# Establishment Report

## MARCELL EXPERIMENTAL FOREST

(Chippewa National Forest and adjacent
Private, Itasca County[1/], and State of Minnesota lands)

Roger R. Bay
February 28, 1962

1/ Tax-forfeited lands are actually owned by the state of Minnesota. Counties are the administrators of such land by law. Commonly, they are referred to as county lands.

## INTRODUCTION

In pursuance of Regulation U-4, of the regulations of the Secretary of Agriculture, and FSH 4063, Chapter 4060, research facilities, the area described in this report is recommended for experimental purposes. This area will be known as the "Marcell Experimental Forest".

This report proposes that approximately 1064 acres of national forest land, and 1194 acres of cooperator lands currently under approved cooperative agreements, be dedicated for purposes of watershed management research in northern Minnesota. The need for this area, the research to be conducted on it, its location, and a description of values are discussed in following sections of this report.

1064
1194
2258

## RELATION TO RESEARCH NEEDS

The State of Minnesota has about 7 million acres of swamplands, over half of which are covered by forests and found principally in the northern part of the state. Streams which arise in these swamp areas are the beginnings of three major drainage systems-- the Mississippi River flowing south, the Rainey River-Hudson Bay drainage system flowing north, and the Great Lakes-St. Lawrence system flowing east. Thus, land management practices on these forested, headwaters swamplands could have far reaching affects.

At the present, little is known about the water relations of these northern swamps. Years ago, many swamps were drained for agriculture or to increase tree growth. Later some drainage ditches were dammed for wildlife purposes. Since then, many people have speculated on the importance of swamps for water storage and for regulating streamflow. Actually, too few facts have been gathered to warrant any sound conclusions.

The Lake States Forest Experiment Station has initiated a bog and swamp hydrology research program aimed at studying the basic hydrology of forested peat swamps. To impliment this program, swamp watersheds are needed on which incoming precipitation, ground water, and run-off can be accurately measured. Small swamp watersheds--complete hydrologic units--are needed on which basic principles of swamp water table behavior, water movement through peats, and streamflow can be measured and analyzed.

Present experimental forests maintained by the experiment station do not contain the necessary swamp watershed units. Therefore, a thorough survey of north-central Minnesota was undertaken to find an area containing such watersheds. The proposed Marcell Experimental Forest is the result of this exhaustive survey.

The proposed experimental forest is made up of two units, a north unit and a south unit (see attached map). Each unit has from 3 to 5 individual swamp watersheds containing swamps ranging in size from 5 to 35 acres. All but two of these swamps have relatively narrow, single outlets which are being gaged or are capable of being gaged. One swamp watershed has two outlets, each one now instrumented with streamflow gages. The largest swamp on the area does not have a gageable outlet but it is available for water table and water movement studies.

Swamps within the watersheds contain peat soils ranging in depth from a few feet to approximately 30 feet. They are typical filled-lake type bogs containing primarily sedge peats in various stages of decomposition. Sphagnum peat is found on the bog surface. Several swamps support poor stands of black spruce, but most of the swamps contain black spruce stands of medium to heavy stocking. Thus, harvest treatments can be applied to these stands for experimental purposes.

The upland area surrounding these swamps is slightly hilly and covered with extensive stands of aspen-birch type, typical of much of north-central Minnesota. Timber stands immediately surrounding the swamps have not been logged although some areas within the proposed experimental forest are presently being cut. This means that timber harvesting treatments can be applied to the upland forests surrounding the swamps to determine their influence on swamp water tables and swamp run-off. Information derived

from studies such as this can be applied to forested areas in a major portion of north-central Minnesota and to similar areas in the Lake States.

Continuous records of swamp water table fluctuations and streamflow from these swamp areas are the first such records to be collected in this nation. Other studies dealing with the physical properties of peat soils, water storage characteristics in swamps, and evapotranspiration from swamp vegetation, will be conducted on these areas. Results from studies such as these can then be related to water table fluctuations within the swamps and in the nearby uplands, and with streamflow from the swamps. Basic principles of bog and swamp hydrology developed on these watersheds will then be used to design and conduct experiments in the large swamp areas covering northern Minnesota and other nearby states. This, then, will be the first, and the only, experimental area in the nation dedicated to northern bog and swamp hydrology studies.

## LOCATION AND OWNERSHIP

The Marcell Experimental Forest is located in Itasca County, 15 miles southeast of Marcell and 25 miles north of Grand Rapids, Minnesota. It consists of two separate units of land. One unit (south unit) is within the boundary of the Chippewa National Forest, on the southeast edge of the Marcell Ranger District. National forest lands, and county and state lands, under cooperative agreements, are included. The second, or north, unit is just outside the national forest boundary and includes private, county, and state lands under approved cooperative agreements (see maps attached).

Total area within the boundaries of the experimental forest is 2287 acres. However, one 33-acre tract of private land is not included as part of the proposed research area. It is not needed for research purposes. The net acreage to be dedicated for research purposes is 2254 acres. Of this, 1063.5 acres are national forest lands and the remainder are now under approved Memoranda of Understanding with the respective cooperators. The cooperators, the acreage involved, and the numbers of their approved Memoranda of Understanding are as follows:

| | | |
|---|---|---|
| Itasca County | 1025 acres | 12-11-009-22417 |
| Walter J. Mornes and Harry O. Mornes | 10 acres | 12-11-009-22418 |
| Minnesota Department of Conservation | 155 acres | 12-11-009-22419 |

Legal descriptions of the lands, ownership, and net acreage figures are listed in Table 1.

Table 1. Legal description of experimental area

| Unit | Description | | Ownership | Area |
|---|---|---|---|---|
| | | | | acres |
| South | T.58N., R. 25W., 4th P.M. | | | |
| | Section 1 | S½SE,S½SW | National forest | 160 |
| | Section 11 | NE¼,SE¼ | State | 40 |
| | | SE¼,SE¼ | National forest | 40 |
| | Section 12 | NE¼,NE¼ | National forest | 40 |
| | | W½, NE¼ | County | 80 |
| | | SE¼,NE¼ | County | 40 |
| | | W½, SE¼ | County | 65.50 |
| | | E½, SE¼ | National forest | 74.50 |
| | | NE¼,SW¼ | State | 35 |
| | | S½, SW¼ (Govt lot 2) | National forest | 54.75 |
| | | NW¼,SW¼ | National forest | 40 |
| | | NW¼ | National forest | 160 |
| | Section 13 | N½, NE¼ | National forest | 57.25 |
| | | SE¼,NE¼ | National forest | 40 |
| | | SW¼,NE¼ | National forest | 39 |
| | | NE¼,SE¼ | National forest | 40 |
| | | SE¼,SE¼ | National forest | 32 |
| | | W½, SE¼ | National forest | 43.75 |
| | | E½, SW¼ | National forest | 42.25 |
| | | S½, NW¼ | National forest | 80 |
| | | NW¼,NW¼ | National forest | 40 |
| | Section 14 | E½, NE¼ | National forest | 80 |
| | South unit subtotal - - - - - - - - - - - - - - - - - - - - | | | 1324.00 |
| North | T.59N., R.25W., 4th P.M. | | | |
| | Section 25 | SW¼,SW¼ | County | 40 |
| | | NW¼,SW¼ | State | 40 |
| | | SW¼,NW¼ (Govt lot 6) | State | 40 |
| | Section 26 | S½, NE¼ | County | 80 |
| | | SE¼ | County | 160 |
| | | S½, SW¼ | County | 80 |
| | | NE¼,SW¼ | County | 40 |
| | 10 acres in SE corner of NW¼ SW¼ | | Private (Mornes and Mornes) | 10 |
| | Section 27 | SE¼,SE¼ | County | 40 |
| | Section 24 | E½, NE¼ | County | 80 |
| | Section 35 | N½ | County | 320 |
| | North unit subtotal - - - - - - - - - - - - - - - - - - - - | | | 930 |
| | Ownership subtotals: | | National forest | 1063.50 |
| | | | State of Minnesota | 155.00 |
| | | | Itasca County | 1025.50 |
| | | | Private | 10.00 |
| | | | TOTAL | 2254.00 |

## AREA BY COVER TYPES

The predominant forest type on the area is aspen-birch. Stands growing on the experimental area are typical of the 5.1 million acres of this upland forest type found in northeastern and north-central Minnesota. The north unit has only a small scattering of other upland types, while the south unit has a small acreage of northern hardwoods, and about 160 acres of jack pine type, most of which has been recently harvested.

A portion of the aspen acreage in the south unit has been partially cut in recent years. However, this remains as aspen-birch type. No cutting was done adjacent to the swamps or in the swamps.

Black spruce is the major forest type found in swamps. Most of this is in sapling and pole size stands, typical of the spruce found in large swamp areas further north.

Cover type acreages are shown in Table 2.

Table 2. Area by Cover Types

| Cover type | Approx. area (acres) | |
|---|---|---|
| | North unit | South unit |
| Aspen-birch | 700 | 789[1/] |
| Northern hardwoods | 10 | 40 |
| Black spruce | 80 | 140 |
| Tamarack | 10 | 15 |
| Mixed-conifer swamp | 50 | - |
| Spruce-balsam | 10 | 20 |
| Red pine | 20 | - |
| Jack pine | - | 160[2/] |
| Jack pine plantation | - | 20 |
| Lowland brush | 20 | 65 |
| Grass and marsh | 30 | 75 |
| Totals | 930 | 1324 |

1/ Approximately 320 acres cut-over during 1959-60-61 in the south unit.

2/ Approximately 120 acres clear-cut during 1959-60-61-62, in the south unit.

## PHYSICAL AND CLIMATIC CONDITIONS

Both units are located very close to the continental divide between the Mississippi River and the Rainy River-Hudson Bay drainage systems. Geologically, this is an area of over-ridden moraine with aprons of outwash gravel and interspersed with numerous small peat swamps and grass marshes. Some of the ridges and hills in the area may have been formed by an early glacial drift of a stoney and sandy nature. These were later covered with a thin veneer of a clay-loam glacial drift which moved across Minnesota from the northwest. When soil sampling and exploring stream gage sites, this sandy-loam to clay-loam drift mantle was found to be 9 to 10 feet thick in some areas. Sandy soil, similar to sandy outwash aprons, was found below it. Bedrock is probably as deep as 200 feet below the surface.

Sandy-loam and loamy-sand soils have developed on this parent material. In a few places on the south unit, the original sandy moraine apparently was not over-ridden with glacial till. Soils on these areas are medium sands and loamy-sands, and support stands of jack pine.

Organic peat soils are found in the swamp areas. These peat deposits vary in thickness from a few feet to 30 feet. Most of the deposits are composed of sedge-type peat, except at the surface where sphagnum peat is presently found.

Mean annual precipitation in this general area is about 24 inches. About one-half of this falls during the period May through August. Snow accounts for about 20 percent of the annual total, however, snowfall is vitally important to ground water recharge and stable lake levels. Snow accumulation and melt, and soil freezing phenomena will be studied in the swamps and the surrounding uplands. These data will be related to water table recharge and spring streamflow.

## DESCRIPTION OF VALUES

### Timber

Low value aspen-birch is the largest upland timber type on the area. Aspen bolts or sawlogs are of highest value, but most of this size class has been recently harvested from the south unit. The north unit contains only a few scattered stands of large aspen. Most of this type on both units is in the pulpwood size class and therefore not readily merchantable. It will be of more value 5 to 10 years from now when watershed treatments will be considered.

There is very little commercial jack pine type remaining on the south unit. Most of it has been harvested under present sales which are now terminating. The north unit has a small area containing scattered, large, white and red pine and a few acres of commercial cedar type. These are relatively inaccessible at the present and contain only a small volume of wood.

Individual watersheds contain only a small volume of black spruce pulpwood. Much of this type is in the sapling size class.

Cover type acreages by size classes for national forest lands are shown in Table 3.

### Watershed

There is no direct consumptive use of surface and groundwater resources in the experimental area. The several small swamp watersheds under study discharge into other swamps or into lakes on, or bordering, the experimental area. Cutaway Lake, at the extreme south end of the south unit has one resort on it. All the lakes receive limited use from fishermen.

Table 3. Approximate area by cover type and size classes on national forest lands.

| Cover type | Size class | | | |
|---|---|---|---|---|
| | Saplings | Poles | Cutover | Total |
| | acres | | | |
| Aspen-birch | 65 | 273.5 | 320 | 658.5 |
| Northern hardwoods | | 15 | | 15 |
| Black spruce | 50 | 60 | 10 | 120 |
| Spruce-balsam | | | 10 | 10 |
| Jack pine | 10 | 30 | 120 | 160 |
| Jack pine plantation | 20 | | | 20 |
| Lowland brush | | | | 30 |
| Grass and marsh | | | | 50 |
| GRAND TOTAL | | | | 1063.5 |

Erosion is not a problem on the area except where roads with high banks have been constructed. The banks and shoulders of a newly constructed national forest access road across the west side of the south unit were treated to prevent sloughing during the fall of 1961. Spring snowmelt will determine the effectiveness of the work. It's possible that more stabilization work will be needed on the extremely high fills and deep cuts.

One of the fills of this same road has apparently blocked the drainage of a small swamp which it crosses and there is evidence of tree mortality on one side of the fill. Some cutting will be conducted in this swamp under a present timber sale contract. Additional salvage cutting may be needed in the future.

Several inactive beaver dams are located in the east-central portion of the south unit. These will need to be watched to prevent beavers from building additional dams and flooding research areas.

Minerals

This area is close to, but not within, the Mesabi Iron Range. Mineral rights on the cooperator lands are retained by the owners. However, there is apparently no danger of mining in this area. Peat has negligible value at the present, and the amount on the area is quite small. No gravel deposits have been found within the boundaries.

Recreation

The south unit is subject to more recreation use than the north unit because of the new national forest access road into the general area. However, even this unit receives little use except by hunters during the fall hunting season. The north unit receives very little use because for most of the year it is accessible by 4-wheel drive vehicles only.

Parts of the shore lines of three different lakes are included in the south unit, and the new access road provides access to several other nearby lakes. Development of access sites on or near the area may increase local use. However, with hundreds of lakes in the near vicinity, the need for development on or adjacent to the experimental area is not high. At present, there are no camp or picnic facilities in the vicinity of either unit.

Fire and vandalism have not been problems in the past year, and adequate signs with prevention messages along with special protection of scientific instruments should keep them from becoming problems in the future. Normal recreational use from grouse hunting, deer hunting, and fishing should not conflict with research purposes.

Other uses

No conflicting uses, such as for dams, power sites, grazing, etc. are anticipated in the foreseeable future.

## ACCESSIBILITY

The south unit is located 26 miles north of Grand Rapids. Approximately half of this distance is covered by black-top road and the other half is all-weather gravel road. A new, 3½-mile timber access road built by the Chippewa National Forest passes through the west edge of the south unit. Several experimental watersheds are directly accessible from this road. Additional woods-roads reach into other parts of this unit and some will need improvement to support year-round travel in the future.

North unit watersheds are located 3 to 4 miles north of the south unit. Accessibility to this area is relatively poor. Four-wheel drive units need to be used most of the year. These roads will need repair in the very near future to facilitate travel to present gaging sites.

New roads are not a major need in the units. Any new road construction will probably be limited to access trails to stream gage or well sites. Repairing and rebuilding existing trails are the major needs.

## EXISTING FACILITIES

Three swamp watersheds located on national forest land in the south unit, have been instrumented since the summer of 1960. Instrumentation includes recording and non-recording swamp wells, a weather station, precipitation network, and run-off measuring devices. Two watersheds in the north unit were similarly instrumented in the fall of 1961 after the land was placed under agreement (photos attached).

No other facilities, such as buildings, exist on the area.

## EFFECT ON ADMINISTRATION OF ADJACENT NATIONAL FOREST LANDS

It is anticipated there will be no conflict with the administration of adjacent national forest lands. The present management compartments in this area have been cut or are now being cut, therefore there would normally be no additional timber sales in the area for some time. After a 4 to 7 year calibration period some cutting will no doubt be prescribed for certain watersheds. These sales will be worked out with the district ranger.

Dedication of the Marcell Experimental Forest will need to be taken into account in the Marcell District's Multiple-Use Plan, particularly with regard to future recreational facilities.

## ARRANGEMENTS FOR MANAGEMENT AND PROTECTION

### South Unit

Since this unit is within the protective boundaries of the Chippewa National Forest, the Marcell District Ranger will assume primary responsibility for protection from fire. The project leader in charge of the experimental forest will prepare a basic fire plan for the area in cooperation with the district ranger. It will specify research participation in fire suppression and other pertinent facts as outlined in FSH 4063.22a. This will be revised, as needed, in advance of each major fire season.

Protection from insects, diseases and animals will be primarily the responsibility of the district ranger. However, the research staff should be continually on the watch for active, incipient, or potential outbreaks, and should promptly report their observations to the district ranger.

Planning for improvements such as roads and buildings on national forest land will be the responsibility of research in cooperation with national forest administration. Permanent research facilities will be the responsibility of the Experiment Station while road and trail improvements and construction will be the responsibility of the Chippewa National Forest. Costs of road maintenance and construction will be borne in accordance with the manner in which funds are allocated to the Region and to the Station. Procedures for improvements, and signs, will be followed as outlined in FSH 4063.23 and 4063.24.

Administration of timber sales on Forest Service lands will be handled by the district ranger. The research staff will handle the planning of timber sales and the designation of sale areas. Most sales will be the result of specific planned studies designed to test the effect of various stand treatments on watershed properties such as runoff, ground water recharge or soil moisture. A timber harvest schedule will be prepared so the ranger can schedule timber sales in his annual and periodic work programs. The need for sale area betterment cooperative deposits will be considered in connection with each sale, and where needed will be collected, subject to legal and administrative restrictions in effect. Procedures for handling timber disposal as outlined in FSH 4063.31 will be followed.

Cultural practices on national forest lands such as planting, seeding, etc., will be planned by the research staff with the cooperation of the district ranger. Projects will generally be carried out under the supervision of the district ranger with cooperation from research (see FSH 4063.32).

Present timber sale areas will be rehabilitated with K-V funds collected by the national forest. The district ranger and the research project leader will cooperate in the planning and carrying out of needed projects on these areas.

Improvements, disposal of timber, and cultural practices on county and state lands in this unit will follow the procedures as outlined in the approved Memoranda of Agreement between the experiment station and these agencies.

North Unit

This unit falls within the protective boundaries of the George Washington State Forest and the Minnesota Conservation Department is responsible for fire protection in this area. The research project leader in cooperation with the Minnesota Division of Forestry, will prepare a fire plan for this unit, also. The plan will specify responsibilities of each organization. This will be reviewed annually before each major fire season.

All the land in this area is covered by approved Memoranda of Understanding with the respective owners or administrators, and all improvements and timber sale activities are governed by these agreements (previously cited).

## PUBLIC SENTIMENT

There is a growing awareness, on the part of the general public, of the importance of northern Minnesota's water resources. Conflicting interests, represented by increased demands for more water at downstream metropolitan areas on the Mississippi River and just as vigorous demands for more stable lake levels on the upper Mississippi River reservoirs, have been brought to the attention of the public. Iron mining companies are concerned about future water supplies for iron ore beneficiation plants. Forest managers are questioning what effects forest practices have on streamflow, lake levels, and ground water recharge.

Itasca County, the Minnesota Conservation Department, and private cooperators have indicated their interest by making land available for watershed management research purposes. These cooperators are favorable to the dedication of this area.

## RECOMMENDATION

The proposed experimental forest contains a number of small forested peat swamps which are compact hydrologic units capable of being instrumented for hydrologic research. Basic principles of swamp hydrology need to be devised and studied on these watersheds to provide basic information to forest land managers in northern Minnesota. Ground water wells, precipitation networks, and streamflow stations have been installed on five different swamp watersheds. A study investigating the physical properties of peat soils is now underway. Thus, the area is already scheduled for long-term research activity.

This is also the first such area in this nation to be dedicated to research in the hydrology of forested swamplands.

In view of these facts, and in order to provide a field facility for the investigation of the hydrologic properties of bogs and swamps, including their contribution to streamflow, and groundwater recharge, in northern Minnesota, it is recommended that the area described in this report be established and designated as the "Marcell Experimental Forest".

| | |
|---|---|
| 2/28/62<br>Date | Roger R. Bay<br>Project Leader, Watershed Management Research |
| 3/23/62<br>Date | M. B. Dickinson<br>Director, Lake States Forest Expt. Sta. |
| 3/19/62<br>Date | John Van Brunger<br>Supervisor, Chippewa National Forest |
| 6/5/62<br>Date | Thurman H. Nospur<br>Regional Forester, R-9 |

Order Establishing Marcell Experimental Forest

By virtue of the authority contained in the McSweeney-McNary Act of May 22, 1908 (45 Stat. 699), and the authority vested in me by the Administrative Regulations of the Department of Agriculture (9 AR 300b and c) and Regulation U-4 of the Regulations of the Secretary of Agriculture, I hereby designate as the Marcell Experimental Forest the lands described in the preceeding report by Roger R. Bay, dated February 28, 1962; said lands shall hereafter be administered as an experimental forest, subject to the said regulations and instructions thereunder and the policies and procedures established by the Forest Service.

Date 9-25-62 M M Nelson
Chief

Figure 1. An aerial view of part of the south unit. The small swamp in the center of the picture is an experimental watershed. This watershed, as well as the other watersheds, is surrounded by well-stocked aspen stands.

Figure 2. A recording well installation. The surrounding black spruce stand is typical of the other swamps.

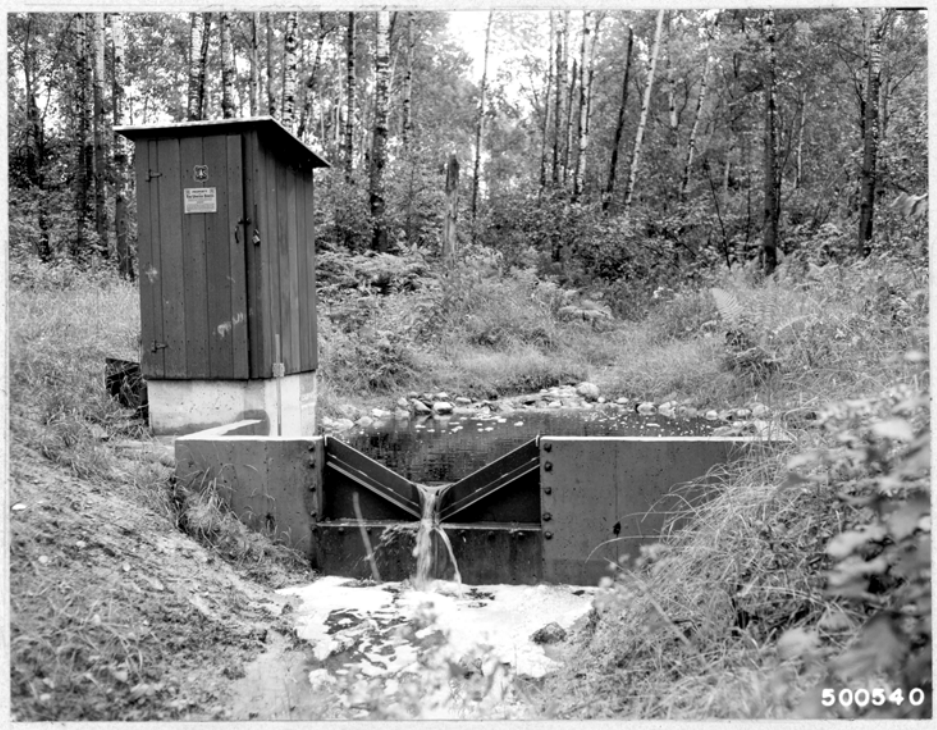
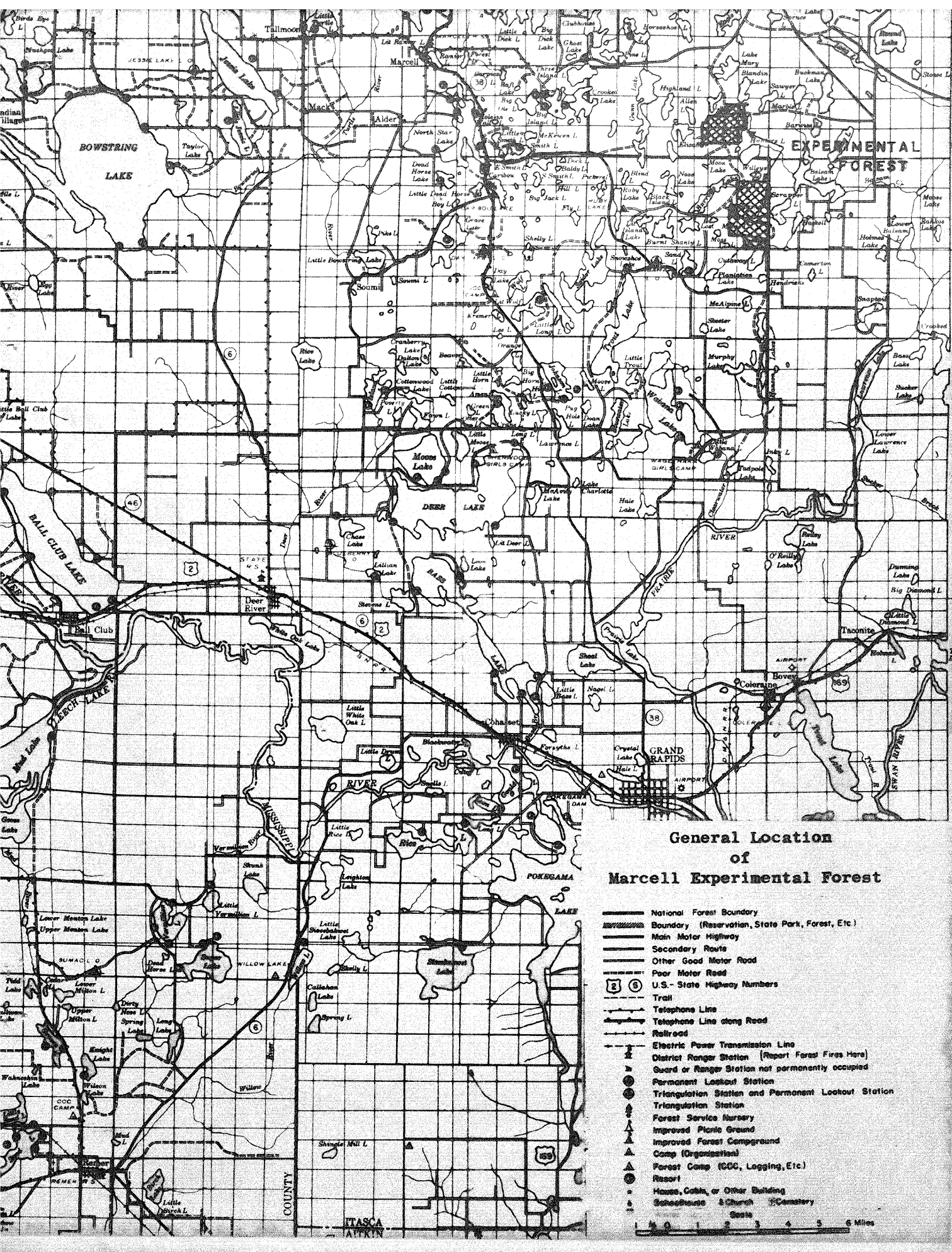
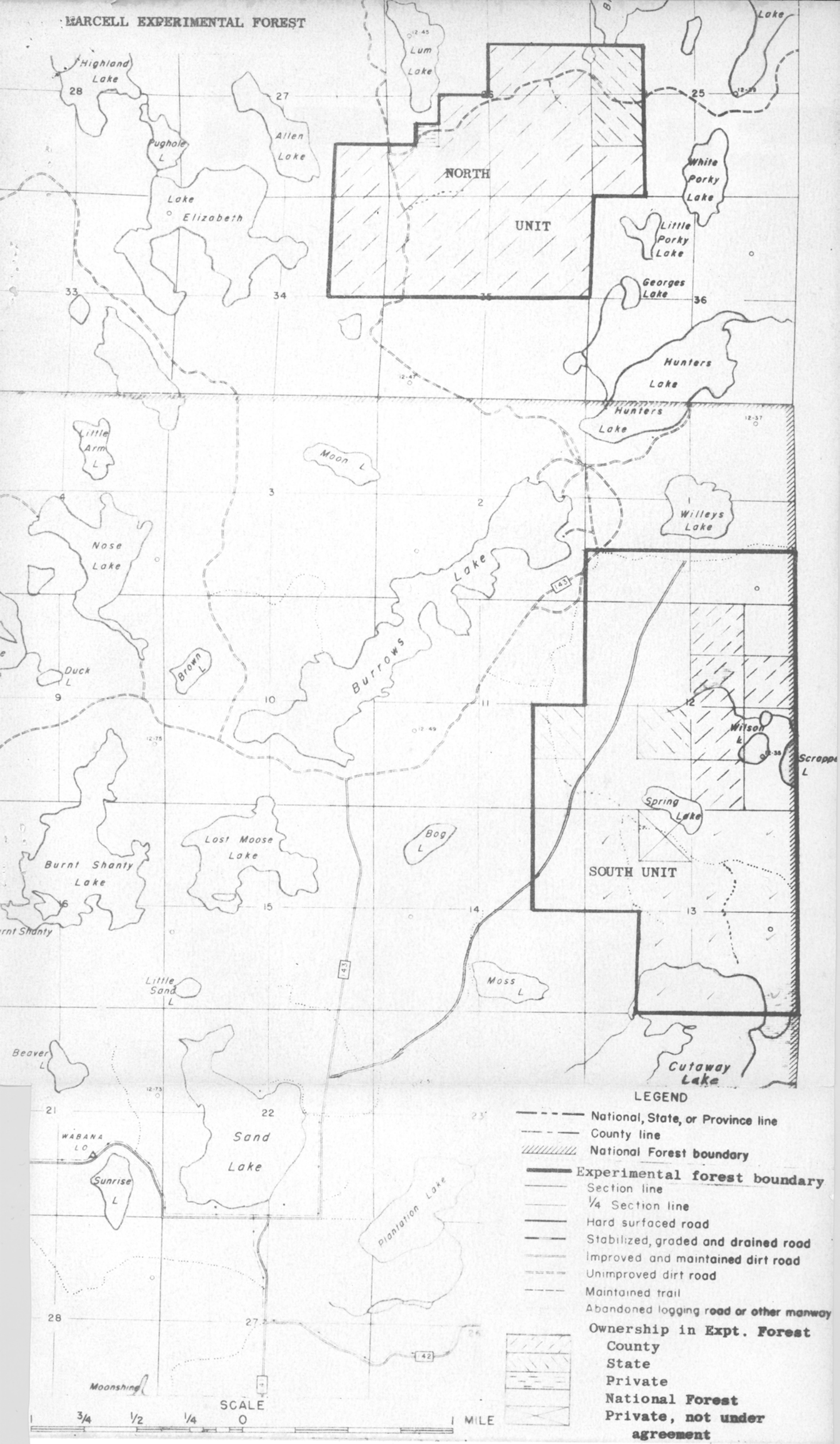



Figure 3. A 120° V-notch weir located at the outlet of an experimental watershed. The swamp is behind the screen of aspen in the background.

Figure 4. A recently constructed type 'H' flume at the outlet of one of the experimental watersheds. This was constructed during a late summer dry period when surface flow had ceased.


General Location
of
Marcell Experimental Forest
National Forest Boundary
Boundary (Reservation, State Park, Forest, Etc.)
Main Motor Highway
Secondary Route
Other Good Motor Road
Poor Motor Road
U.S.- State Highway Numbers
Trail
Telephone Line
Telephone Line along Road
Railroad
Electric Power Transmission Line
District Ranger Station (Report Forest Fires Here)
Guard or Ranger Station not permanently occupied
Permanent Lookout Station
Triangulation Station and Permanent Lookout Station
Triangulation Station
Forest Service Nursery
Improved Picnic Ground
Improved Forest Campground
Camp (Organization)
Forest Camp (CCC, Logging, Etc.)
Resort
House, Cabin, or Other Building
Schoolhouse & Church Cemetery
Scale
6 Miles
EXPERIMENTAL FOREST
BOWSTRING LAKE
BALL CLUB LAKE
DEER LAKE
POKEGAMA LAKE
Marcell
Tallmoon
Alder
Soumi
Deer River
Ball Club
Cohasset
GRAND RAPIDS
Coleraine
Bovey
Taconite
Remer
ITASCA
AITKIN
COUNTY

# MARCELL EXPERIMENTAL FOREST