potential to support a mix of fire-dependent and mesic hardwood NPCs, although the mesic hardwood NPCs have significantly more potential on the till plain deposits. The lowland areas may support wet forest, acid peatland, or forested rich peatland NPCs. Wet forest NPCs have noticeably more potential than the other lowland NPCs on the portion of the subwatershed that intersects with the Rosey Lake Plain LTA to the northeast of Leech Lake.









Figure 76. Potential native plant communities.



Water Resources Summary

The Leech Lake Subwatershed is home to Leech Lake as its name implies, as well as many other smaller lakes. Of the lakes with available water quality data, 2 are improving and 7 are stable/no trend. This subwatershed also has 8 lakes of high or outstanding biodiversity significance, as well as 4 cisco refuge lakes, 1 trout lake, 12 priority wild rice lakes and 9 priority shallow lakes. Additionally, the Leech Lake Subwatershed contains 46 miles of streams, none of which are impaired.





Note: Since this map has been developed, the water quality trend in Williams Lake and Shingobee Lake has changed to 'no trend'.

Protection Status

88% of the Leech Lake Subwatershed is currently protected, mostly by public waters and the Chippewa National Forest. This exceeds the subwatershed protection goal of 75%, and therefore the Leech Lake Subwatershed is a low priority for forest land protection.



Figure 78. Protected lands.

Figure 79. Minor watershed protection levels.



Subwatershed No. 6 Leech River (HUC 701010206)

Description

The Leech River Subwatershed drains 171 square miles of Cass County and receives water from the Leech Lake Subwatershed. It is in the northeast corner of the Leech Lake River Major Watershed and its primary land covers and forest. are wetland The subwatershed's inlet is the Leech Lake Dam between Leech Lake and the Leech River on the subwatershed's western border. The outlet to the Leech River Subwatershed and the entire Leech Lake River Major Watershed is where the Leech River converges with the Mississippi River on the subwatershed's eastern border.

Figure 80. Elevation.



Geography

Most of the Leech River Subwatershed is nearly level and covered by an outwash or lake plain on which large areas of peatlands have formed. In contrast, the southern arm of the subwatershed intersects with the Sugar Hills Moraine LTA, which is rolling to steep end moraine formed by the Wadena Lobe glacier and later by the Des Moines Lobe glacier.





Past, Current, and Potential Future Forest Conditions

The historical vegetation in the Leech River Subwatershed was estimated to be dominated by conifer swamps, which covered more than half of the subwatershed area. Within the upland areas coniferous forests of jack and red pine were present on the outwash deposits, while deciduous forests of northern hardwoods, aspen, and birch were typically found on the till plains and moraines. Today the forest remains largely intact with relatively little fragmentation. The current forest composition is primarily in the aspen/birch forest type group in the uplands and spruce/fir in the lowlands.

Estimates of the potential native plant communities (NPCs) indicate that the lowland area has the potential to support wet forest, acid peatland, and forested rich peatland NPCs. The upland area has the potential to support both fire-dependent and mesic hardwood NPCs, although generally the potential for fire-dependent NPCs is greater in the area to the north of the Leech River, while mesic hardwoods NPCs have greater potential south of the river.



Figure 82. Historic vegetation cover, Marschner.





Figure 84. Potential native plant communities.



Water Resources Summary

The Leech River Subwatershed is largely a stream-based watershed with relatively few lakes. It is home to the Leech River as its name implies, as well as a few other smaller streams. The single lake with available water quality data has no trend. This subwatershed also has 5 lakes of outstanding biodiversity significance, as well as 7 priority wild rice lakes and 8 priority shallow lakes. Additionally, the Leech River Subwatershed contains 52 miles of streams, none of which are impaired.





Protection Status

90% of the Leech River Subwatershed is currently protected, mostly by the Chippewa National Forest, Bowstring State Forest, and the Mud Goose Wildlife Management Area. This exceeds the subwatershed protection goal of 75%, and therefore the Leech River Subwatershed is a low priority for forest land protection.





Figure 87. Minor watershed protection levels.



This page intentionally left blank

Ecological Pathway to Sustainable Forest Management

Below is the general sequence of concepts and products that were developed for and/or integrated into the 2nd generation North Central Landscape Plan as a suggested ecological pathway to help land managers and owners work from the landscape scale down to the site level when planning specific forest management activities.

1. Ecological Classification System

- a. Field Guide to the Native Plant Communities of Minnesota: The Laurentian Mixed Forest Province
- b. DNR ECS website (http://www.dnr.state.mn.us/ecs/index.html)
- North Central Landscape Conditions and Trends Report (pp. 3.2-3.6) (<u>https://mn.gov/frc/docs/north-central_Conditions&Trends_2017.pdf</u>)
- North Central Landscape Resource Atlas (pp. 37-41) (<u>https://mn.gov/frc/docs/NC_Resource_Atlas_May2016.pdf</u>)
- e. North Central Landscape Plan (p. 3.2) (https://mn.gov/frc/docs/NC_Landscape_Plan.pdf)

2. Native Plant Communities

- a. Field Guide to the Native Plant Communities of Minnesota: The Laurentian Mixed Forest Province
- b. Field Guide to the Native Plant Communities of Minnesota: The Eastern Broadleaf Forest Province
- c. DNR NPC website (<u>http://www.dnr.state.mn.us/npc/index.html</u>)
- d. North Central Landscape Conditions and Trends Report (pp. 3.7-3.8) (<u>https://mn.gov/frc/docs/north-central_Conditions&Trends_2017.pdf</u>)
- e. North Central Landscape Resource Atlas (pp. 65-66) (<u>https://mn.gov/frc/docs/NC_Resource_Atlas_May2016.pdf</u>)
- f. North Central Landscape Plan Appendix D (<u>https://mn.gov/frc/docs/NC_Landscape_Plan_Appendix.pdf</u>)

3. Potential Native Plant Communities

- a. Geospatial Modeling of Native Plant Communities of Minnesota's Laurentian Mixed Forest (<u>http://mn.gov/frc/docs/NPC_Technical_Report_Final_Jan2013.pdf</u>)
- Mapping Potential Native Plant Communities of Minnesota's Laurentian Mixed Forest (<u>http://mn.gov/frc/docs/Potential Native Plant Communities Summary Final-Jan2014.pdf</u>)
- c. Potential Native Plant communities of Minnesota's Eastern Broadleaf Forest (<u>https://data.nrri.umn.edu/data/dataset/cb6d64e5-fb67-4b05-b9cc-</u> <u>5bbebdb3568a/resource/43c8d895-709b-4b82-ae22-7dade35ac1df/download/nrri-tr-2019-01.pdf</u>)
- d. GIS data sources:
 - Laurentian Mixed Forest: <u>http://data.nrri.umn.edu/data/dataset/nemn-pnpc</u>
 - Laurentian Mixed Forest & Eastern Broadleaf Forest: https://data.nrri.umn.edu/data/dataset/npc-ebf-Imf
- e. North Central Landscape Conditions and Trends Report (pp. 3.8-3.12) (<u>https://mn.gov/frc/docs/north-central_Conditions&Trends_2017.pdf</u>)
- f. North Central Landscape Resource Atlas (pp. 69-92) (https://mn.gov/frc/docs/NC_Resource_Atlas_May2016.pdf)

4. Vegetation Management Framework Goals and Strategies

a. North Central Landscape Plan – Section 7 (https://mn.gov/frc/docs/NC_Landscape_Plan.pdf)

5. <u>Climate Change Considerations and Strategies</u>

- Minnesota Forest Ecosystem Vulnerability Assessment and Synthesis: A Report from the Northwoods Climate Change Response Framework Project (http://www.fs.fed.us/nrs/pubs/gtr/gtr_nrs133.pdf)
- b. Forest Adaptation Resources: Climate Change Tools and Approaches for Land Managers (<u>https://www.fs.fed.us/nrs/pubs/gtr/gtr_nrs87-2.pdf</u>)
- c. Climate Change Field Guide for Northern Minnesota Forests: Site-level consideration and adaption (<u>https://forestadaptation.org/sites/default/files/ClimateChangeFieldGuide_NMNForests_HiRes.</u> pdf)
- d. Minnesota Private Landowner Climate Scorecard (<u>https://forestadaptation.org/sites/default/files/KeepYourWoodsHealthyforTomorrow_MN.pdf</u>)
- e. Climate Change Atlas (https://www.fs.fed.us/nrs/atlas/)
- f. NPC silviculture strategies for forest stand prescriptions (<u>https://www.dnr.state.mn.us/forestry/ecs_silv/npc/index.html</u>)
- g. North Central Landscape Conditions and Trends Report (pp. 3.21-3.25) (<u>https://mn.gov/frc/docs/north-central_Conditions&Trends_2017.pdf</u>)
- h. North Central Landscape Plan Appendix D (<u>https://mn.gov/frc/docs/NC_Landscape_Plan_Appendix.pdf</u>)
- i. North Central Landscape Plan (pp. 4.9-10, 7.20-21) (<u>https://mn.gov/frc/docs/NC_Landscape_Plan.pdf</u>)

6. Silvicultural Considerations

- a. MN DNR Tree Suitability Table (<u>http://files.dnr.state.mn.us/forestry/ecssilviculture/treetables.pdf</u>)
- b. NPC silviculture strategies for forest stand prescriptions (<u>https://www.dnr.state.mn.us/forestry/ecs_silv/npc/index.html</u>)
- c. Great Lakes Silvicultural Library (<u>https://silvlib.cfans.umn.edu/</u>)
 d. North Central Landscape Plan Appendix D
- (https://mn.gov/frc/docs/NC_Landscape_Plan_Appendix.pdf)
- e. North Central Landscape Plan Appendix E (<u>https://mn.gov/frc/docs/NC_Landscape_Plan_Appendix.pdf</u>)

7. <u>Tatum Guides – in development</u>

a. NPC silviculture strategies for forest stand prescriptions (<u>https://www.dnr.state.mn.us/forestry/ecs_silv/npc/index.html</u>)



Linking Forest & Water Planning and Implementation through LSPs and 1W1Ps

Note: Landscape stewardship plans (LSPs) like the MPCA Watershed Restoration and Protection Strategies (WRAPs) and the MDH Groundwater Restoration and Protection Strategies (GRAPs) provide an important information and relevant context from state water and forest resource programs to inform comprehensive local water management (1W1Ps) processes. Members of the 1W1P committees are encouraged to consider the recommendations in this document for incorporation into their plans. Through the integration of landscape stewardship plans and 1W1Ps, conservation professionals and landowners are working together to address the following national priorities from the USDA Forest Service:

- Conserve Working Forest Lands.
- Protect Forests from Harm.
- Enhance Public Benefits from Trees and Forests.

"A lake is the landscape's most beautiful and expressive feature. It is Earth's eye; looking into which the beholder measures the depth of his own nature."

- Henry David Thoreau



Index Information – Leech Lake River Major Watershed

Subwd no.	Subwatershed name	HUC no.	Acres	No. of minors
1	Steamboat River	701010201	85,826	9
2	Kabekona River	701010202	77,237	7
3	Woman Lake	701010203	104,319	9
4	Boy River	701010204	148,715	20
5	Leech Lake	701010205	332,672	20
6	Leech River	701010206	109,202	10
	Totals		857,971	75

