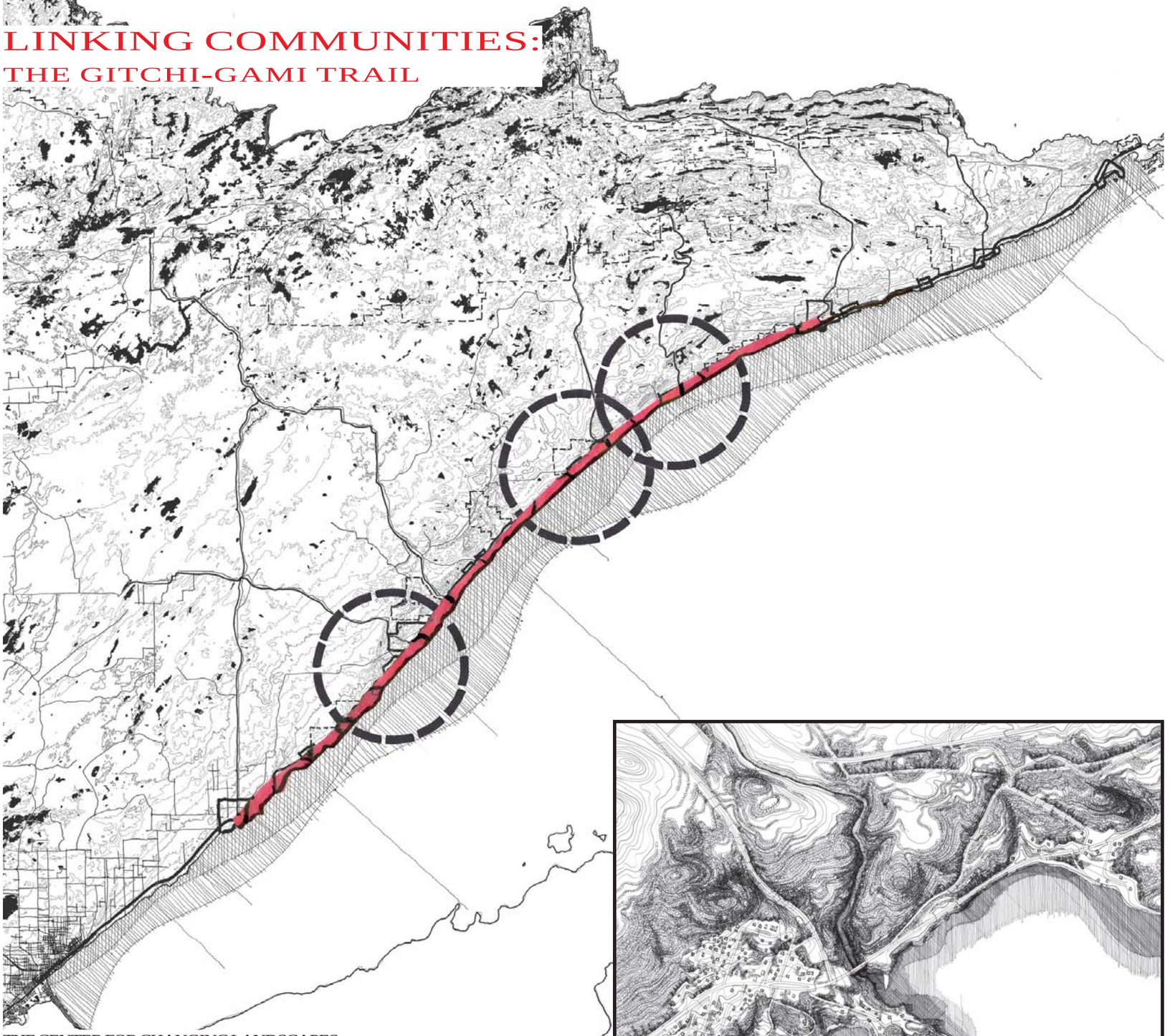
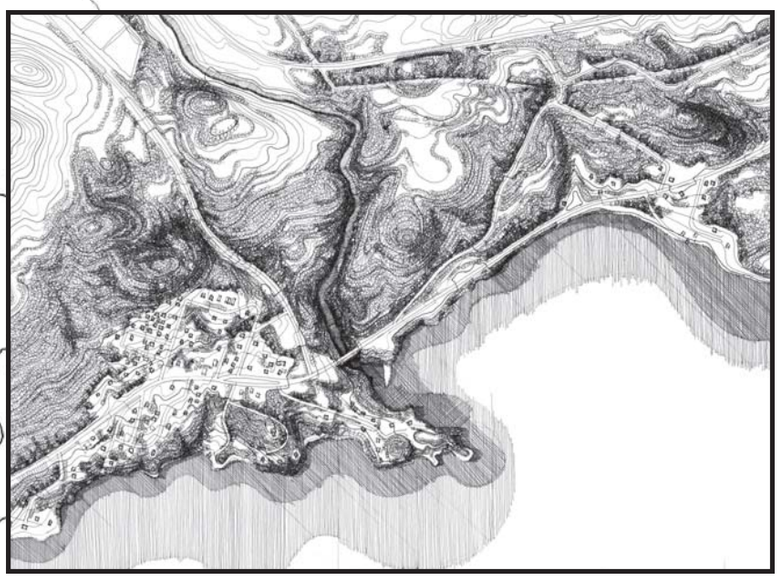
LINKING COMMUNITIES:
THE GITCHI-GAMI TRAIL





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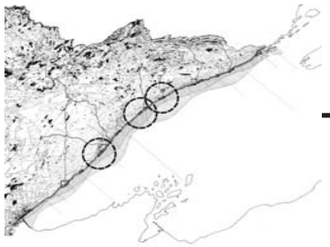
COLLEGE OF ARCHITECTURE &
LANDSCAPE ARCHITECTURE
COLLEGE OF NATURAL RESOURCES
UNIVERSITY OF MINNESOTA



ACKNOWLEDGEMENTS

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Natural Resources
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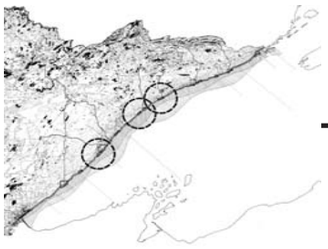


INTRODUCTION

PROJECT SCOPE:

Recreation, natural and cultural resource protection, tourism, and community livability are promoted by designs for Gitchi-Gami State Trail by a University-DNR-community partnership using design, computer technology, and community participation.

This work augments the Department of Natural Resource's state trail work with communities to create a whole systems approach to integrating state trails in communities and their landscapes. Future development patterns in the trail corridor were projected using computer technology. Site specific designs for the integration of the trail with communities that address such elements as trail head facilities, parking lots, trail orientation, trail connections to natural and cultural sites, community trail system that connects to the state trail, and in some cases, the state trail corridor itself are provided.

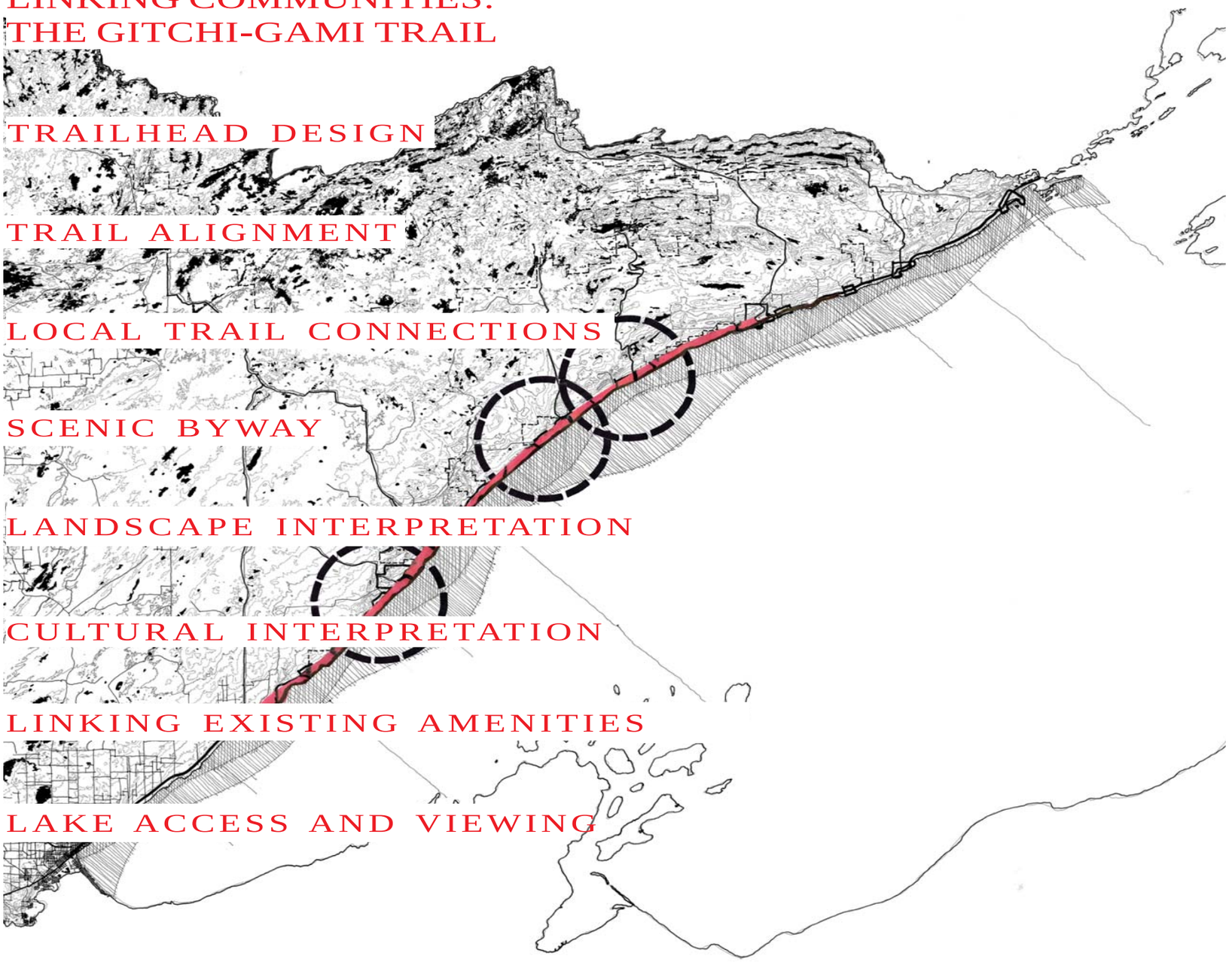
State recreational trails are very popular because they create opportunities for Minnesotans to experience the natural environment, add to the livability of communities, and contribute considerably to the tourism economy. Valuable in and of themselves, state trails can leverage even more value if the larger context of natural resource systems, cultural amenities, future development patterns, and community form are considered and linked to trail corridors. This project extends and enhances the traditional DNR Trails and Waterways Division corridor-based trail planning on the Gitchi Gami Trail. The Gitchi-Gami Trail was selected based on timeliness, community interest, opportunities to enhance and create amenities, and the need to remove trail development challenges.

A project team from the Center for Changing Landscapes, an interdisciplinary center of the College of Architecture and Landscape Architecture (CALA) and the College of Natural Resources (CNR) of the University of Minnesota, the Trails and Waterways Division of the Department of Natural Resources, users groups, other state agencies such as MNDOT, and local community groups worked together on selected sites on the Gitch-Gami Trail.

The DNR led work with communities and trail groups to ensure local and user input on recreational, tourism, and community issues. The Center for Changing Landscapes provided both technical and design expertise. CNR project team members used existing data, satellite imaging and sophisticated computer technology including neural network modeling methodology to project current land use trends and model land transformations that predict future land use scenarios. CALA project team members created design scenarios for the Gitchi-Gami State Trail, local trails that connect to the state trail, amenities that can be visited from the trail, and the trail communities. The work was presented in public meetings for discussion, feedback, and final presentations.

The project has several products. Maps provide information about the ecology of the trail environment, project future development, land use trends in the trail corridor. Designs were created that can be used by communities to implement work that informs future development patterns and makes connections to the state trail by enhancing local landscapes and community form.

LINKING COMMUNITIES: THE GITCHI-GAMI TRAIL



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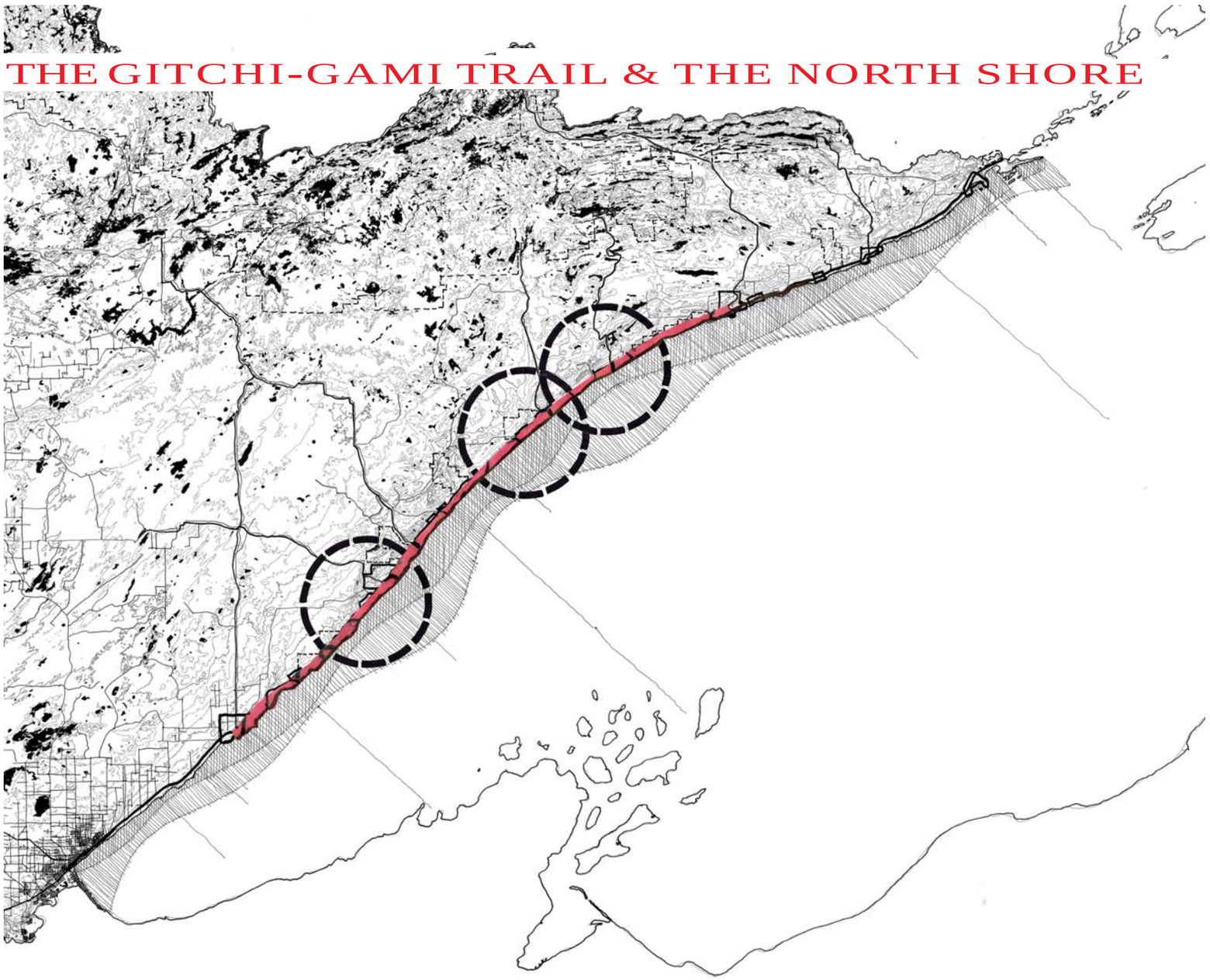
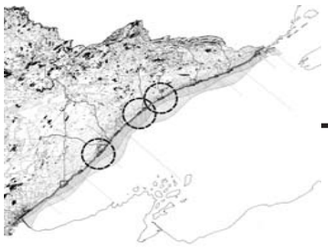
LAKE SUPERIOR

THE GITCHI-GAMI TRAIL & THE NORTH SHORE





THE REGION

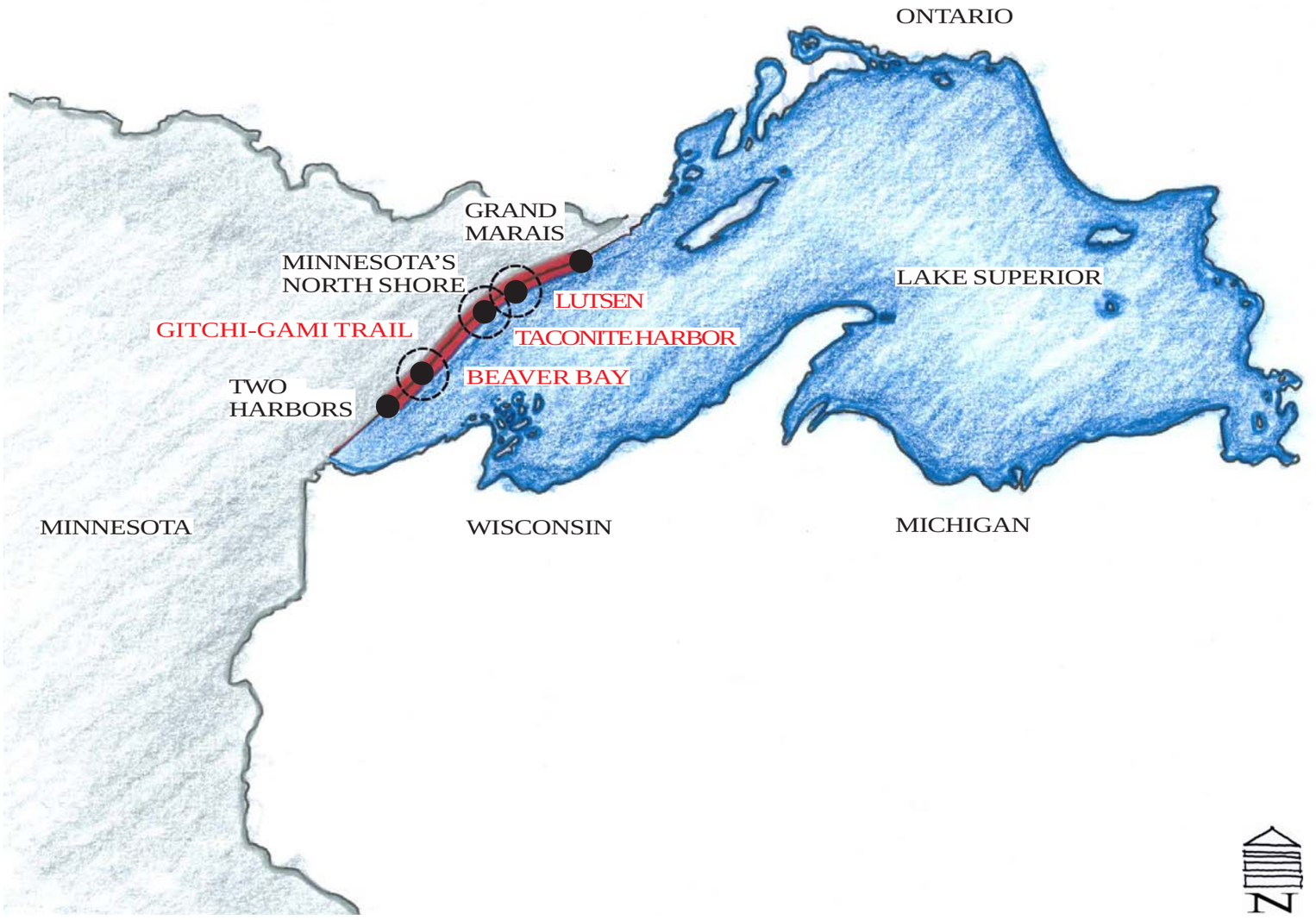
LAKE SUPERIOR:

Water covers 70% of the earth's surface area, but only 3% of it is freshwater. Saltwater makes up 97% of the earth's water supply. Of the earth's freshwater, 90% is locked up in glaciers, polar ice caps, and groundwater aquifers. Only 0.32% of the world's water is available in freshwater lakes and rivers. Lake Superior is the largest freshwater lake in the world, and contains 10% of the world's fresh surface water. Lake Superior, with a volume of 2,934 cubic miles, or 3 quadrillion gallons, holds as much water as the other Great Lakes combined, enough water to cover all of North and South America to a depth of 1 foot.

Lake Superior is 350 miles long and 160 miles wide, with a shoreline length of 2,726 miles and a maximum lake depth of 1,279 feet. The average lake depth is 489 feet. Lake Superior's water surface area of 31,700 square miles is equal to the area of Massachusetts, Rhode Island, Vermont, and New Hampshire combined. It takes the sun 30 minutes to cross Lake Superior. It is large enough to influence local weather patterns, creating cooler summer temperatures and warmer winter temperatures along the shore than occur just a few miles inland.

Lake Superior has its own periodic seiche (SAYSH), caused by wind and barometric pressure, which pushes and pulls water from one side of the lake to the other, much like oceanic tides. The lake is classified as ultra-oligotrophic by limnologists who study lakes, meaning its cold, sterile water has few nutrients and slow growth rates. Water temperatures average 40 degrees in the summer. Lake Superior is the cleanest of the Great Lakes, with an unmatched water clarity that allows visibility of 30 feet or more. Because of its large volume, however, the lake has a slow replacement rate, making it highly susceptible to pollution. It takes 191 years for natural processes to replace all the water currently in Lake Superior.

The lake first filled with glacial meltwater 10,000 years ago. The drainage basin of Lake Superior is relatively small, at 49,300 square miles, when compared to the lake's large 31,700 square mile surface area. The drainage basin is 89% forested, which helps contribute to water clarity. The elevation of Lake Superior is 602 feet above sea level. Over 1,000 ships a year visit the twin ports of Duluth-Superior, making Duluth-Superior the largest freshwater port in the world. Ships export grain, iron ore, and lumber from Minnesota. Fierce storms hit the lake in November and March, whipping up waves 10 to 20 feet high. There are more than 350 shipwrecks in Lake Superior.


ONTARIO
GRAND MARAIS
MINNESOTA'S NORTH SHORE
LUTSEN
GITCHI-GAMI TRAIL
TACONITE HARBOR
BEAVER BAY
TWO HARBORS
LAKE SUPERIOR
MINNESOTA
WISCONSIN
MICHIGAN
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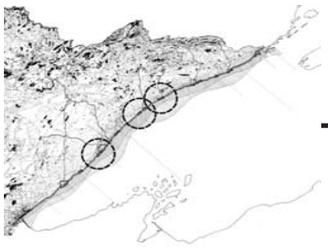


THE REGION

THE GITCH-GAMI TRAIL & THE NORTH SHORE:

Currently segments of the Gitchi Gami Trail are being planned and built. When complete, the trail will extend along the North Shore of Lake Superior from the City of Two Harbors to the City of Grand Marais. In places the trail will run parallel to Highway 61, the North Shore Scenic Drive. In other places the trail will leave the highway to travel through state parks and communities. The trail will be a major amenity in an amenity-rich environment for residents and visitors alike. It offers an opportunity to:

Experience and enjoy Lake Superior, the many rivers that cascade down the rocky terrain to the lake, the flora and fauna in this very special microclimate, and the cultural heritage of the area,

Create trailheads in communities; a strategy that will help support the community's economy and add to the community's livability by providing access to the trail by local residents, and

Link the numerous recreational resources available in this very special landscape into a system of recreation amenities that can be accessed from each other.

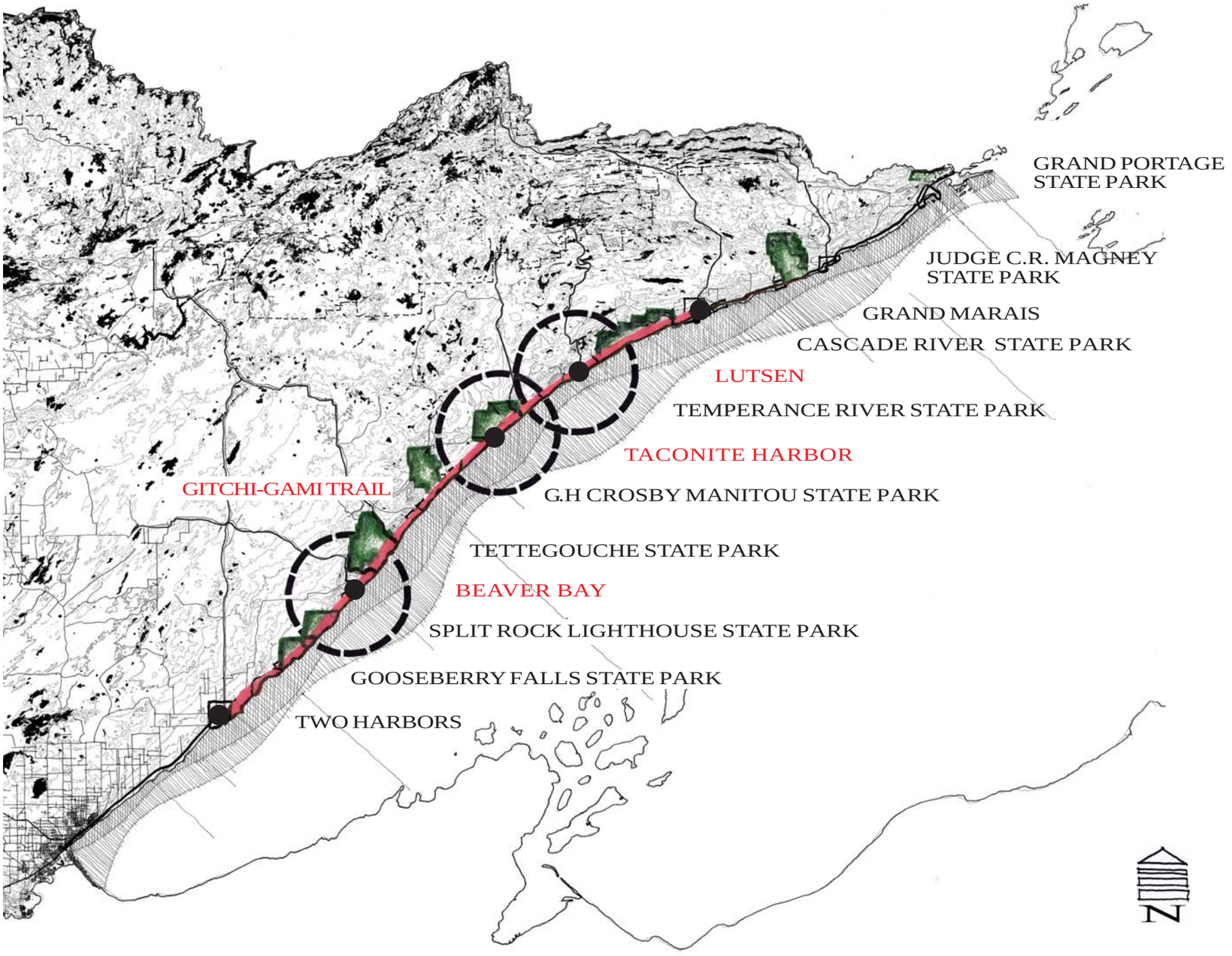
THE LARGER CONTEXT:

Minnesota's "North Shore" of Lake Superior is like no other place in the Midwest. In a region characterized by flat prairies and rolling farm fields, the North Shore offers deep, dark forests, rugged mountains, and a windswept coastline with crashing waves. Fresh streams tumble through rocky gorges into the ice cold waters of Lake Superior. The North Shore has a refreshing and invigorating character that is unique in the Upper Midwest.

The North Shore of Lake Superior is a popular destination for recreationalists from throughout the United States and Canada. When completed the Gitchi-Gami Trail will wind its way along the narrow edge of Lake Superior, parralleling the North Shore Scenic Drive, which extends from Duluth to the Canadian Border. Dramatic views of rocky beaches, jagged cliffs, thundering waterfalls, and sheltering pines are revealed around every bend in the road. The Arrowhead Region of northeastern Minnesota contains the state's last significant tracts of old-growth pine and white cedar forest. Wolves, moose, deer, black bear, and birds of prey roam the forests, while salmon and trout swim the clear waters of Lake Superior and its tributary streams.

Eight state parks, three state forests, one national forest, a national monument, and several wayside parks provide numerous opportunities to experience the outdoors. The Superior Hiking Trail winds 200 miles along the rocky mountain tops overlooking the North Shore. Every state park has a network of well maintained trails. Fishing boats, sailboats, kayaks, and tour boats are available for rent and hire along the shore. In winter, hundreds of miles of groomed trails attract cross-country skiers, snowshoers, and snowmobilers. Lutsen Mountain is the Midwest's largest downhill ski resort.

The North Shore's rich history is deeply connected to the cultural traditions of its inhabitants. Native Americans have lived on the North Shore since the retreat of the last glaciers 12,000 years ago. French missionaries and fur traders began arriving over 350 years ago. Many place names along the North Shore originate from Ojibway words or their French translations. Scandinavian immigrants arrived to work the mines and settle the land. The charming logging and fishing communities of the North Shore retain their ethnic heritage. The Sawbill, Caribou, Arrowhead, and Gunflint Trails lead inland to the Boundary Waters Canoe Area Wilderness. Museums and state park interpretive centers help tell the story of the North Shore.


GRAND PORTAGE STATE PARK
JUDGE C.R. MAGNEY STATE PARK
GRAND MARAIS
CASCADE RIVER STATE PARK
LUTSEN
TEMPERANCE RIVER STATE PARK
TACONITE HARBOR
G.H CROSBY MANITOU STATE PARK
GITCHI-GAMI TRAIL
TETTEGOUCHE STATE PARK
BEAVER BAY
SPLIT ROCK LIGHTHOUSE STATE PARK
GOOSEBERRY FALLS STATE PARK
TWO HARBORS
N

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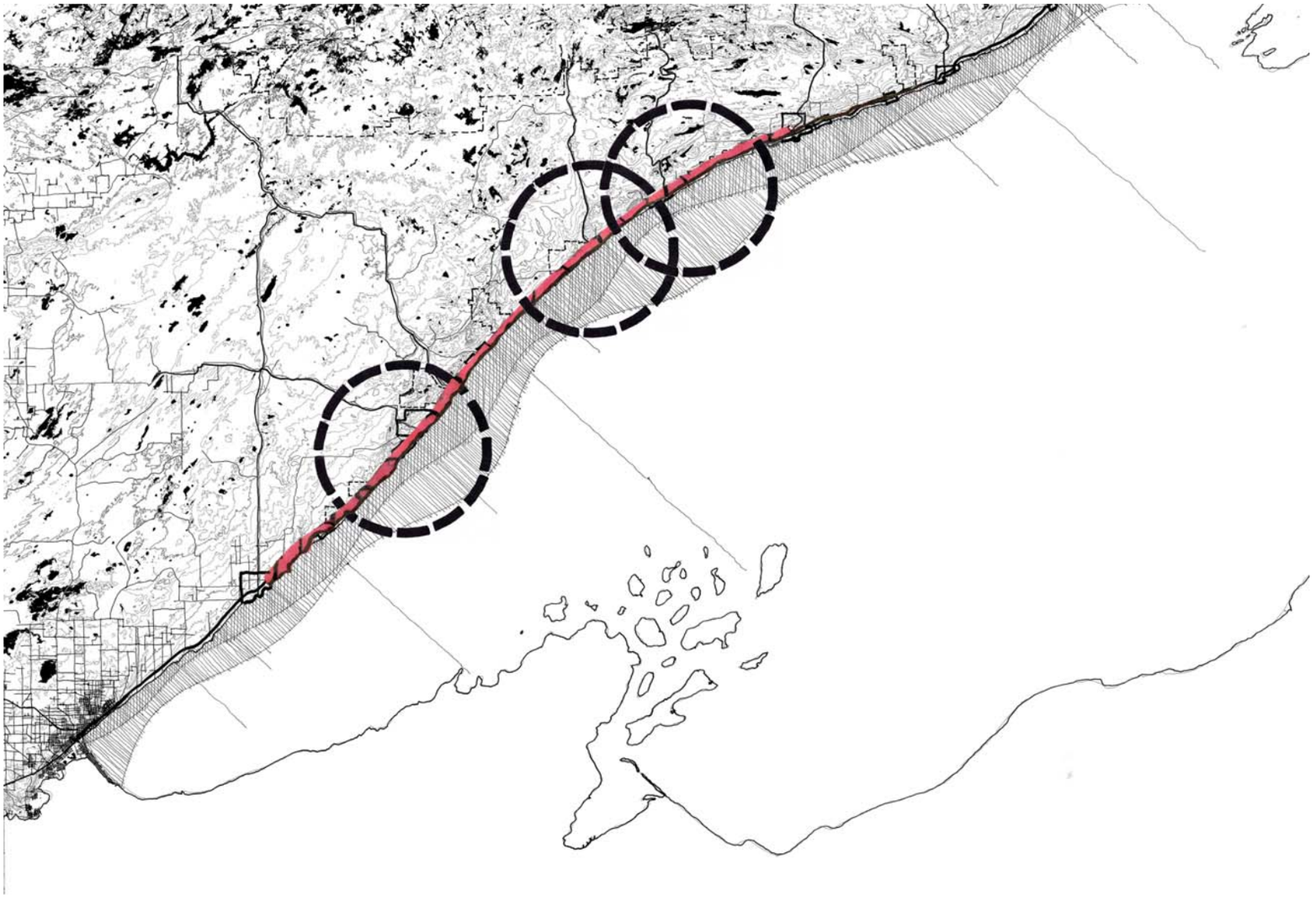
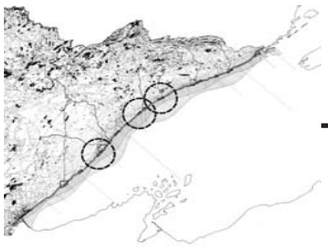
THE GITCHI-GAMI TRAIL & LINEAR RECREATIONAL SYSTEMS

GEOGRAPHIC INFORMATION SYSTEMS OVERVIEW

LAND TRANSFORMATION MODELING OVERVIEW





ANALYSIS

THE GITCHI-GAMI TRAIL & LINEAR RECREATIONAL SYSTEMS:

The Gitchi-Gami Trail runs from Two Harbors to Garand Marais moving through a landscape rich in natural beauty, and historic significance. Running parallel to the trail are the many other linear recreational systems on the North Shore. Even though these systems often run parallel to each other, the connections between them are weak or do not exist. The design investigations explored opportunities to create linkages that strengthen the region as network of recreational amenities that can be accessed from communities.

THE NORTH SHORE STATE TRAIL:

This 146 mile natural surface trail from Duluth to Grand Marais provides multiple opportunities for recreation along the North Shore. Primarily used by snowmobiles, it traverses St. Louis, Lake, and Cook counties in northeastern Minnesota. The trail winds its way through the forests behind the outer bluffs that overlook Lake Superior, and provides access to some of the most rugged and beautiful scenery in Minnesota. The trail also connects the Grants-In-Aid (GIA) trails at Silver Bay, Beaver Bay, Finland, Tofte, and Lutsen, as well as numerous local trails created and maintained by local snowmobile clubs.
http://www.dnr.state.mn.us/state_trails/north_shore/index.html

THE SUPERIOR HIKING TRAIL:

The Superior Hiking Trail is a 205-mile footpath that follows the rocky ridgeline above Lake Superior in northeastern Minnesota. It begins just north of Two Harbors, MN, and ends just before the Canadian border. The trail has 30 trailheads and 81 backcountry campsites making it ideal for both day hikes and backpacking. There are no fees, reservations, or permits required to hike or backpack on the trail.
http://www.shta.org/

THE NORTH SHORE SCENIC DRIVE:

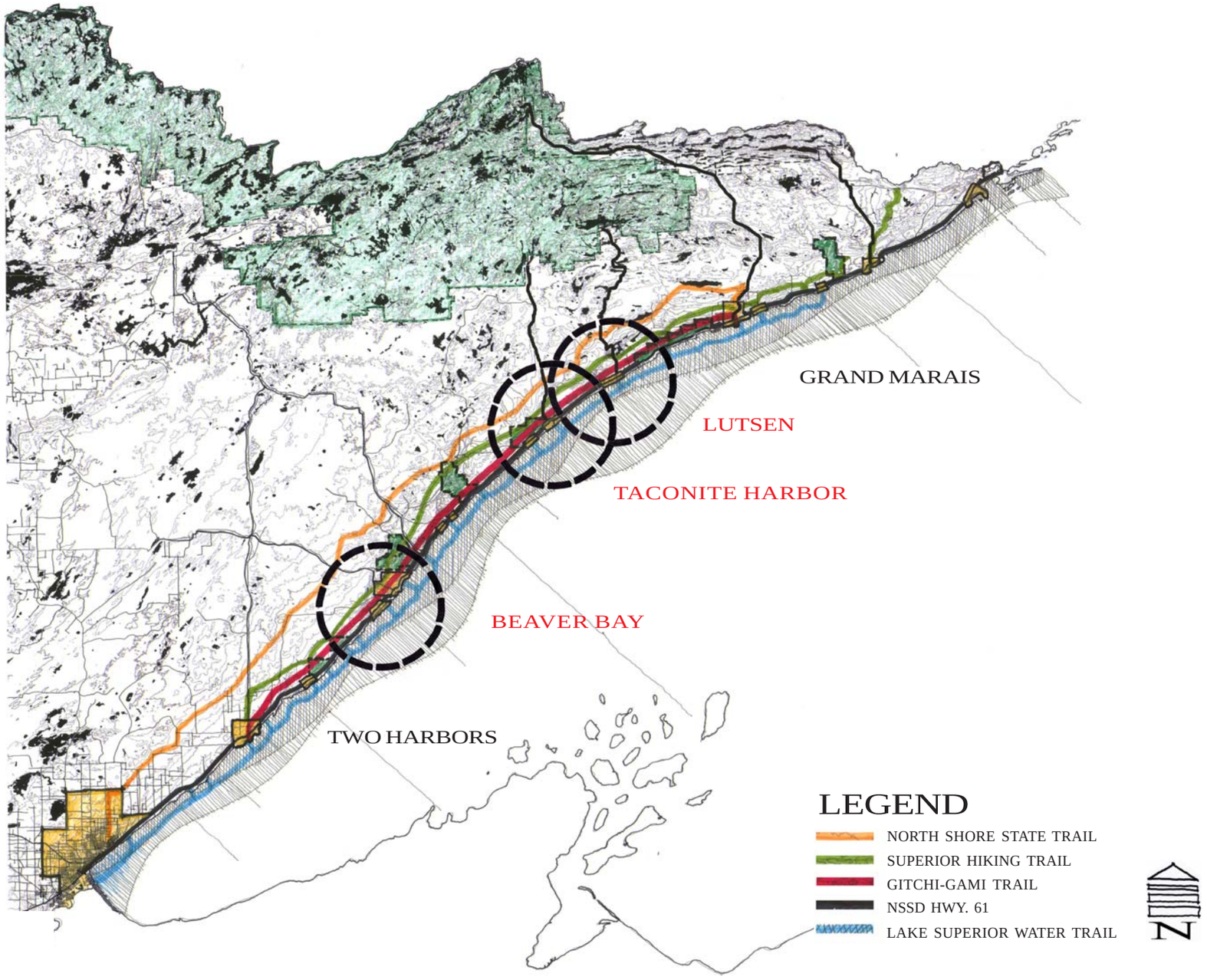
The North Shore Scenic Drive has been awarded All-American Road status from Duluth to Grand Portage, based on its recreational and scenic qualities. The citation describes the North Shore as some of the most spectacular scenery in the country, wedged between the rugged Superior Highlands and the vast expanse of a shining inland sea. High quality experiences abound with opportunities to enjoy the outdoors along one of the greatest trail systems in the nation. The North Shore is one of the primary destinations for recreational driving in the Midwest. The unique geography, spectacular topography, diversity of habitat, and colorful heritage of its settlers combines to tell the story of a rich history, deeply rooted in plentiful natural resources, and dotted with innumerable points of interest giving visitors a reason to come back and visit again and again.

THE LAKE SUPERIOR WATER TRAIL:

Established by the Minnesota Legislature in 1993, the Minnesota portion of the Lake Superior Water Trail will eventually extend from the St. Louis Bay in Duluth to the Pigeon River on the Canadian border, a distance of approximately 150 miles. Cooperative efforts in Ontario, Wisconsin, Michigan, and First Nations will develop a water trail completely around Lake Superior, primarily for use by sea kayakers. The development and maintenance of the Water Trail is a joint effort of the Minnesota Department of Natural Resources and the Lake Superior Water Trail Association of Minnesota.
http://www.dnr.state.mn.us/kayaking/lswt/about.html

UNITED STATES FOREST SERVICE (USFS) TRAILS:

The United States Forest Service (USFS) trails include the Sawbill Trail in Tofte, the Caribou Trail in Lutsen, the Gunflint Trail in Grand Marais, and the Arrowhead Trail near Hovland. These roads are the major trails leading inland that provide access to the BWCA from the shore of Lake Superior.


GRAND MARAIS
LUTSEN
TACONITE HARBOR
BEAVER BAY
TWO HARBORS
LEGEND
NORTH SHORE STATE TRAIL
SUPERIOR HIKING TRAIL
GITCHI-GAMI TRAIL
NSSD HWY. 61
LAKE SUPERIOR WATER TRAIL
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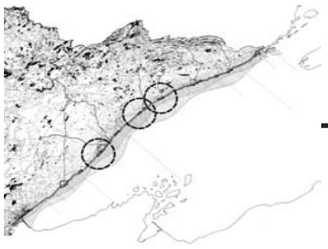


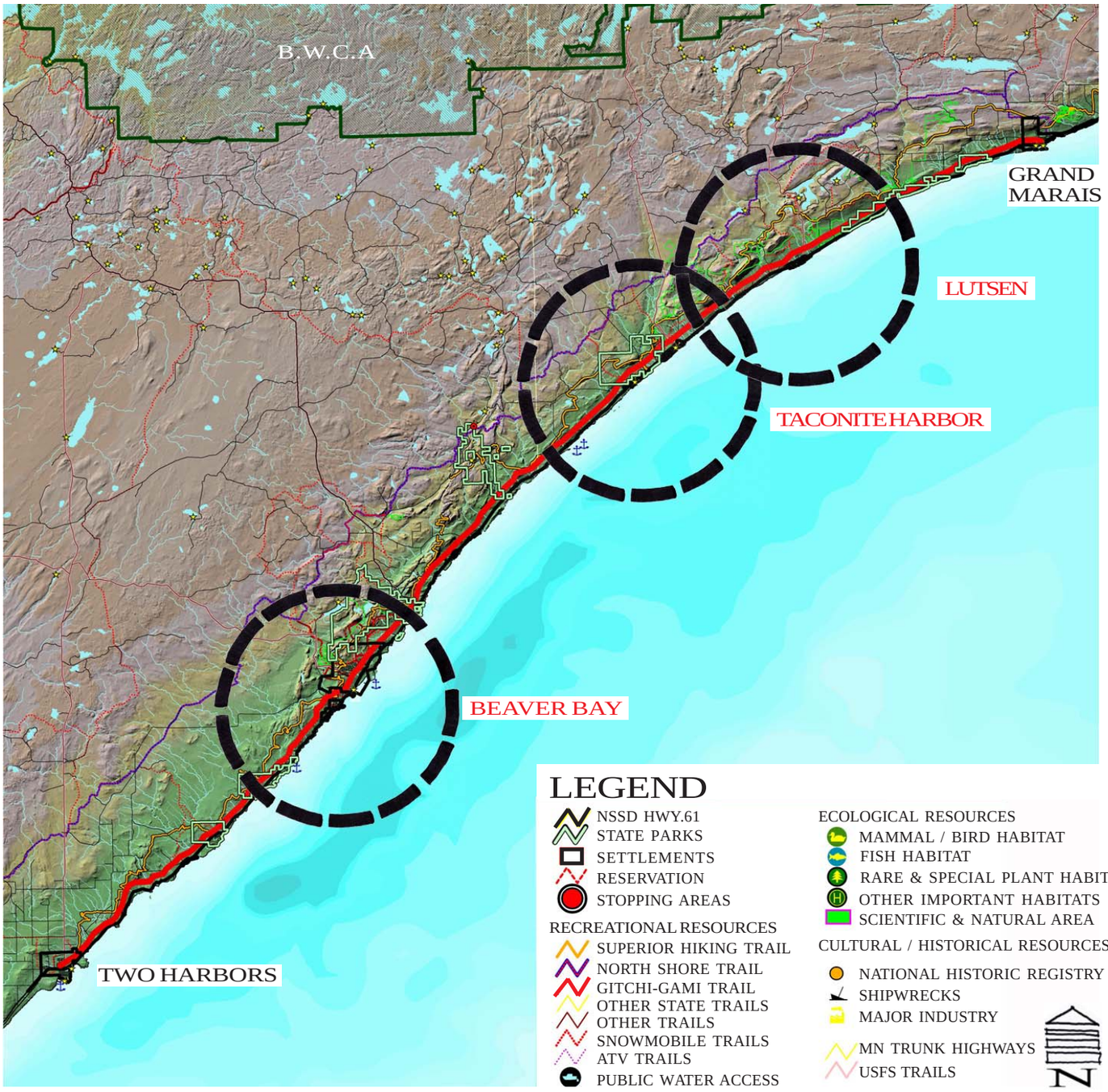
ANALYSIS

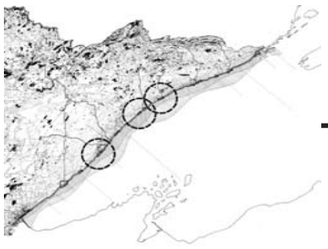
GEOGRAPHIC INFORMATION SYSTEMS OVERVIEW:

Through the use of GIS technologies hundreds of data layers were analyzed and organized into thematic maps. This layering of information, research, and analysis formed the foundation and tools needed for the planning and design. By documenting and studying the multiple assets and themes, a holistic approach to the corridor design was developed that responds to the ecological, cultural, historic, and economic sustainability issues of the region. A regional resource analysis was made of the length of the Gitchi-Gami Trail from Two Harbors to Grand Marais and included the following base data layers:

- Bedrock Geology
- Surficial Geology
- Topography
- Infrastructure
- Elevation
- Ecology
- Development
- Infrastructure
- Historic Structures
- Hydrology
- Original Vegetation
- National Wetlands Inventory
- Native Plant Communities
- Biological Diversity
- Ecological Class
- FEMA Floodplains
- Landforms
- County Well Index
- Transportation
- User Needs
- Utilities
- Water Quality
- Land Use
- Land Cover
- Population Change from 1990 - 2000
- Gap Land Ownership

These layers were used as the basis from which an ecological understanding of this region was derived. The maps produced from these layers include: Geology, Topography, Hydrology, Original Vegetation, Ecology, Landcover, Development, Infrastructure, Land Ownership, Historic Structures, and Recreational Sites. These thematic maps and a brief description of each are found in the index pages 98-121.


B.W.C.A
GRAND MARAIS
LUTSEN
TACONITE HARBOR
BEAVER BAY
TWO HARBORS
LEGEND
NSSD HWY.61
STATE PARKS
SETTLEMENTS
RESERVATION
STOPPING AREAS
RECREATIONAL RESOURCES
SUPERIOR HIKING TRAIL
NORTH SHORE TRAIL
GITCHI-GAMI TRAIL
OTHER STATE TRAILS
OTHER TRAILS
SNOWMOBILE TRAILS
ATV TRAILS
PUBLIC WATER ACCESS
ECOLOGICAL RESOURCES
MAMMAL / BIRD HABITAT
FISH HABITAT
RARE & SPECIAL PLANT HABITAT
OTHER IMPORTANT HABITATS
SCIENTIFIC & NATURAL AREA
CULTURAL / HISTORICAL RESOURCES
NATIONAL HISTORIC REGISTRY
SHIPWRECKS
MAJOR INDUSTRY
MN TRUNK HIGHWAYS
USFS TRAILS
N



ANALYSIS

LAND TRANSFORMATION MODELING OVERVIEW:

To determine how much non-urban land within and around the Gitchi-Gami Trail will transition to urban land in the future, by the years 2020 and 2050, analysts from the College of Natural Resources used a digital modeling tool called the Land Transformation Model (LTM). Developed by Michigan State University, this tool uses land use and land use change data from the past to predict how land use will change in the future. The model makes its predictions by considering factors that drive change, like distance to lakes, distance to interstates, and elevation. Details of this model and its application in this study are provided in the appendix pages 122-125.

PURPOSE OF THE REPORT:

The research team will analyze the area's natural systems, existing natural and cultural amenities, development patterns, and land uses. The purpose of this report is twofold: First, to describe the application of the Land Transformation Model (LTM) (11) to an analysis and projection of land use for the Lake Country Scenic Byway study area in North Central Minnesota shown in figure 1. Second, to show how the LTM results can be applied to guide specific community planning and design.

STUDY AREA:

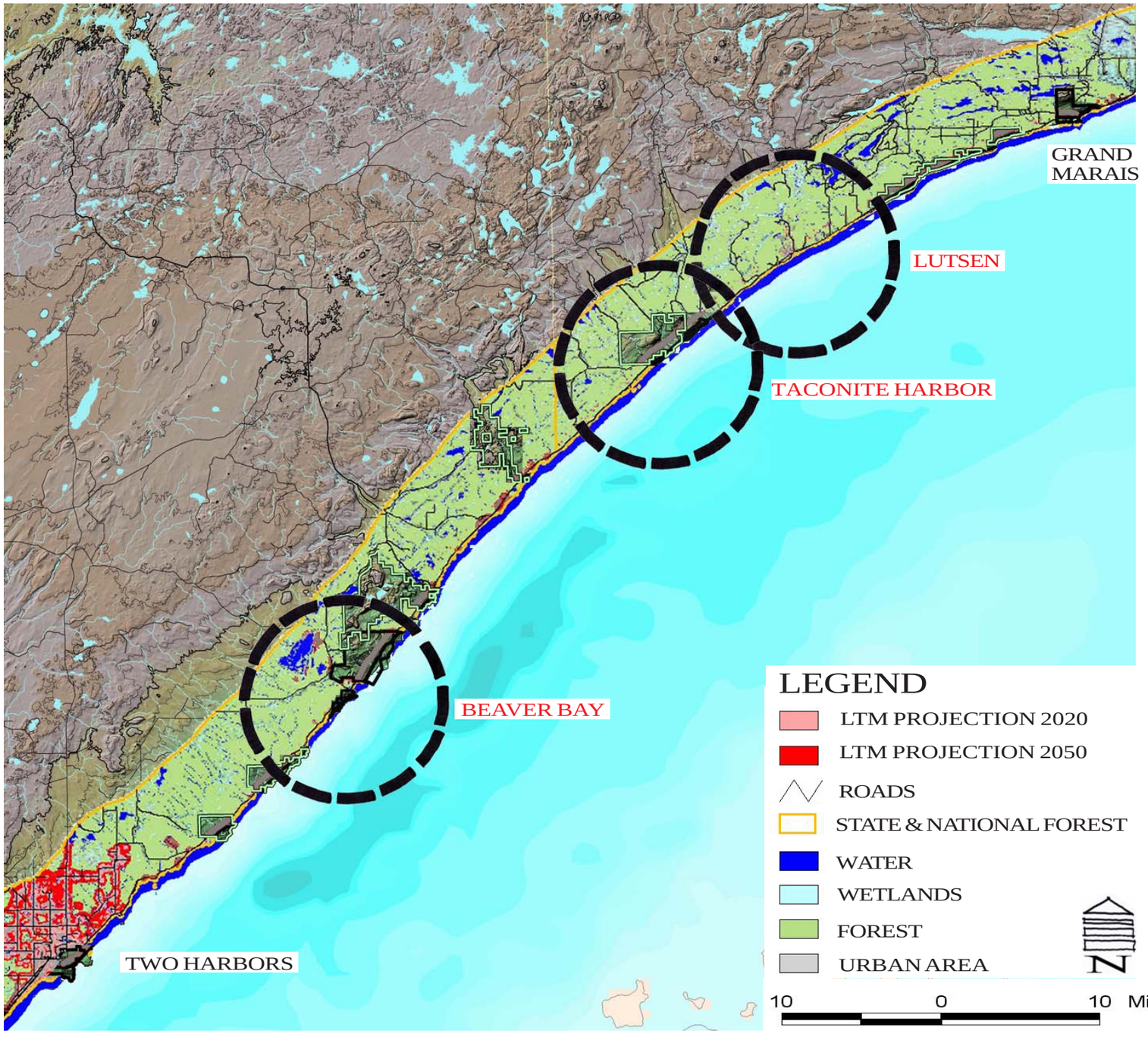
The study area traverses the length of the North Shore of Lake Superior in Minnesota. This is an area long known for its fishing, golfing, biking, and birding opportunities. Additionally, the area is an important part of the northern forest ecosystem that provides high quality aesthetic features, important contributions to the resource supply for the forest products industry, and habitat for a wide range of game and non-game wildlife species. Our study focuses on the North Shore settlements between Two Harbors and Grand Marais. A full report of the North Shore LTM findings is found in the appendix pages 120-124.

URBAN TRANSFORMATION PROJECTION FOR 2020 AND 2050:

Using the same method to project the 1991-2000 urban transformation, analysts projected urban transformation for years 2020 and 2050. Here's what they found: The LTM projected a 57 percent increase in the area classified as urban land between 2000 and 2020. The increase projected for 2000 to 2050 was 143 percent. Among the 10-predictor variables, the three most significant variables for predicting land-use change were, in decreasing order of importance: distance to urban; elevation, and; distance to highways and county roads, specifically highway 61. Based on these variables, the LTM indicates that over the 9-year period, non-urban to urban land change is concentrated around areas of existing population and development.

The Gitchi-Gami Trail may also be analyzed further by subregion based on differences in landscape character or selected communities.

In using these projections, caution is urged to avoid over-interpretation. These projections assume the patterns of change observed from 1991-2000 will continue. That further implies continuation of the driving forces and constraints behind change. Yet we know there is change in these forces and constraints over time. Thus the projections should be viewed as suggestive of change and where it will likely occur, but not as a precise forecast. Additionally, the 2050 projection should be viewed as much more speculative than the projection to 2020.


GRAND MARAIS
LUTSEN
TACONITE HARBOR
BEAVER BAY
TWO HARBORS
LEGEND
LTM PROJECTION 2020
LTM PROJECTION 2050
ROADS
STATE & NATIONAL FOREST
WATER
WETLANDS
FOREST
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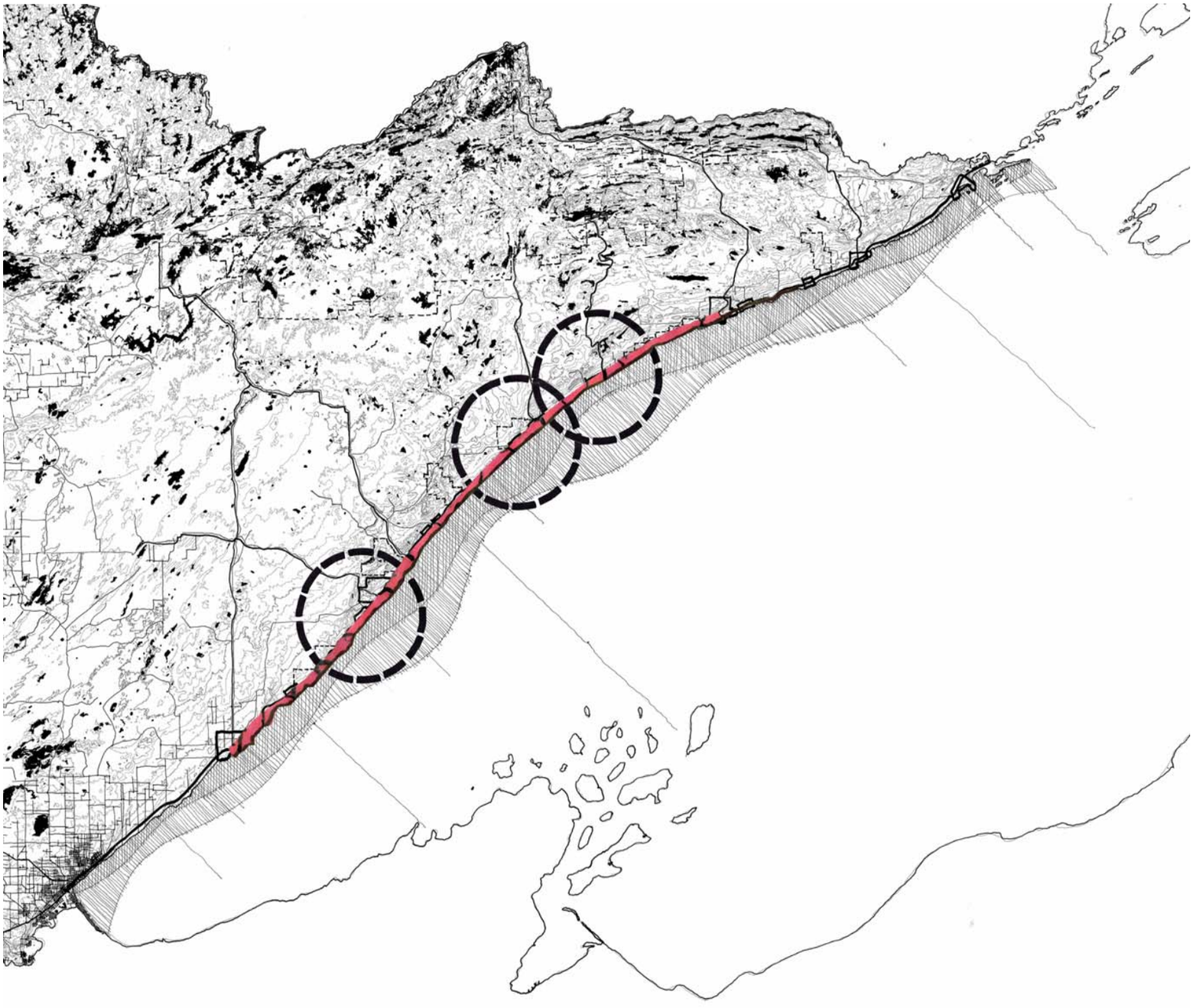
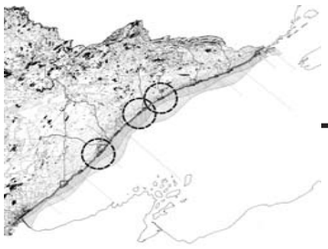
COMMUNITY SELECTION & DESIGN STRATEGIES





TRAIL STRATEGIES

COMMUNITY SELECTION & DESIGN STRATEGIES:

Because the project budget did not permit working in each community, communities were selected in consultation with the Department of Natural Resources, the Department of Transportation, and community groups. Criteria used for selection included trail construction schedule, community interest, opportunities to enhance and create amenities, and the need to remove trail development challenges. Three communities along the trail were selected: Beaver Bay, Lutsen, and Taconite Harbor.

COMMUNITY:

Making the Gitchi-Gami State Trail a viable asset to each community as it passes through drove the design work. The trail was made more visible by designing a trailhead as a major place in each community. Opportunities to link the trail to the other community amenities and the enrichment of the existing community form were pursued simultanously.

IDENTITY & INTERPRETATION:

A design vocabulary of kiosks, signs, fencing, and bicycle racks was created to give the trail a memorable identity. Although different in history and development, all the communities along the trail are linked to the Lake Superior and regional natural resources. A kiosk strategy was developed to create a rich and diverse interpretative narrative relating natural and culture features of each community and the region.

THE LARGER CONTEXT:

The existing patterns of the North Shore's natural and cultural resources were studied to identify their intrinsic qualities. Although the North Shore is usually identified as a narrow strip of land immediately adjacent to Lake Superior, the project took a larger view. Drawings of the larger landscape were produced. These drawings are interpretations of the larger landscape and are a key to creating a linked network of recreational systems.

LEVERAGING:

Because of the richness of recreational systems on the North Shore; the Gitchi-Gami trailheads and North Shore Scenic Drive rest stops were co-located in order to strengthen each system, leverage the resources of each system, create a synergy between the systems, and lessen their impact on the natural environment.

CENTER FOR CHANGING LANDSCAPES
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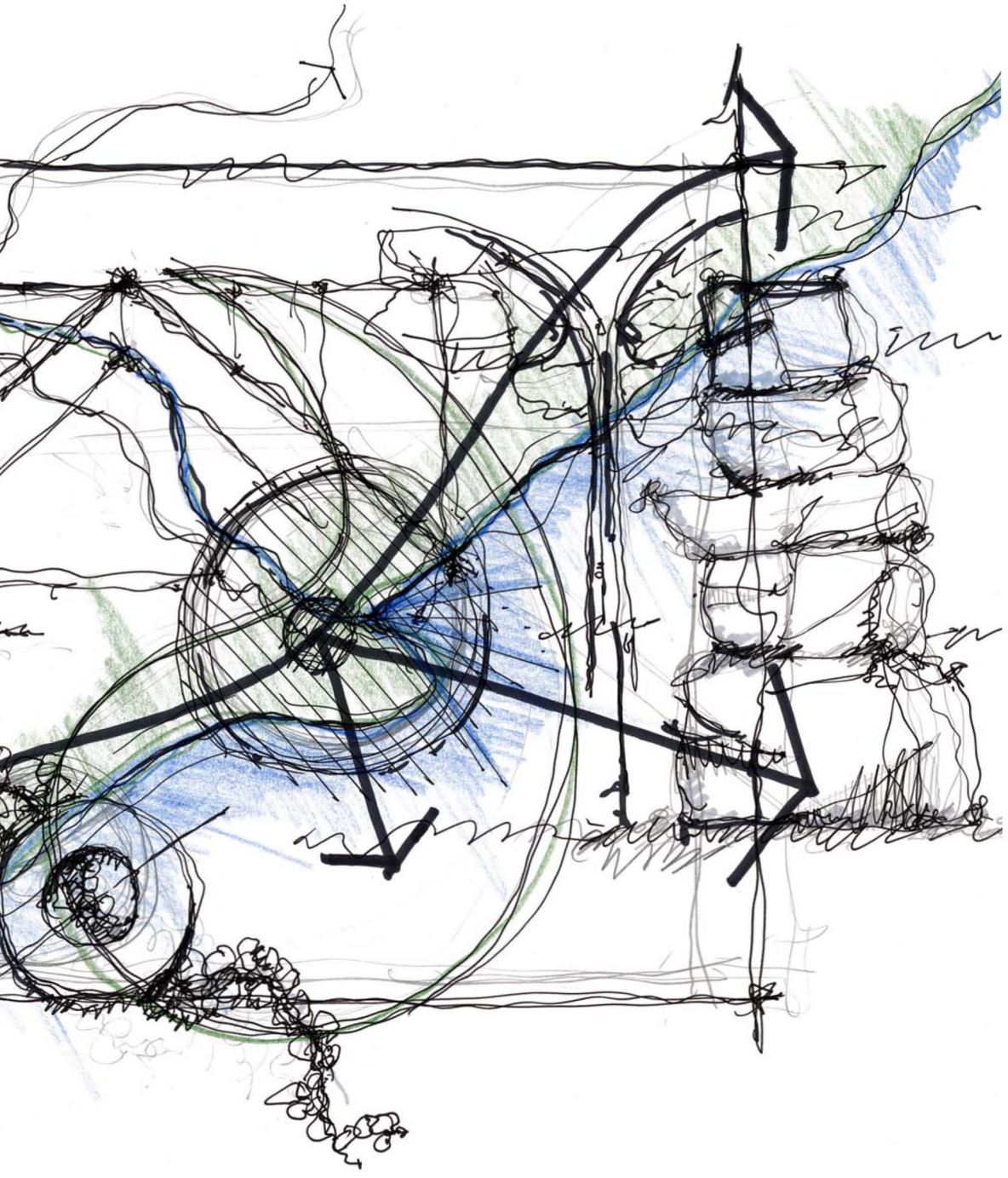


BEAVER BAY

CENTER FOR CHANGING LANDSCAPES
UNIVERSITY OF MINNESOTA

ANALYSIS

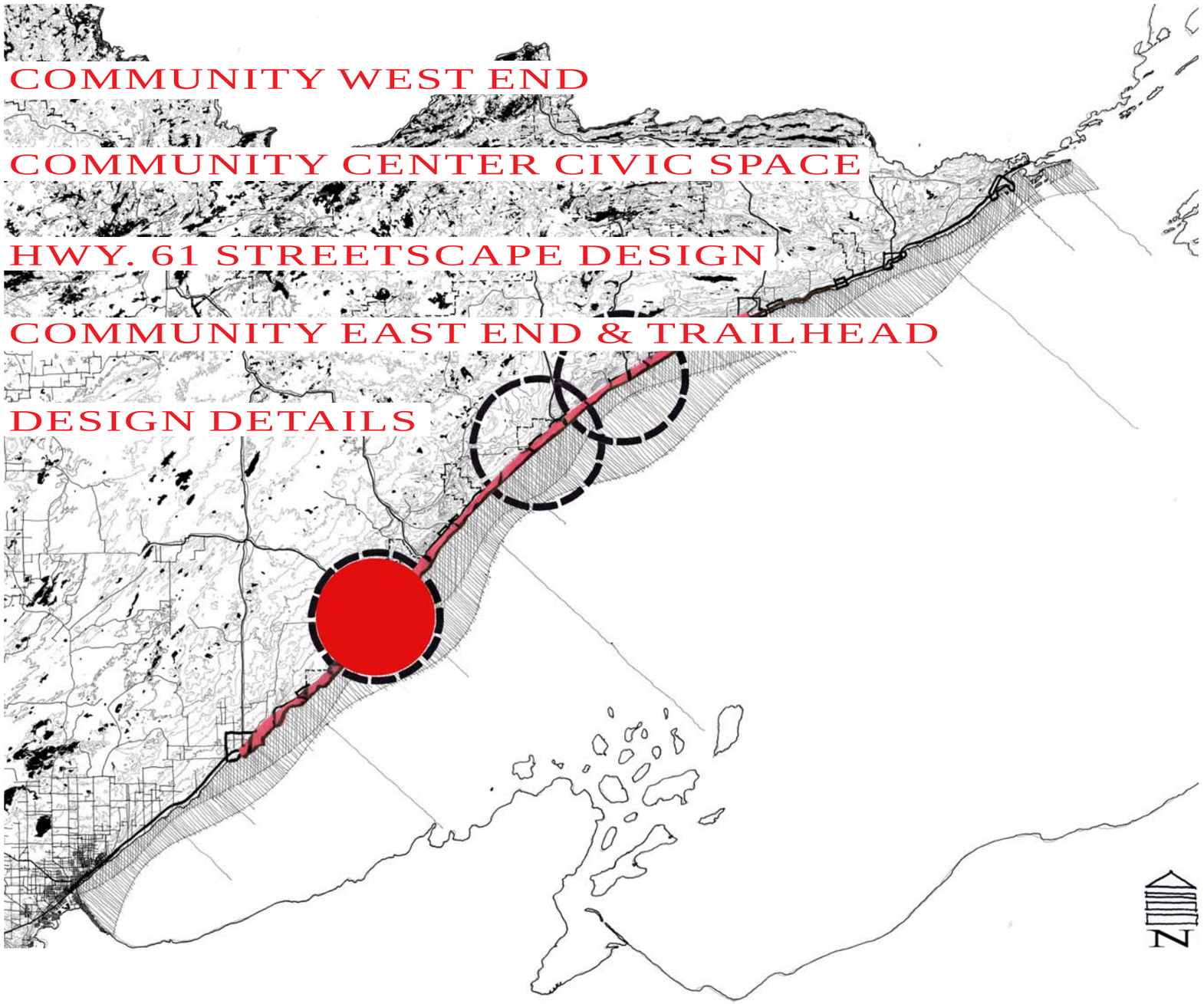
COMMUNITY WEST END

COMMUNITY CENTER CIVIC SPACE

HWY. 61 STREETSCAPE DESIGN

COMMUNITY EAST END & TRAILHEAD

DESIGN DETAILS



BEAVER BAY

AREA CHARACTER ANALYSIS:

Beaver Bay, a small community at the mouth of the picturesque Beaver River, is the oldest community on the North Shore. A nineteenth century grist mill was located at the falls of the Beaver River, and for years it has been a summer colony. The river has good trout fishing, and a community smelt fry is held every spring. Located near many recreational amenitites including two state parks, the community has a number of resorts and is a popular visitor stop.

DESCRIPTION OF PHOTOGRAPHS:

Existing HWY. 61 streetscape in Beaver Bay

East Gateway (View looking west to potential sign location)

West Gateway (View looking east to trailhead site)

Beaver River falls

Beaver Bay community center

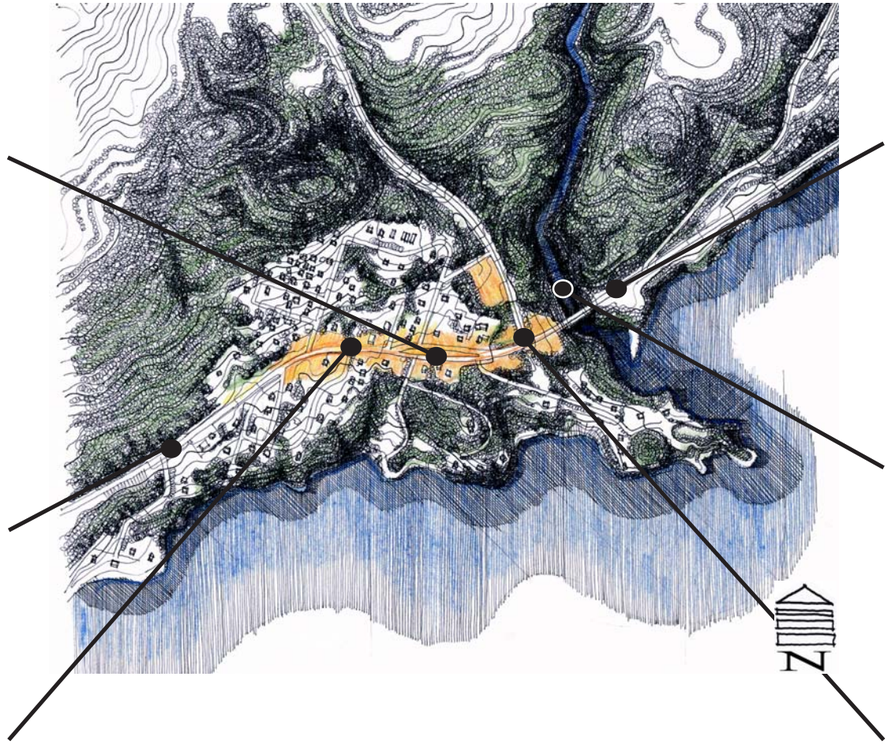
Potential Gitch-Gami Trailhead

BEAVER BAY: OBLIQUE VIEWS

TRAILHEAD SITE FROM LAKE SUPERIOR

MOUTH OF THE BEAVER RIVER

EXISTING HWY. 61 STREETSCAPE IN BEAVER BAY



EAST GATEWAY

WEST GATEWAY

BEAVER RIVER FALLS

BEAVER BAY COMMUNITY CENTER

POTENTIAL GITCHI-GAMI TRAILHEAD

BEAVER BAY

DESIGN OPPORTUNITY ANALYSIS: FOUR KEY AREAS

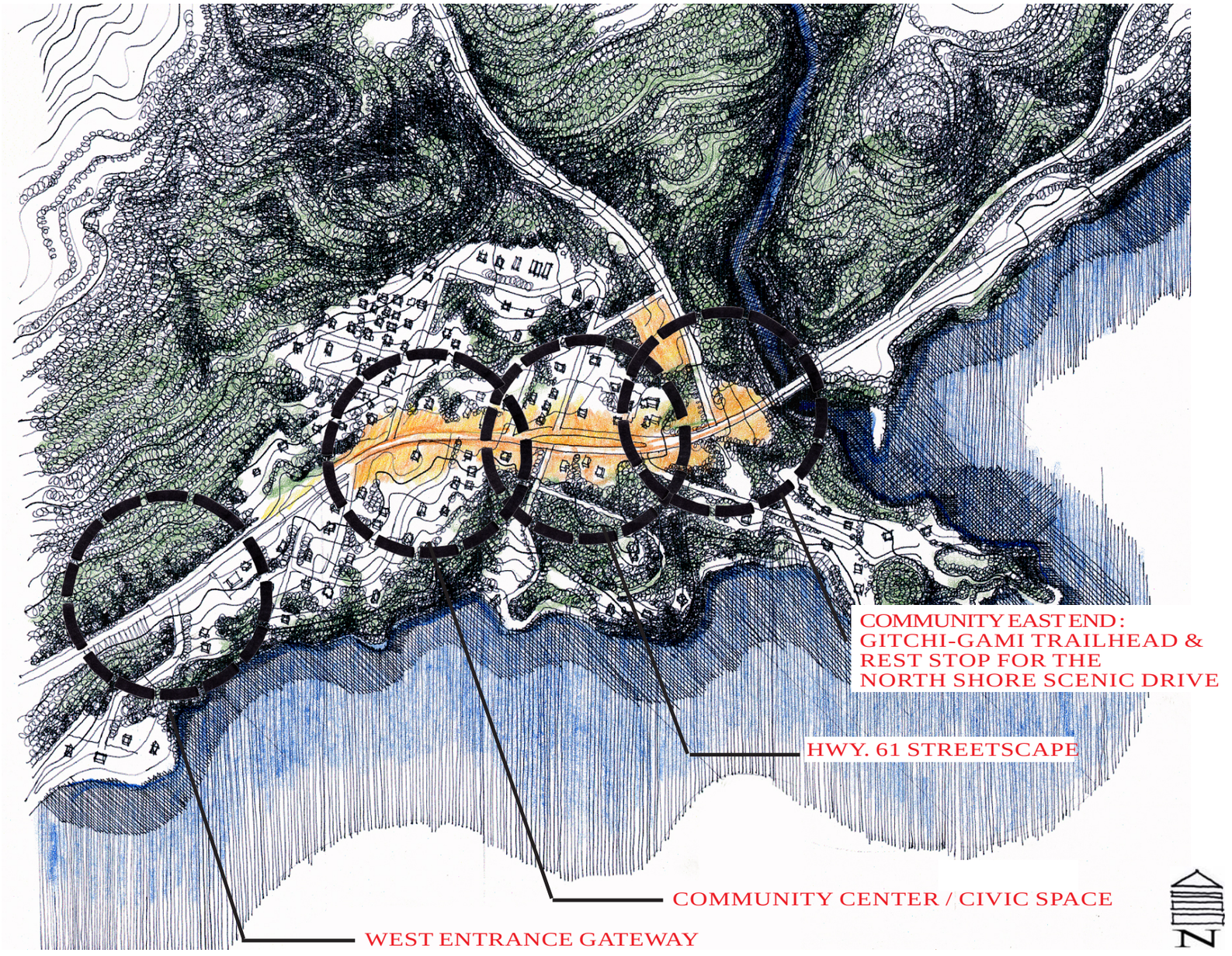
Beaver Bay has four areas of design opportunity; these include:

Creating a gateway at the west entrance into the community,

Configuring a civic space as a setting for the Beaver Bay Community Center,

Designing the HWY. 61 streetscape which reinforces the community identity of Beaver Bay, and

Organizing the community's east end creating a Gitch-Gami Trail Trailhead and a rest stop for the North Shore Scenic Drive as a focal point.


COMMUNITY EAST END :
GITCHI-GAMI TRAILHEAD &
REST STOP FOR THE
NORTH SHORE SCENIC DRIVE
HWY. 61 STREETSCAPE
COMMUNITY CENTER / CIVIC SPACE
WEST ENTRANCE GATEWAY
N

BEAVER BAY

ANALYSIS OF OPPORTUNITIES & CONSTRAINTS:

Located at the mouth of the Beaver River, Beaver Bay has many resources that provide opportunities within the community; these opportunities include:

First views of Beaver Bay geologic intrusion,

A potential connection to the Superior Hiking Trail,

Many resorts,

A visitors' information center,

Commercial development that includes restaurants, filling stations, small shops, and a museum,

Community center building,

Four sites of national historic significance that include the water tower, the old school, and John Beargrease's grave,

The scenic Beaver River with its beautiful falls, and

A vacant parking lot that overlooks the Beaver River and its falls.

The community also has elements that provide design constraints; these constraints include:

Limited space for changing the alignment of Highway 61,

A short depth to bedrock,

Erosion on the banks of the Beaver River,

High speeds of traffic through town,

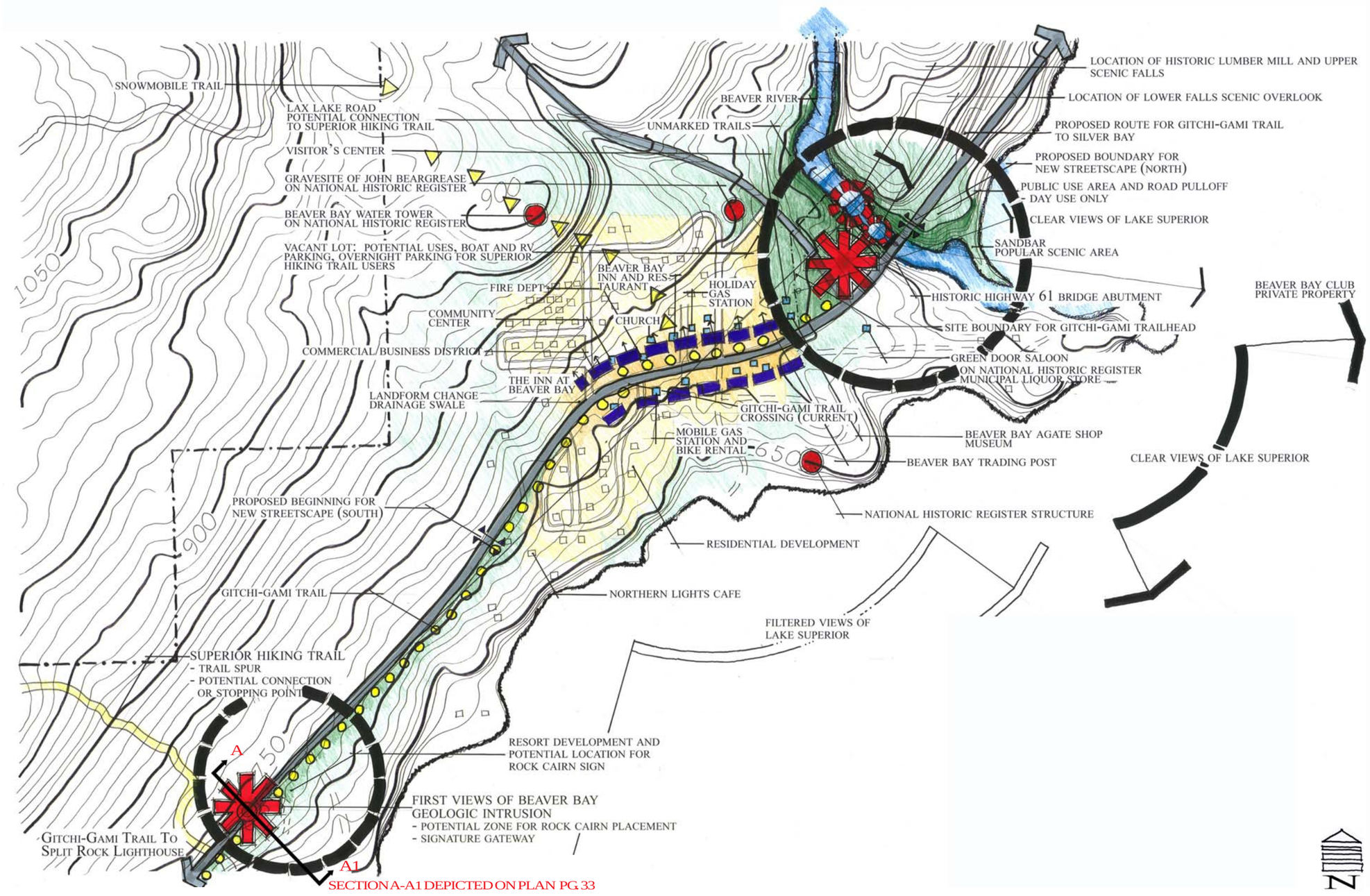
Key pieces of land in private ownership,

Limited or obscured community signs,

Circulation conflicts,

Weak connections between the business district and other resources, and

Poor pedestrian and bicycle circulation patterns.


SNOWMOBILE TRAIL
LAX LAKE ROAD
POTENTIAL CONNECTION
TO SUPERIOR HIKING TRAIL
VISITOR'S CENTER
GRAVESITE OF JOHN BEARGREASE
ON NATIONAL HISTORIC REGISTER
BEAVER BAY WATER TOWER
ON NATIONAL HISTORIC REGISTER
VACANT LOT: POTENTIAL USES, BOAT AND RV
PARKING, OVERNIGHT PARKING FOR SUPERIOR
HIKING TRAIL USERS
COMMERCIAL/BUSINESS DISTRICT
LANDFORM CHANGE
DRAINAGE SWALE
PROPOSED BEGINNING FOR
NEW STREETSCAPE (SOUTH)
GITCHI-GAMI TRAIL
SUPERIOR HIKING TRAIL
- TRAIL SPUR
- POTENTIAL CONNECTION
OR STOPPING POINT
GITCHI-GAMI TRAIL TO
SPLIT ROCK LIGHTHOUSE
BEAVER RIVER
UNMARKED TRAILS
BEAVER BAY
INN AND RESTAURANT
FIRE DEPT
HOLIDAY
GAS
STATION
COMMUNITY
CENTER
CHURCH
THE INN AT
BEAVER BAY
GITCHI-GAMI TRAIL
CROSSING (CURRENT)
MOBILE GAS
STATION AND
BIKE RENTAL
RESIDENTIAL DEVELOPMENT
NORTHERN LIGHTS CAFE
RESORT DEVELOPMENT AND
POTENTIAL LOCATION FOR
ROCK CAIRN SIGN
FIRST VIEWS OF BEAVER BAY
GEOLOGIC INTRUSION
- POTENTIAL ZONE FOR ROCK CAIRN PLACEMENT
- SIGNATURE GATEWAY
A
A1
SECTION A-A1 DEPICTED ON PLAN PG.33
LOCATION OF HISTORIC LUMBER MILL AND UPPER
SCENIC FALLS
LOCATION OF LOWER FALLS SCENIC OVERLOOK
PROPOSED ROUTE FOR GITCHI-GAMI TRAIL
TO SILVER BAY
PROPOSED BOUNDARY FOR
NEW STREETSCAPE (NORTH)
PUBLIC USE AREA AND ROAD PULLOFF
- DAY USE ONLY
CLEAR VIEWS OF LAKE SUPERIOR
SANDBAR
POPULAR SCENIC AREA
HISTORIC HIGHWAY 61 BRIDGE ABUTMENT
SITE BOUNDARY FOR GITCHI-GAMI TRAILHEAD
GREEN DOOR SALOON
ON NATIONAL HISTORIC REGISTER
MUNICIPAL LIQUOR STORE
BEAVER BAY AGATE SHOP
MUSEUM
BEAVER BAY TRADING POST
NATIONAL HISTORIC REGISTER STRUCTURE
FILTERED VIEWS OF
LAKE SUPERIOR
BEAVER BAY CLUB
PRIVATE PROPERTY
CLEAR VIEWS OF LAKE SUPERIOR
1050
900
650
750
700
N

BEAVER BAY

COMMUNITY WEST END:

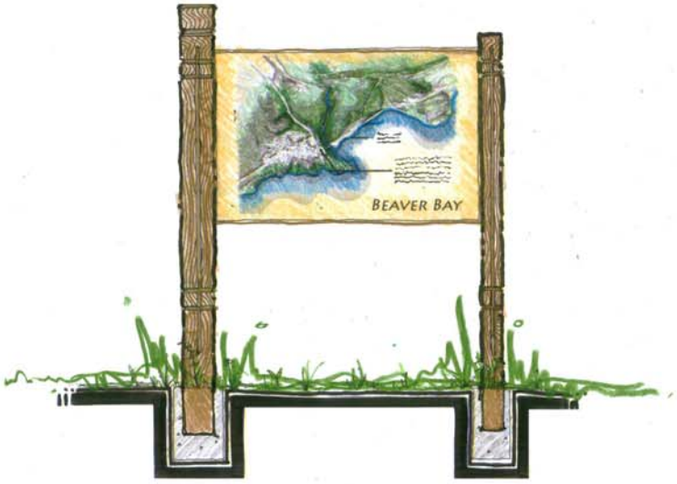
Gitchi-Gami Trail and North Shore Scenic Drive (NSSD HWY.61) signs announce the entry into Beaver Bay. These signs:

Are placed where the views of the Beaver Bay intrusion (bedrock and land form) and the entry to the community are first experienced,

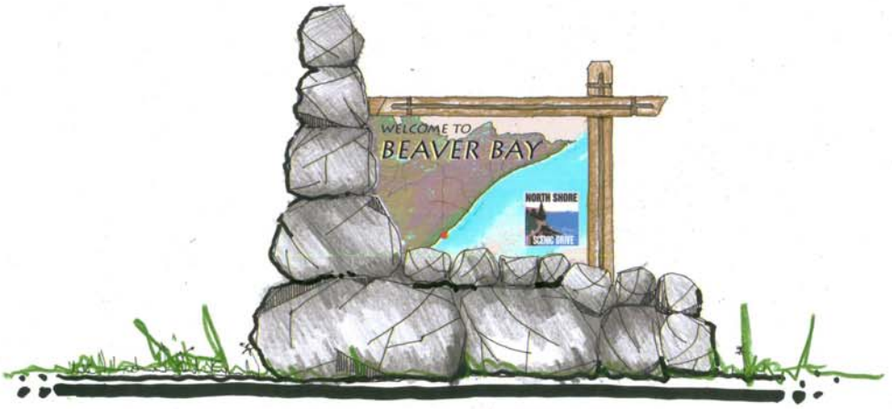
Use the regional design vocabulary of the Gtichi-Gami Trail and North Shore Scenic Drive, and

Are constructed of regional materials.

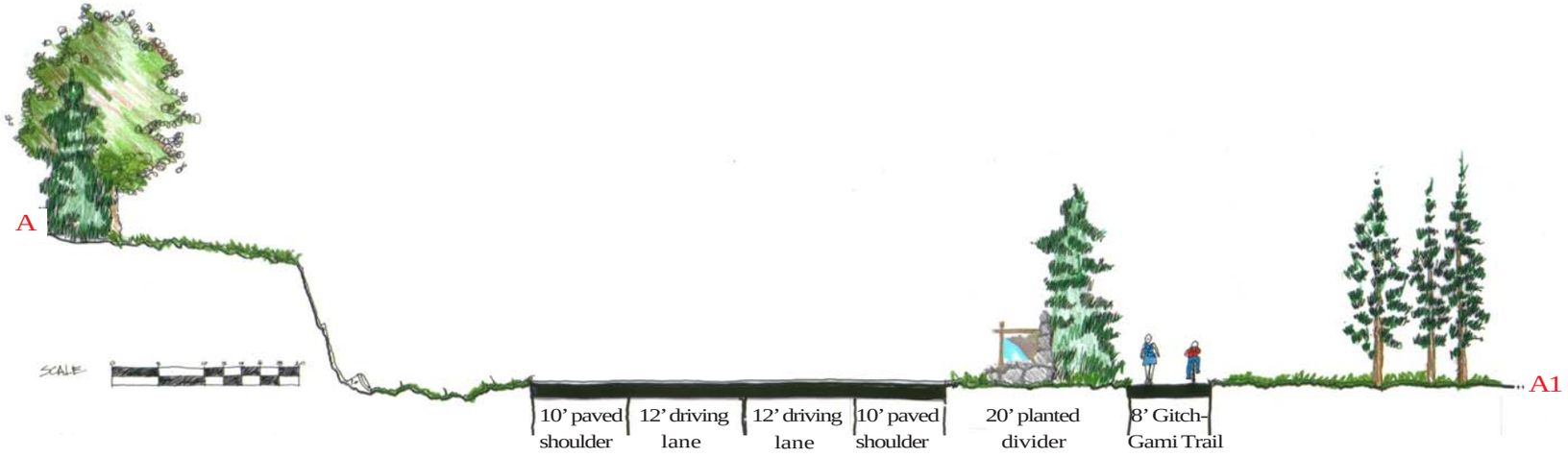
HIGHWAY SIGN



NORTH SHORE SCENIC DRIVE ROCK CAIRN SIGN



NSSD HWY 61 & GITCHI-GAMITRAIL SECTION A-A1: (FROM ANALYSIS PLAN PAGE 31)



BEAVER BAY

COMMUNITY CENTER CIVIC SPACE:

A civic space is designed to announce the eastbound progression to Beaver Bay's community core by:

Retrofitting the existing Beaver Bay community sign with a frame to match the gateway sign's timbers and relocating it to the intersection of Highway 61 and Mac Donald Ave,

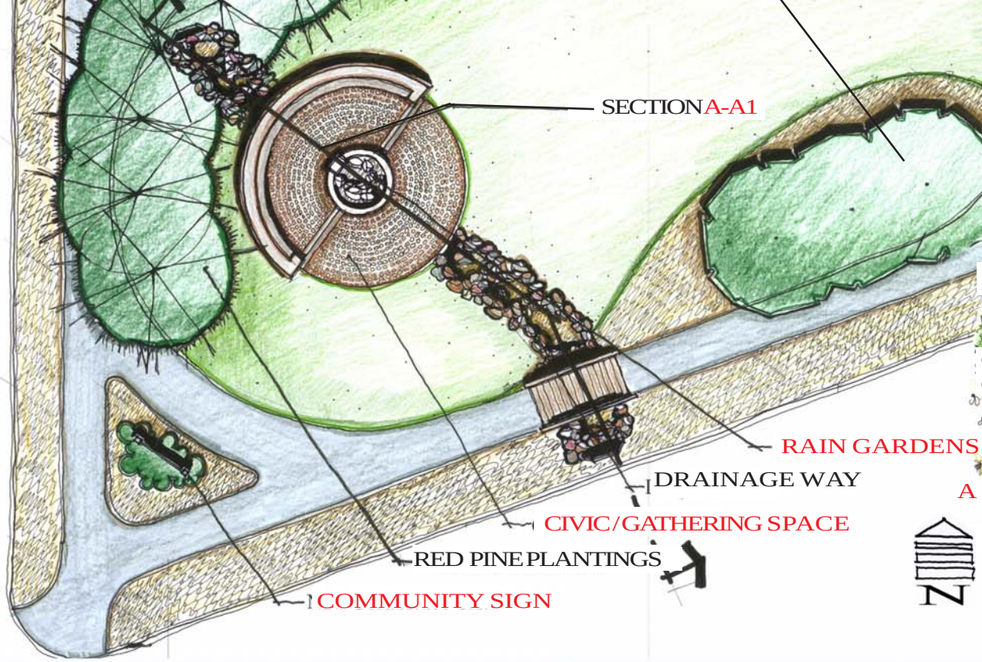
Making a community civic / gathering space at the corner with seating, interpretive elements, and a rain garden of native plantings, boulders, and a water feature,

Creating a tree-lined approach with parking and the beaver sculpture as a setting for the community center, and

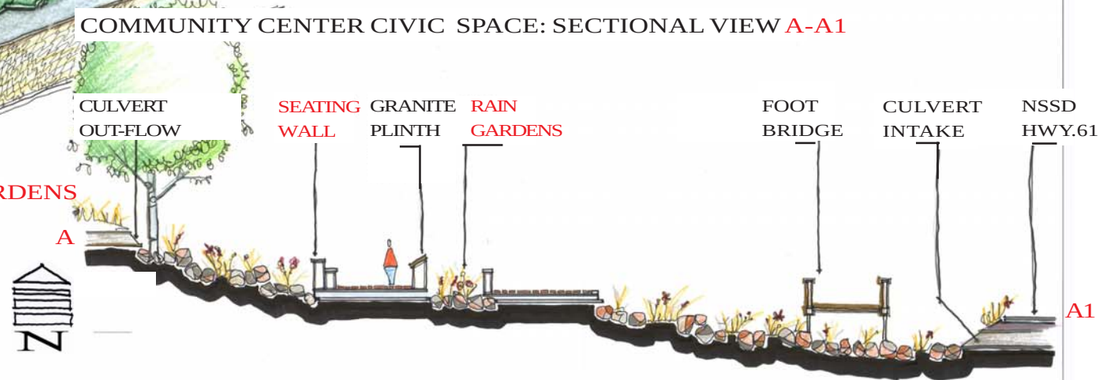
Connecting this space to the existing park.

PERSPECTIVE VIEW OF COMMUNITY CENTER GATHERING SPACE & COMMUNITY SIGN

PLAN VIEW OF COMMUNITY CENTER GATHERING SPACE & RAIN GARDEN



COMMUNITY CENTER CIVIC SPACE: SECTIONAL VIEW A-A1



BEAVER BAY

HWY. 61 STREETSCAPE DESIGN:

The Community Center Park and the “Main Street” bind the west end and the east end of the community core. Changes to the North Shore Scenic Drive (Hwy. 61) are suggested to give further definition to the community core. Both options create a:

Defined trail crossing at Mac Donald Ave,

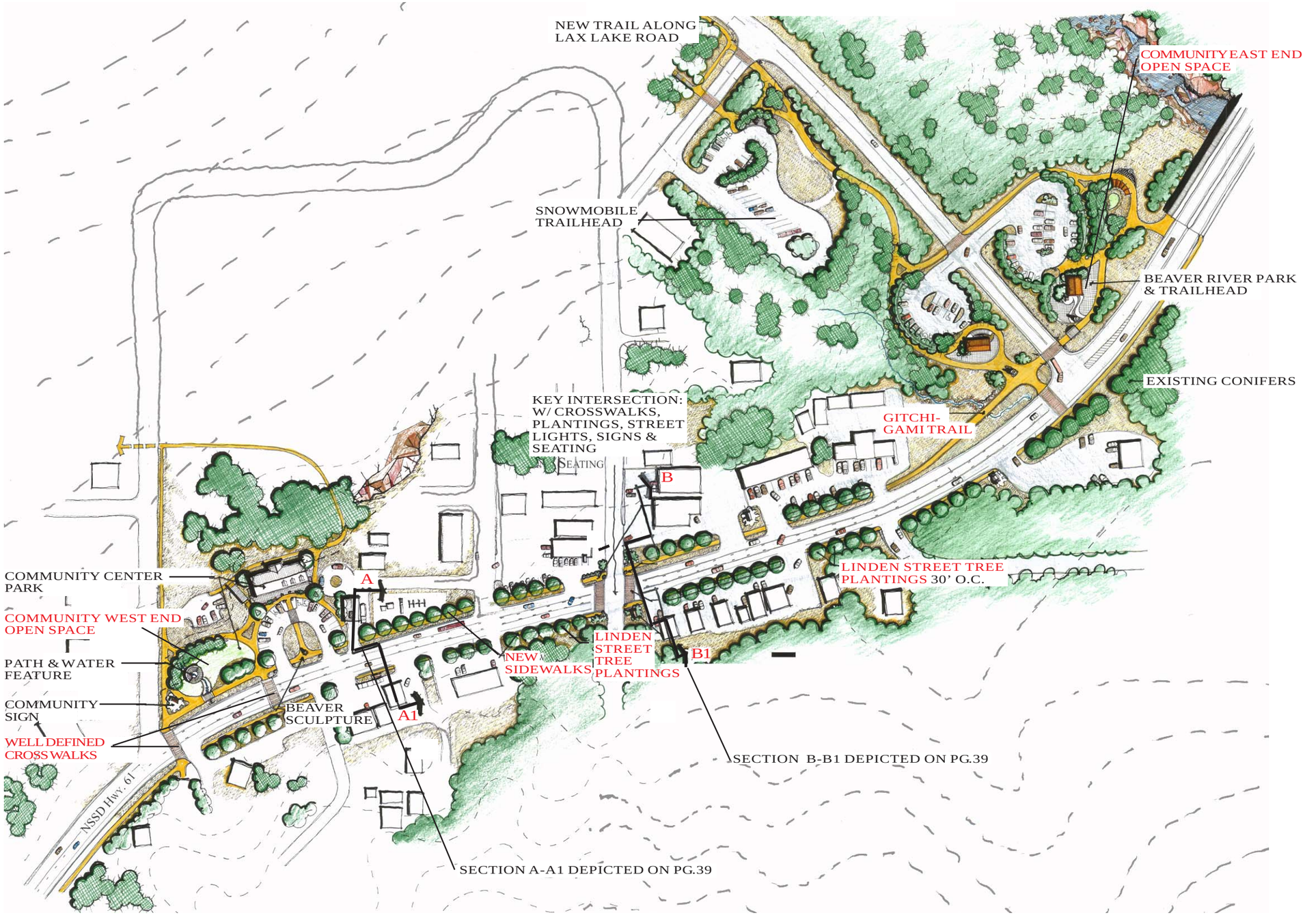
Series of well-defined pedestrian crosswalks,

Street tree plantings that calm traffic and create a pedestrian-scale enclosure,

New sidwalk on each side of Hwy. 61,

Pedestrian circulation system in the community core, and

Design for public open spaces at each end of the community defining the community core.


NEW TRAIL ALONG LAX LAKE ROAD
COMMUNITY EAST END OPEN SPACE
SNOWMOBILE TRAILHEAD
BEAVER RIVER PARK & TRAILHEAD
EXISTING CONIFERS
KEY INTERSECTION: W/ CROSSWALKS, PLANTINGS, STREET LIGHTS, SIGNS & SEATING
SEATING
GITCHI-GAMI TRAIL
B
COMMUNITY CENTER PARK
A
LINDEN STREET TREE PLANTINGS 30' O.C.
COMMUNITY WEST END OPEN SPACE
LINDEN STREET TREE PLANTINGS
B1
NEW SIDEWALKS
PATH & WATER FEATURE
COMMUNITY SIGN
BEAVER SCULPTURE
A1
WELL DEFINED CROSS WALKS
SECTION B-B1 DEPICTED ON PG.39
NSSD Hwy. 61
SECTION A-A1 DEPICTED ON PG.39

BEAVER BAY

HWY. 61 STREETSCAPE DESIGN: SECTIONAL VIEWS

THE OPTION ONE STREETSCAPE DESIGN:

Adds trees to the existing swale,

Reduces the shoulder on the north side of the road from 8 feet to 2 feet,

Moves the highway lanes 6 feet north, and

Provides a new 6-foot sidewalk along the south edge.

THE OPTION TWO STREETSCAPE DESIGN:

Adds trees to the existing roadside swale,

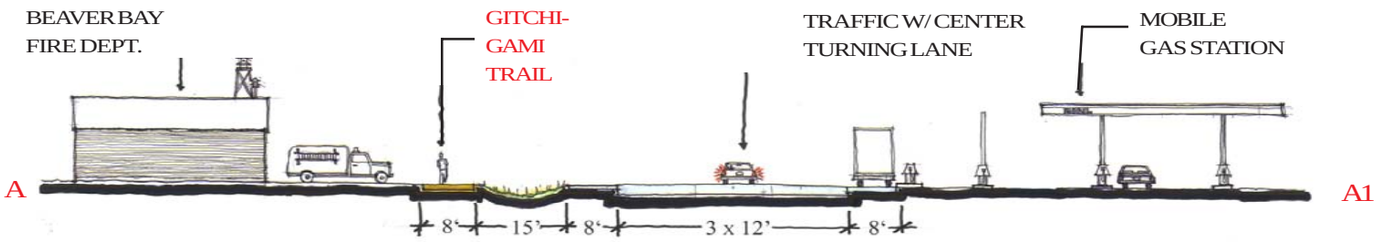
Reduces the vegetated swale from 15 feet to 9 feet,

Moves the highway lanes 6 feet north, and

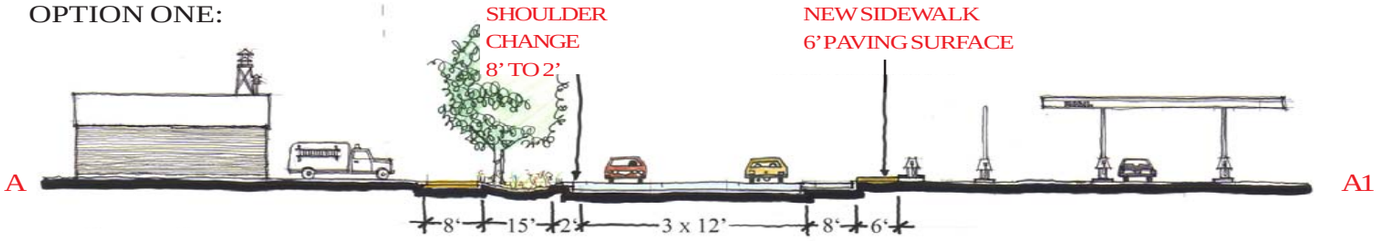
Provides a new 6-foot sidewalk along the south edge.

STREETSCAPE OPTIONS FOR A-A1:

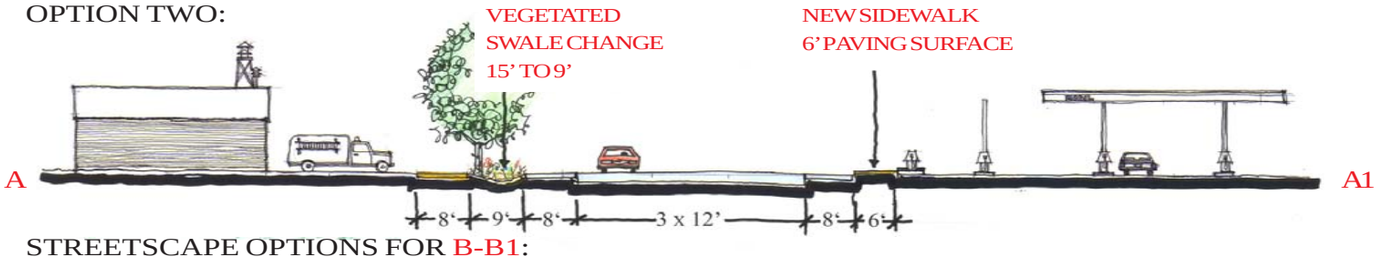
EXISTING CONDITION:



OPTION ONE:

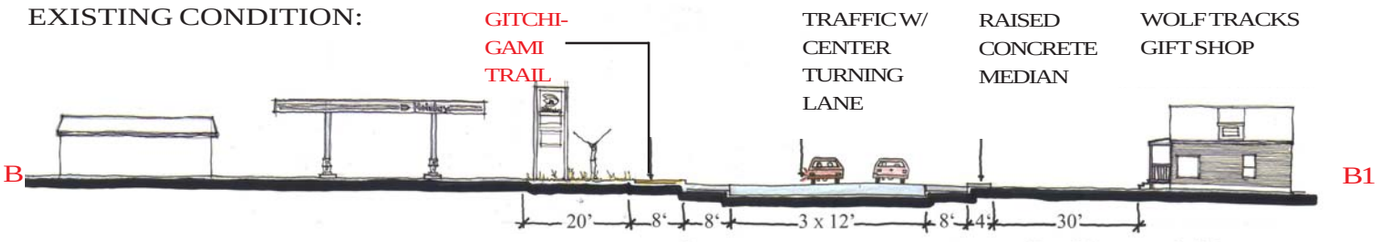


OPTION TWO:

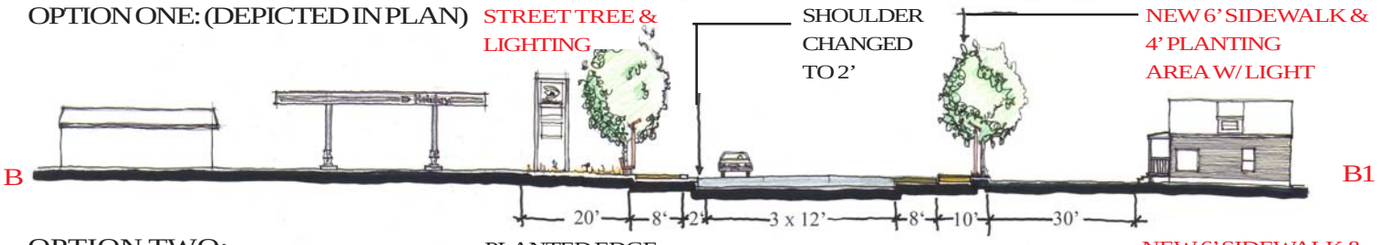


STREETSCAPE OPTIONS FOR B-B1:

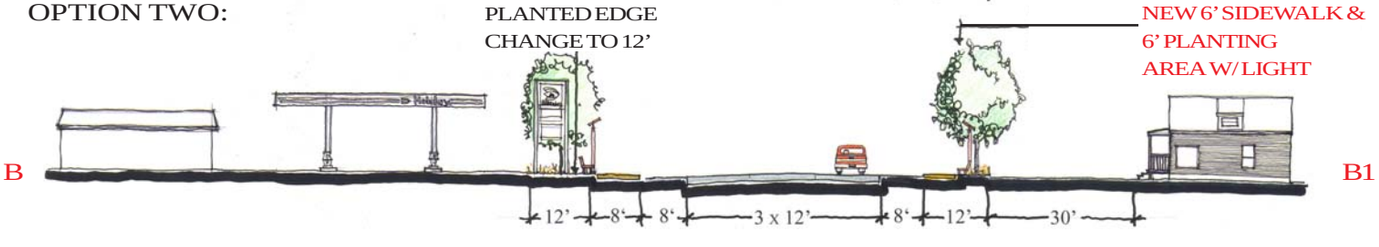
EXISTING CONDITION:

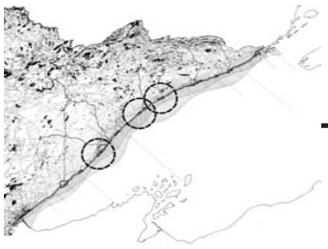


OPTION ONE: (DEPICTED IN PLAN)



OPTION TWO:





BEAVER BAY

COMMUNITY EAST END & TRAILHEAD:

CIRCULATION SYSTEM:

The new pathway system connects the:

Beaver River Park,

Superior Hiking Trail Trailhead,

Historic cemetery,

Additional parking, and

Commercial core.

BEAVER RIVER PARK & TRAILHEAD:

The new Beaver River Park is the dominant feature of the east end. It is both a trailhead for the Gitchi-Gami Trail and a rest stop for the North Shore Scenic Drive. Built on vacate land, it features:

A millstone promontory and shelter that overlooks the river and the falls,

An interpretative kiosk,

A North Shore Scenic Drive cairn sculpture,

Bicycle racks,

A parking lot for 35 cars that is designed to reduce erosion on the riverbank, and

Facilities (restrooms and a drinking fountain).

BEAVER BAY VISITORS CENTER & MUSUEM:

The site of the existing Beaver Bay Visitors Center was designed to:

Provide a visible setting for the John Beargrease Memorial,

Serve as an important link between the Beaver River Park and the commercial core, and

Accommodate 20 parked cars.

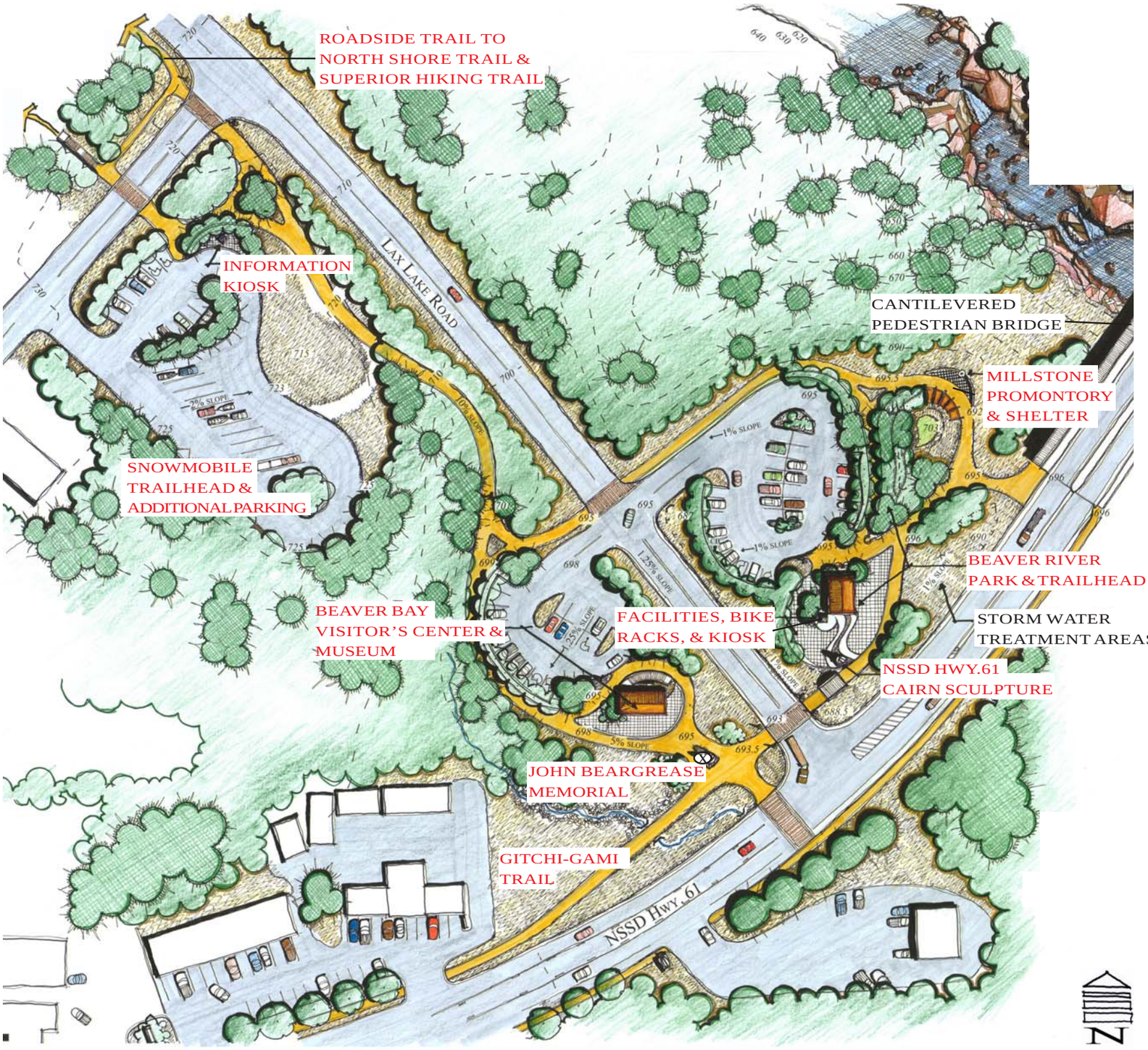
SNOWMOBILE TRAILHEAD & ADDITIONAL PARKING:

Additional parking is provided on underutilized land along Lax Lake Road. This space:

Has an information kiosk,

Accommodates 14 cars and 14 cars with trailers, and

Serves as a trailhead for the snowmobile trail in winter.


ROADSIDE TRAIL TO NORTH SHORE TRAIL & SUPERIOR HIKING TRAIL
INFORMATION KIOSK
LAX LAKE ROAD
CANTILEVERED PEDESTRIAN BRIDGE
MILLSTONE PROMONTORY & SHELTER
SNOWMOBILE TRAILHEAD & ADDITIONAL PARKING
BEAVER RIVER PARK & TRAILHEAD
STORM WATER TREATMENT AREAS
BEAVER BAY VISITOR'S CENTER & MUSEUM
FACILITIES, BIKE RACKS, & KIOSK
NSSD HWY.61 CAIRN SCULPTURE
JOHN BEARGREASE MEMORIAL
GITCHI-GAMI TRAIL
NSSD HWY. 61
2% SLOPE
10% SLOPE
1% SLOPE
25% SLOPE
5% SLOPE
N

BEAVER BAY

COMMUNITY EAST END & TRAILHEAD:

The site designs of the Visitors Center & Museum and Beaver River Park share a number of things in common. Both were designed to be part of a whole, and both compliment each other. Each has:

A parking lot that collects storm water and channels it into swale system,

An interconnected swale system that filters storm water before it is infiltrated or carried to the river or the lake,

Interpretive elements, and

Native plants and trees.

The building on each site:

Provides complimentary functions,

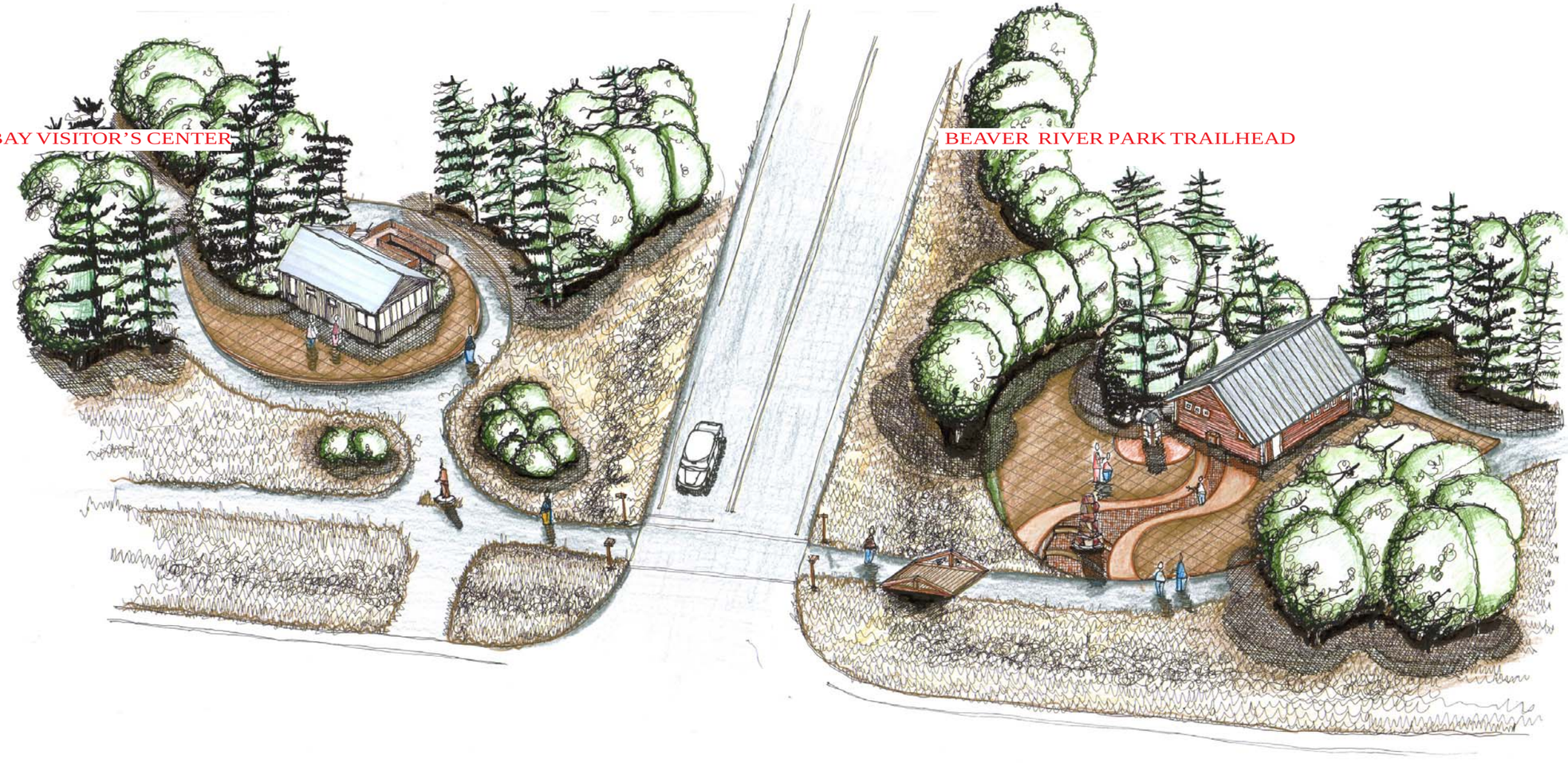
Reflects the culture of the region,

Uses regional materials, and

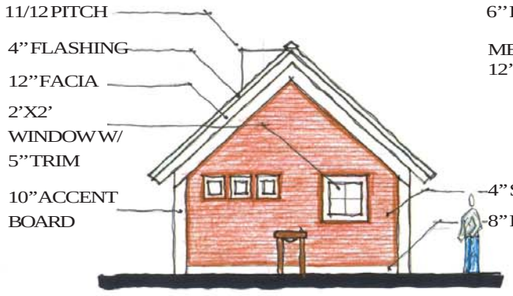
Is in scale with each other.

BEAVER BAY VISITOR'S CENTER

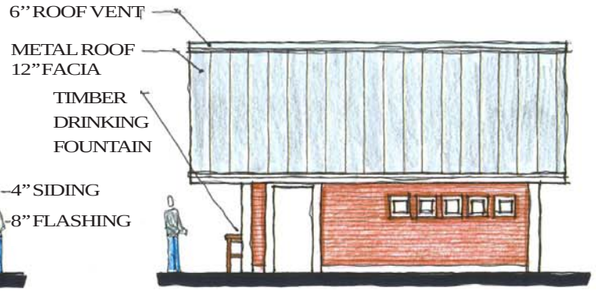
BEAVER RIVER PARK TRAILHEAD



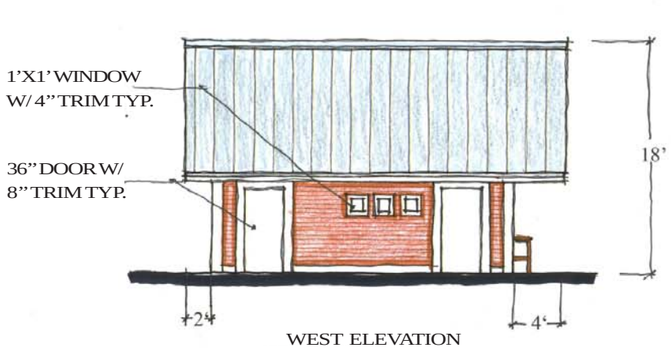
TRAILHEAD FACILITIES STRUCTURE



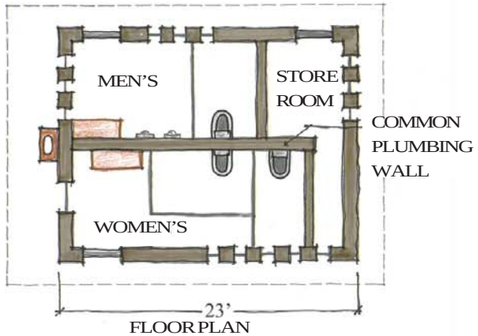
SOUTH ELEVATION



EAST ELEVATION



WEST ELEVATION



FLOOR PLAN

BEAVER BAY

DESIGN DETAILS: MILLSTONE PROMONTORY

The original millstone from the Beaver Bay Grist Mill is still in the community of Beaver Bay and is available to be used as an interpretive element. This design creates a promontory dedicated to telling the story of the millstone at a vantage point that overlooks the river and the original mill location. The location and the story enrich the Beaver River Park while capitalizing on the views of the river gorge. The promontory:

Uses the turf knoll overlook to create a shelter that extends from the land form and continues visually to the river,

Uses landform, trees, and structures to create an enclosed space with a trail access,

Provides a resting area with fence, bench, and interpretive panel details,

Places the millstone on a steel pedestal at the location of the mill site overlook,

Allows visitors to interact with history by using a rotating mount that allows the stone to be turned, and

Incorporates Gitchi Gami Trail design elements.

The Millstone Promontory overlooks the Beaver River and falls; it features:

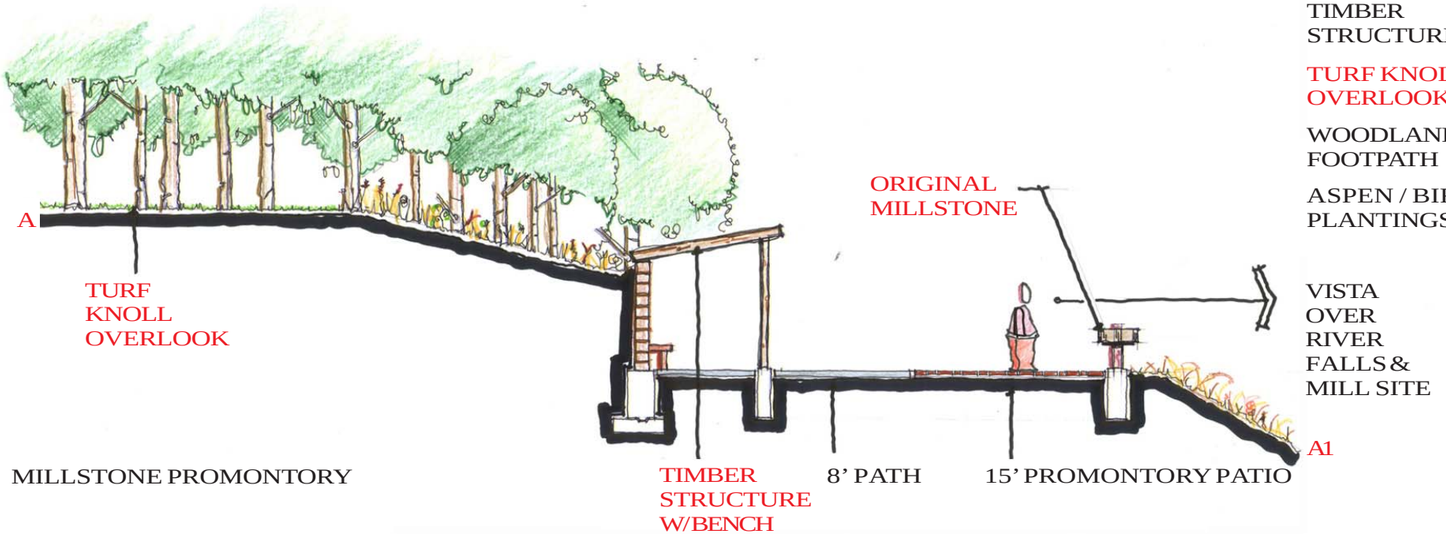
A timber structure with a bench,

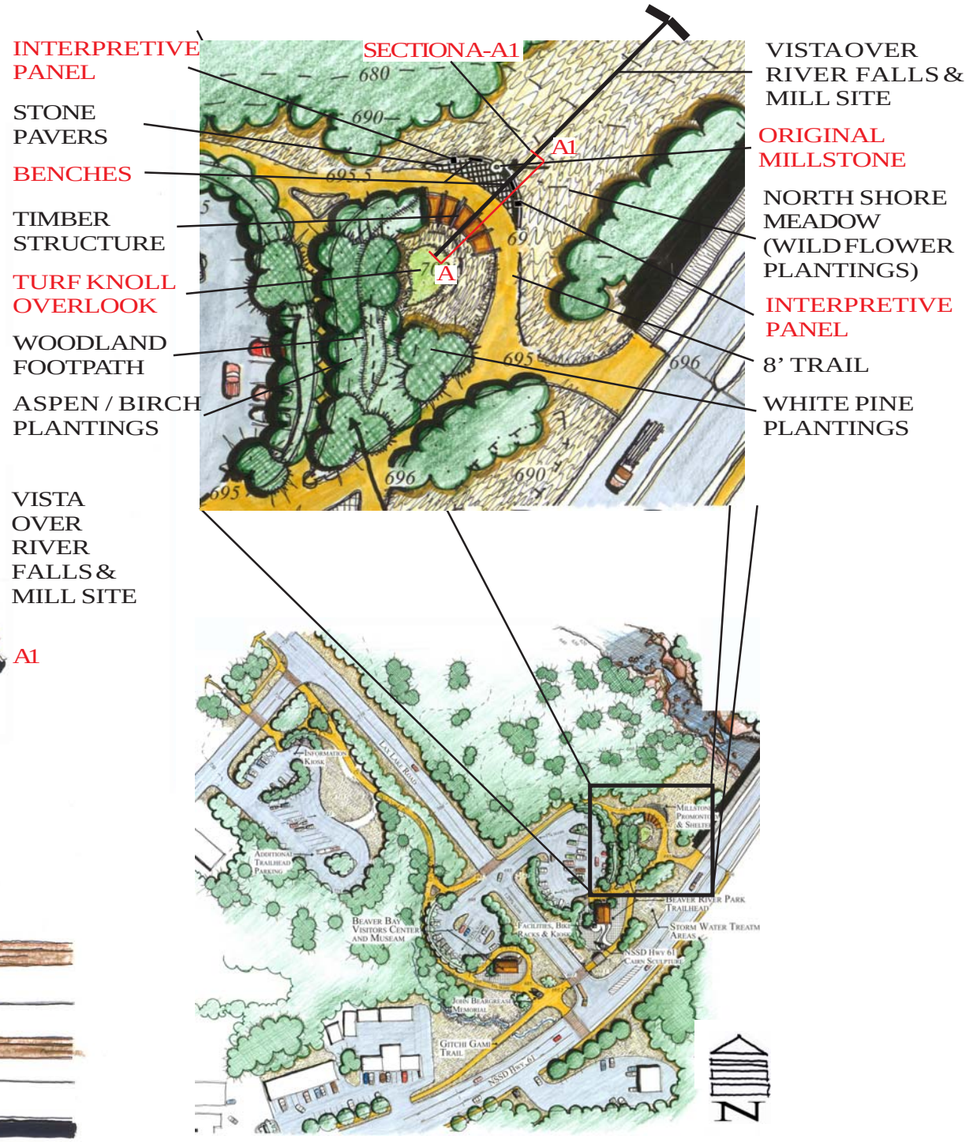
A viewing patio,

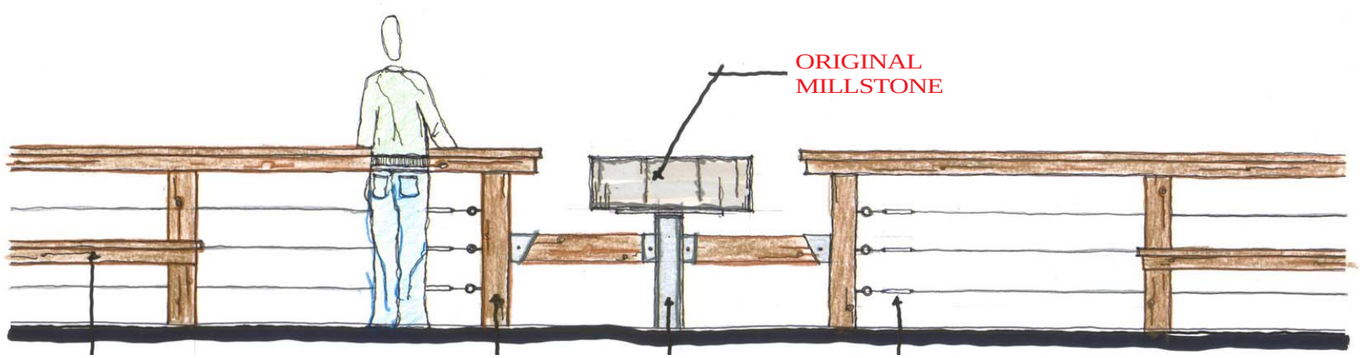
The millstone from the old mill that was once powered by the Beaver River, and

Gitchi-Gami Trail timber and steel signature fencing that is modified to display the historic mill stone.

SECTION OF TURF KNOLL OVERLOOK,TIMBER STRUCTURE & PROMONTORY







BEAVER BAY

DESIGN DETAILS: KIOSK & INTERPRETIVE STRATEGY

This signature kiosk is to be placed along the trail to interpret the both the natural and the cultural landscape.

KIOSK:

Each kiosk will have Gitchi-Gami logo and a drawing of the larger landscape that portrays its very spectacular richness. The other three panels on the four-sided kiosk interpret the special place in which it is located. The two panel version includes a small bench designed into the kiosk to provide shelter and a rest spot along the trail while displaying the regional graphic and either a local or historical information. The kiosk's form recalls the shore's Scandinavian heritage. Is it made of wood and steel, products that play important roles in the region's economy. Local rocks are embedded in the kiosk's concrete base.

THE KIOSK'S INTERPRETATIVE PANELS:

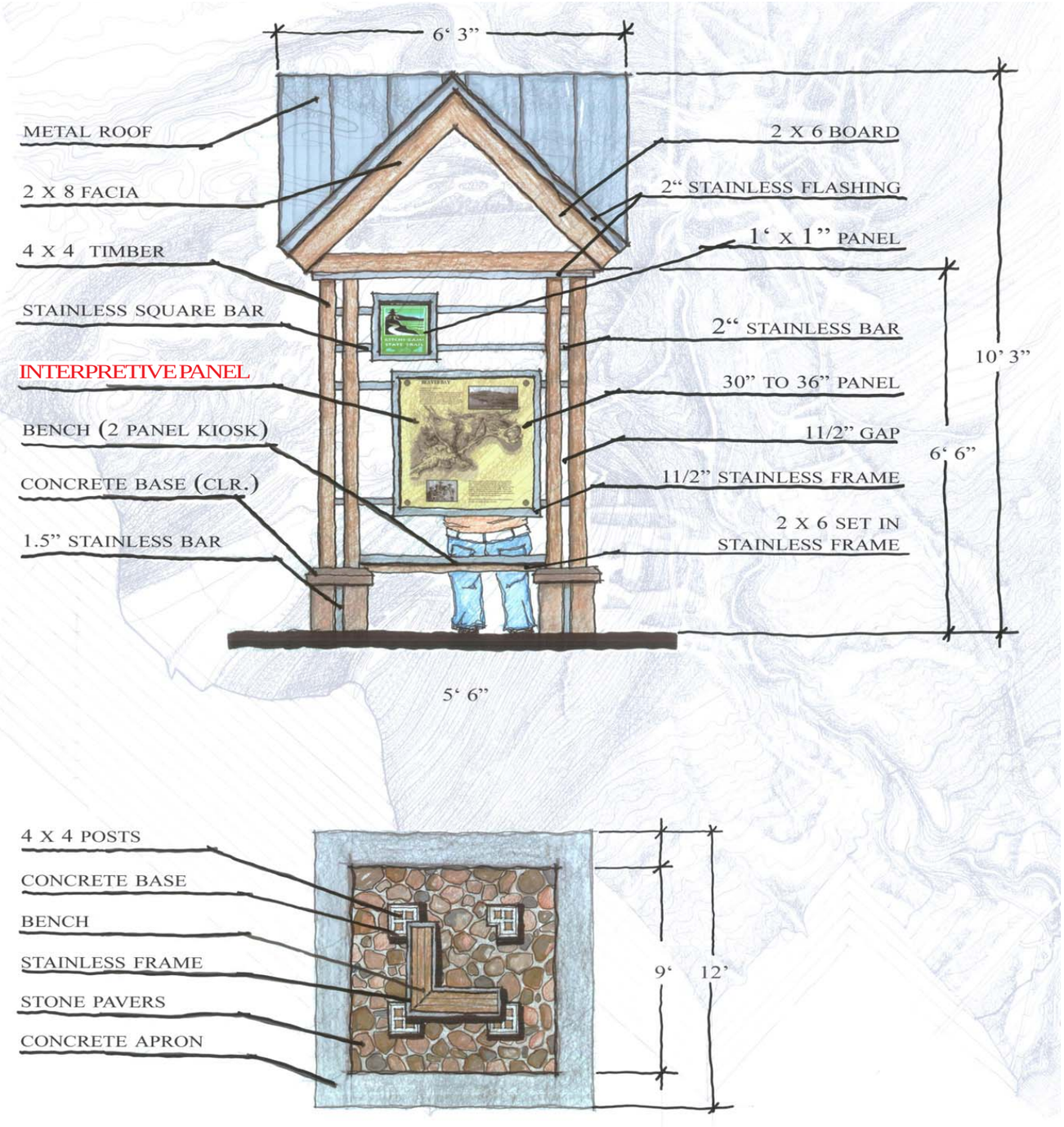
Regional Panel: The regional panel calls out the communities, the state parks, the Boundary Waters Canoe Area, and the region's major linear recreational systems. These systems are the Gitchi-Gami Trail, the North Shore Trail, the North Shore Scenic Drive, the Superior Hiking Trail, and the Superior Water Trail. It also identifies the community in which the kiosk is placed in order to tell the viewer," You are here."

Local Panel: The local panel is a bird's eye drawing of the local area depicting its landscape and calling out its linear recreational systems. Community resources such as parks, local trails, the central business area, and trailheads are noted.

History & Culture: The history and culture panel presents the community's natural and cultural history through narrative, maps, drawings, and photographs.

Special Focus: The fourth panel could display a calendar of local events and information about local businesses. It may dispense brochures and maps. Special interpretive information addressing the vegetation, hydrology, geology, and other environmental characteristics may be displayed.

BEAVER RIVER PARK KIOSK DESIGN: (2 PANEL W/ BENCH)



BEAVER BAY

DESIGN DETAILS: NSSD CAIRN, HWY & TRAIL SIGNS

NORTH SHORE SCENIC DRIVE SIGNATURE CAIRN:

This cairn is the identifying object for the scenic drive. It reflects the importance of rocks in the North Shore landscape, and can be used to mark important public places along the shore. At Taconite Harbor two cairns flank the entrance road to the village center to mark it. This cairn is:

The signature sign for the North Shore Scenic Drive,

Made of regional rock,

Used to identify important places along the North Shore, and

Placed at the rest stop/trailhead at Beaver River Park.

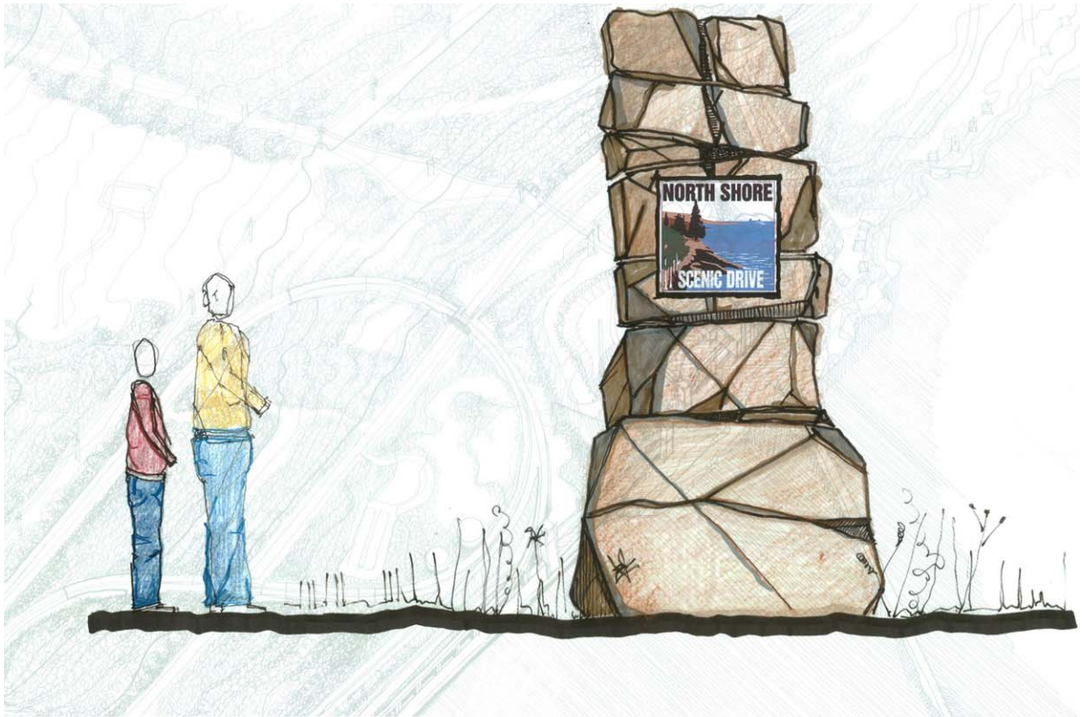
GITCHI-GAMI TRAIL & HWY. SIGNS:

Two signs of timber and steel were designed for use along the trail. The larger sign may be used for a map or for interpretative materials at places of special interest. The smaller sign is for the Gitchi-Gami Trail logo and may be used periodically to identify the trail.

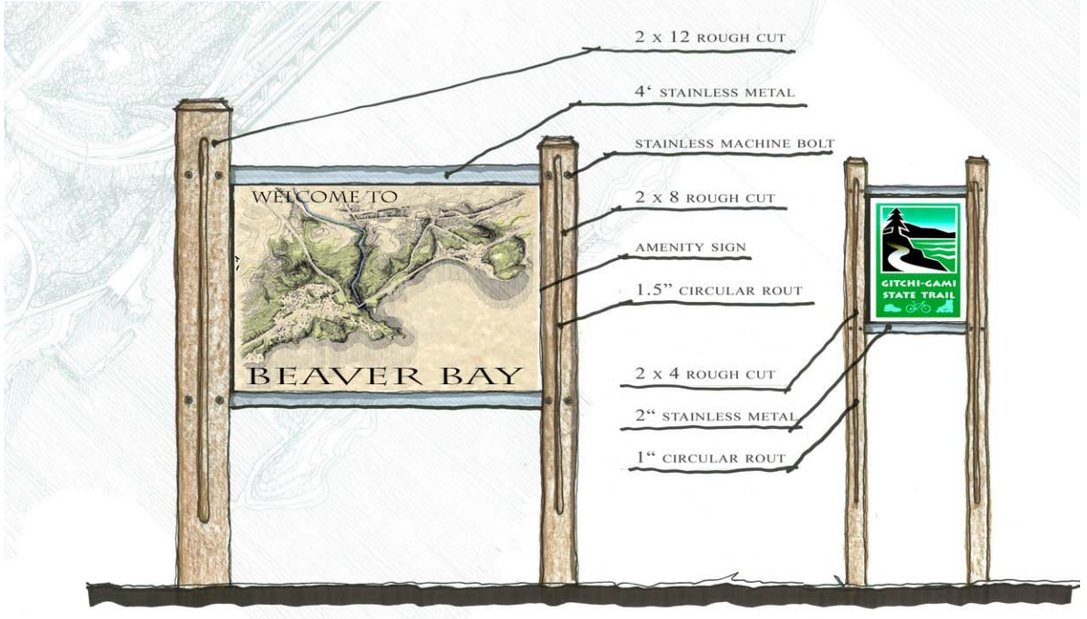
DESIGN DEVELOPMENT:

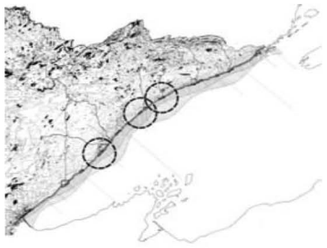
Design development addresses both the Gitchi-Gami Trail and North Shore Scenic Drive. The intent is to create a common “Regional Design Vocabulary” that fosters an identity along the North Shore, and creates connections that will lead to cooperative descision making and potential project funding.

NORTH SHORE SCENIC DRIVE CAIRN SIGN



GITCHI-GAMI TRAIL & HWY SIGNS

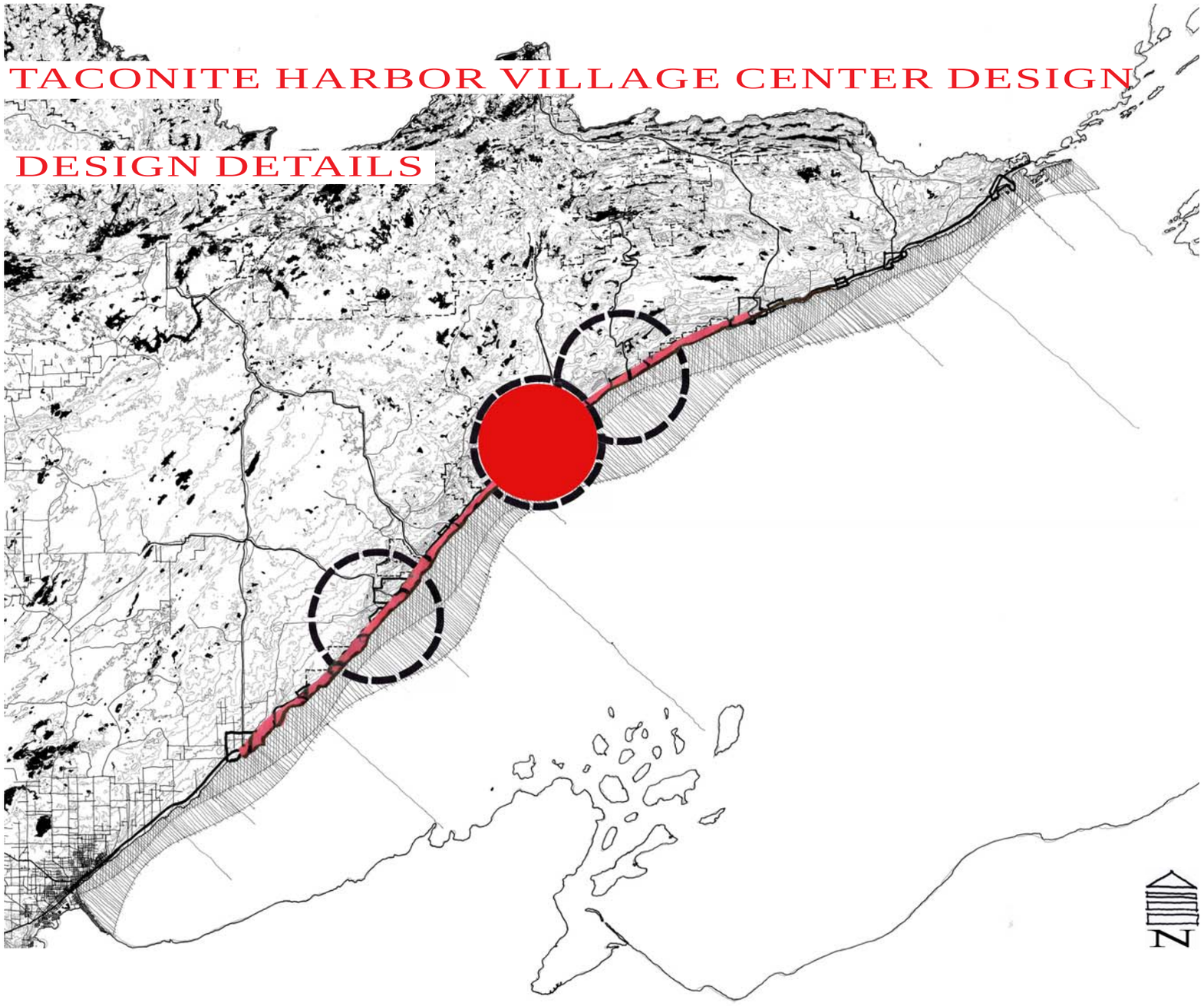




ANALYSIS

TACONITE HARBOR VILLAGE CENTER DESIGN

DESIGN DETAILS



TACONITE HARBOR

AREA CHARACTER ANALYSIS:

Taconite Harbor has served for many years as a major iron ore facility on the North Shore. The harbor, the massive loading dock, and the railroad line are landmark structures that remind the visitor of the important role that the mining industry has played on the North Shore. Currently Minnesota Power Company has a power plant and owns a large tract of land at Taconite Harbor. The company is exploring development opportunities for its land and is entertaining the potential of ceding some land by Two Island River to the State for public use. Recently public access to Lake Superior has been provided at Taconite Harbor; a safe harbor and a boat launch have been built by the State of Minnesota.

DESCRIPTION OF PHOTOGRAPHS:

Two Island River

Railroad bridge at Hwy. 61

Proposed village site

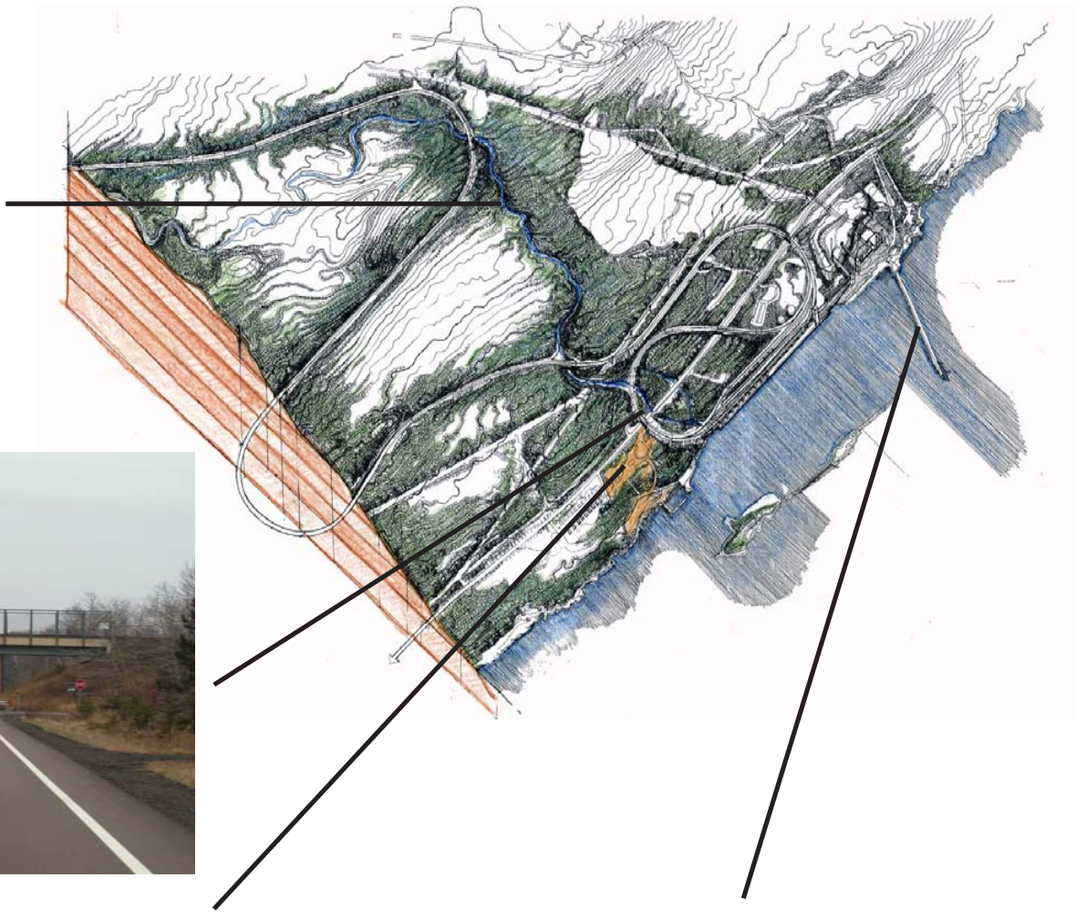
Taconite ore dock facility

TACONITE HARBOR: OBLIQUE VIEWS

THE VILLAGE CENTER SITE FROM LAKE SUPERIOR

EXISTING BOAT LAUNCH

TWO ISLAND RIVER



RAILROAD BRIDGE AT HWY.61

PROPOSED VILLAGE SITE

TACONITE ORE DOCK FACILITY

TACONITE HARBOR

ANALYSIS OF EXISTING CONDITIONS:

Taconite Harbor is the best example of the industrialized landscape on the North Shore. The drawing shows the nature of the human interventions that created this landscape. The elements include the:

Massive ore dock facility,

Manmade harbor with its sea walls,

Power plant,

Utility corridor, and

Rail line with its “s” curve that dominates the landscape as it crosses Highway 61 three times while moving down the slope to the harbor below.

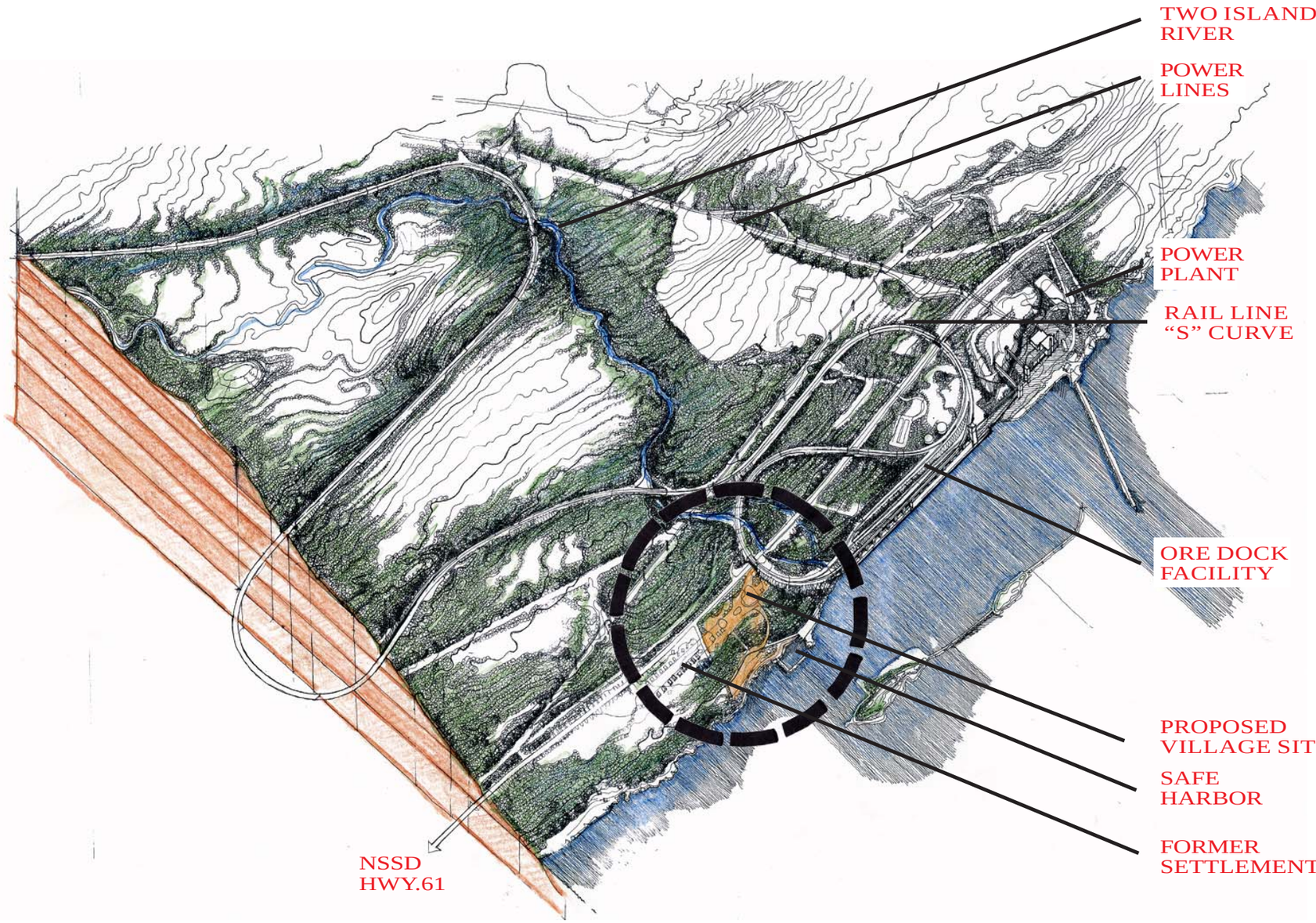
TWO ISLAND RIVER:

This scenic river:

Bisects the Taconite Harbor Area.

Flows into Lake Superior at the harbor just east of the boat launch and the safe harbor, and

Has a very picturesque and unique inland waterfall.


TWO ISLAND RIVER
POWER LINES
POWER PLANT
RAIL LINE "S" CURVE
ORE DOCK FACILITY
PROPOSED VILLAGE SITE
SAFE HARBOR
FORMER SETTLEMENT
NSSD HWY.61

TACONITE HARBOR

THE VILLAGE CENTER PLAN:

Minnesota Power has preliminary plans to develop the area along the shore of Lake Superior west and south of the harbor for residential and commercial use. The plans incorporate the Gtichi-Gami Trail as a spine or armature from which the new Taconite Harbor Village will be organized. The plans were originally produced by Whorley Architects of Duluth and revised by the design team at the Center for Changing Landscapes. It suggests that the commercial development be grouped in a village center, creating an environment like those seen in Scandinavian coastal settlements. The design provides a scheme which seeks to capitalize on the development's proximity to the Gitchi-Gami Trail and the North Shore Scenic Drive and to create a sense of place for the new community. The trail plays an important role in the center. The village center includes:

Marking the entrance on Highway 61 with a North Shore Scenic Drive cairn gate,

Bisecting the village center with the Gitchi-Gami Trail,

Making a paved village square that accommodates a variety of buildings,

Bounding the center with large parking lots on both its west and the east edges,

Using native North Shore plants and trees, and

Creating water features that treat storm water runoff.

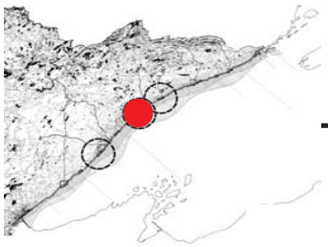
The buildings at the village center include:

The Sawtooth Center as the focal point, and

Retail, office, restaurant, gas station, and a community center sited between the Gitch-Gami Trail and the parking lots.


HWY. 61
NSSD CAIRN GATES
GITCHI GAMI TRAIL ROUTE
PARKING 90 STALLS
SCULPTURE SIGNAGE
SAWTOOTH CENTER
GITCHI GAMI TRAIL
(FUTURE EXPANSION ON TOP
OF RAILROAD GRADE)
FOOD & FUEL W/ CAFE
GGT KIOSK
TERRACE WALL
GGT BIKE RACKS
RETAIL STORES
PARKING 15 STALLS
NORTH SHORE WILDFLOWER MEADOW PLANTINGS (TYP.)
PAVING PATTERN DENOTES GGT BIKE CIRCULATION
PARKING
VILLAGE TOWER
RESTARANT PUB
5 FOOT CONTOURS
(EXISTING)
COMMUNITY CENTER W/ KIOSK
OFFICE SPACE
RAIN GARDEN AND POND
RETAIL STORES
TRAILER PARKING
FLOWING WATERS STONE PAVING
HARBOR ROAD
PARKING 95 STALLS
CASCADE CREEK AND POND
GITCHI GAMI TRAIL
PARKING 15 STALLS
N
NORTH
SCALE 1" = 30'

57



TACONITE HARBOR

DESIGN DETAILS:

A new village is created on the north shore of Lake Superior taking precedent from Scandinavian coastal settlements. This pedesstrian-oriented design encourages social interaction. The village is carved out of the natural landscape and built around recreational infrastructures to create a “green” corridor from lake shore to Hwy 61. Designed for access to multiple amenities, the new village embodies the North Shore experience and serves as a model for community building. The village center details include:

Bicycle racks of timber and steel,

A storm water feature of local stone and native plants,

Paved surfaces that define the village square,

A timber village tower,

Building massing and details that reflect the North Shore’s Scandinavian heritage, and

Building materials that reflect North Shore’s timber and steel industries.

SAWTOOTH CENTER

VILLAGE TOWER

TACONITE HARBOR

GITCHI-GAMI TRAIL SIGNATURE DETAILS:

A number of signature elements were designed to give identity to the Gitch-Gami Trail as it winds its way along the North Shore.

SIGNATURE KIOSK:

The trail kiosk is to be used at trailheads. It is made of timber and steel, two materials that have played important roles in the economy of the North Shore. Its concrete base is embedded with local stone, a material that is found all along the shore. The kiosk is designed to:

Reflect the form of Scandinavian inspired coastal settlement buildings,

Display the features of the larger landscape found at its location, and

Enable both region and local interpretative material to be displayed.

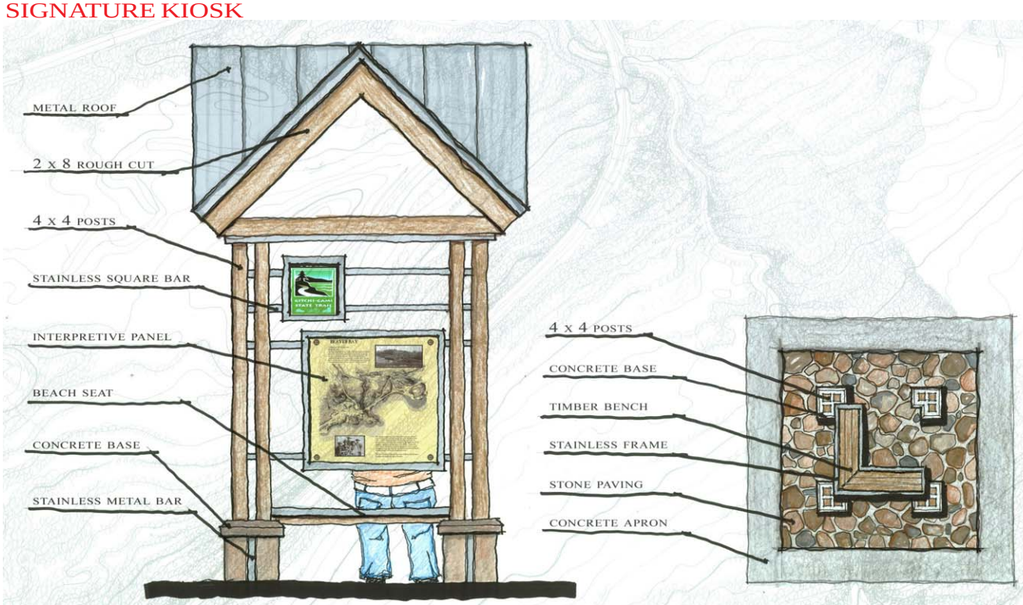
NORTH SHORE SCENIC DRIVE SIGNATURE CAIRN:

This cairn is the identifying object for the North Shore Scenic Drive. It reflects the importance of rocks in the North Shore landscape and can be used to mark important public places along the shore. At Taconite Harbor two cairns flank the entrance road to the village center.

GITCHI-GAMI TRAIL SIGNS:

Two signs of timber and steel were designed for use along the trail. The larger sign may be used for a map or for interpretative materials at places of special interest. The smaller sign is for the Gitchi-Gami Trail logo and may be used periodically to identify the trail.

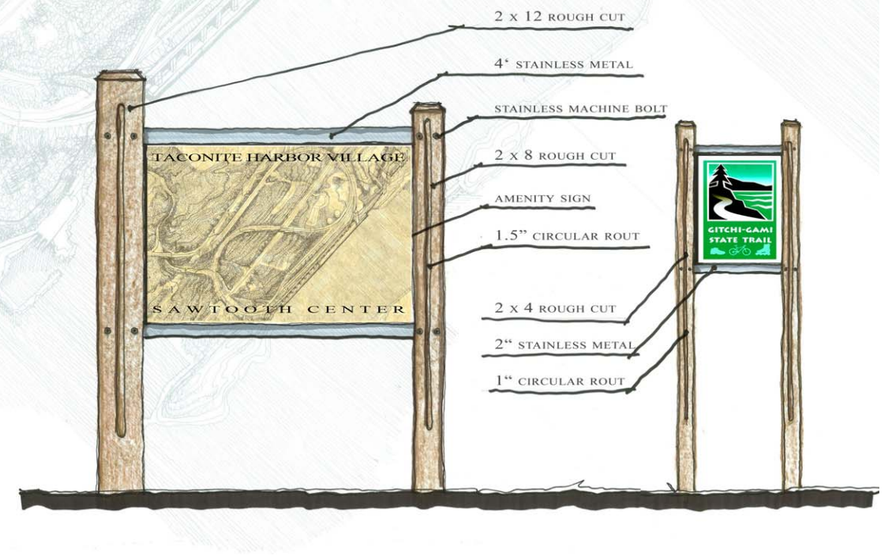
SIGNATURE KIOSK



NORTH SHORE SCENIC DRIVESIGNATURE CAIRN

INTERPRETIVE PANEL GRAPHIC DESIGN

GITCHI-GAMI TRAIL & HIGHWAY SIGNS



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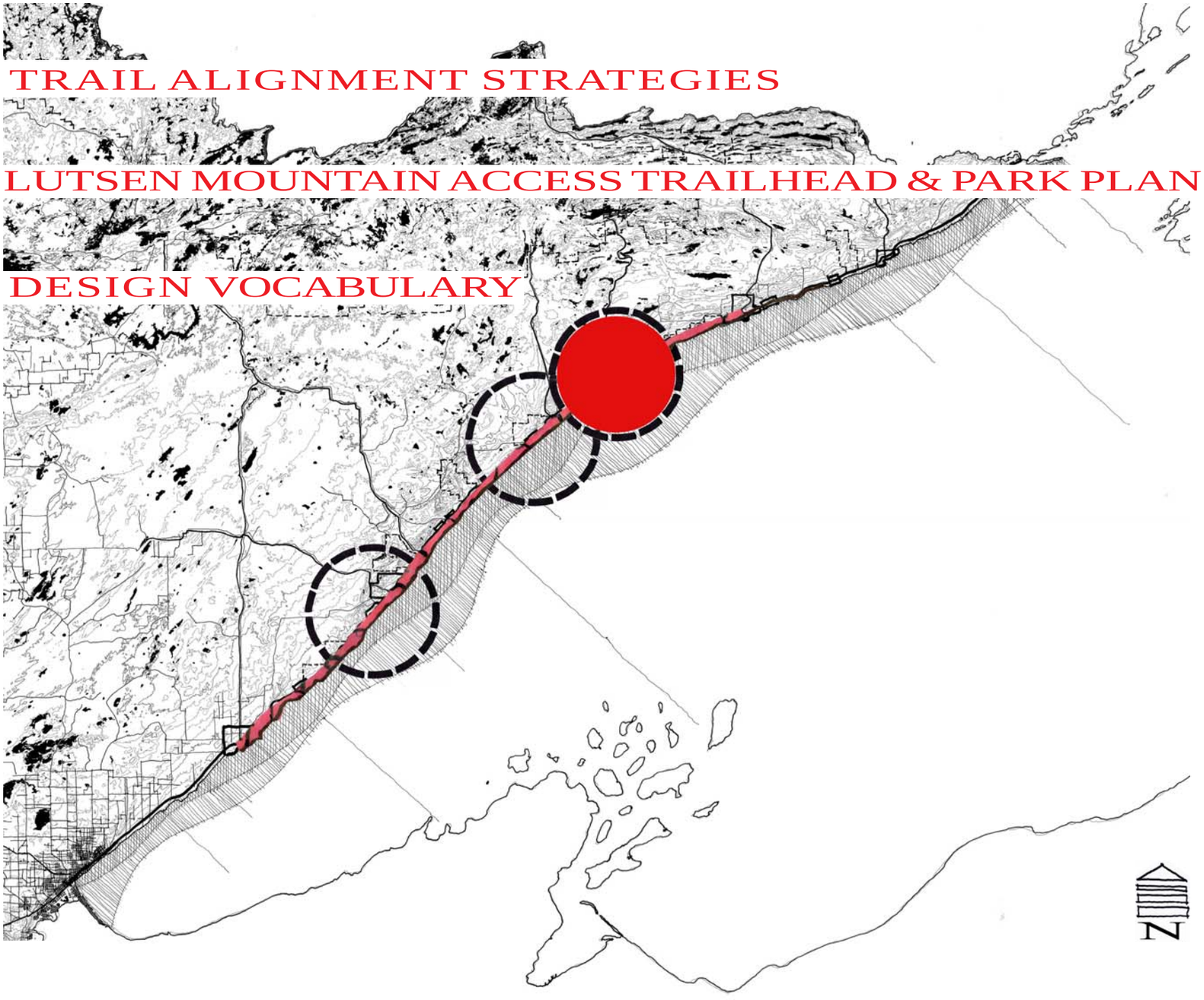
UNIVERSITY OF MINNESOTA

ANALYSIS

TRAIL ALIGNMENT STRATEGIES

LUTSEN MOUNTAIN ACCESS TRAILHEAD & PARK PLAN

DESIGN VOCABULARY



LUTSEN CROSSING

AREA CHARACTER ANALYSIS:

Lutsen is a small community that is a popular year-around recreational area. Terrific fishing and a beautiful deep gorge characterize the Poplar River. The Sawtooth Mountians have one of the greatest vertical drops along the North Shore. The community has had resorts since the nineteenth century. Resorts and second homes are strung along the lakeshore, businesses that cater to locals and visitors are clustered along Highway 61, and a ski/golf village is located inland up Ski Hill Road.

DESCRIPTION OF PHOTOGRAPHS:

Poplar River: The Poplar River and its ravine wind through the area before entering Lake Superior at a landmark resort.

Historic Highway 61 bridge abutment: The old Highway 61 bridge abutement overlooks the Poplar River and its ravine.

Approach to east: When approaching Lutsen from Duluth, many signs greet the visitor.

Distinct Architecture: Lutsen has many buildings designed by Edwin Lundie, a famous Minnesota architect. These timber buildings are made of local materials. Their form and details reflect the culture of the area's early Scandinavian settlers.

Lutsen Town center: Although many of Lutsen's commercial buildings are spread out along Highway 61, especially those that cater to tourists; a number of buildings are grouped together to form a small town center.

Lutsen Park: Located on the shore of Lake Superior just off Highway 61, this park provides picnic areas and access to the lake for residents and visitors.

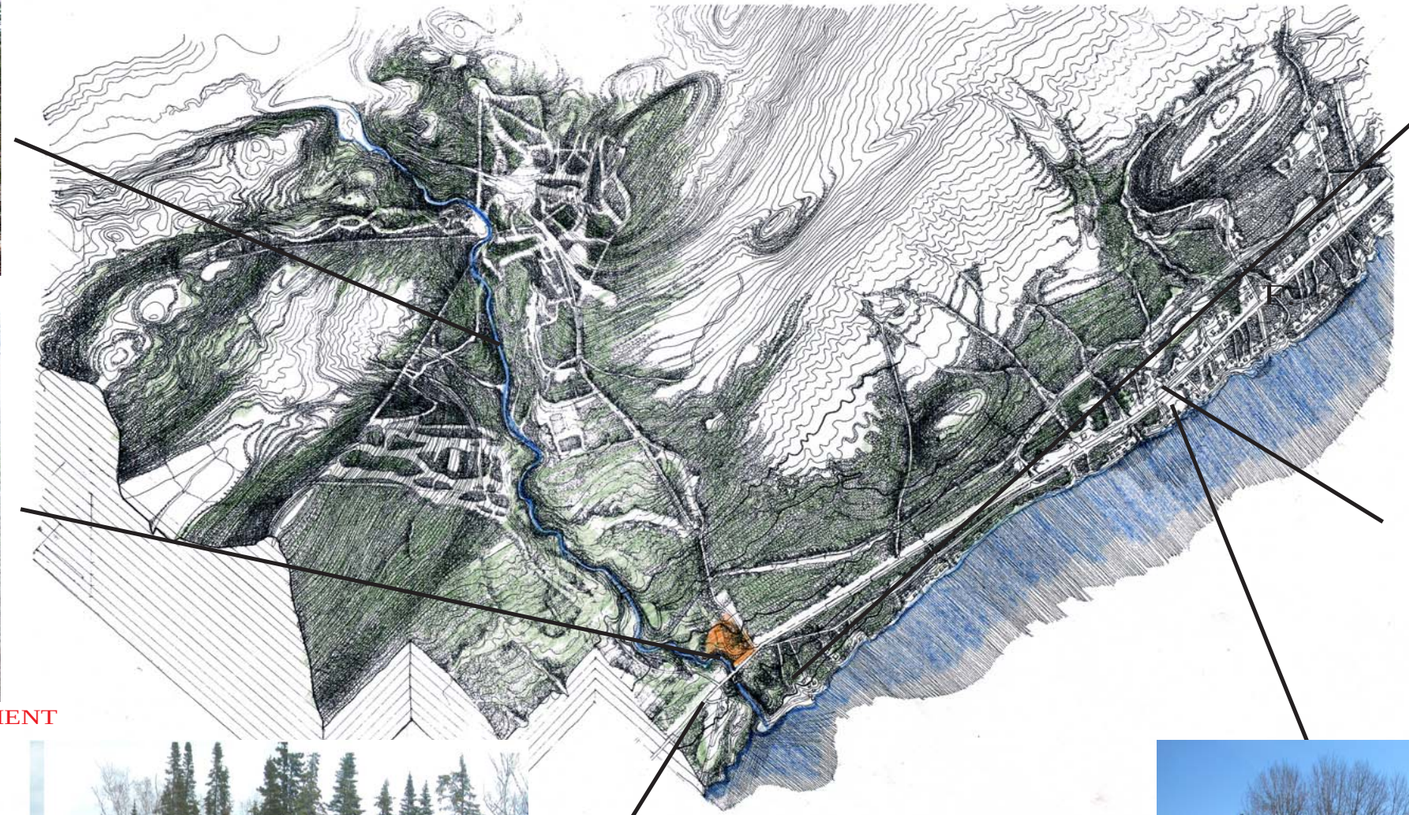
LUTSEN: OBLIQUE VIEWS

INTERSECTION OF SKI HILL RD. FROM LAKE SUPERIOR

LUTSEN PARK FROM LAKE SUPERIOR

POPLAR RIVER

HISTORIC HWY.61 BRIDGE ABUTMENT



DISTINCT ARCHITECTURE

LUTSEN TOWN CENTER

EASTERN APPROACH

LUTSEN PARK

LUTSEN CROSSING

ANALYSIS OF EXISTING CONDITIONS:

Lutsen is a recreational hub on the North Shore. The drawing shows the relationships between existing recreational destinations and opportunities present in this part of the North Shore landscape. The elements include the:

Lutsen Resort,

Potential NSSD rest stop and trailhead site,

North Shore Scenic Drive Hwy. 61,

Lutsen town center and park,

The Gitchi-Gami Trail

Historic Hwy. 61 bridge abutments, and

The Sawtooth Mountains.

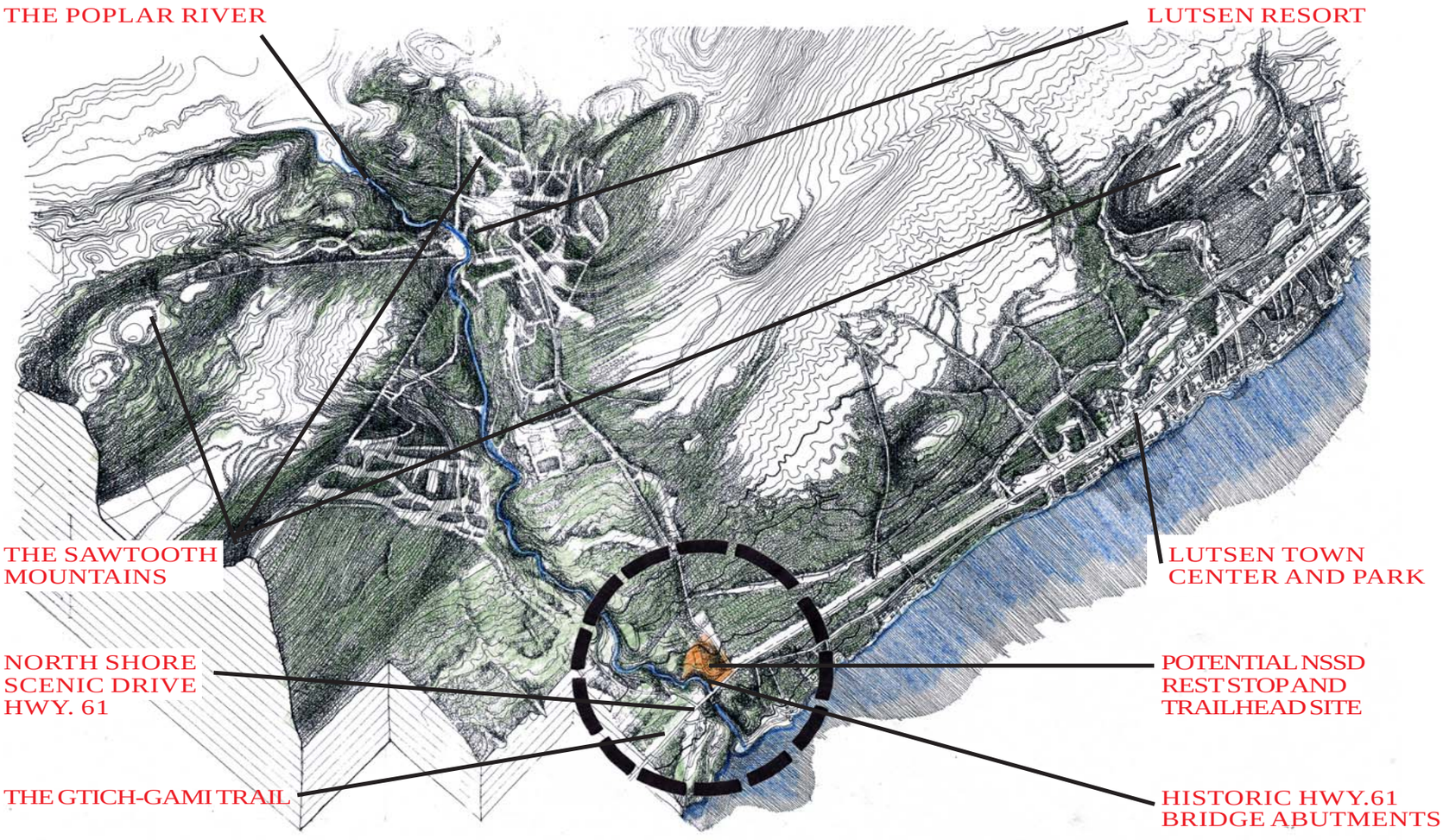
THE POPLAR RIVER:

This scenic river:

Runs through the Lutsen Resort providing excellent fishing opportunities,

Flows past the proposed park site providing multiple viewing opportunities, and

Has a unique character of steep, rocky banks.


THE POPLAR RIVER
LUTSEN RESORT
THE SAWTOOTH MOUNTAINS
LUTSEN TOWN CENTER AND PARK
NORTH SHORE SCENIC DRIVE HWY. 61
POTENTIAL NSSD REST STOP AND TRAILHEAD SITE
THE GTICH-GAMI TRAIL
HISTORIC HWY.61 BRIDGE ABUTMENTS

LUTSEN CROSSING

AREA TRAIL NETWORK POTENTIALS:

The Lutsen Area has a variety of trails for cyclists, hikers, cross country skiers, and snowmobile users that make up a multi-season trail network that extends into the interior landscape. Although many of these trails are well known and very popular, those that are unmarked or poorly marked are less known. There are opportunities to strengthen the network and increase the trails' visibility by creating connections between existing trails, improving their markings, and sponsoring special trail events. Because the Gitchi-Gami Trail will run parallel to the Lake Superior, it could serve as a spine that intersects with these trails at strategic locations. Some of the strategic locations along the proposed Gitchi-Gami Trail are listed below; some are potential trailhead locations.

TOFTE/SAWBILL TRAIL:

This location offers on opportunity for a multi-purpose trailhead, a parking lot, a trail sign, and connections to other trails.

ONION RIVER ROAD:

This location offers an opportunity to connect to other bike trails, a snowmobile trail, and the Superior Hiking Trail.

LUTSEN CROSSING:

This important Highway 61 and Ski Hill Road intersection provides an opportunity for a facility that could be both a major trailhead and a rest stop for the North Shore Scenic Drive. Because it is contiguous to the Poplar River, it could also provide access to the river.

LUTSEN VILLAGE:

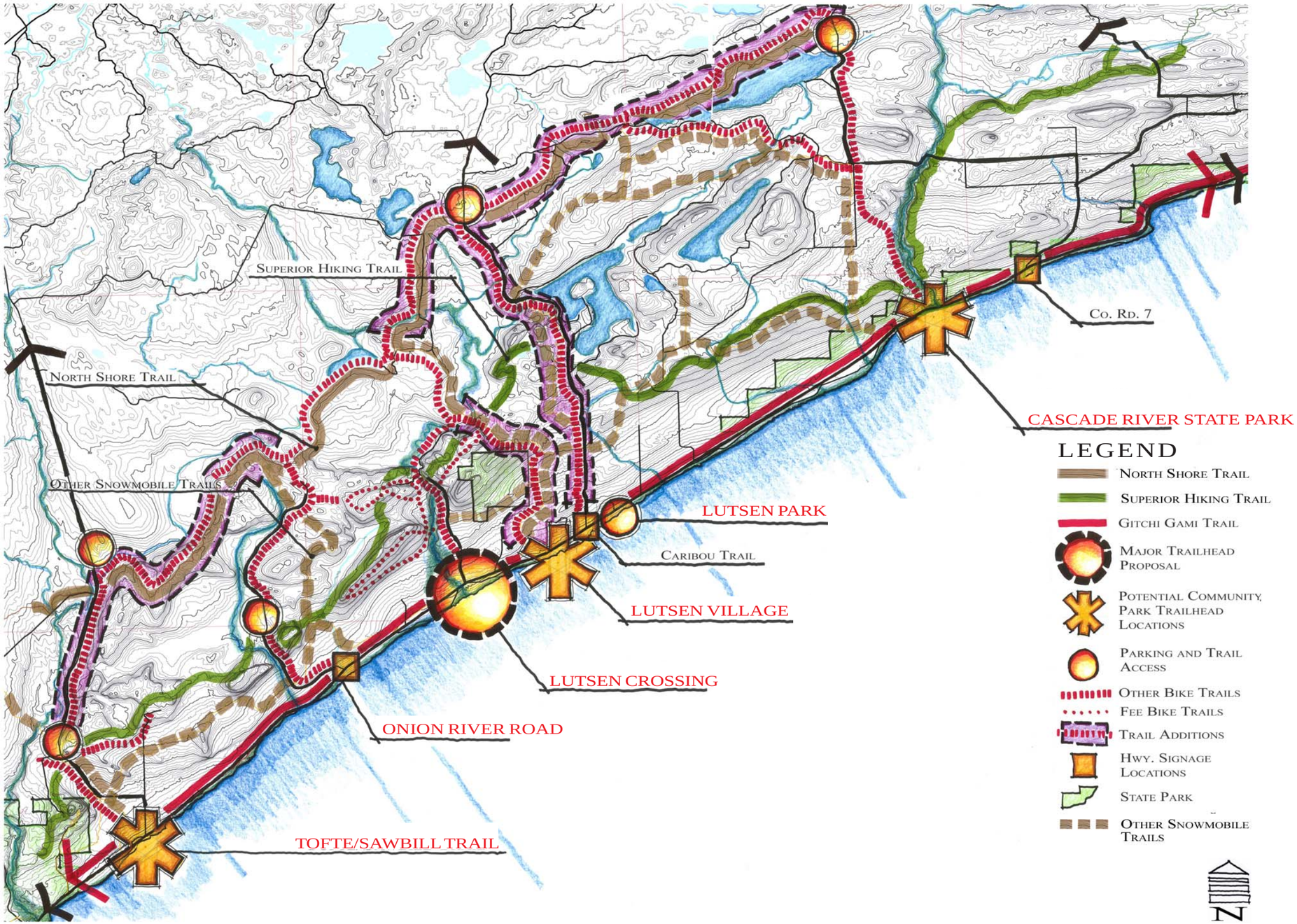
A trailhead at this site could connect the trail with other trails in the area and help support the local businesses at this location. Any trailhead and trailhead parking should be designed to support the future expansion of the village center.

LUTSEN PARK:

This local park with its picnic facilities, parking areas, and access to Lake Superior make it a potential trailhead location.

CASCADE RIVER STATE PARK:

This beautiful state park has many amenities and is connected to the Superior Hiking Trail and a local bike trail. A trailhead could be located here.


SUPERIOR HIKING TRAIL
NORTH SHORE TRAIL
OTHER SNOWMOBILE TRAILS
CO. RD. 7
CASCADE RIVER STATE PARK
LUTSEN PARK
CARIBOU TRAIL
LUTSEN VILLAGE
LUTSEN CROSSING
ONION RIVER ROAD
TOFTE/SAWBILL TRAIL
LEGEND
NORTH SHORE TRAIL
SUPERIOR HIKING TRAIL
GITCHI GAMI TRAIL
MAJOR TRAILHEAD PROPOSAL
POTENTIAL COMMUNITY, PARK TRAILHEAD LOCATIONS
PARKING AND TRAIL ACCESS
OTHER BIKE TRAILS
FEE BIKE TRAILS
TRAIL ADDITIONS
HWY. SIGNAGE LOCATIONS
STATE PARK
OTHER SNOWMOBILE TRAILS
N

LUTSEN CROSSING

LOCAL TRAIL ALIGNMENT POTENTIALS:

There are a number of options for trail alignments in the trail segment from the Onion River to the village center. The trail could be sited between Highway 61 and the lake along the county roads, it could follow a utility line corridor along the hillside, or it could be a combination of the two. It is necessary for the trail to cross Highway 61 in all of these options. The implications of these alignment options are described in more detail below.

ONION RIVER:
A new trail bridge is needed at this location. The Ray Burgland Rest Stop could be expanded to provide access to the trail.

NORTHSIDE ALIGNMENT:
This alignment sited along the existing utility corridor would separate the trail from Highway 61, connect to a series of local bicycle trails, move though woods that have views to Lake Superior, provide access to the village center and Cascade State Park, and eliminate additional crossings of Highway 61. It would require paving and a stripe.

ONION RIVER ROAD:
A trail access point sign could go here.

SOUTHSIDE ALIGNMENT:
This frontage road alignment would provide a separation from Highway 61. This roadside trail would require new paving and a stripe.

COUNTY ROAD 34 ALIGNMENT:
In this segment on the south side the trail is a roadside trail along an unpaved road. It follows the old Highway 61 alignment and meanders past entrances to resort properties in a woodland environment. It would require paving and a stripe.

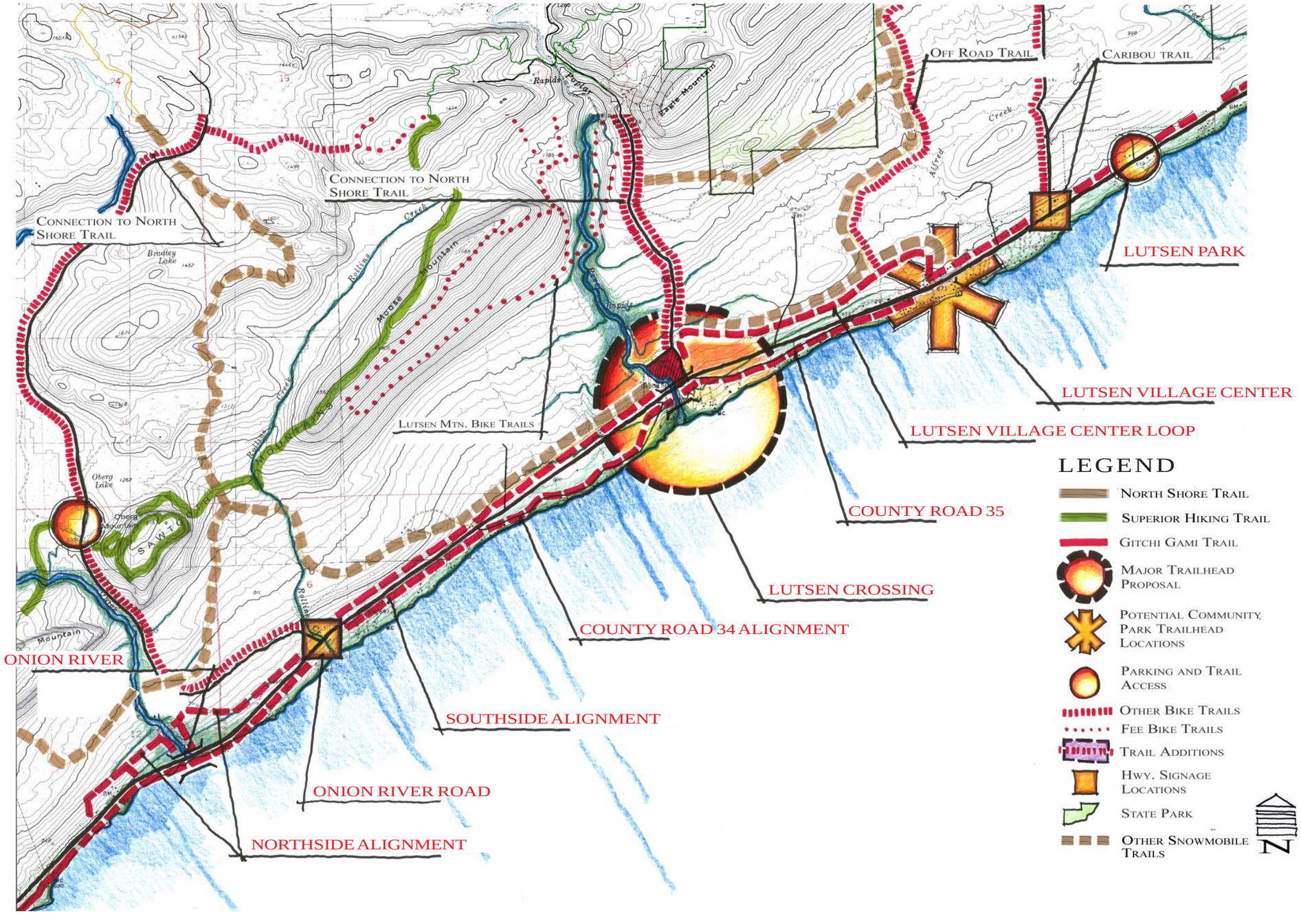
LUTSEN CROSSING:
The land at the northwest corner of the intersection of Ski Hill Road and Highway 61 provides an opportunity for siting a combined facility that serves as a major trailhead for the Gitchi-Gami Trail, a rest stop for the North Shore Scenic Drive, and a welcoming space to the Lutsen Community. Public access to the Popular River could be provided, and the old highway bridge abutements on the site could serve as overlooks to the river below. The snowmobile trail could be rerouted away from the golf course and the historic cemetery through this site. New paving and striping are required.

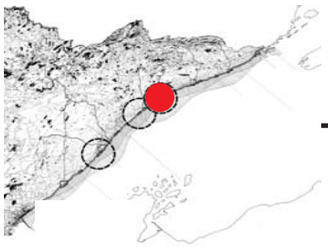
COUNTY ROAD 35:
This roadside segment parallels county Road 35, an unpaved road. New paving with a stripe are required.

LUTSEN VILLAGE CENTER LOOP:
Running along the existing utility corridor, this segment connects Lutsen Crossing and the Ski Hill Road with the Lutsen Village Center and local trails. Located on a hillside, it provides views of Lake Superior.

LUTSEN VILLAGE CENTER:
A trailhead could be built by the Village Center. The additional traffic could support the local businesses. Parking for trail users would need to be provided, and parking for current customers and clients would have to be maintained. If the trail were to cross here from the south side; the crossing needs to be clearly marked, and the speed of traffic on Highway 61 reduced.

LUTSEN PARK:
This community park could be a trailhead. Its access to the lake and picnic areas could make it a very pleasant stop along the trail.


CONNECTION TO NORTH SHORE TRAIL
CONNECTION TO NORTH SHORE TRAIL
OFF ROAD TRAIL
CARIBOU TRAIL
LUTSEN PARK
LUTSEN VILLAGE CENTER
LUTSEN VILLAGE CENTER LOOP
LUTSEN MTN. BIKE TRAILS
COUNTY ROAD 35
LUTSEN CROSSING
COUNTY ROAD 34 ALIGNMENT
ONION RIVER
SOUTHSIDE ALIGNMENT
ONION RIVER ROAD
NORTHSIDE ALIGNMENT
LEGEND
NORTH SHORE TRAIL
SUPERIOR HIKING TRAIL
GITCHI GAMI TRAIL
MAJOR TRAILHEAD PROPOSAL
POTENTIAL COMMUNITY PARK TRAILHEAD LOCATIONS
PARKING AND TRAIL ACCESS
OTHER BIKE TRAILS
FEE BIKE TRAILS
TRAIL ADDITIONS
HWY. SIGNAGE LOCATIONS
STATE PARK
OTHER SNOWMOBILE TRAILS
N



LUTSEN CROSSING

LUTSEN MOUNTAIN ACCESS TRAILHEAD & PARK PLAN:

Located strategically on the approach to the community, this site could be developed as a shared facility for both the Gitchi-Gami Trail and the North Shore Scenic Drive. It could reinforce the unique character of the community by reflecting the famous Lundie design aesthetic that is a signature feature of the buildings in Lutsen Area.

TRAIL ALIGNMENT IMPLICATIONS:

If the trail were sited on the south side of the highway, a well-marked Highway 61 crossing and a trail bridge across the Poplar River would be required. If the trail were located on the north side, the snow-mobile trail could be realigned away from the golf course and the historic cemetery. A well-marked trail crossing on Ski Hill Road and a dual use bridge that could serve both the Gitchi-Gami Trail and the snowmobile trail would be needed.

DESIGN FEATURES:

Lutsen Crossing is characterized by :

Signs and structures that reflect the Lundie design aesthetic,

Interpretation of the area on the kiosk,

Native plants in a North Shore meadow as a setting for the North Shore Scenic Drive sign cairn,

The reuse of the old Highway 61 alignment as the major pedestrian spine through the site,

The reuse of the old Highway 61 bridge abutements for a viewing promontory and a new

pedestrian bridge across the Poplar River,

A pedestrian trail that provides public access to the river,

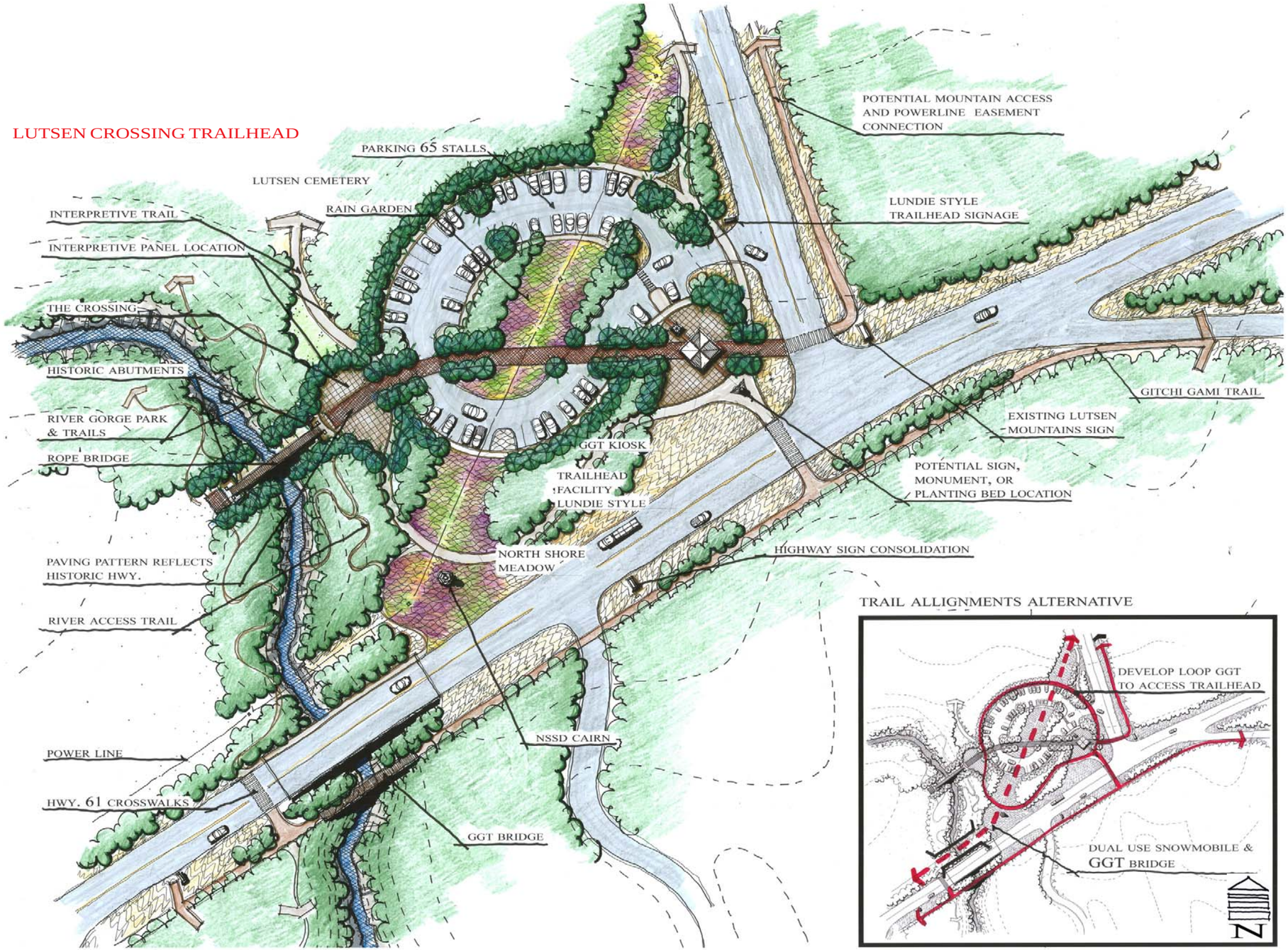
A pathway to the historic cemetery,

A setting for a landmark monument or a bed of native plants,

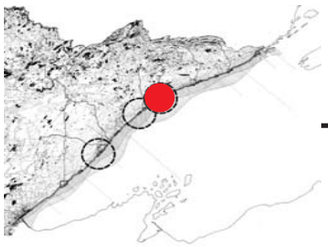
Bicycle racks, restrooms, and parking for 65 cars, and

A pedestrian rope bridge.

LUTSEN CROSSING TRAILHEAD



TRAIL ALLIGNMENTS ALTERNATIVE



LUTSEN CROSSING

DESIGN VOCABULARY:

These drawings show the design vocabulary for the Lutsen Crossing site. The historic bridge promontory, the Lundie-style building, the Lundie-style bridgehead, and the trail fencing all work together to reinforce the identity of Lutsen Crossing as a special place along the trail.

BRIDGE ABUTMENT VIEWING PROMONTORY & LUNDIE-STYLE ROPE BRIDGE & BUILDING:

On the left, the drawing depicts the pedestrian bridge with its Lundie-style detailing and the Gitchi-Gami signature fence on the top edge of the Poplar River Ravine. On the right, the view from the walkway on the old Highway 61 corridor towards the Lundie-style building is depicted. Trees on the old highway right-of way form an allee that directs the pedestrian towards the building.

SIGNS:

This drawing depicts the trailhead sign on the right side of Highway 61. The signature Gitchi-Gami sign is modified to reflect Lutsen's Lundie aesthetic. Across the highway from the trailhead sign is the North Shore Scenic Drive cairn.

LUNDIE-STYLE BRIDGE, HISTORIC ABUTMENTS AND BUILDING

POPLAR RIVER PROMONTORY, BRIDGE AND WHITE PINE ALLEE

SIGNATURE ELEMENTS

CENTER FOR CHANGING LANDSCAPES
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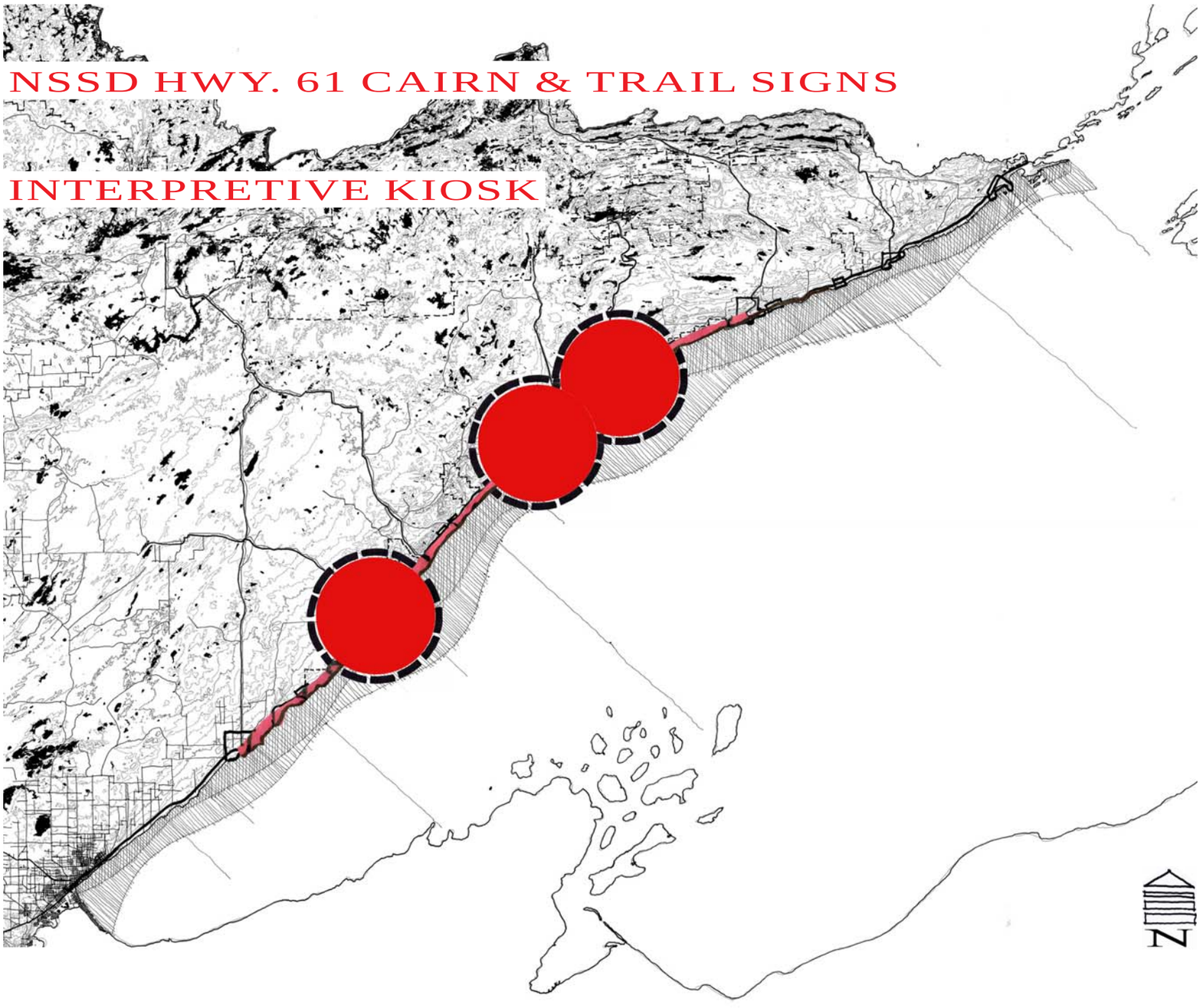
BICYCLE RACKS & FENCING

NSSD HWY. 61 CAIRN & TRAIL SIGNS

INTERPRETIVE KIOSK



SIGNATURE ELEMENTS

BICYCLE RACKS & FENCING:

A kiosk, signs, fencing, and bike racks were designed as a group of signature elements to give identity to the Gitchi-Gami Trail. An interpretive plan was also proposed for kiosk These elements are to be used throughout the trail's length, in trail communities, and at trailheads. The form of these elements and the materials from which that they are made reflect the region's beauty, culture, and economy. The North Shore was settled in the nineteenth century with settlers from Northern Europe that brought their building styles with them. The North Shore is an area of breathtakingly beautiful forests and rugged rocks. The underlying geology and its picturesque rock outcroppings give the North Shore its special rugged character. The timber industry has been and still is an important part of the region's economy. Iron ore and taconite have also played an important role in the region's economy; as evidenced by the mining industry's large facilities at Silver Bay and Taconite Harbor. The signature elements are made of timber, steel, and rock. They reflect the vocabulary of things built in the north woods.

BICYCLE RACKS:

The bicycle racks have the same design vocabulary and the same materials as the signs.

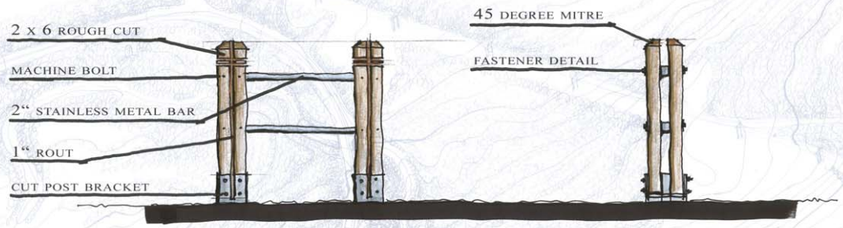
GITCHI-GAMI TRAIL FENCING DETAIL:

This fencing is designed to be applied at the gathering spaces, rest stops, overlooks, and trailheads. The fencing is designed to be durable and keep trail users a safe distance from potential off trail dangers, or historical/ecological features. Benchs can be incorporated along the fence.

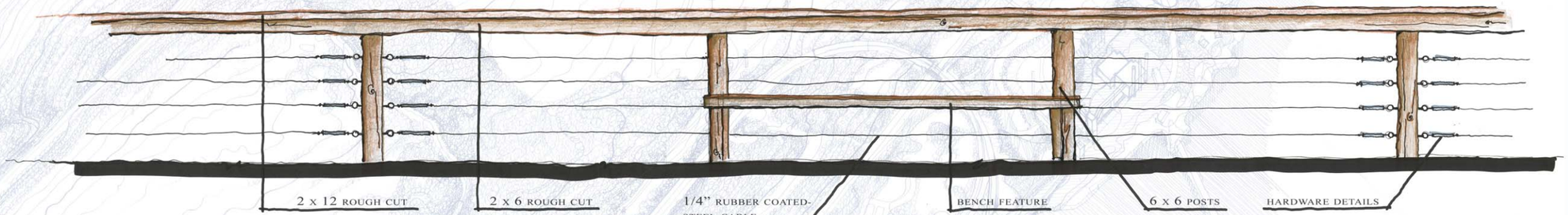
HWY. 61 & GRADE SEPARATED FENCING:

The fencing is designed to be durable and not to intrude on the environment. The design is flexible so it can be used in a variety of ways. It can be modified to accept special conditions like to display the mill-stone in the Beaver Bay promontory or to add a bench, and it can have a top rail or not. It is made of rough-cut timber and coated steel cable. The fence posts have a vertical route and routed, mitered tops.

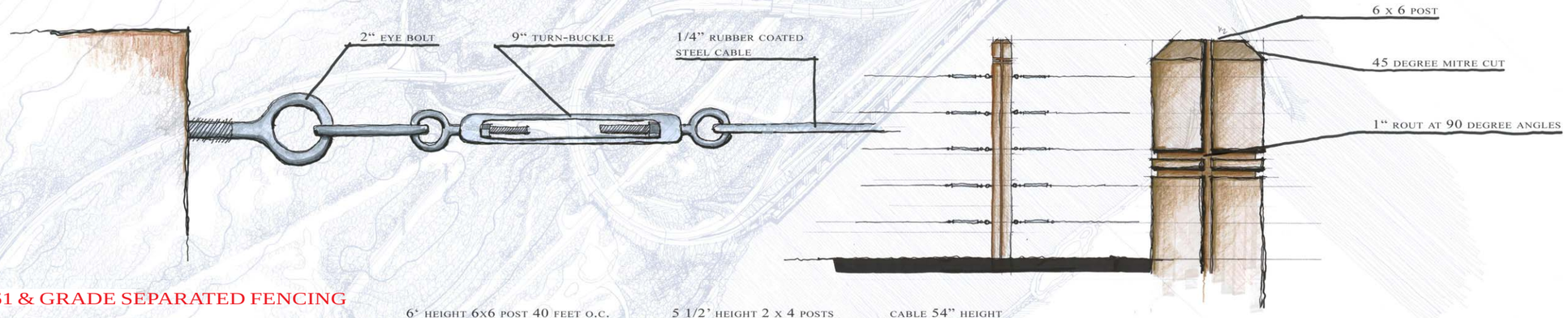
BICYCLE RACKS



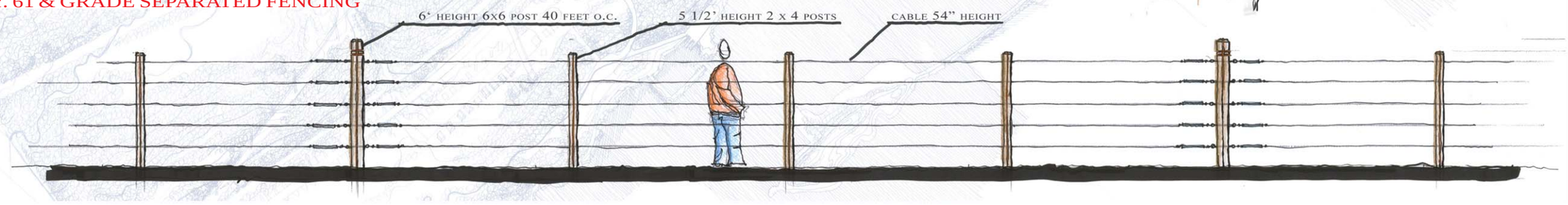
GITCHI-GAMI TRAIL FENCING DETAIL



HARDWARE DETAILS



HWY. 61 & GRADE SEPARATED FENCING



SIGNATURE ELEMENTS

NSSD HWY.61 CAIRN & TRAIL SIGNS:

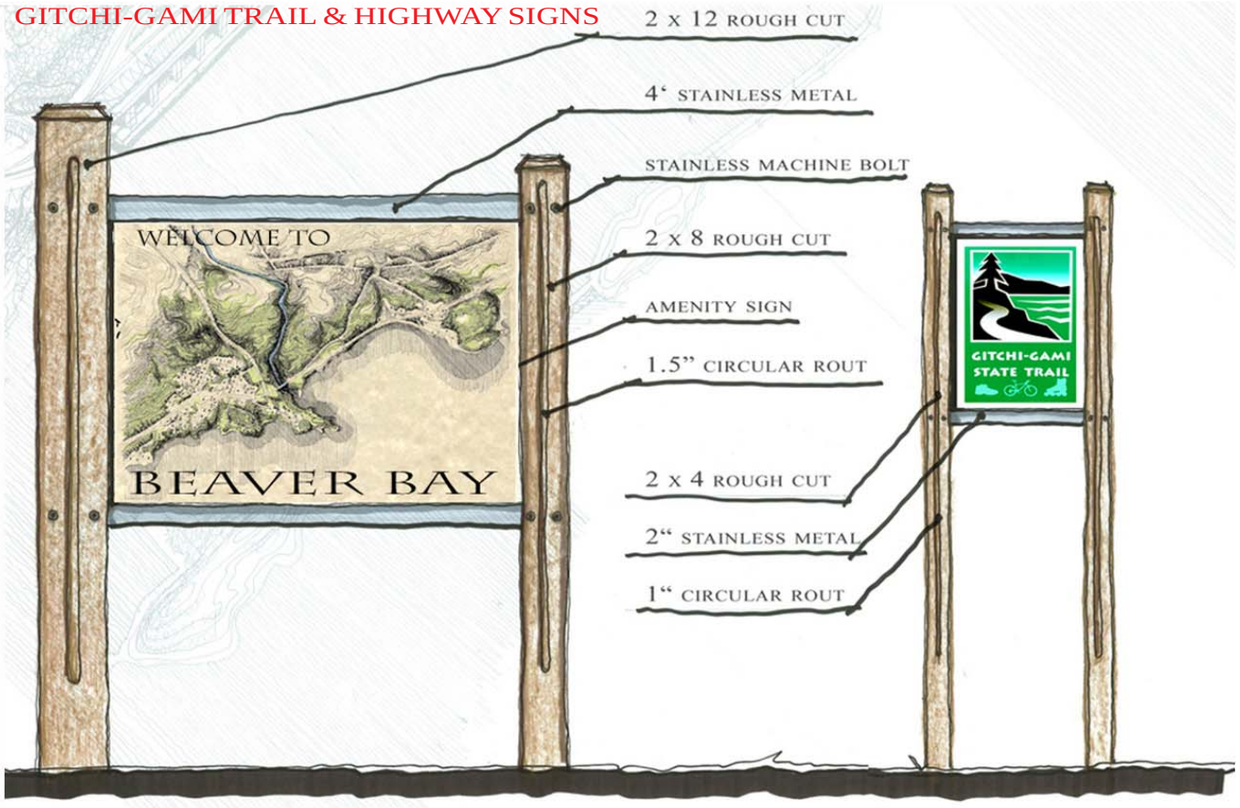
GITCHI-GAMI TRAIL & HIGHWAY SIGNS:

Two different sign sizes were designed. The smaller sign accommodates the Gitchi-Gami Trail logo. The larger sign has two interpretative panels. Sign posts made of 2x6 rough cut timber, have routed, mitered tops, and are bolted to the concrete base with a cut post bracket. The sign is held in place by a two-inch stainless steel metal bar and fastened by bolts.

NORTH SHORE SCENIC DRIVE SIGNATURE CAIRN SIGN:

This cairn is the identifying object for the scenic drive. It reflects the importance of rocks in the North Shore landscape, and can be used to mark important public places along the shore. At Taconite Harbor two cairns flank the entrance road to the village center to mark it.

GITCHI-GAMI TRAIL & HIGHWAY SIGNS



NORTH SHORE SCENIC DRIVE SIGNATURE CAIRN SIGN

SIGNATURE ELEMENTS

INTERPRETIVE KIOSK:

This signature kiosk is to be placed along the trail to interpret the both the natural and the cultural landscape. Each kiosk will have Gitchi-Gami logo and a drawing of the larger landscape that portrays its very spectacular richness. The other three panels on this four-sided kiosk interpret the special place in which it is located. The kiosk's form recalls the shore's Scandinavian heritage. Is it made of wood and steel, products that play important roles in the region's economy. Local rocks are embedded in the kiosk's concrete base.

INTERPRETATIVE PANELS:

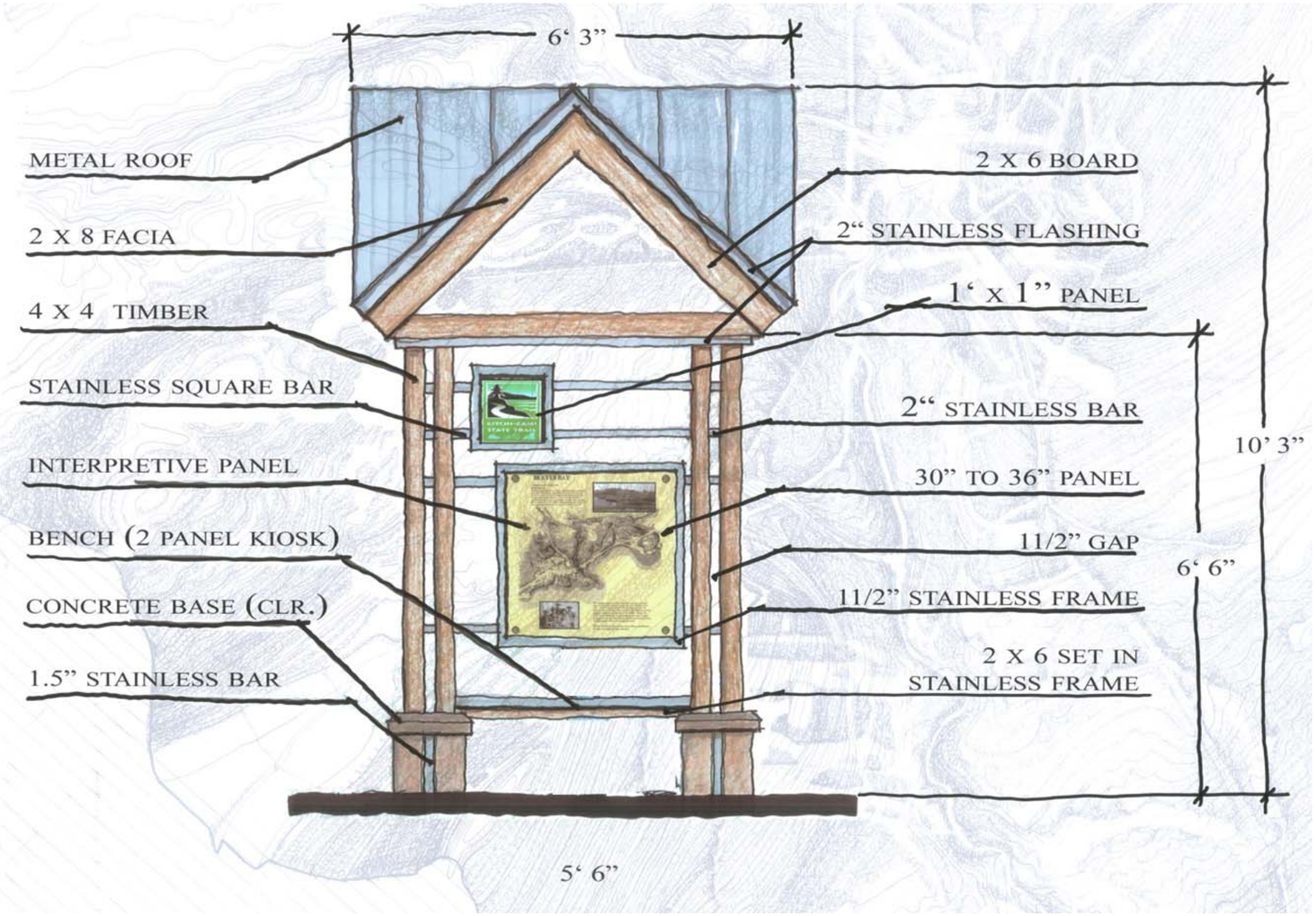
Regional Panel: The regional panel calls out the communities, the state parks, the Boundary Waters Canoe Area, and the region's major linear recreational systems. These systems are the Gitchi-Gami Trail, the North Shore Trail, the North Shore Scenic Drive, the Superior Hiking Trail, and the Superior Water Trail. It also identifies the community in which the kiosk is placed in order to tell the viewer," You are here."

Local Panel: The local panel is a bird's eye drawing of the local area depicting its landscape and calling out its linear recreational systems. Community resources such as parks, local trails, the central business area, and trailheads are noted.

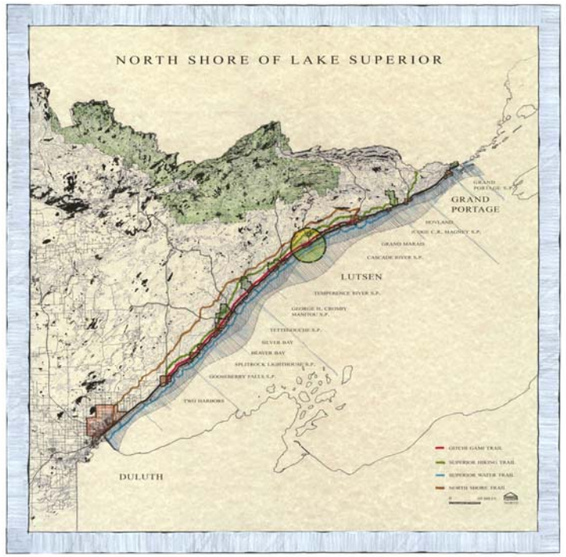
History & Culture: The history and culture panel presents the community's natural and cultural history through narrative, maps, drawings, and photographs.

Special Focus: The fourth panel could display a calendar of local events and information about local businesses. It may dispense brochures and maps. Special interpretive information addressing the vegetation, hydrology, geology, and other environmental characteristics may be displayed.

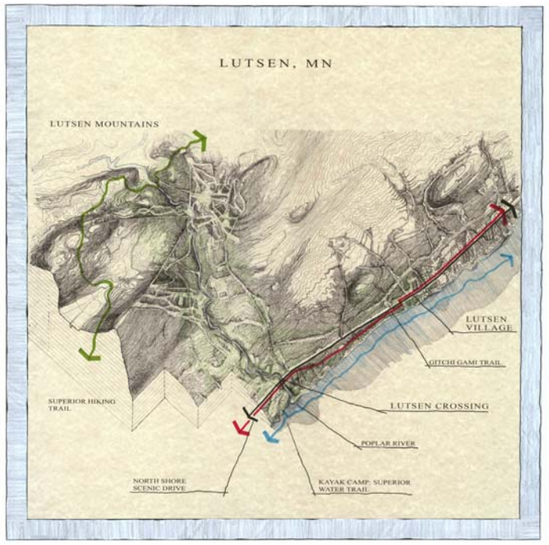
4 PANEL INTERPRETIVE KIOSK

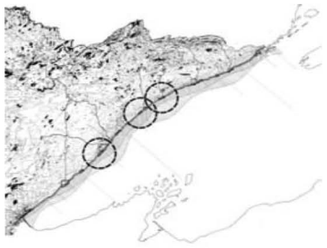


REGIONAL PANEL



LOCAL PANEL





APPENDIX

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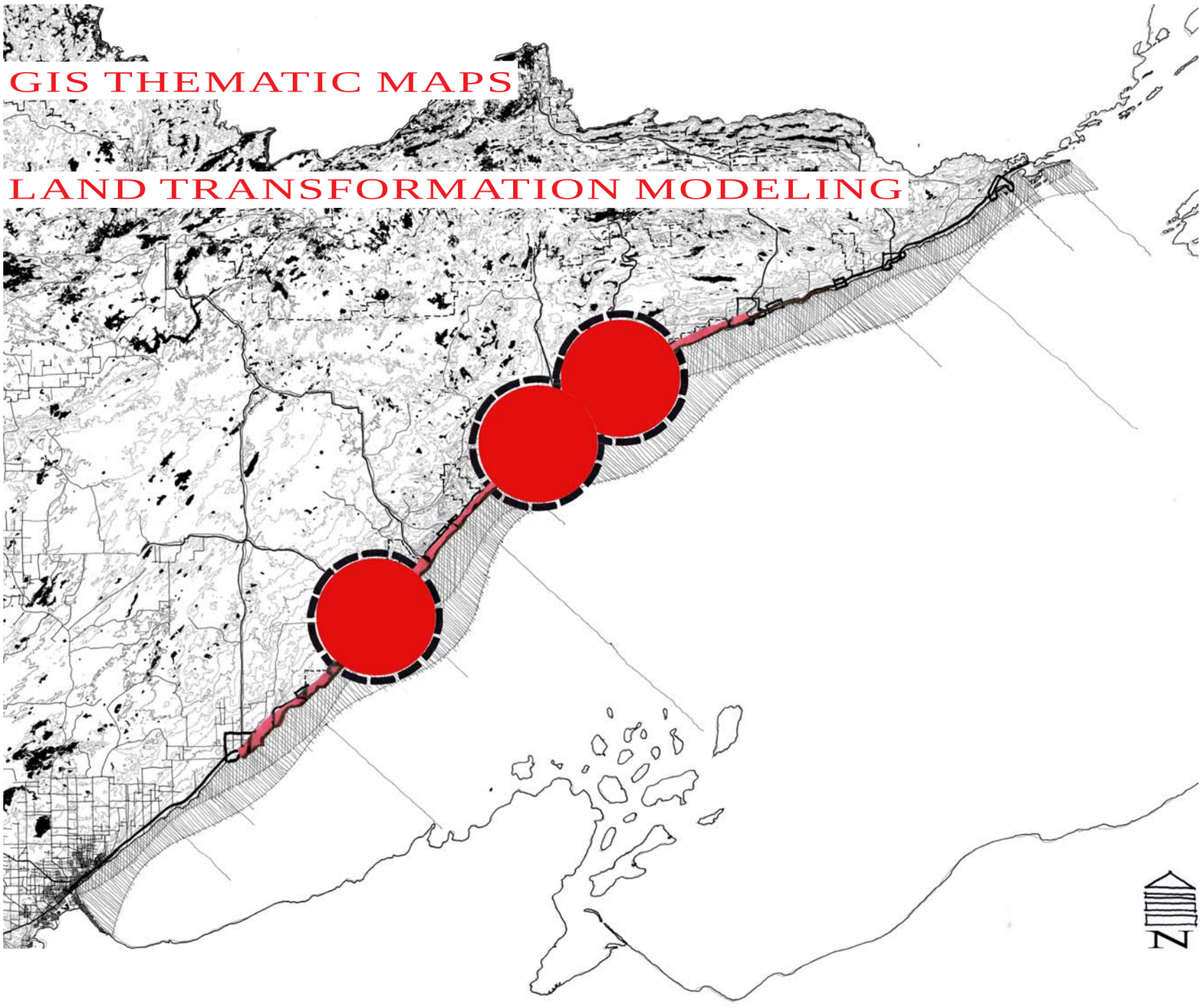
PRELIMINARY DESIGN

GIS THEMATIC MAPS

LAND TRANSFORMATION MODELING



APPENDIX

BEAVER BAY PRELIMINARY DESIGN:

STREETSCAPE MASTERPLAN & DESIGN FEATURES

The new streetscape along Hwy. 61 in downtown Beaver Bay reworks the existing road into a new configuration slowing traffic and producing a parkway-like pedestrian experience. The entrance to town on both sides will become the transition areas which mark town boundaries and create an awareness of the recreational opportunities found in the region. This corridor will also be used to highlight the change in landscape character when one first encounters the Beaver Bay geologic intrusion that is seen faintly as distant hills and forested valleys. New crosswalks are placed to increase access to area shops and services on both sides of Hwy. 61.

Design features include:

Colorful paving that marks the crosswalks and

Safety islands that become green pockets along Hwy. 61

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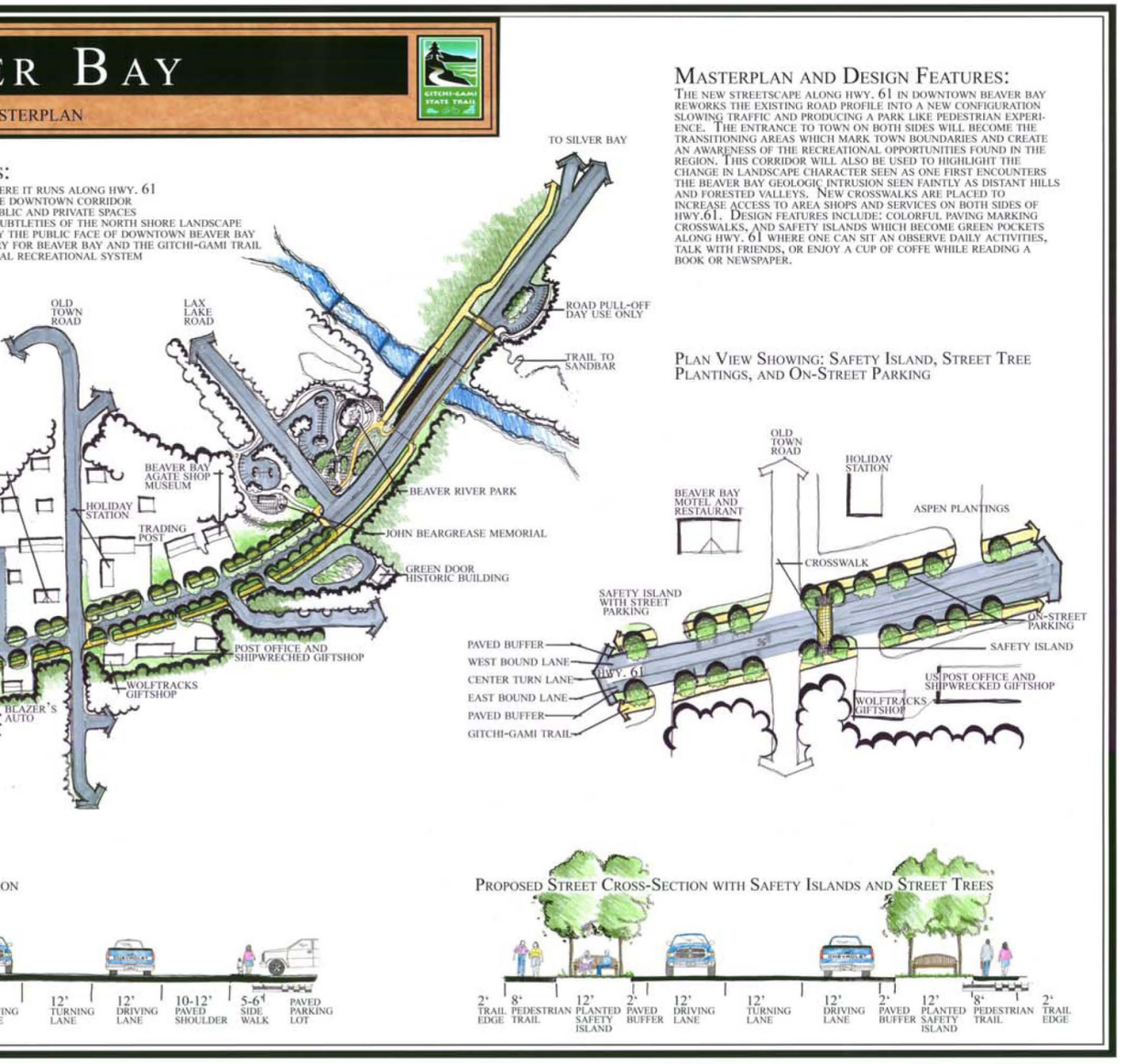

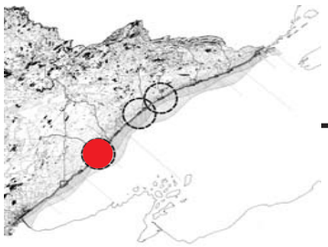

APPENDIX

BEAVER BAY PRELIMINARY DESIGN:

BEAVER RIVER PARK MASTERPLAN & DESIGN FEATURES

The Beaver River Park masterplan highlights site features producing a set of experiences that enhance the Gitchi-Gami Trail system and Beaver Bay by creating a gathering space for locals and visitors. Beaver River Park also addresses on-site issues such as traffic and pedestrian safety, Gitchi-Gami Trail routing and trailhead design, and on-site stormwater concerns with an ecologically sustainable design. Key features include:

Sinuous paths that meander and cross the site leading the visitor to the river,

Earthen berms symbolic of the North Shore's landscape that frame site and river gorge views,

Restroom structures influenced by Norwegian commercial boat house design,

Informational kiosks with artist rendered drawings depicting the hidden and unique landform subtleties of the Beaver Bay landscape, and

Bike racks for use by Gitchi-Gami Trail patrons,

These elements combined with the hilltop green, historic mill ruins, and river gorge viewing platforms create a destination along the Gitchi-Gami Trail.

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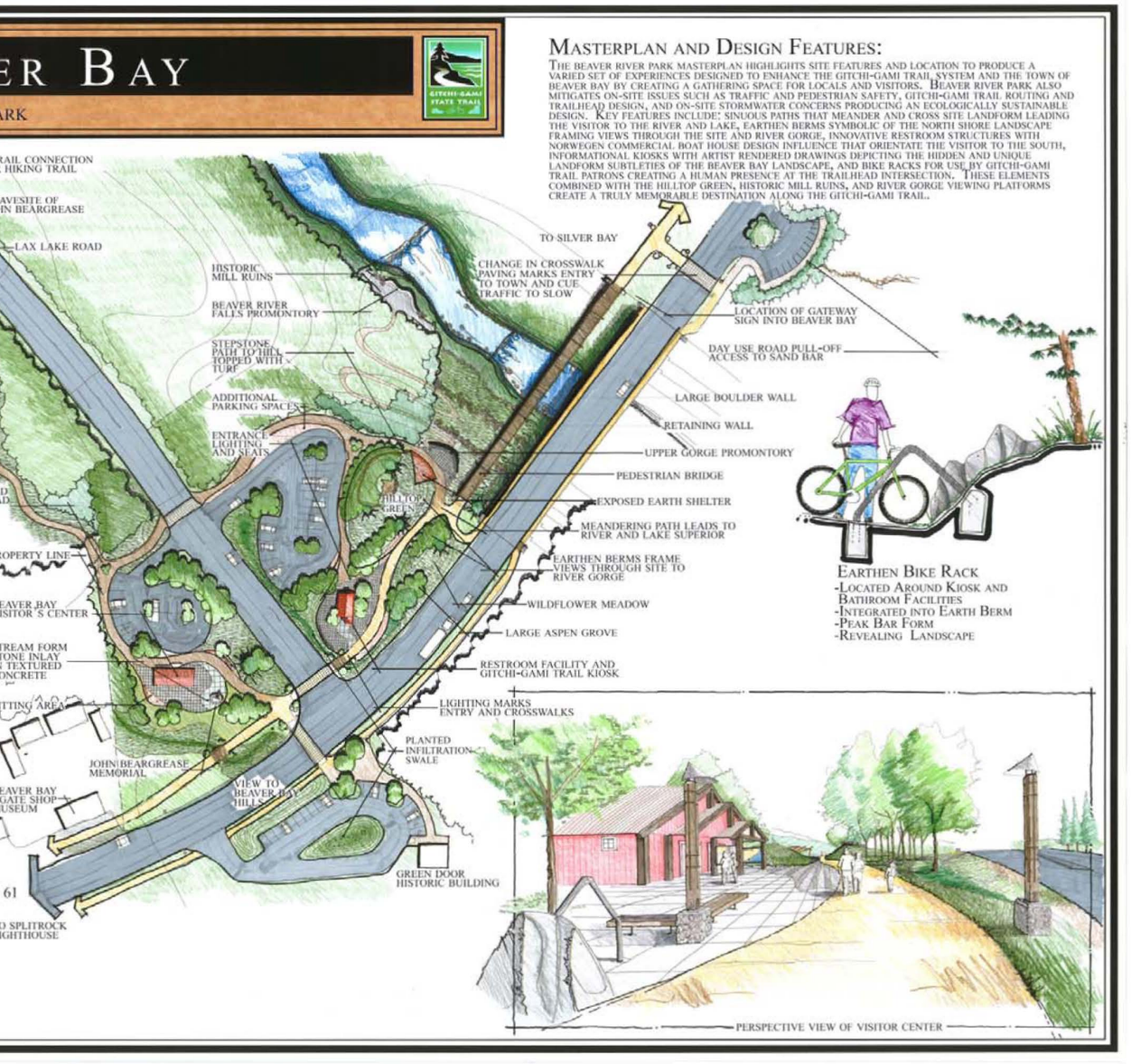

MASTERPLAN AND DESIGN FEATURES:

THE BEAVER RIVER PARK MASTERPLAN HIGHLIGHTS SITE FEATURES AND LOCATION TO PRODUCE A VARIED SET OF EXPERIENCES DESIGNED TO ENHANCE THE GITCHI-GAMI TRAIL SYSTEM AND THE TOWN OF BEAVER BAY BY CREATING A GATHERING SPACE FOR LOCALS AND VISITORS. BEAVER RIVER PARK ALSO MITIGATES ON-SITE ISSUES SUCH AS TRAFFIC AND PEDESTRIAN SAFETY, GITCHI-GAMI TRAIL ROUTING AND TRAILHEAD DESIGN, AND ON-SITE STORMWATER CONCERNS PRODUCING AN ECOLOGICALLY SUSTAINABLE DESIGN. KEY FEATURES INCLUDE: SINUOUS PATHS THAT MEANDER AND CROSS SITE LANDFORM LEADING THE VISITOR TO THE RIVER AND LAKE, EARTHEN BERMS SYMBOLIC OF THE NORTH SHORE LANDSCAPE FRAMING VIEWS THROUGH THE SITE AND RIVER GORGE, INNOVATIVE RESTROOM STRUCTURES WITH NORWEGEN COMMERCIAL BOAT HOUSE DESIGN INFLUENCE THAT ORIENTATE THE VISITOR TO THE SOUTH, INFORMATIONAL KIOSKS WITH ARTIST RENDERED DRAWINGS DEPICTING THE HIDDEN AND UNIQUE LANDFORM SUBTLETIES OF THE BEAVER BAY LANDSCAPE, AND BIKE RACKS FOR USE BY GITCHI-GAMI TRAIL PATRONS CREATING A HUMAN PRESENCE AT THE TRAILHEAD INTERSECTION. THESE ELEMENTS COMBINED WITH THE HILLTOP GREEN, HISTORIC MILL RUINS, AND RIVER GORGE VIEWING PLAITFORMS CREATE A TRULY MEMORABLE DESTINATION ALONG THE GITCHI-GAMI TRAIL.

EARTHEN BIKE RACK

-LOCATED AROUND KIOSK AND BATHROOM FACILITIES
-INTEGRATED INTO EARTH BERM
-PEAK BAR FORM
-REVEALING LANDSCAPE

APPENDIX

BEAVER BAY PRELIMINARY DESIGN:

MILLSTONE PARK MASTERPLAN & DESIGN FEATURES

The Millstone Park masterplan highlights the Beaver River and Beaver Bay's settlement history by revealing local history to users. Millstone Park also mitigates on-site issues such as traffic and pedestrian safety, Gitchi-Gami Trail routing and trailhead design, and on-site stormwater concerns. Key features include:

Paths that direct views to the Beaver Bay hills and Lake Superior while leading the visitor to the river and lake,

Gently sloping topography and aspen plantings create rooms and frame views,

Restroom facility design influenced by Scandinavian architecture,

Information kiosks include artist rendered drawings depicting the hidden and unique landform subtleties of the Beaver Bay landscape, and

Bike racks for trail users at the trailhead.

These elements combined with the historic mill ruins and river gorge viewing platforms create a unique destination along the Gitchi-Gami trail.

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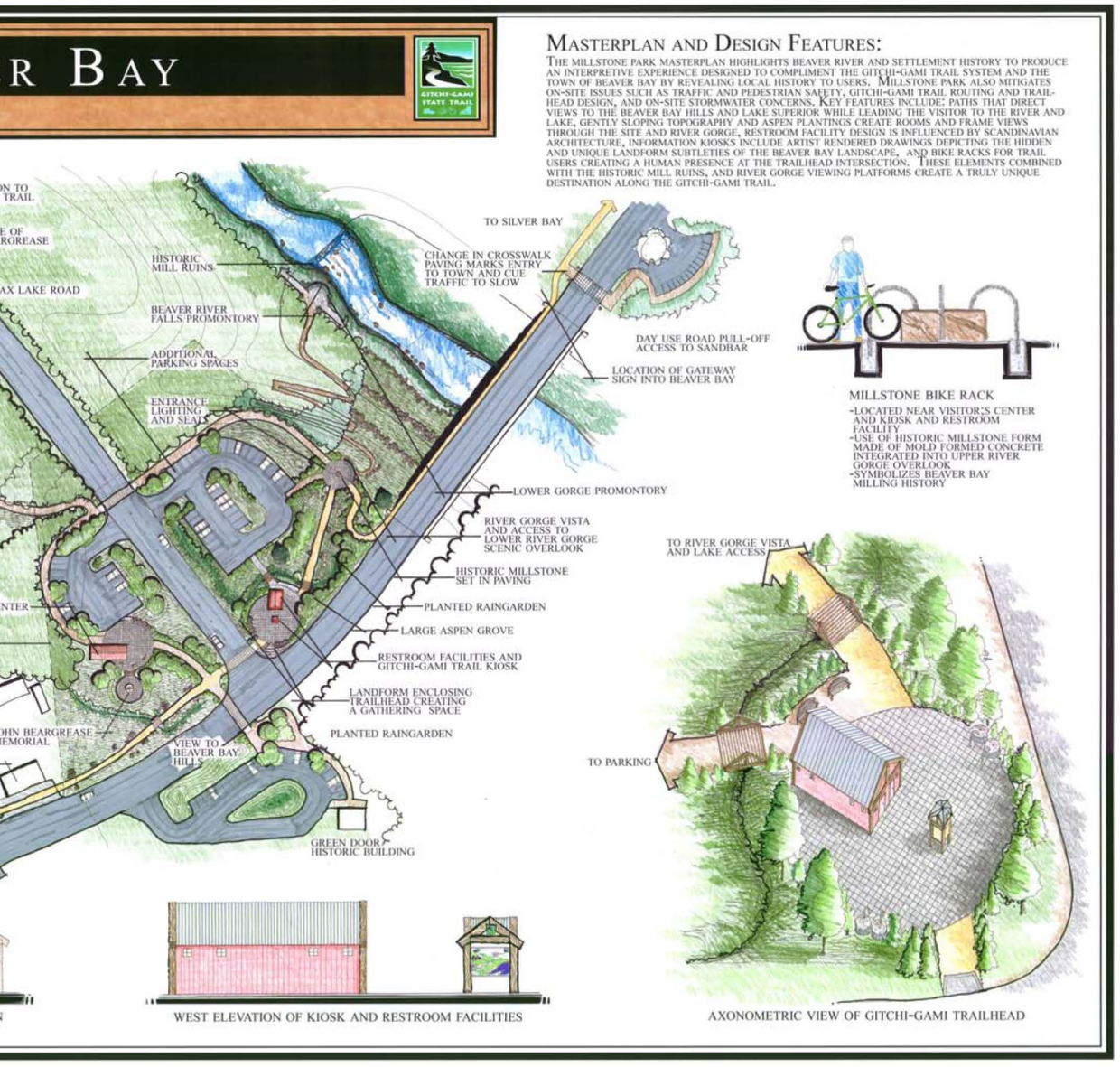


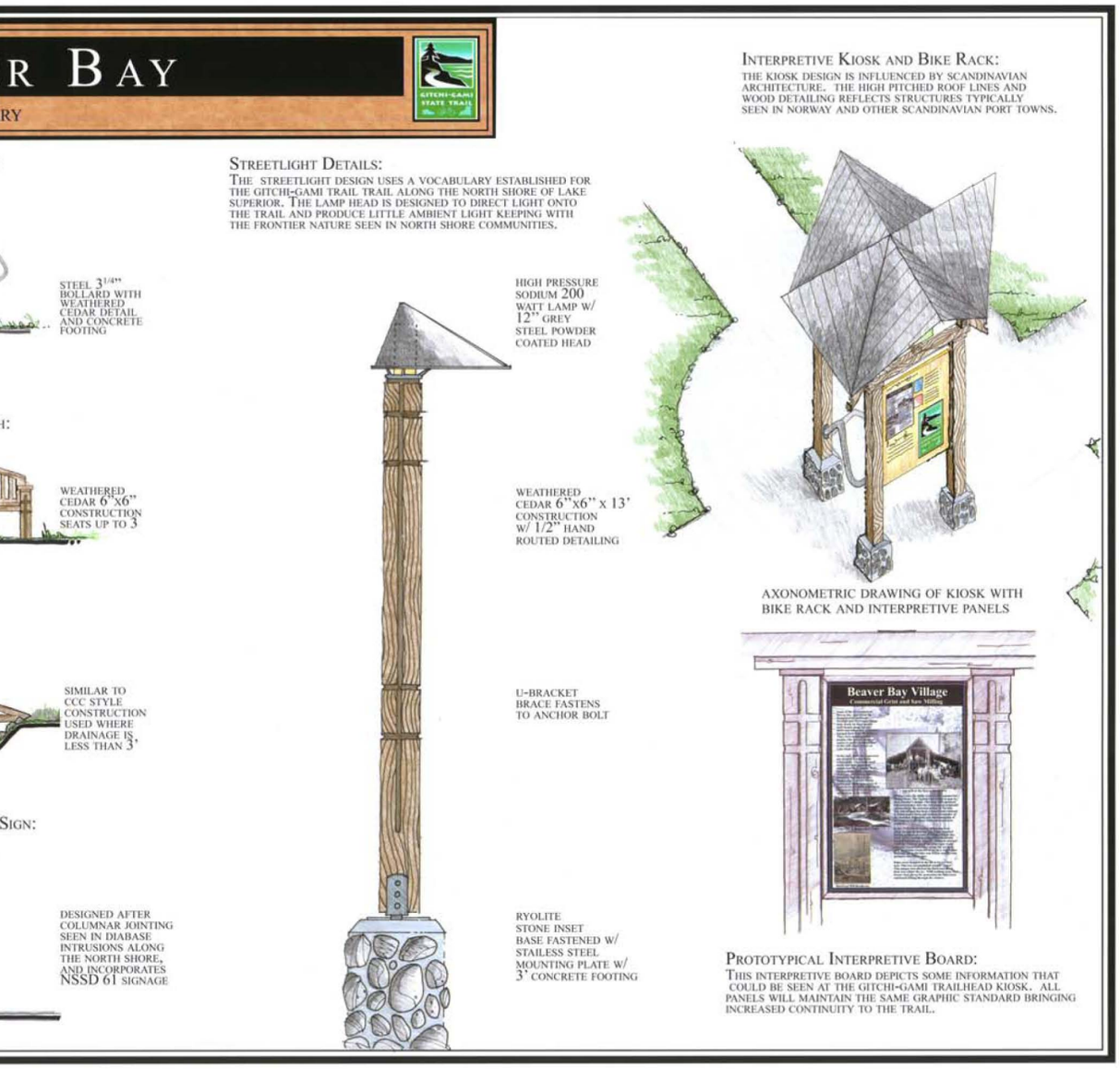
APPENDIX

BEAVER BAY PRELIMINARY DESIGN:
DESIGN DETAILS

STREETLIGHT DETAILS:
The streetlight design uses a vocabulary established for the Gitchi-Gami Trail. The lamp head is designed to direct light onto the trail and produce little ambient light to maintain the night sky.

INTERPRETIVE KIOSK AND BIKE RACK:
The kiosk design is influenced by Scandinavian architecture. The high-pitched roof and wood detailing reflects structures typically seen in Norway and other Scandinavian port towns.

PROTOTYPICAL INTERPRETIVE BOARD:
The interpretive board depicts some information that could be seen at the Gitchi-Gami trailhead kiosk. The same graphic standard and conventions are maintained with all the boards erected along the trial.


R BAY
RY
GITCHI-GAMI STATE TRAIL
STEEL 3 1/4" BOLLARD WITH WEATHERED CEDAR DETAIL AND CONCRETE FOOTING
H:
WEATHERED CEDAR 6"X6" CONSTRUCTION SEATS UP TO 3
SIMILAR TO CCC STYLE CONSTRUCTION USED WHERE DRAINAGE IS LESS THAN 3'
SIGN:
DESIGNED AFTER COLUMNAR JOINTING SEEN IN DIABASE INTRUSIONS ALONG THE NORTH SHORE, AND INCORPORATES NSSD 61 SIGNAGE
STREETLIGHT DETAILS:
THE STREETLIGHT DESIGN USES A VOCABULARY ESTABLISHED FOR THE GITCHI-GAMI TRAIL TRAIL ALONG THE NORTH SHORE OF LAKE SUPERIOR. THE LAMP HEAD IS DESIGNED TO DIRECT LIGHT ONTO THE TRAIL AND PRODUCE LITTLE AMBIENT LIGHT KEEPING WITH THE FRONTIER NATURE SEEN IN NORTH SHORE COMMUNITIES.
HIGH PRESSURE SODIUM 200 WATT LAMP W/ 12" GREY STEEL POWDER COATED HEAD
WEATHERED CEDAR 6"X6" X 13' CONSTRUCTION W/ 1/2" HAND ROUTED DETAILING
U-BRACKET BRACE FASTENS TO ANCHOR BOLT
RYOLITE STONE INSET BASE FASTENED W/ STAILESS STEEL MOUNTING PLATE W/ 3' CONCRETE FOOTING
INTERPRETIVE KIOSK AND BIKE RACK:
THE KIOSK DESIGN IS INFLUENCED BY SCANDINAVIAN ARCHITECTURE. THE HIGH PITCHED ROOF LINES AND WOOD DETAILING REFLECTS STRUCTURES TYPICALLY SEEN IN NORWAY AND OTHER SCANDINAVIAN PORT TOWNS.
AXONOMETRIC DRAWING OF KIOSK WITH BIKE RACK AND INTERPRETIVE PANELS
Beaver Bay Village
PROTOTYPICAL INTERPRETIVE BOARD:
THIS INTERPRETIVE BOARD DEPICTS SOME INFORMATION THAT COULD BE SEEN AT THE GITCHI-GAMI TRAILHEAD KIOSK. ALL PANELS WILL MAINTAIN THE SAME GRAPHIC STANDARD BRINGING INCREASED CONTINUITY TO THE TRAIL.

APPENDIX

LUTSEN CROSSING PRELIMINARY DESIGN:
LUTSEN MOUNTAIN ACCESS TRAILHEAD OPTION ONE

DESIGN FEATURES:

Lutsen Crossing is characterized by

Signs and structures that reflect the Lundie design aesthetic,

Interpretation of the area on the kiosk,

Native plants in a North Shore meadow as a setting for the North Shore Scenic Drive sign cairn,

The reuse of the old Highway 61 alignment as the major pedestrian spine through the site,

The reuse of the old Highway 61 bridge abutements for a viewing promontory and a new pedestrian bridge across the Poplar River,

A pedestrian trail that provides public access to the river,

A pathway to the historic cemetery,

A setting for a landmark monument or a bed of native plants, and

Bicycle racks, restrooms, and parking for 50 cars.

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APPENDIX

LUTSEN CROSSING PRELIMINARY DESIGN:
LUTSEN MOUNTAIN ACCESS TRAILHEAD OPTION TWO

DESIGN FEATURES:

Lutsen Crossing is characterized by

Signs and structures that reflect the Lundie design aesthetic,

Interpretation of the area on the kiosk,

Native plants in a North Shore meadow as a setting for the North Shore Scenic Drive sign cairn,

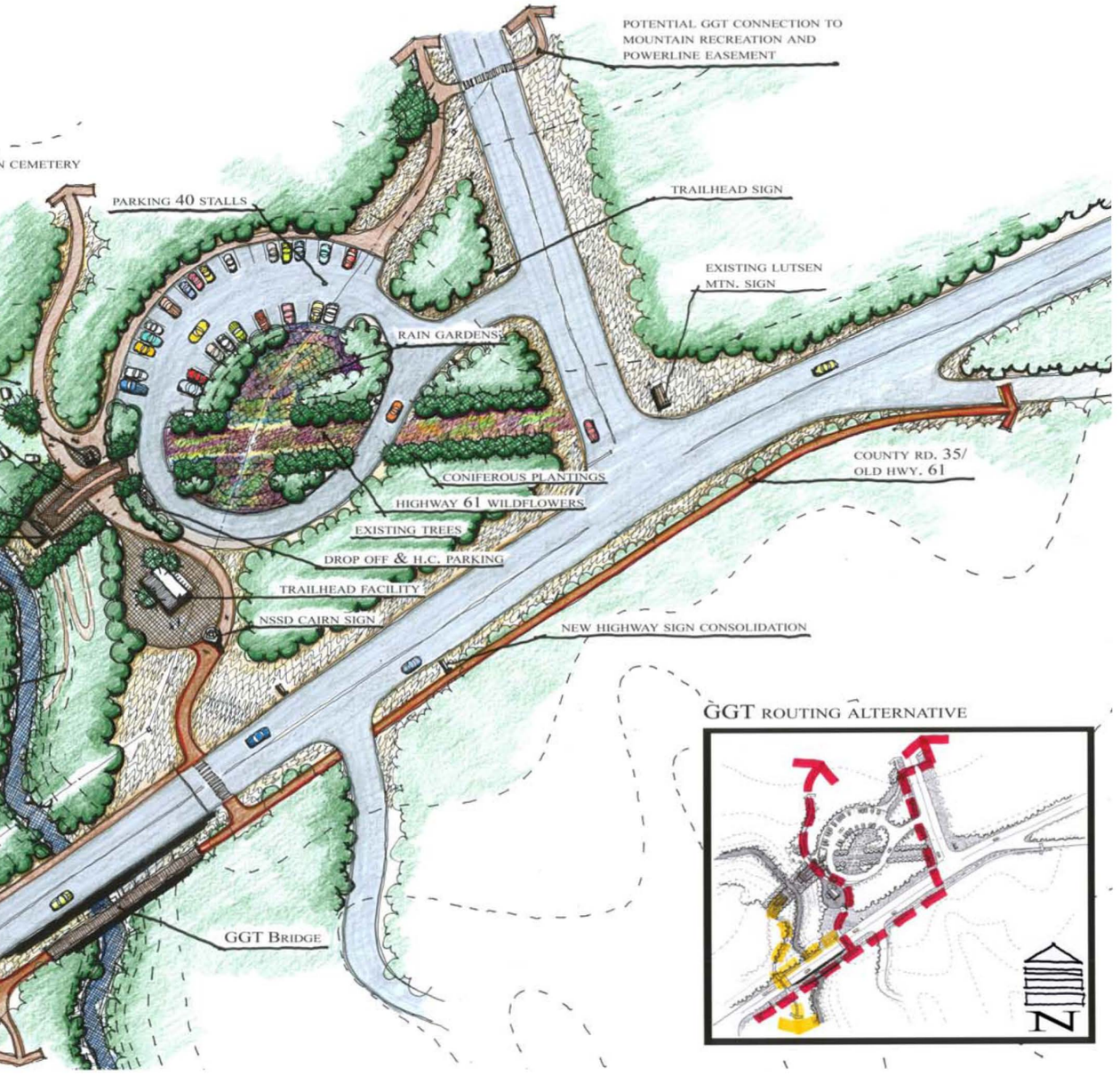
The reuse of the old Highway 61 alignment as the major planted spine through the site,

A pedestrian trail that provides public access to the river,

A pathway to the historic cemetery,

A setting for a landmark monument or a bed of native plants, and

Bicycle racks, restrooms, and parking for 65 cars.


POTENTIAL GGT CONNECTION TO MOUNTAIN RECREATION AND POWERLINE EASEMENT
N CEMETERY
PARKING 40 STALLS
TRAILHEAD SIGN
EXISTING LUTSEN MTN. SIGN
RAIN GARDENS
COUNTY RD. 35/ OLD HWY. 61
CONIFEROUS PLANTINGS
HIGHWAY 61 WILDFLOWERS
EXISTING TREES
DROP OFF & H.C. PARKING
TRAILHEAD FACILITY
NSSD CAIRN SIGN
NEW HIGHWAY SIGN CONSOLIDATION
GGT ROUTING ALTERNATIVE
GGT BRIDGE
N

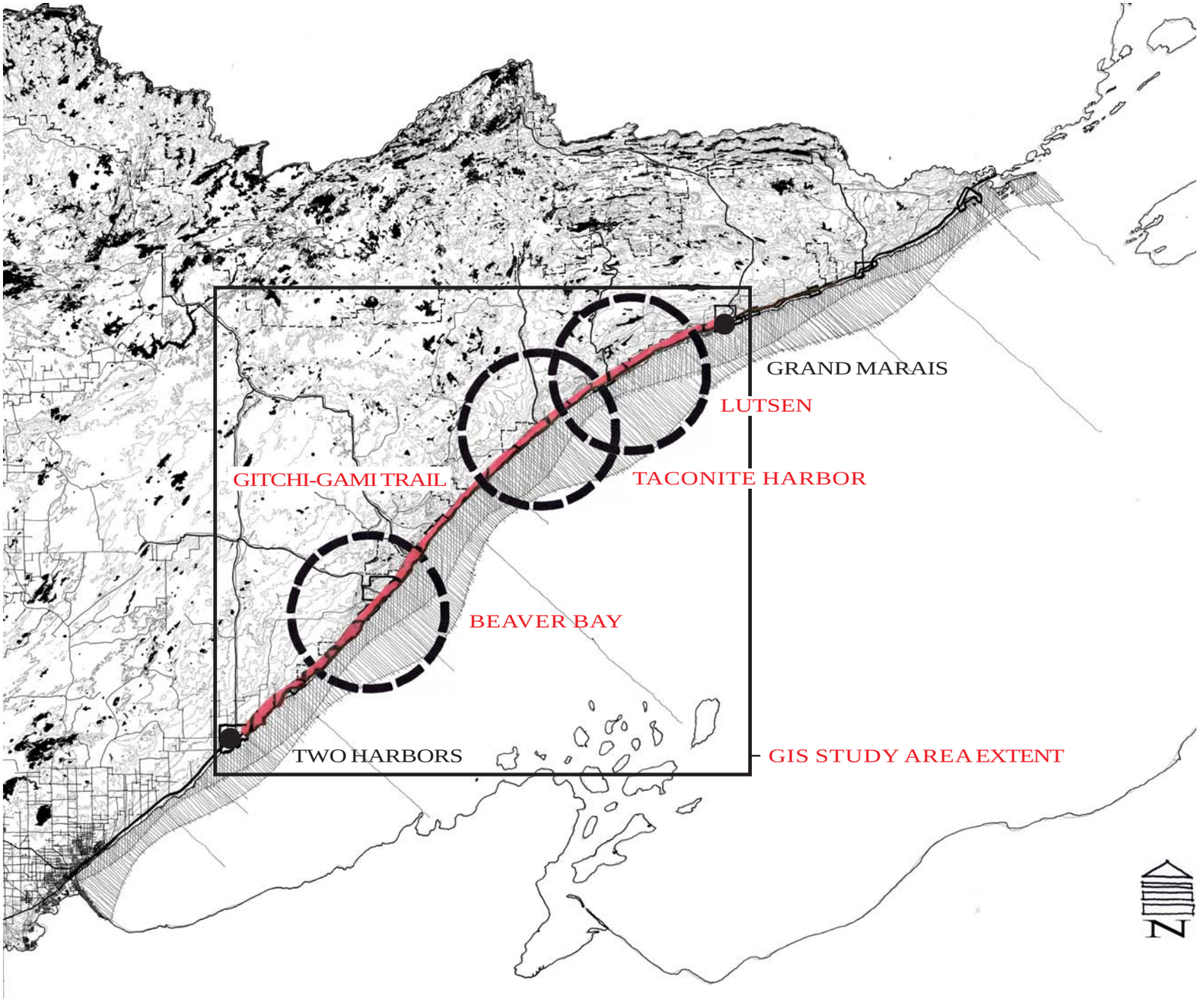
APPENDIX

GEOGRAPHIC INFORMATION SYSTEMS (GIS)THEMATIC MAPS:

The first step in the design process is analyzing the landscape to understand its complex layers of geology, landform, vegetation, history, and culture. In order to perform the analysis, GIS data was collected and then processed into different layers according to themes. Each theme become an individual map. Like laying transparencies over each other, these thematic maps are layered to reveal relationships within the complexity of the landscape.

Hundreds of individual data layers were chosen and combined into the thematic maps representing bedrock geology, surficial geology, infrastructure, elevation, hydrology, original vegetation, native plant communities, biodiversity sites, national wetlands inventory, land use, land cover, population change, and land ownership. Thematic maps from Two Harbors to Grand Marais were then produced.

Analyzing the landscape in this layered manner serves as the basis for developing a regional identity through design. Mapping the attributes of a region allows the design to celebrate the uniqueness of the area through use of regional materials, native vegetation, and local land form vocabulary.


GRAND MARAIS
LUTSEN
TACONITE HARBOR
GITCHI-GAMI TRAIL
BEAVER BAY
TWO HARBORS
GIS STUDY AREA EXTENT
N

APPENDIX

GEOLOGY

The Laurentian Mountains formed 2.7 billion years ago as the Earth's crust cooled and solidified. Over hundreds of millions of years, several miles' thickness of this rock eroded away to reveal Ely Greenstone that had formed deep in the Earth's crust. These deformed and metamorphosed granites make up the Canadian Shield, which forms the ancient core and foundation of the North American continent.

From 2.2 to 1.9 billion years ago a vast inland sea flooded the interior of the continent. Sediments accumulated at the bottom of this sea to depths of several thousands of feet. These are some of the oldest sedimentary rocks in the world. These sandstones and graywacke (muddy or dirty sandstones) are visible in the Rove Formations around the Grand Portage area and include the iron bearing formations of the Mesabi Iron Range.

Approximately 1 billion years ago the Earth's crust began to pull apart in a great zone of crustal thinning known as the Midcontinent Rift System. Basaltic lava poured through cracks in the Earth's surface and spread out on the flat landscape. Hundreds of these lava flows accumulated on top of each other to form the North Shore Volcanic Group. Their combined weight caused the already thin crust to subside, forming the Lake Superior basin and tilting up layers of rock on the edges of the rift system. Magma that cooled underground formed the more resistant, diabase rocks of the Duluth Complex that form most of the rugged hills and ridges of the North Shore, including at Split Rock, Manitou, Tettagouche, and Carlton Peak.

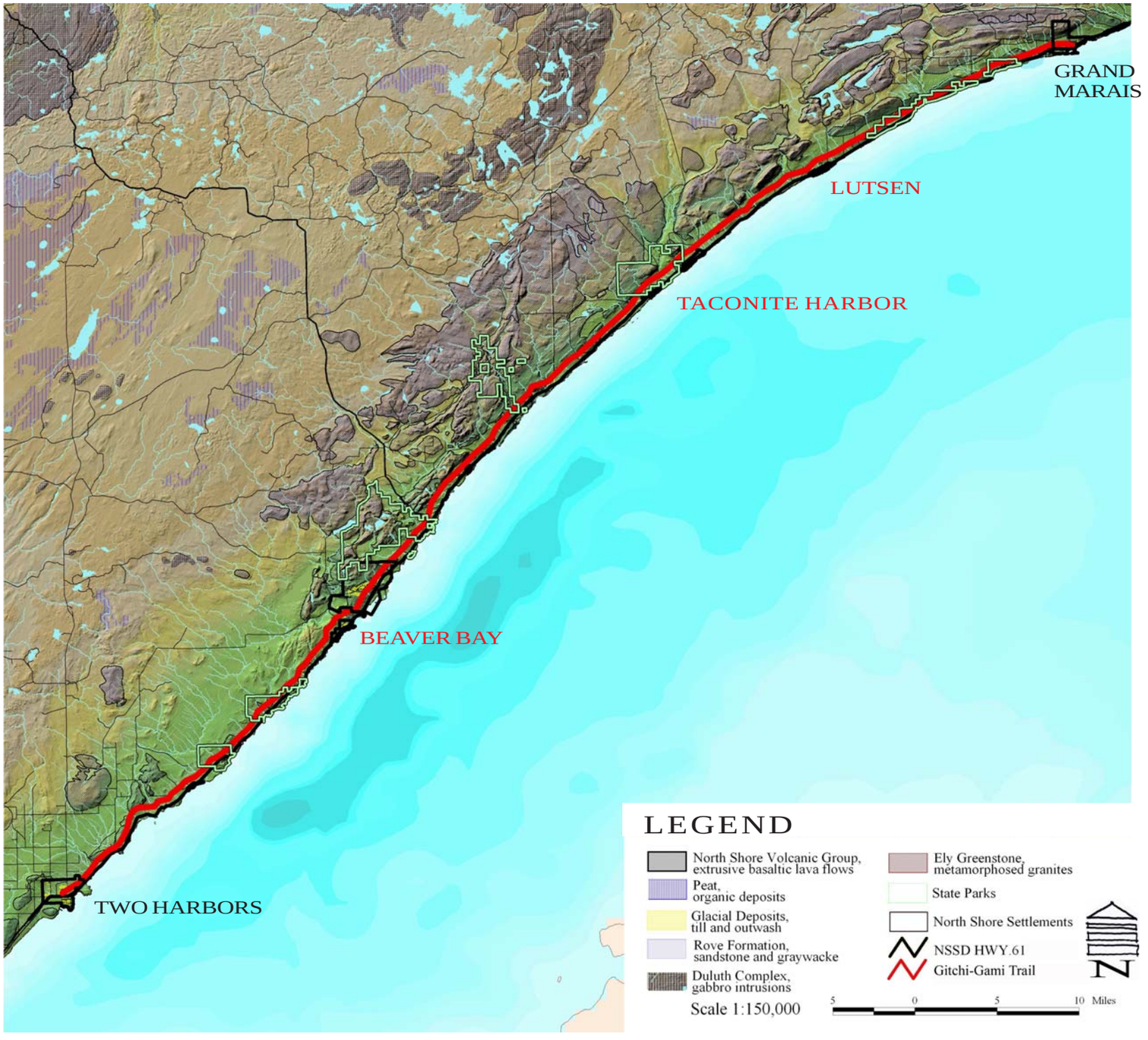
The falls on the Gooseberry, Baptism, Cross, and Temperance Rivers flow over different layers of basaltic lava flows. The jagged form of the Sawtooth Mountains illustrates the tilting layers of lava at the edge of the rift system with their gradual slope extending under Lake Superior to the south and their steep slope facing north. Columnar joints and vertical fractures that develop as lava flows cool and shrink are visible at Gooseberry and Temperance Rivers. Gas bubbles trapped in the solidifying lava gradually fill up with dissolved minerals to form amygdules like the Agates are commonly found along the North Shore. Lava dikes cooled vertically in cracks around Grand Portage, instead of horizontally on the surface of the earth as occured elsewhere on the North Shore, resulting in a pattern of steep, narrow ridges that criss-cross the landscape.

RESOURCES FOUND ALONG THE GITCHI-GAMI TRAIL:

Two Harbors to Beaver Bay is generally flat, except for the more resistant diabase intrusion that forms Silver Cliff and Lafayette Bluff. Outcroppings of the soft, flat, basaltic lava flows can be seen at Gooseberry Falls. Another diabase intrusion occurs at Split Rock Lighthouse.

Beaver Bay to Tofte is characterized by the rocky, humpback forms of the more resistant diabase intrusion known locally as the Beaver Bay Complex. These outcroppings occur along the lake creating a rugged shoreline that forces the road further inland and includes such familiar sights as Palisade Head, Shovel Point, Carlton Peak and the gorges of the Baptism, Manitou, Caribou, Cross and Temperance Rivers.

Tofte to Grand Marais is characterized by the jagged profile of the Sawtooth Mountains rising gradually out of Lake Superior in a series of ridges with steep back slopes. Their cuesta form is the result of the North Shore Volcanic Group's flat, basaltic lava flows tilting up under their own weight.


GRAND MARAIS
LUTSEN
TACONITE HARBOR
BEAVER BAY
TWO HARBORS
LEGEND
North Shore Volcanic Group, extrusive basaltic lava flows
Peat, organic deposits
Glacial Deposits, till and outwash
Rove Formation, sandstone and graywacke
Duluth Complex, gabbro intrusions
Ely Greenstone, metamorphosed granites
State Parks
North Shore Settlements
NSSD HWY.61
Gitchi-Gami Trail
Scale 1:150,000
5 0 5 10 Miles
N

APPENDIX

TOPOGRAPHY

Two million years ago, mile thick glaciers began advancing out of Canada. Four great periods of glacial advance have been identified; the Kansan, Nebraskan, Illinoian, and Wisconsin, each followed by subsequent periods of retreat. The glaciers scoured away softer sedimentary rocks and basaltic lavas in the Lake Superior basin and left two types of deposits, till and outwash. Till is unsorted material that is directly deposited by the ice in the form of moraines. Outwash is transported by meltwaters and deposited in layers sorted by the size of its particles. While the last ice sheet was blocking existing lower outlets to the east, Lake Superior occupied higher levels than it does today.

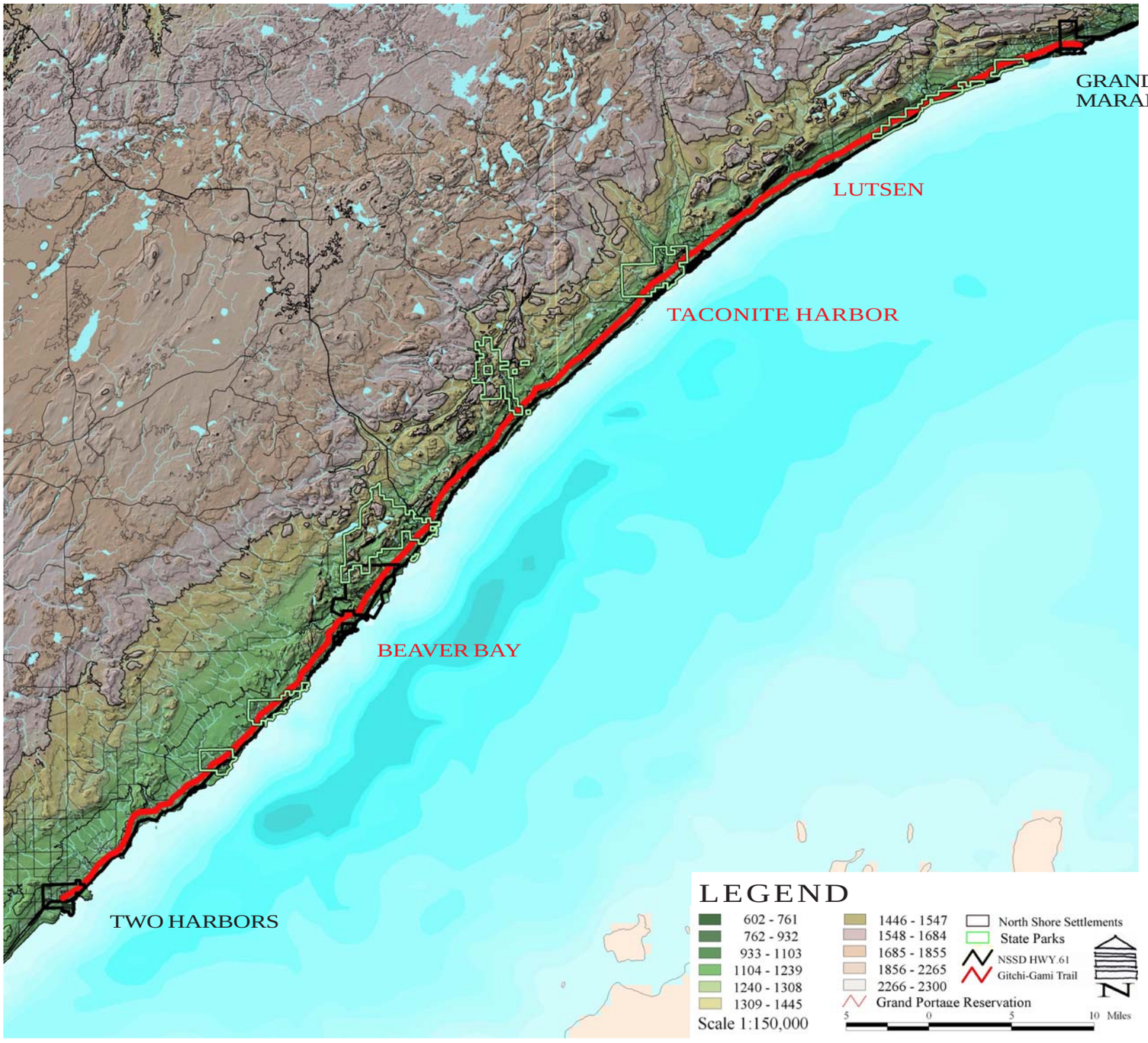
Striations etched into the bedrock by slow moving glaciers are visible in many locations along the North Shore. Abandoned beach terraces are visible at Caribou River where sand and gravel from higher lake levels covers the volcanic bedrock.

RESOURCES FOUND ALONG THE GITCHI-GAMI TRAIL:

Two Harbors to Beaver Bay is generally flat, except for a single rugged intrusion that extends in a perpendicular direction toward the shoreline.The intrusion creates a rugged shoreline where it meets Lake Superior, necessitating the tunnels at Silver Cliff and Lafayette Bluff, and generating spectacular views out over the lake. Another smaller intrusion meets the shoreline up the road to create the promontory at Split Rock Lighthouse.

The humpback form of the Beaver Bay Complex intrusion parallels Lake Superior from Beaver Bay to Tofte creating a rugged shoreline of alternating rocky headlands, sheer cliffs, and secluded coves. The road moves further inland and to higher elevations where it can be wider and straighter through the inland forests to avoid such familiar landmarks as Palisade Head, Shovel Point, Carlton Peak and the gorges of the Baptism, Manitou, Caribou, Cross and Temperance Rivers.

Tofte to Grand Marais is characterized by the jagged profile of the Sawtooth Mountains rising gradually out of Lake Superior in a series of ridges with steep back slopes. Their cuesta form is the result of the North Shore Volcanic Group's flat, basaltic lava flows tilting up under their own weight and provides the opportunity to connect the numerous peaks and ridges with recreational trails and and skihills.


GRAND MARAIS
LUTSEN
TACONITE HARBOR
BEAVER BAY
TWO HARBORS
LEGEND
602 - 761
762 - 932
933 - 1103
1104 - 1239
1240 - 1308
1309 - 1445
1446 - 1547
1548 - 1684
1685 - 1855
1856 - 2265
2266 - 2300
Grand Portage Reservation
North Shore Settlements
State Parks
NSSD HWY 61
Gitchi-Gami Trail
N
Scale 1:150,000
5 0 5 10 Miles

APPENDIX

HYDROLOGY

The streams of the North Shore are generally short and steep, draining small watersheds. They flow southeast to Lake Superior through surface deposits of glacial till, uplifted glacial lake sediments, and bedrock in which they have eroded deep gorges. Near Duluth the streams have virtually no lakes in the headwaters so that during times of snowmelt or heavy rain, floodwaters develop rapidly and run off quickly. During drought, flows are extremely low. To the northeast the streams have a more stable flow; lakes and marshes in the headwaters act as natural regulators retarding high flows during storms and slowly releasing stored water during drought to maintain higher minimum flows.

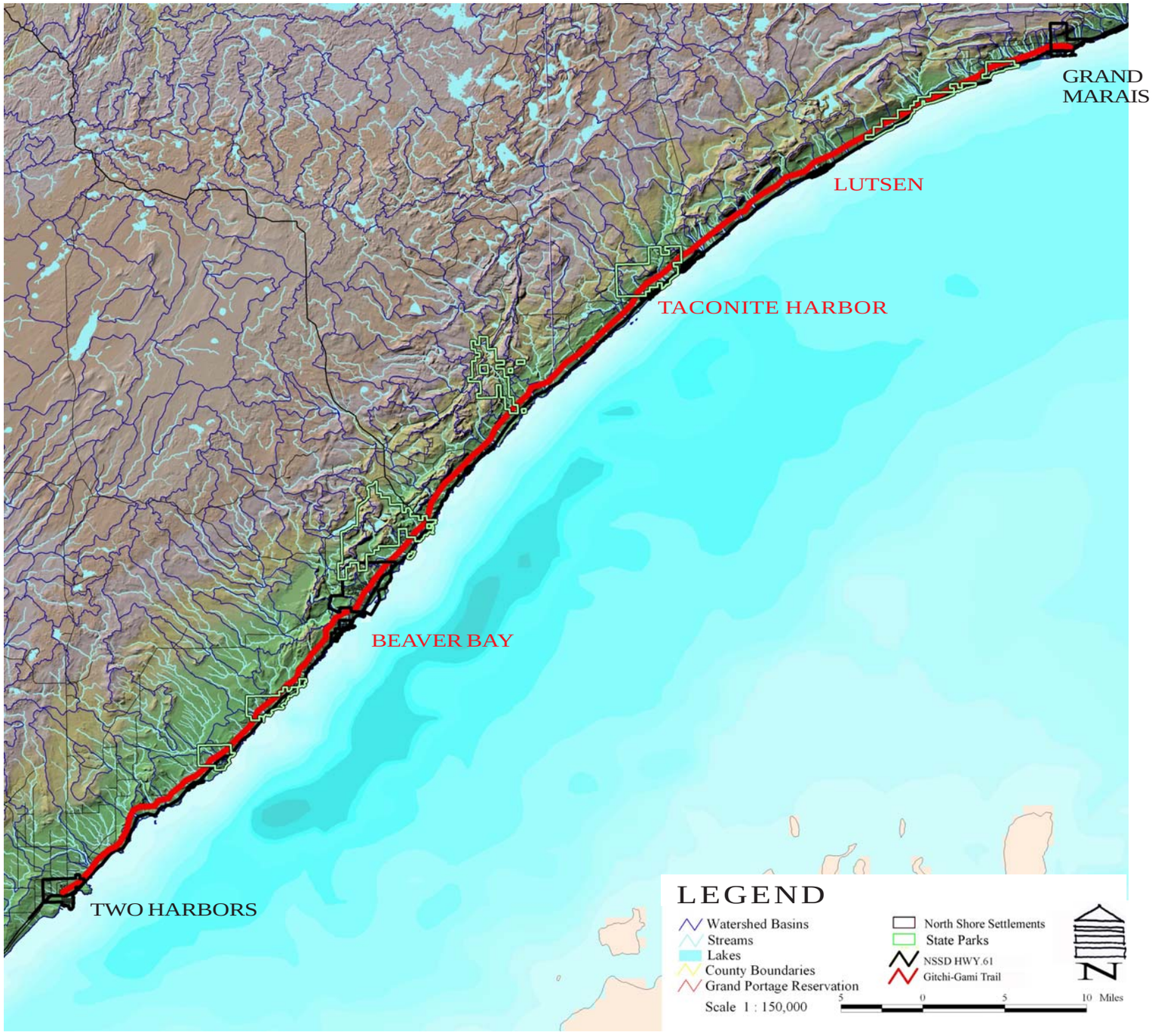
With relatively deep water so close to shore, Lake Superior's biological communities are concentrated in the narrow and shallow nearshore areas. The lake's clear water is extremely cold and infertile resulting in food production rates that are much lower than in other lakes. Non-point source pollution is one of the major threats affecting water quality in Lake Superior. These threats are due to erosion, sedimentation, and run-off from failing septic systems. Approximately 36 miles of Minnesota's shoreline has been identified as high erosion hazard by the Minnesota Pollution Control Agency. Approximately 55% of North Shore septic systems are deemed failures as described by Chapter 7080 of the Indivdual Sewage Treatment Sytems Standards. Lake Superior and its tributaries are extremely fragile ecosystems that retain their pristine conditions because they have not experienced the same amount of development and pollution as the other Great Lakes.

RESOURCES FOUND ALONG THE GITCHI-GAMI TRAIL:

The Gooseberry and Baptism Rivers lack water storage in their headwaters and consequently discharge fluctuates seasonally. They may be virtually dry in late summer. High waterfalls in their lower reaches dropping 400-900 feet in the last several miles provide scenic opportunities in state parks.

From the Manitou to Two Island Rivers, large watersheds and high waterfalls with some head water storage in lakes and swamps stabilize water flow, thereby creating some of the best trout streams along the North Shore.

From the Cross to Devil Track Rivers, large watersheds with many lakes and marshes in their headwaters result in more stable flows and relatively high water temperatures more suited to warm water fish species such as northern pike and smallmouth bass in the upper reaches. These streams cascade through state park gorges so narrow and deep they seem more like caves than river channels.


GRAND MARAIS
LUTSEN
TACONITE HARBOR
BEAVER BAY
TWO HARBORS
LEGEND
Watershed Basins
Streams
Lakes
County Boundaries
Grand Portage Reservation
North Shore Settlements
State Parks
NSSD HWY 61
Gitchi-Gami Trail
Scale 1 : 150,000
5 0 5 10 Miles
N

APPENDIX

ORIGINAL VEGETATION

The original vegetation along most of the North Shore was coniferous forest. The Great Lakes Pine Forest, comprised of white and red pine, paper birch and aspen, occurred on thin glacial till over the underlying bedrock in northern Minnesota. White and red pines dominated the shoreline to Little Marais. Beyond Little Marais, paper birch and aspen outnumbered the pines in the forest. Near Hovland several tracts of white and red pine dominated the forest.

The dry open conditions under the jack pine canopy allow for a variety of understory plants. Ericaceous (heath family) shrubs such as wintergreen and blueberry are especially common. On deeper soils hazel may form impenetrable thickets. Balsam fir, owing to its great shade tolerance, tends to form extensive stands in the absence of frequent fires. Natural disturbances including fire, wind, and spruce budworm epidemics often result in extensive areas of even aged aspen-birch forest. All along the North Shore mixed hardwood, maple, and pine forests occurred on the cooler, shadier backslopes of hills and ridges inland from the lake. Conifer bogs and swamps also occured inland, where hills and ridges blocked the drainage to Lake Superior.

Forest fires created a dynamic ecosystem composed of early post-fire stands of jack pine and red pine and mature old growth stands of white pine. In general, red pine was more abundant than white pine and occurred on coarsely textured dry sites prone to fire. White pine stands occurred on the mesic (moist) sites of stream margins and lower slopes less subject to fires. Fire opens the ground plane to direct sunlight and exposes the mineral soil seedbed, both of which are necessary requirements for jack pine reproduction.

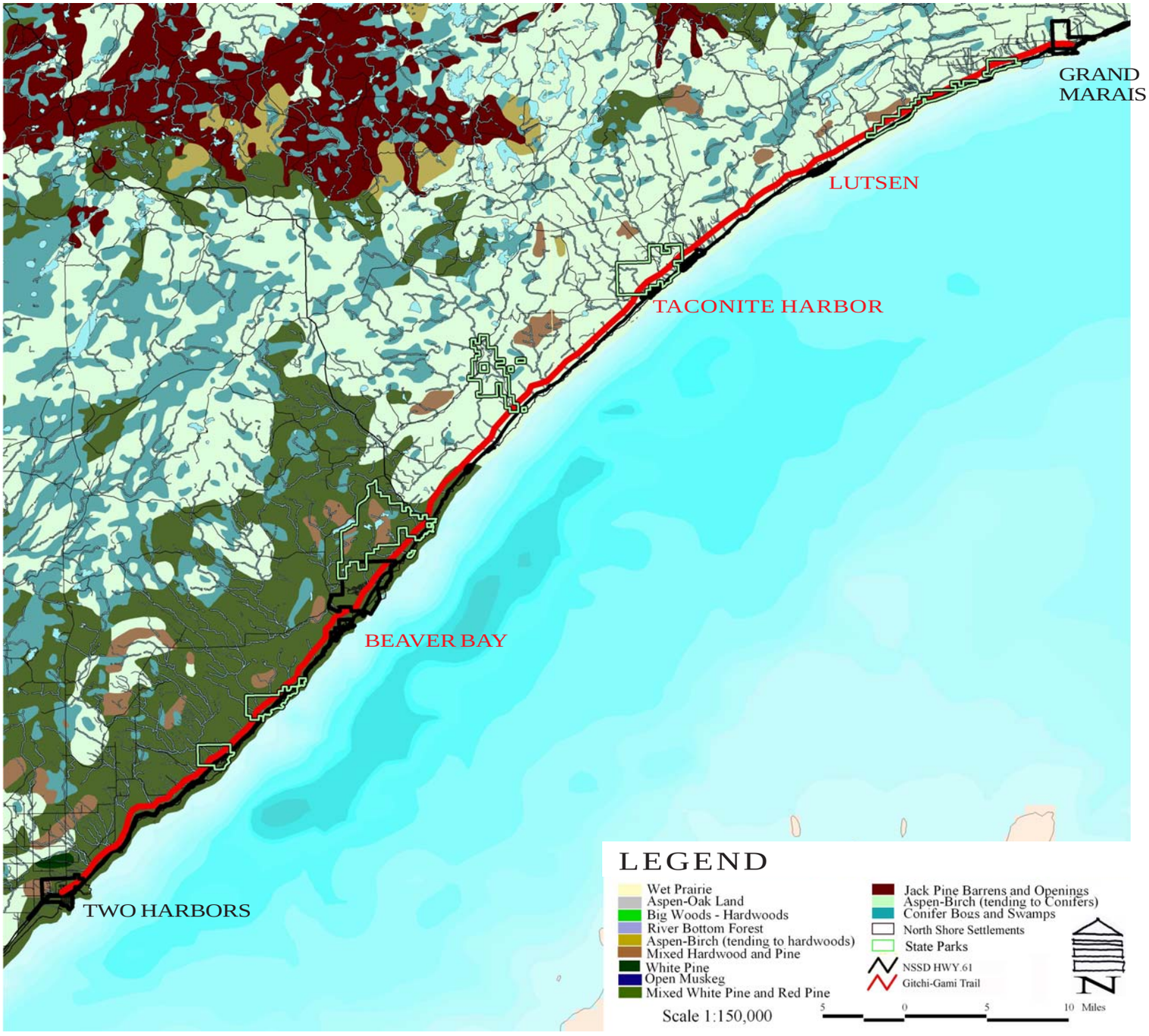
Disturbance is a natural part of the ecological cycle. Fire was responsible for the origin and presence of the vast pine stands. Red and white pines with their thick, insulated layers of bark, and branches that don't start until half way up the trunk, were usually able to survive fires raging on the forest floor, aspen and birch with their thin bark and numerous branches were not. Without periodic fires to remove the quick growing aspen and birch, pine saplings are quickly crowded out and denied access to the sunlight they needed to survive. If their are no young pines when the mature trees die of old age, the forest will slowly evolve from pine to aspen and birch. Today the entire forest has been disturbed by logging.

RESOURCES FOUND ALONG THE GITCHI-GAMI TRAIL:

Two Harbors to Beaver Bay was dominated by white and red pine forest.

Beaver Bay to Tofte saw the transition from white and red pine to forest dominated by aspen and birch.

Tofte to Grand Marais was aspen and birch dominated pine forest.


GRAND MARAIS
LUTSEN
TACONITE HARBOR
BEAVER BAY
TWO HARBORS
LEGEND
Wet Prairie
Aspen-Oak Land
Big Woods - Hardwoods
River Bottom Forest
Aspen-Birch (tending to hardwoods)
Mixed Hardwood and Pine
White Pine
Open Muskeg
Mixed White Pine and Red Pine
Jack Pine Barrens and Openings
Aspen-Birch (tending to Conifers)
Conifer Bogs and Swamps
North Shore Settlements
State Parks
NSSD HWY.61
Gitchi-Gami Trail
N
Scale 1:150,000
5 0 5 10 Miles

APPENDIX

ECOLOGY

Rare plant communities and animal nesting sites occur with great frequency along the North Shore. Remnant patches of original vegetation support populations of plants and animals that have otherwise disappeared from the North Shore as humans alter the landcover. Habitat is especially critical to migratory birds that must go around rather than across the expanse of Lake Superior on their migratory flights. The abundance of rocky cliffs minimizes the nesting habitat available for waterfowl and shorebirds. Arctic plant communities occur under favorable microclimates in disjunct locations. Local stream trout and anadromous trout from Lake Superior use the streams and rivers of the North Shore to spawn and reproduce.

Diverse old-growth pine forests no longer exist on the North Shore. The current forest is mostly highly disturbed, young, even-aged, second-growth aspen and birch forest. Even the few places where remnant patches of old-growth pine forest remain are not what they used to be. The suppression of forest fires over the last 100 years has halted the natural cycle of regeneration. As mature pine trees age and die there are no young pines in the forest to take their place. Without fire, the aspen, birch, and fir out-compete young pines.

In 1854 woodland caribou were common, moose uncommon, and deer nonexistent along the North Shore. The young aspen and birch forests of today, with frequent openings created by logging, are not able to support wolf and caribou populations. In the absence of predators, deer have moved into the forest in great numbers and are devouring their favorite food source, tender, young pine saplings. The presence of deer in old-growth forests, further disrupts the natural cycle of regeneration by removing young pines and further shifting the forest composition to aspen and birch.

Optimum deer habitat is 45-60% deciduous of which 25-35% is aspen and 25% is ten years old or less. Another 5-10% should be grassy openings and 15-20% should have conifers for protective cover. Logging the pine forests replaced moose and caribou habitat with deer habitat. Large deer populations were reported on the North Sore by the 1930s. Second growth aspen is short-lived, maturing in 50-70 years. When second growth aspen forest began maturing in the 1960s, deer numbers decreased and moose recovered. Wolves were blamed for the decline in deer. Today, as loggers harvest the mature second growth aspen forest for pulpwood, deer numbers are rebounding, and moose are once again in decline.

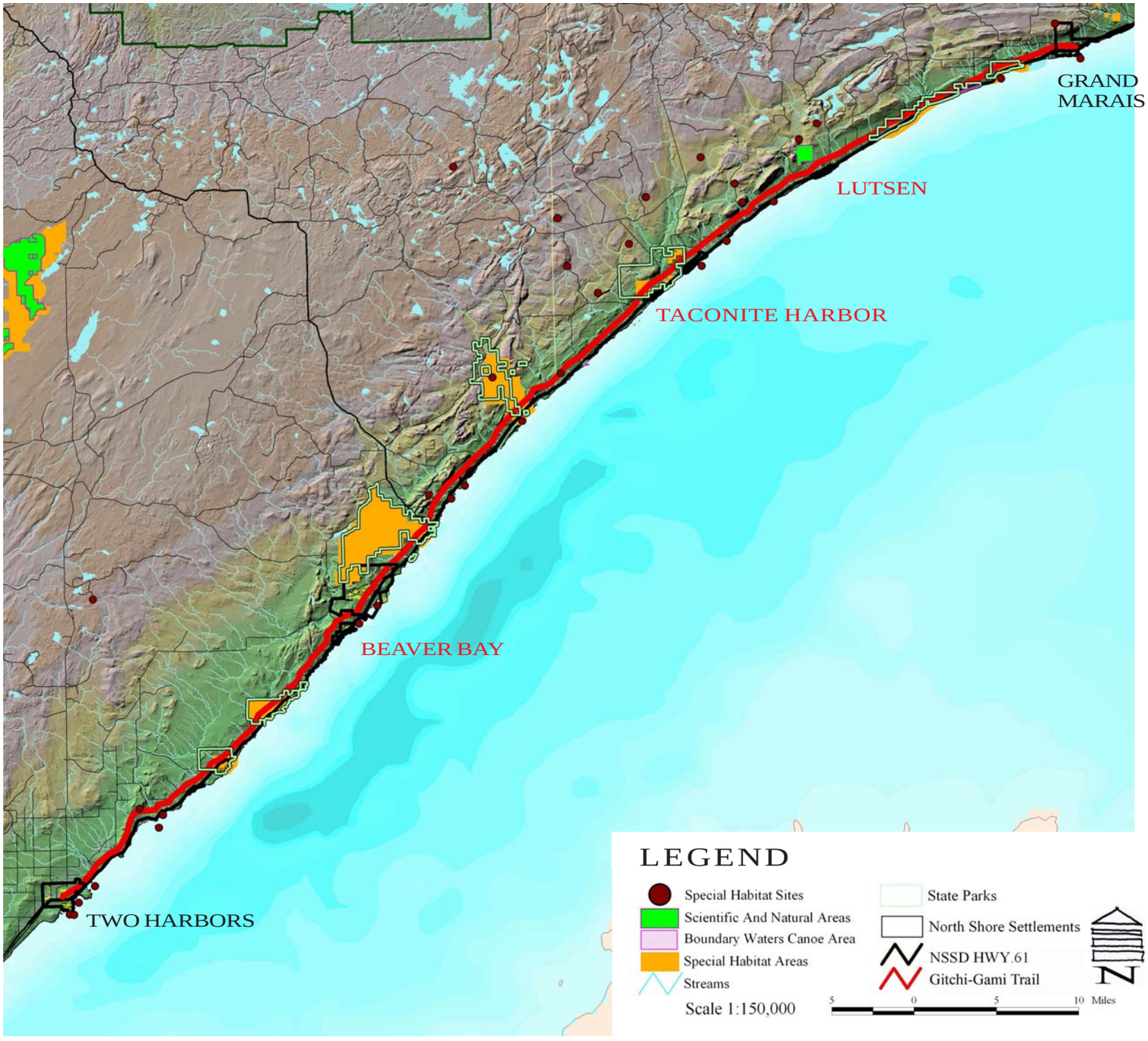
State Parks are important habitat centers on the North Shore that are managed to increase their habitat value. Controlled fires can be set to keep the aspen and birch at bay. Fenced exclosures keep deer out until the pines are tall enough that deer can't reach their tender branches. State parks also provide habitat corridors for the movement of birds and animals between the shore of Lake Superior and the state and national forests inland.

RESOURCES FOUND ALONG THE GITCHI-GAMI TRAIL:

The Two Harbors to Beaver Bay segment contains colonial waterbird nesting habitat, and rare plant and animal habitat, and shorebird migratory habitat.

The Beaver Bay to Tofte contains arctic disjunct plant communities, northern hardwood and upland cedar forests, fish spawning areas, and deer yards.

The Tofte to Grand Marais segment contains arctic and alpine disjunct plant communities, fish spawning areas, and poor fen wetland habitat.


GRAND MARAIS
LUTSEN
TACONITE HARBOR
BEAVER BAY
TWO HARBORS
LEGEND
Special Habitat Sites
Scientific And Natural Areas
Boundary Waters Canoe Area
Special Habitat Areas
Streams
State Parks
North Shore Settlements
NSSD HWY.61
Gitchi-Gami Trail
Scale 1:150,000
5 0 5 10 Miles
N

APPENDIX

LANDCOVER

During the economic boom years following World War II, the supply of high-grade iron ore slowly declined. Researchers at the University of Minnesota perfected a method for taconite beneficiation and the Reserve Mining plant was built in 1955 to process low-grade taconite ores and the new town of Silver Bay sprang up around it. The opening of the St. Lawrence Seaway in 1959 connected the Great Lakes to international markets.

The first artificial connection between the Atlantic Ocean and the Great Lakes - the Erie Canal completed in 1823 - introduced the sea lamprey to the lower Great Lakes. The Welland Ship Canal allowed sea lampreys access to the Great Lakes above Niagara Falls in 1829. The first sea lamprey was observed in Lake Ontario in 1835, in Lake Erie in 1921, in Lake Huron in 1937 and in Lake Superior in 1946. By the late 1940s, lake trout in Lakes Huron and Michigan were essentially extirpated. Sea lampreys devastated Lake Superior's native trout populations during the 1950s, until effective sea lamprey control programs were initiated in the 1960s.

Today tourism is the leading economic activity on the North Shore. Naniboujou Lodge was built in 1928 as a private club. The Nelson family built Lutsen Ski Resort in 1949.

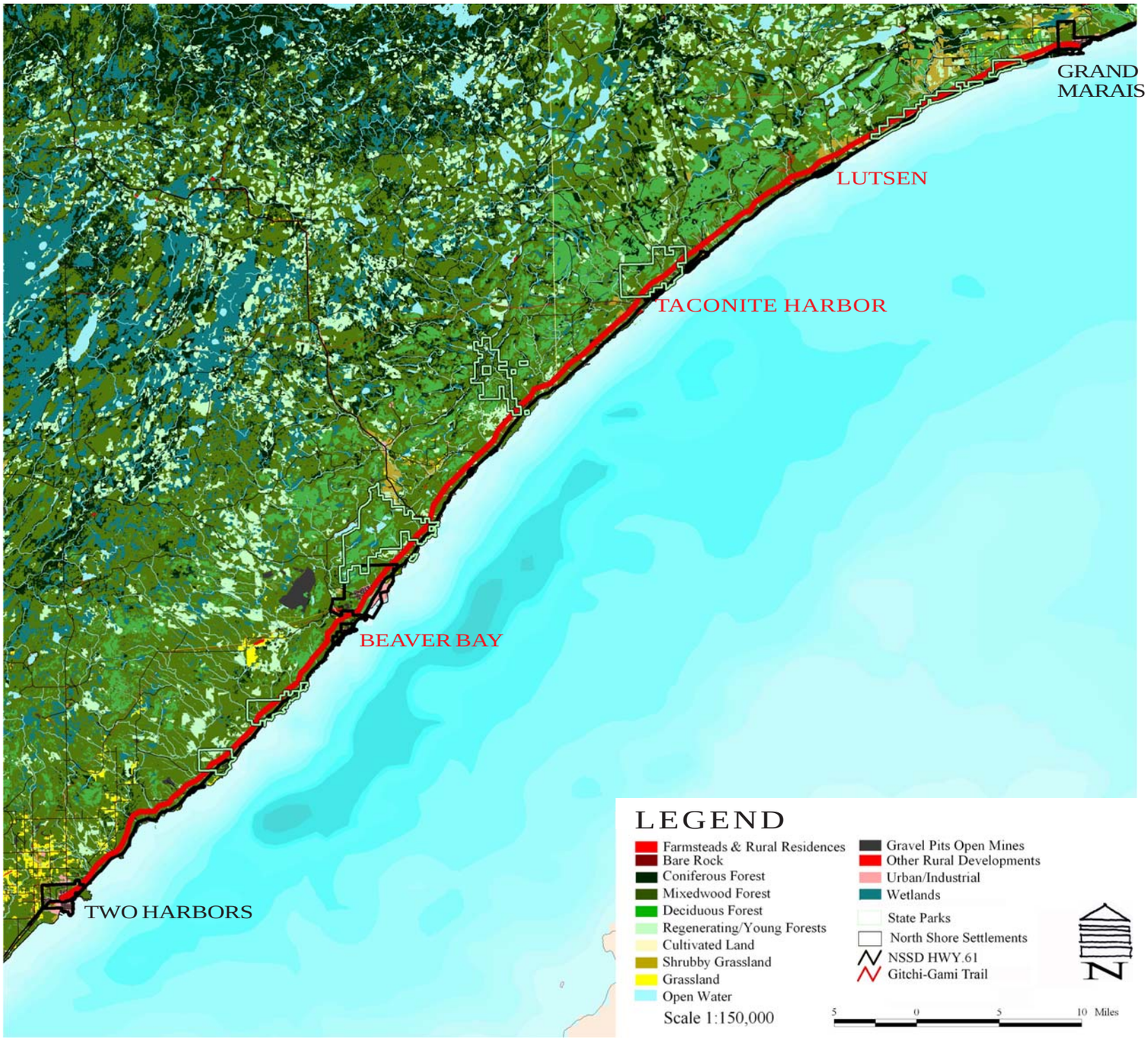
A variety of experiences is available on the North Shore moving through alternating stands of pine and then aspen or birch. Today the forests are primarily mixedwood forest along the shore with aspen and paper birch dominating pines on the front slopes and deciduous sugar maples on the back slopes. There are many stands of shrubs and young regenerating forest where logging has recently occurred. Coniferous forests survive only in wetland areas. The gravel bars at some of the North Shore streams formed after clear-cutting exposed the bare slopes and hillsides of the river valleys to erosion. Spawning beds in the rivers silted over and water temperatures increased due to the lack of shade. Logs gouged streambeds to the point they are only now healing. A logjam once blocked the Stewart River for 3 years.

RESOURCES FOUND ALONG THE GITCHI-GAMI TRAIL:

This segment contains the historic communities of Two Harbors and Beaver Bay and many small, rustic, Ma & Pa resorts and cabins.

This segment contains the large industrial operations and iron ore loading facilities at Silver Bay and Taconite Harbor.

This segment contains the resort commnities of Tofte, Lutsen, and Grand Marais.


GRAND MARAIS
LUTSEN
TACONITE HARBOR
BEAVER BAY
TWO HARBORS
LEGEND
Farmsteads & Rural Residences
Bare Rock
Coniferous Forest
Mixedwood Forest
Deciduous Forest
Regenerating/Young Forests
Cultivated Land
Shrubby Grassland
Grassland
Open Water
Gravel Pits Open Mines
Other Rural Developments
Urban/Industrial
Wetlands
State Parks
North Shore Settlements
NSSD HWY.61
Gitchi-Gami Trail
Scale 1:150,000
5 0 5 10 Miles
N

APPENDIX

DEVELOPMENT

Historically, communities nestled into the rugged North Shore had more of a connection to the land or the lake than they did to each other. Finnish, Swedish, Norwegian, and German communities were isolated from each other as much by the rugged landscape as they were by language. Frequent river gorges and impenetrable forests made travel along the shore nearly impossible, except for the most hardy, like postman John Beargrease. Most of the communities on the North Shore were only accessible to the outside world by boat until the mid 1920s. In fact, most community locations were selected for the shelter provided by a harbor or river mouth for loading and unloading boats.

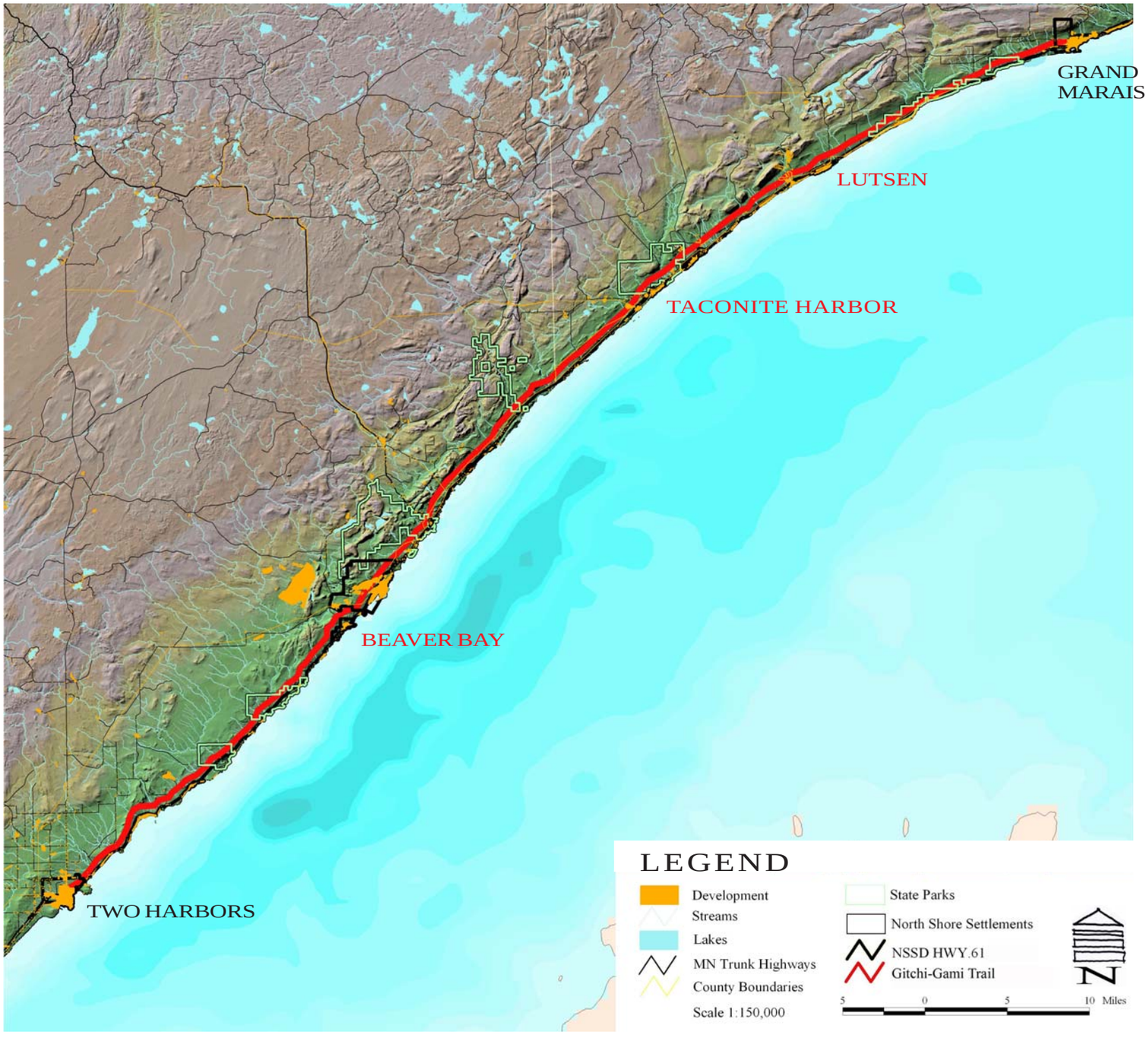
Traveling inland was typically much easier, especially along the path of least resistance cut by rivers through the hills and trees. Communities prospered or perished based on the availability of inland natural resources, including iron ore deposits, harvestable lumber, the presence of game birds and animals, and the supply of fish in the streams and waters of Lake Superior. Today's communities depend on the steady flow of tourists into the region, seeking outdoor recreation on the forested hills above the river gorges and Lake Superior.

RESOURCES FOUND ALONG THE GITCHI-GAMI TRAIL:

There are many small, rustic homes and Ma & Pa resorts visible along the Gitch-Gami Trail from Two Harbors to Beaver Bay. You pass directly through the historic towns of Beaver Bay and Two Harbors. Popular, historic state parks at Gooseberry Falls and Split Rock Lighthouse have numerous scenic views from bridges over river gorges.

The Trail from Beaver Bay to Tofte is planned to be further inland through the forest to avoid rugged landforms along the lakeshore. There are fewer buildings and services visible in this stretch of the trail. The modern town of Silver Bay is entirely inland and not visible from the pro posed trail. Tettegouche and Crosby-Manitou contain the most inland backcountry areas of all the state parks and require getting out of your car to enjoy the scenic views. Iron ore loading docks at Silver Bay and Taconite Harbor are visible along the lakeshore. Highway 1 is major inland artery to Finland, Wolf Ridge ELC, Ely, and the Boundary Waters Canoe Area.

Larger, newer homes and resorts occur along the trail from Tofte to Grand Marais. Schroeder, Tofte, Lutsen and Grand Marais have many seasonal homes, resorts, and numerous scenic views of the Sawtooth Mountains, and state park river gorges are visible from the planned trail including Carlton Peak, Leveaux Mountain, Cross River, Temperance River, and Cascade River.


GRAND MARAIS
LUTSEN
TACONITE HARBOR
BEAVER BAY
TWO HARBORS
LEGEND
Development
Streams
Lakes
MN Trunk Highways
County Boundaries
Scale 1:150,000
State Parks
North Shore Settlements
NSSD HWY.61
Gitchi-Gami Trail
N
5 0 5 10 Miles

APPENDIX

INFRASTRUCTURE

The Gitchi-Gami Trail is planned to run from Two Harbors to Grand Marais. Except for iron ore shipments from the range to Silver Bay and Taconite Harbor, railroads extend up the North Shore only to Two Harbors. Loading dock facilities for ore boats occur in Two Harbors, Silver Bay, and Taconite Harbor. Public Access Boat Launches on Lake Superior are maintained in Two Harbors, Twin Points, Silver Bay Marina, Taconite Harbor, Schroeder, Tofte, Grand Marais, Hovland, Horseshoe Bay, and Grand Portage. Additional public access boat ramps occur on numerous inland lakes and streams.

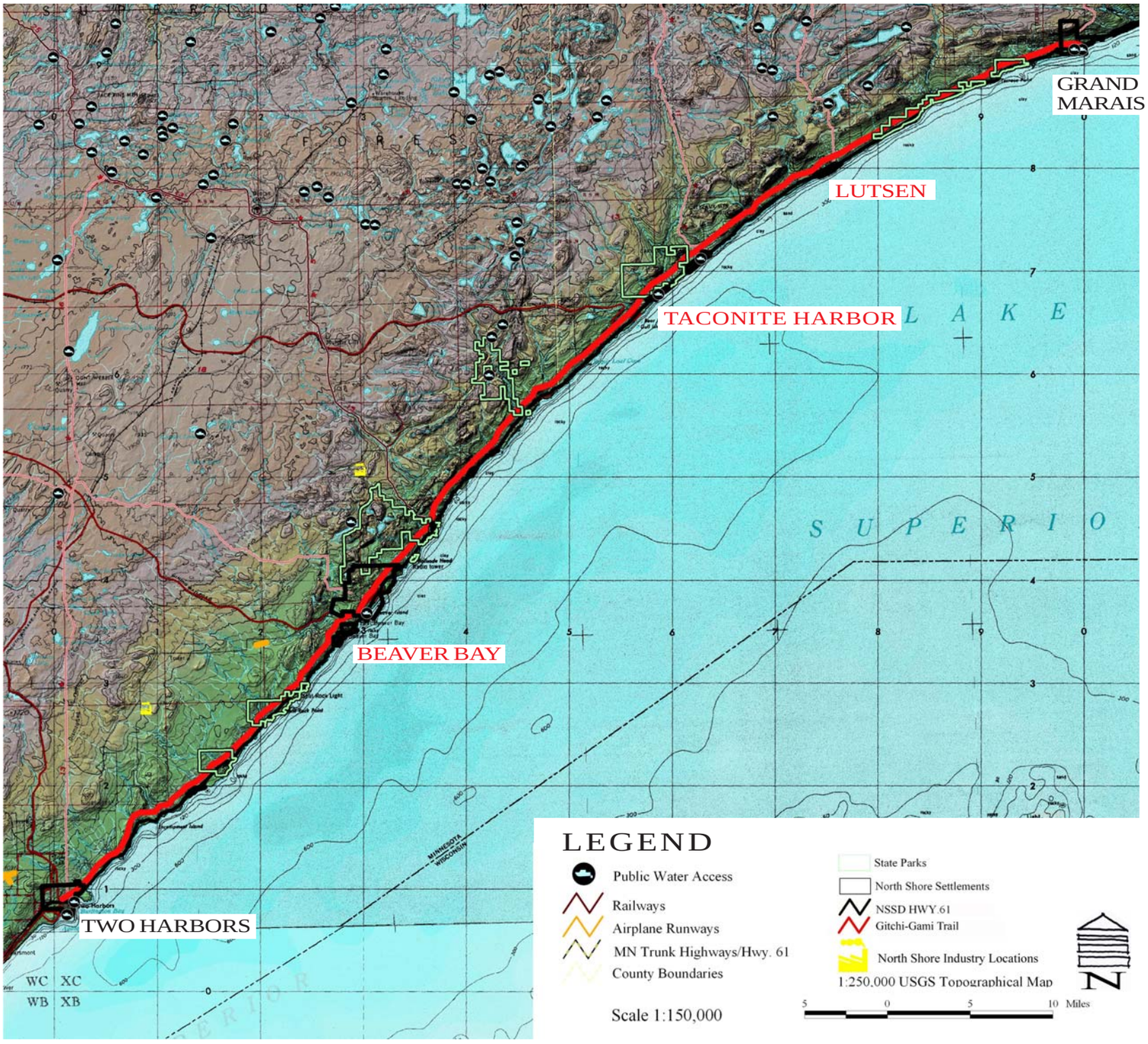
Municipal sewage treatment lagoons exist in Two Harbors, Beaver Bay, Lutsen, and Grand Marais. Airports serve the communities of Two Harbors, Beaver Bay, Tofte, and Grand Marais. Interior roads to inland areas occur at Two Harbors (County Road 2 to Ely), Beaver Bay (SNF Scenic Byway to the Iron Range), Illgen City (Highway 1 to Ely), Tofte (Sawbill Trail to BWCAW), Lutsen (Caribou Trail to BWCAW), Grand Marais (Gunflint Trail to BWCAW), and Hovland (Arrowhead Trail to BWCAW).

RESOURCES FOUND ALONG THE GITCHI-GAMI TRAIL:

The area from Two Harbors to Beaver Bay contains the most people and the most infrastructure, including; 4 public access boat launches, 2 airports, 2 municipal sewage treatment lagoons, 2 roads inland, and the terminus of passenger railroad service.

The area from Silver Bay to Taconite Harbor contains very little infrastructure, including; rail road lines to carry iron ore to the loading facilities at Silver Bay and Taconite Harbor, 1 public access boat launch, and 1 road inland.

The area from Tofte to Grand Marais contains 3 public access boat launches, 2 airports, 2 sewage treatment lagoons, and 3 inland roads.


GRAND MARAIS
LUTSEN
TACONITE HARBOR
BEAVER BAY
TWO HARBORS
F O R E S T
L A K E
S U P E R I O
MINNESOTA
WISCONSIN
WC XC
WB XB
LEGEND
Public Water Access
Railways
Airplane Runways
MN Trunk Highways/Hwy. 61
County Boundaries
State Parks
North Shore Settlements
NSSD HWY.61
Gitchi-Gami Trail
North Shore Industry Locations
1:250,000 USGS Topographical Map
Scale 1:150,000
5 0 5 10 Miles
N

APPENDIX

LAND OWNERSHIP

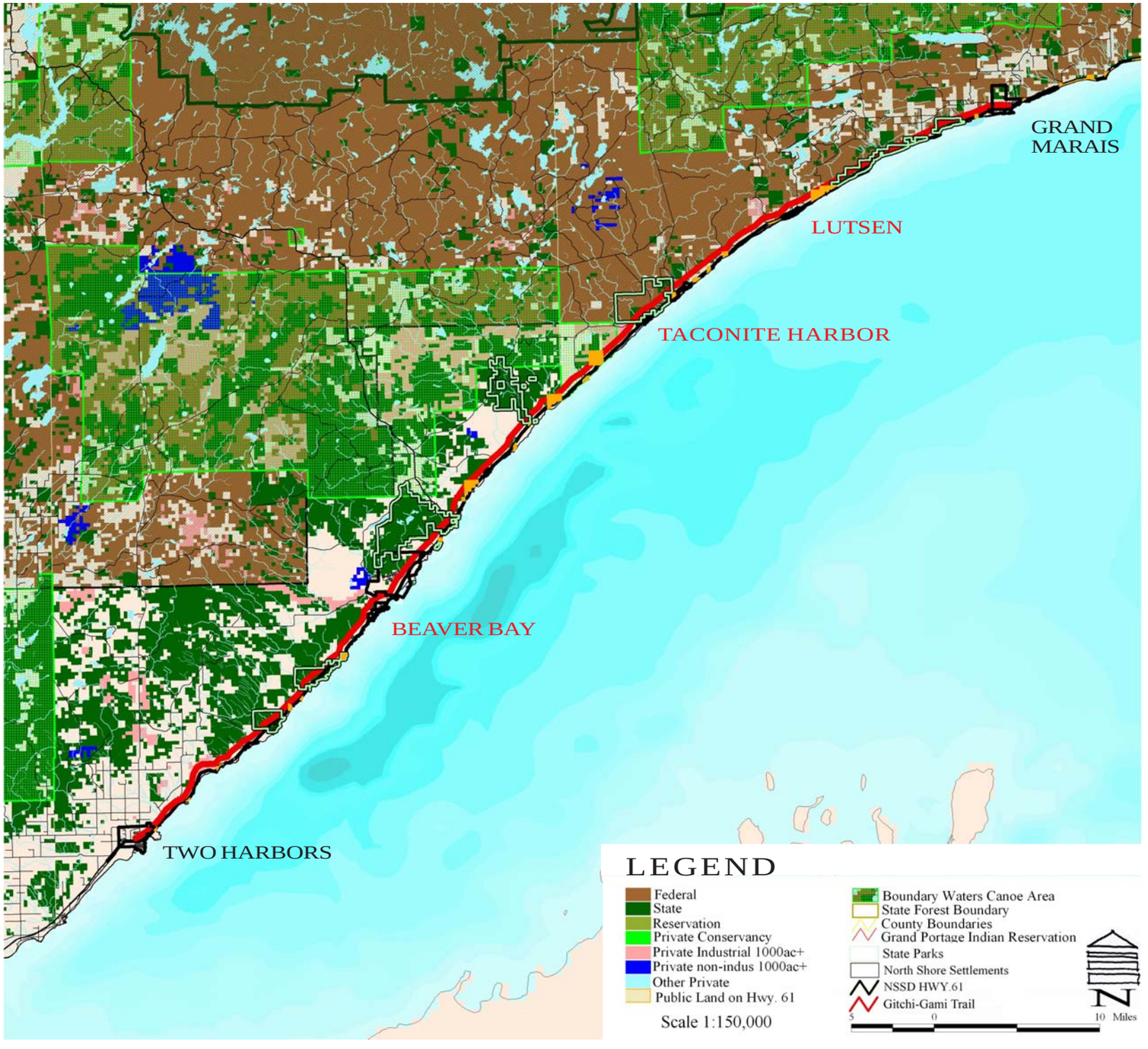
Federal ownership dominates the North Shore within the Superior National Forest from Schroeder to beyond Grand Marais. The Grand Portage Indian Reservation dominates the tip of the Arrowhead Region. State parks and state forests dominate locally at Gooseberry Falls, Split Rock Lighthouse, Tettegouche, Crosby-Manitou, Temperance River, Cascade River, Judge Magney, Finland, Pat Bayle and Grand Portage. Large parcels of privately owned industrial land occur in Two Harbors, Silver Creek, Silver Bay, and Taconite Harbor.

RESOURCES FOUND ALONG THE GITCHI-GAMI TRAIL:

The shoreline from Two Harbors to Beaver Bay is mostly in private ownership except for state land at Gooseberry Falls and Split Rock Lighthouse State Parks and along the shore's backslopes.

Much of the shoreline and inland areas from Beaver Bay to Tofte are privately owned except in Tettegouche and Crosby-Manitou State Parks and in Finland State Forest.

Only a narrow corridor of private ownership exists along the shore from Tofte to Grand Marais, interrupted by public land at Cascade River State Park. All inland areas are federally owned in the Superior National Forest.


GRAND MARAIS
LUTSEN
TACONITE HARBOR
BEAVER BAY
TWO HARBORS
LEGEND
Federal
State
Reservation
Private Conservancy
Private Industrial 1000ac+
Private non-indus 1000ac+
Other Private
Public Land on Hwy. 61
Boundary Waters Canoe Area
State Forest Boundary
County Boundaries
Grand Portage Indian Reservation
State Parks
North Shore Settlements
NSSD HWY.61
Gitchi-Gami Trail
Scale 1:150,000
5 0 10 Miles

APPENDIX

HISTORIC STRUCTURES

Historic structures occur mainly in the communities of Two Harbors, Beaver Bay, Finland, Schroeder, Lutsen, Grand Marais, Hovland, and Grand Portage as well as at Gooseberry Falls, the oldest state park on the North Shore. Silver Bay, the newest town on the North Shore in 1955, has no historic structures.

A wide variety of historic structures has been designated along the North Shore including churches, cemeteries, abandoned CCC camps and logging camps, lighthouses, iron ore loading docks, locomotives, train depots, tugboats, shipwrecks, fishing piers, farm buildings, fur trade stockades, log lodges and resorts, missionary camps, and Native American sites. This wide variety reflects the broad scope of human industries and occupations that existed in North Shore communities multiple cultures.

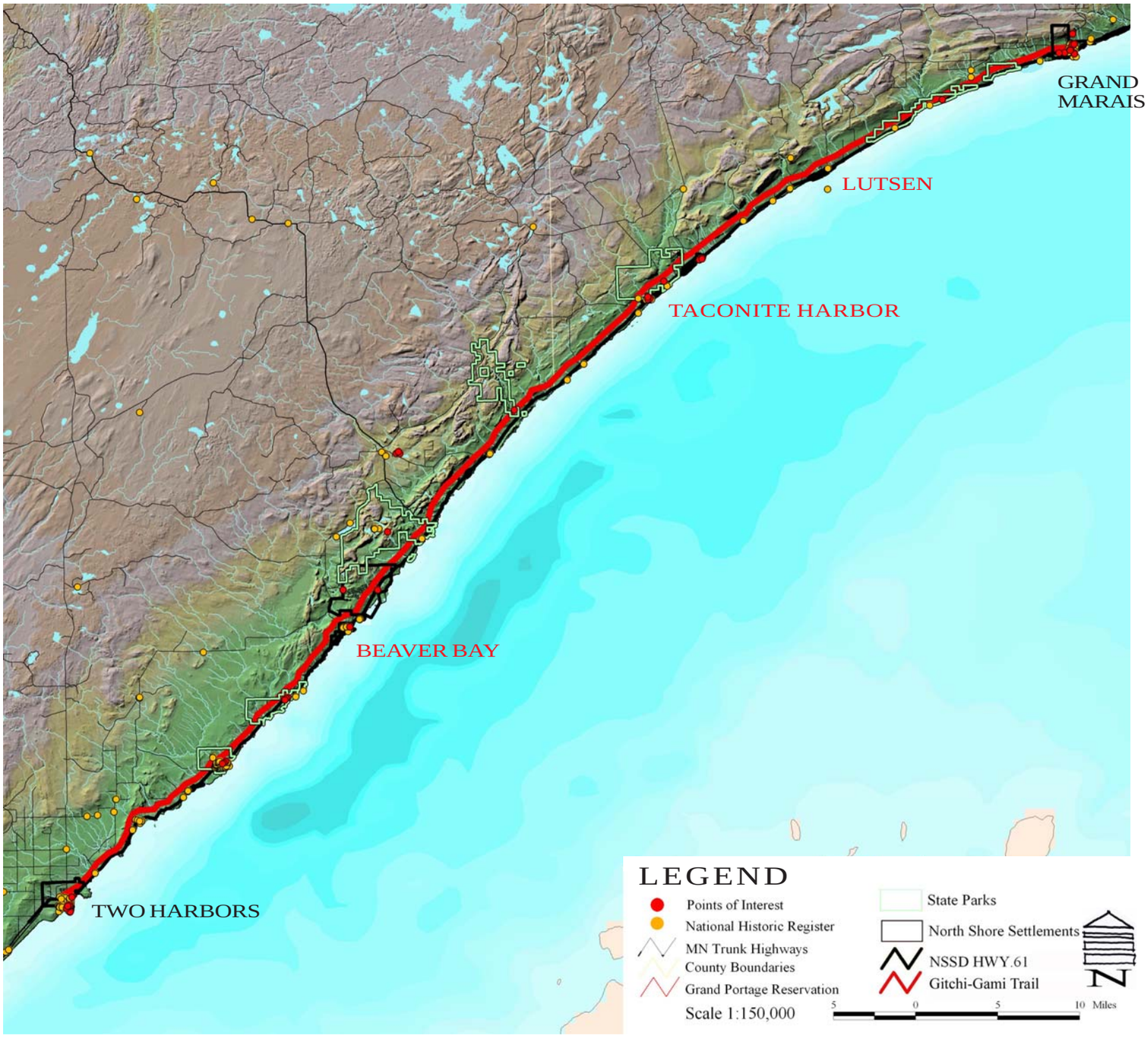
Cultural festivals and public gatherings are also centered in the communities of the North Shore. Two Harbors hosts the county fair, Folk Festival, Harbor Fest, and Heritage Days. Beaver Bay sponsors the Smelt Fry. Illgen City hosts St. Urho's Days, Tofte has a fireworks display on the Fourth of July. Grand Marais sponsors the Fisherman's Picnic, Playhouse, Dog Days Winter Carnival, and Northern Lights. Hovland proclaims itself the Lake Trout Capital of the World and Grand Portage re-enacts Rendezvous Days.

RESOURCES FOUND ALONG THE GITCHI-GAMI TRAIL:

Historic structures are concentrated in the historic communities of Two Harbors, Castle Danger, and Beaver Bay as well as Gooseberry Falls and Split Rock Lighthouse State Parks.

There are fewer historic structures along the North Shore from Silver Bay to Taconite Harbor. There are a couple of historic structures in the communities of Little Marais and Schroeder. There is also a collection of Finnish log homes in Finland, but there are no historic structures in Silver Bay, since it was only built in 1955. Historic structures from old logging camps survive at Tettegouche State Park and Sugarloaf Interpretive Center.

There are more historic structures in the communities of Tofte, Lutsen, and Grand Marais. There are historic log lodges at Lutsen and at the Cascade River. An historic lighthouse and harbor facilities are in Grand Marais and the ruins of an old pier remain in Tofte.


GRAND MARAIS
LUTSEN
TACONITE HARBOR
BEAVER BAY
TWO HARBORS
LEGEND
Points of Interest
National Historic Register
MN Trunk Highways
County Boundaries
Grand Portage Reservation
State Parks
North Shore Settlements
NSSD HWY.61
Gitchi-Gami Trail
Scale 1:150,000
5 0 5 10 Miles
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APPENDIX

RECREATIONAL SITES

There are several regional trails that parallel the shoreline. They are the North Shore State Trail, Lake Superior Hiking Trail, Lake Superior Water Trail, and Gitchi Gami State Trail. Otherwise, recreation opportunities tend to be concentrated in population centers, especially in and around Silver Bay and in the stretch from Lutsen to Grand Marais. Silver Bay trails are more popular with local residents, while the trails at Lutsen are more frequented by visitors and tourists.

Lutsen Mountain is one of the largest downhill ski hills in the Midwest. There are 4 golf courses on the North Shore; Lakeview National in Two Harbors, Silver Bay Country Club in Silver Bay, Superior National in Lutsen, and Gunflint Hills in Grand Marais. Rock climbing is a popular activity, especially on the cliffs at Palisade Head, Shovel Point, and along the Baptism River. Fishermen flock to the North Shore streams all summer, but especially during the spring and fall spawning runs. Charter fishing boats and excursion boats are available in most communities. Rock hounds collect numerous agates and thomsonite. Hunting for deer, moose, black bear, and upland game birds, is popular. Scuba diving to shipwrecks is possible.

Inland roads provide access to additional recreational opportunities amidst the lakes and trees of Superior National Forest, Finland, Pat Bayle, and Grand Portage State Forests, and the Boundary Waters Canoe Area Wilderness. County Road 2 heads inland from Two Harbors, Superior National Forest Scenic Byway Highway 15 leaves Silver Bay, and Highway 1 turns north from Illgen City. The Sawbill Trail out of Tofte, Caribou Trail out of Lutsen, Gunflint Trail out of Grand Marais, and Arrowhead Trail out of Hovland all reach the southern edges of the Boundary Waters.

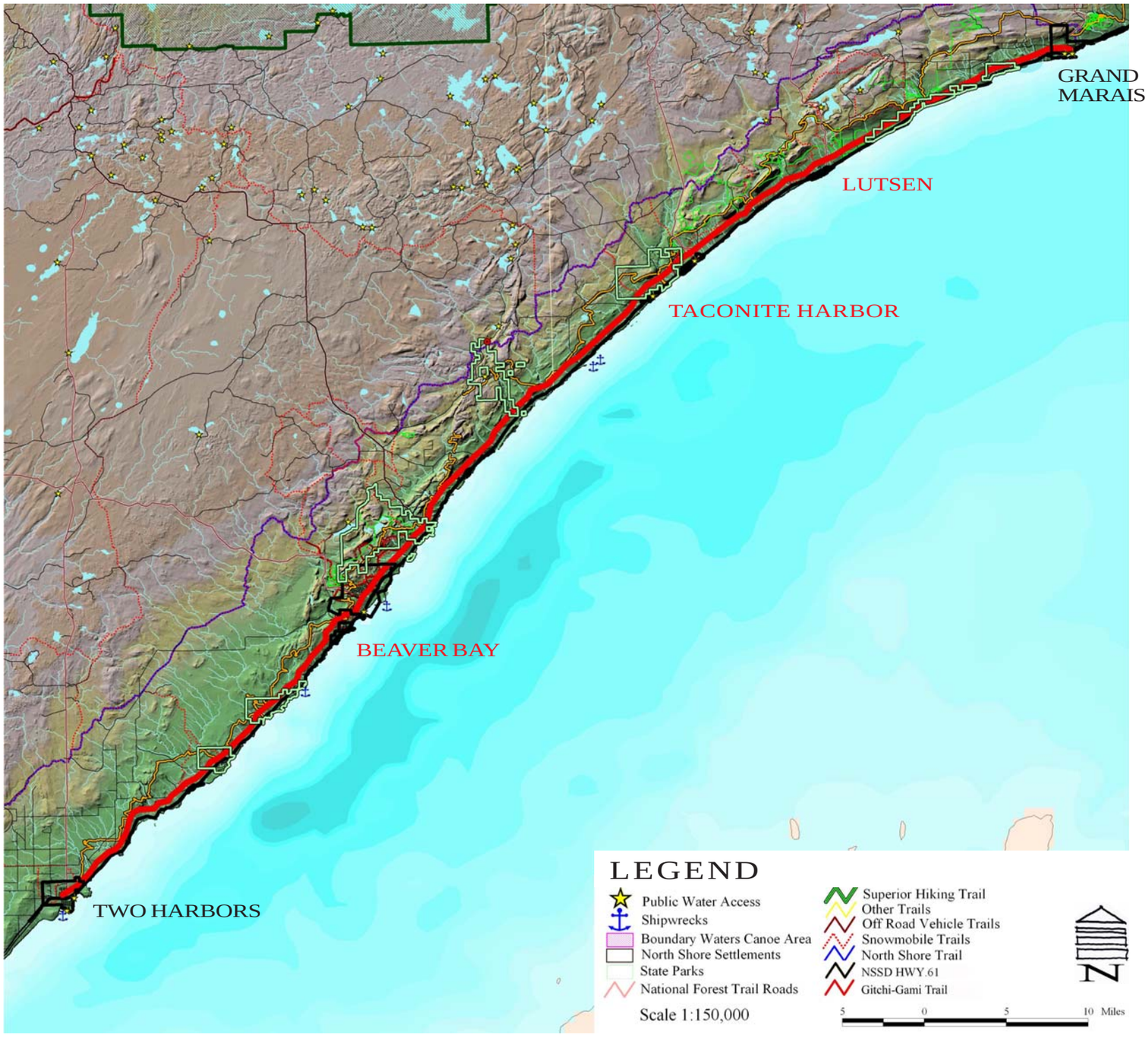
Public Water Access boat launches for Lake Superior occur at Two Harbors, Twin Points, Silver Bay Marina, Taconite Harbor, Schroeder, Tofte, Grand Marais, Hovland, Horseshoe Bay and Grand Portage. Numerous inland access points also exist for backcountry lakes of all shapes and sizes. Those portions of the North Shore's streams and rivers held in public ownership also provide recreation opportunities, including the magnificent string of State Parks from Flood Bay, Gooseberry Falls, and Split Rock Lighthouse to Palisade Head, Tettegouche (Baptism River), Crosby-Manitou, Caribou Falls, Cross River, Temperance River, Ray Bergland (Onion River), Cascade River, Devil's Track River, Kadunce River, Judge C. R. Magney (Brule River), and Grand Portage (Pigeon River).

RESOURCES FOUND ALONG THE GITCHI-GAMI TRAIL:

The district from Two Harbors to Beaver Bay contains 4 Public Water Access boat launches, 2 very popular state parks in Gooseberry Falls and Split Rock Lighthouse, 1 golf course, and 1 road in land. Numerous hiking, cross-county skiing, snowmobiling, and kayaking trails parallel the shore.

The district from Silver Bay to Taconite Harbor contains 1 Public Water Access boat launch, 1 golf course, 2 state parks, and 2 inland roads. In addition there are many local recreational trails in the woods around Silver Bay.

The district from Tofte to Grand Marais contains 3 Public Water Access boat launches, 2 state parks, 2 golf courses, 3 inland roads, Lutsen Mountain, and an abundance of local trails in the Sawtooth Mountains.


GRAND MARAIS
LUTSEN
TACONITE HARBOR
BEAVER BAY
TWO HARBORS
LEGEND
Public Water Access
Shipwrecks
Boundary Waters Canoe Area
North Shore Settlements
State Parks
National Forest Trail Roads
Superior Hiking Trail
Other Trails
Off Road Vehicle Trails
Snowmobile Trails
North Shore Trail
NSSD HWY.61
Gitchi-Gami Trail
Scale 1:150,000
5 0 5 10 Miles
N

APPENDIX

LAND TRANSFORMATION MODELING:

THE LAND TRANSFORMATION MODEL (LTM)

Before analysts could make the 2020 and 2050 urban transformation projections, they first simulated a projection for a year for which they had actual urban transformation data. Using data from the years 1991 and 2000, they projected urban transformation of the Gitchi Gami Trail area for this 9-year period. To do so, they first obtained raw data including satellite images, road maps, land cover maps, and various geographic data layers of the area from the 1991 and 2000 dates.

DATA FOR LTM MODELLING**:** Data for input to the LTM model was obtained from a variety of sources noted below.

LANDSAT THEMATIC MAPPER IMAGES: Landsat satellites capture moderate resolution images of the earth from space. For the Gitchi Gami, analysts classified Landsat images from 1991 and 2000 to generate land cover/land use maps of the study area. The land cover/land use was classified as: Water and rivers, lowland forest, upland forest, agriculture/grass, urban and lowland non-forest.

GAP ANALYSIS PROGRAM (GAP) VEGETATION MAP: The Minnesota GAP vegetation map is a detailed, hierarchically organized vegetation cover map produced by computer classification of combined two-season pairs of early 1990s Landsat imagery. The GAP vegetation map was used to create a lowland mask to separate lowland forest areas from lowland non-forest areas in the Landsat images noted above. It also served as an aid to the generation of land cover/land use classifications.

U.S. GEOLOGICAL SURVEY DIGITAL ELEVATION MODELS: Digital Elevation Models, commonly referred to as DEMs, are data files that illustrate an area's elevation. Before computers, DEMs were simply a collection of elevation points for an area organized into lists or tables. But today, computer software takes this data and generates three-dimensional views of an area based on these elevation points and allowing for a more thorough analysis. DEMs are available through the U.S. Geological Survey (USGS).

DEPARTMENT OF TRANSPORTATION 2001 ROADS**:** This data set contains roadway centerlines for roads from the USGS 1:24,000 mapping series. Those roadways that are interstate, trunk highway, or county state aid highway are current through the 2001 construction season. Other roads, if not updated, are described as shown on the published quadrangle.

DIGITAL LINE GRAPHS HYDROLOGICAL WATER AND WETLAND DATA: Digital Line Graphs (DLGs) are datasets that represent cartographic information from USGS maps. For the Gitchi Gami Trail area, analysts used the hydrological water and wetland data layers.

NATIONAL FOREST**:** The dataset that represents the location of national forest boundaries within the state is Natforest which was created by the U.S. Forest Service. This data was used in the development of an exclusionary layer for the LTM.

INDIAN RESERVES:The dataset that represents the location of Indian reservation boundaries within the state is Reservtn. This data was used in the development of an exclusionary layer for the LTM.

CENSUS BLOCK: U.S. Census block level data with population information for 1991 and 2000.

Next, these data were processed using ArcGIS, a computer software package. This allowed analysts to identify ten factors, or predictor variables, affecting urban transformation between 1991 and 2000.

TEN PREDICTOR VARIABLES:

Elevation

Slope

Aspect

Distance to interstate highway

Distance to County aid highway

Distance to lakes

Distance to streams

Distance to lowland

Distance to urban

Population density

Next, these predictor variables, along with the land cover maps from 1991 and 2000 and an exclusionary layer, were loaded into the LTM. The exclusionary layer, which is a data layer representing land where development is prohibited, included interstate highway, county aid highway in 1991, water and rivers, state and national parks, Indian reservations, and the initial 1991 urban area. To generate the 1991-2000 urban transformation projection, analysts relied on the LTM's Artificial Neural Network (ANN) to sort the predictor variables, land cover/land use maps, and the exclusionary layer. Artificial neural networks serve the LTM the same way that neurons serve the human brain. Both are an information processing hub.

After the LTM ran its course, a map of "change likelihood values" for the Gitchi Gami Trail was generated illustrating which areas were highly likely to change from non-urban to urban by 2000. For the Gitchi Gami Trail, the three most significant variables for predicting land-use change were, in decreasing order of importance: distance to urban; elevation, and; distance to highways and county roads, specifically highway 61.

URBAN TRANSFORMATION SIMULATION: 2000

With the "change likelihood values" and the land cover maps from 1991 and 2000, analysts determined that the Gitchi Gami Trail experienced a major increase in transformation of non-urban to urban land during this period. In fact, the area classified as urban land increased by 30 percent from 1991 to 2000. To aid the understanding of these changes, we note the area classified as urban land in 1991 was 13,724 acres.

By overlaying this projection on the actual urban transformation between 1991 and 2000, analysts were also able to examine the accuracy of the projections. The projection was typically 30-50 percent accurate depending on the part or subregion of the study area considered –– a typical pixel level of accuracy for the LTM. Accuracies exceeding 45-50% are considered very unusual and perhaps due to overfitting of the model. However, accuracy can be judged several ways: agreement in the actual pixels that changed and/or agreement in the total number of pixels changing to urban.

APPENDIX

LAND TRANSFORMATION MODELING:

The LTM model is a digital tool developed by Michigan State University to assist planners and resource managers to develop improved decisions that affect the environment and local to regional economies. The LTM uses recent land use change, population growth, transportation, proximity or density of important landscape features such as rivers, lakes, recreational sites, and high-quality vantage points as inputs to model future land use change.

The LTM models employs Artifical Neural Networks, similar to the intricate pathways established in the human brain. The Artifical Neural Net is a process that utilizes a machine learning approach to numerically solve relationships between inputs and outputs (Michigan State University 1996). The LTM relies on Geographic Information Systems (GIS), artificial neural network routines, land use data from at least two dates, and customized geospatial analysis tools. Raw GIS data (e.g., thematic layers) is first acquired, then processed, and converted to an ARC/INFO GRID format with cell sizes of 30m x 30m.

INPUTS TO THE LTM MODELLING PROCESS

LandSat Thematic Mapper Images:

Landsat satellites capture moderate resolutions images of the earth from space. For this project, analysts classified LandSat TM5 image data from dates in or near 1991 and 2000 to generate land cover/land use maps of the study area. Specifically, one Landsat scene, path-26 row-27, covers the extent of the Gitchi Gami Trail. The land cover classification of the 1991 base layer used a TM image from August 28, 1991. The image was selected based its quality (i.e., lack of clouds and haze) and nearness to the base date of 1991. The 2000 land cover classification used a single image from the ETM+ sensor corresponding to July 25, 1999. Again the image was chosen based on clarity and nearness to the base date 2000. All the images were rectified to the MDOT road layer, with a final rectification error of less than 15 meters.

The ISODATA algorithm was used to classify the images into the following classes: Water and rivers, lowland forest, upland forest, agriculture/grass, urban and lowland non-forest. These classes were established based on the abilities of the sensor, our research requirements, and by referencing Anderson's Land Use / Land Cover classification system. The resulting classes are described in table 1.

Table 1. Description of land cover/land use classes.

Land cover/land use class	**Description**
Water and Rivers	Permanent open water, lakes
Lowland forest	Lowland forested area. Forest defined as a minimum of 70% canopy closure. It includes coniferous, deciduous, and mixed forest.
Upland forest	Upland forest area. Forest defined as a minimum of 70% canopy closure. It includes coniferous, deciduous, and mixed forest.
Agriculture/grass	Includes planted cropland, rangeland, fallow, and natural grassland.
Urban	Includes commercial, industrial, residential, and transportation.
Lowland non-forest	Lands that are sometimes covered with water or have waterlogged soils.

GAP ANALYSIS PROGRAM (GAP) VEGETATION MAP:

The Minnesota GAP vegetation map is a detailed, hierarchically organized vegetation cover map produced by computer classification of combined two-season pairs of early 1990s Landsat imagery. The map was developed as part of the Upper Midwest Gap Analysis Program whose goal it is to maintain biodiversity by identifying those species and plant communities that are not adequately represented in existing conservation lands. There are typically 4 levels or classes in Gap Analysis. The GAP vegetation map was used to create a lowland mask to separate lowland forest areas from lowland non-forest areas in the Landsat images noted above. It also served as an aid to the generation of land cover/land use classifications.

U.S. GEOLOGICAL SURVEY (USGS) DIGITAL ELEVATION MODELS (DEM):

The DEMs were standardized to 30-meter grid cells, UTM Zone 15, NAD83, vertical units in feet and were joined into one statewide file. All the DEMs are Level 2 quality. Level 2 DEMs have been processed or smoothed for consistency and edited to remove identifiable systematic errors. A vertical RMSE of one-half of the contour interval, determined by the source map, is the maximum permitted. Systematic errors may not exceed one contour interval specified by the source graphic.

DEPARTMENT OF TRANSPORTATION 2001 ROADS:

This data set contains roadway centerlines for roads found on the USGS 1:24,000 mapping series. Those roadways that are Interstate, Trunk Highway, or CSAH (county state/aid Highway) are current through the 2001 construction season. Other roads, if not updated, are depicted as shown on the published quadrangle.

HYDROLOGICAL LAKE AND WETLAND DATA:

The 1:100,000 scale hydrography data was derived from USGS Digital Line Graphs (DLG)'s of the same scale. This data contains only the polygon portion of the DLG database. Area features are described as lakes, wetlands, inundated areas, tailings ponds, sewage ponds, fish hatcheries, and other minor water body types.

NATIONAL FOREST:

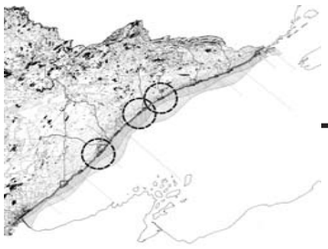
Natforest, which represents national forest boundaries within the state, is a layer of the State of Minnesota BaseMap 2001 which consists of a number of individual data layers or themes digitized from 1:24000 USGS 7.5-minute quadrangles. These data layers fall into the following broad categories: transportation system, civil and political boundaries, and surface water. Natforest originated as a polygon coverage with the U.S. Forest Service. It is available through the Minnesota Department of Transportation.

INDIAN RESERVES:

Reservtn, which represents Indian reservation boundaries within the state, is a layer of the State of Minnesota BaseMap 2001, which consists of a number of individual data layers, or themes digitized from 1:24000 USGS 7.5-minute quadrangles. It is available through the Minnesota Department of Transportation.

CENSUS BLOCK:

U.S. Census block level data with population information for 1990 and 2000 was obtained from the U.S. Census Bureau.



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