1953

A Greater Great Northern: Wood, Water, Power, and People, Making Paper in a Completely Integrated Operation, from Forest to Consumer

Great Northern Paper Company

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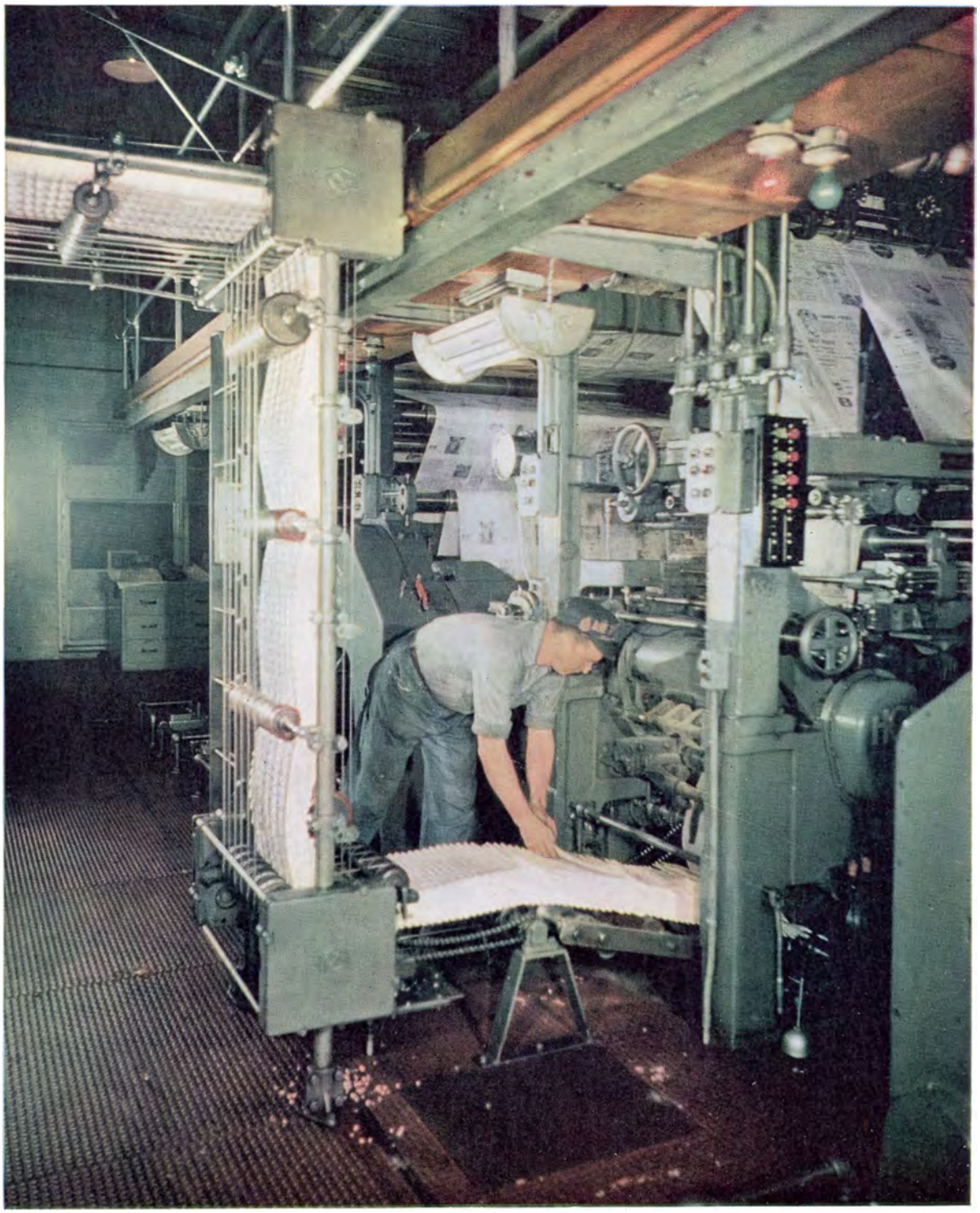
A Greater

GREAT NORTHERN

GREAT NORTHERN PAPER COMPANY



High-speed newspaper press printing on Great Northern paper. This modern press, printing from rolls, can print, assemble and fold more than 50,000 complete newspapers per hour.

A GREATER

GREAT NORTHERN

Wood, water, power, and people, making paper in a completely integrated operation, from forest to consumer.

Mt. Katahdin from Abol Stream

GREAT NORTHERN PAPER COMPANY

Executive and General Offices: Bangor, Maine

Sales Office: 342 Madison Avenue, New York 17, N. Y.

Mills: Millinocket, East Millinocket, and Madison, Maine

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Paper in America

Until the year 1690, when the first paper mill in America was built at Germantown, Pennsylvania, American printers and other users of paper were dependent upon imports from Europe. Paper was at that time made by hand, in relatively small sheets, from rags, flax and similar vegetable fibres.

The American paper industry grew rapidly, and by 1776 was firmly established in Pennsylvania, New York, Massachusetts, Connecticut and Maine. Expansion was encouraged by tariffs on imported paper, and by 1810 there were over two hundred mills in operation. Early in the nineteenth century, the introduction into this country of cylinder and fourdrinier machines which could produce a continuous sheet of paper accelerated production still further. For many years, however, the industry continued to be handicapped by a shortage of raw materials.

Modern Paper Making

The modern pulp and paper industry began with the discovery that wood fibres could be separated and made into a pulp from which paper could be manufactured. The first wood pulp was produced in America in 1855, less than one hundred years ago. In 1952, over 60 per cent of United States production of paper and board was derived from new wood fibre and 33 per cent from re-pulped waste paper, the balance being made up of raw materials such as rags and straw. Based on value of shipments, the manufacture of pulp, paper and paper board is now one of the ten largest industries in the United States. In 1952, over 500 companies, employing approximately 250,000 workers, produced 24.4 million tons of paper and paper board. Twenty-five years ago United States production of paper and paper board amounted to only about 10.5 million tons.

Newsprint

By far the largest single grade of paper consumed in the United States is newsprint. The increasing demand for this commodity has been tremendous. Only world depression and wartime controls have interrupted the steadily rising consumption trend. It is estimated that in the year 1810 about 500 tons of paper were used by United States newspapers. In 1952, United States consumption of newsprint was approximately six million tons.

Until the manufacture of groundwood pulp was introduced into this country in 1867, newspapers used various kinds of paper, although as early as 1820 there was a grade known as "news". However, with the advent of the groundwood process (which produces more pulp from a cord of wood than any other known method) mills were built expressly for the purpose of making paper for use on newspaper presses, and the newsprint industry was born. By 1899, the new industry was well established, and domestic production amounted to 569,212 tons. In that year, the Great Northern Paper Company, the largest producer of newsprint in the United States, was formed.

The purpose of this story is to present, in answer to many requests, information respecting the history, operations, properties and current expansion program of the Great Northern Paper Company.

GREAT NORTHERN PAPER

Largest manufacturer of newsprint in the United States, with

The operations of Great Northern Paper Company are concentrated in the four northern counties of Maine, which constitute one of the world's finest natural locations for large-scale paper mill development, with timber and water-power resources in abundance. The area comprising these counties is bounded on three sides largely by Canada. The upper end of Aroostook County actually lies north of Montreal and Quebec. It contains 17,114 square miles, of which the Great Northern Paper Company owns 3,530 square miles. In this area it operates its three pulp and paper mills and the seven hydro developments which supply the mills with power, and conducts its pulpwood cutting and purchasing activities.

Great Northern's present plants, properties and organization are the result of over fifty years of imaginative planning, and the efforts of thousands of people working together to a common end.

Millinocket Mill

The Millinocket Mill is located on the West Branch of the Penobscot River about 85 miles north of Bangor.

It is a completely integrated plant, producing all its own requirements of pulp, as well as sulphite pulp for the other two mills. Wood handling and preparing equipment includes two separate barking drum installations, hydraulic auxiliary barkers, chippers and chip screens, and piling facilities. The groundwood mill contains 30 Great Northern hydraulic grinders driven by water wheels and electric motors, and is equipped with the most up-to-date type of screening equipment. The sulphite mill has seven digesters and has been completely modernized, as to both pulp production and screening equipment. The paper mill has ten fourdrinier newsprint machines, six trimming 138 inches each, and four 146 inches each. It also has one cylinder machine, trimming 76 inches, producing newsprint roll wrappers and similar papers. Steam is provided by a coal-burning stoker-fired boiler plant. The mill has a water filtration plant, the usual finishing room facilities, and a completely equipped machine shop.

Capacity is approximately 900 tons of newsprint per day.

East Millinocket Mill

The East Millinocket Mill is also located on the West Branch of the Penobscot River about ten miles below Millinocket.

Its wood preparing and handling facilities include both drum and hydraulic barkers, and pulpwood stackers. The grinder room is equipped with 12 Great Northern hydraulic grinders, driven by water wheels and electric motors. A commercial-scale pilot plant for producing hardwood chemi-groundwood pulp is also in operation, with two pressure pretreating chambers and one Great Northern grinder. Sulphite pulp is supplied from the Millinocket Mill. The paper mill has four fourdrinier newsprint machines, each trimming 146 inches. Its finishing room is equipped with cutters for sheet paper. An oil-burning boiler plant provides steam, and the mill has a fully equipped machine shop.

COMPANY

a record of continuous production since 1900

Capacity is approximately 320 tons of newsprint per day. The East Millinocket Mill is the site of the company's current expansion program (page 38).

Madison Mill

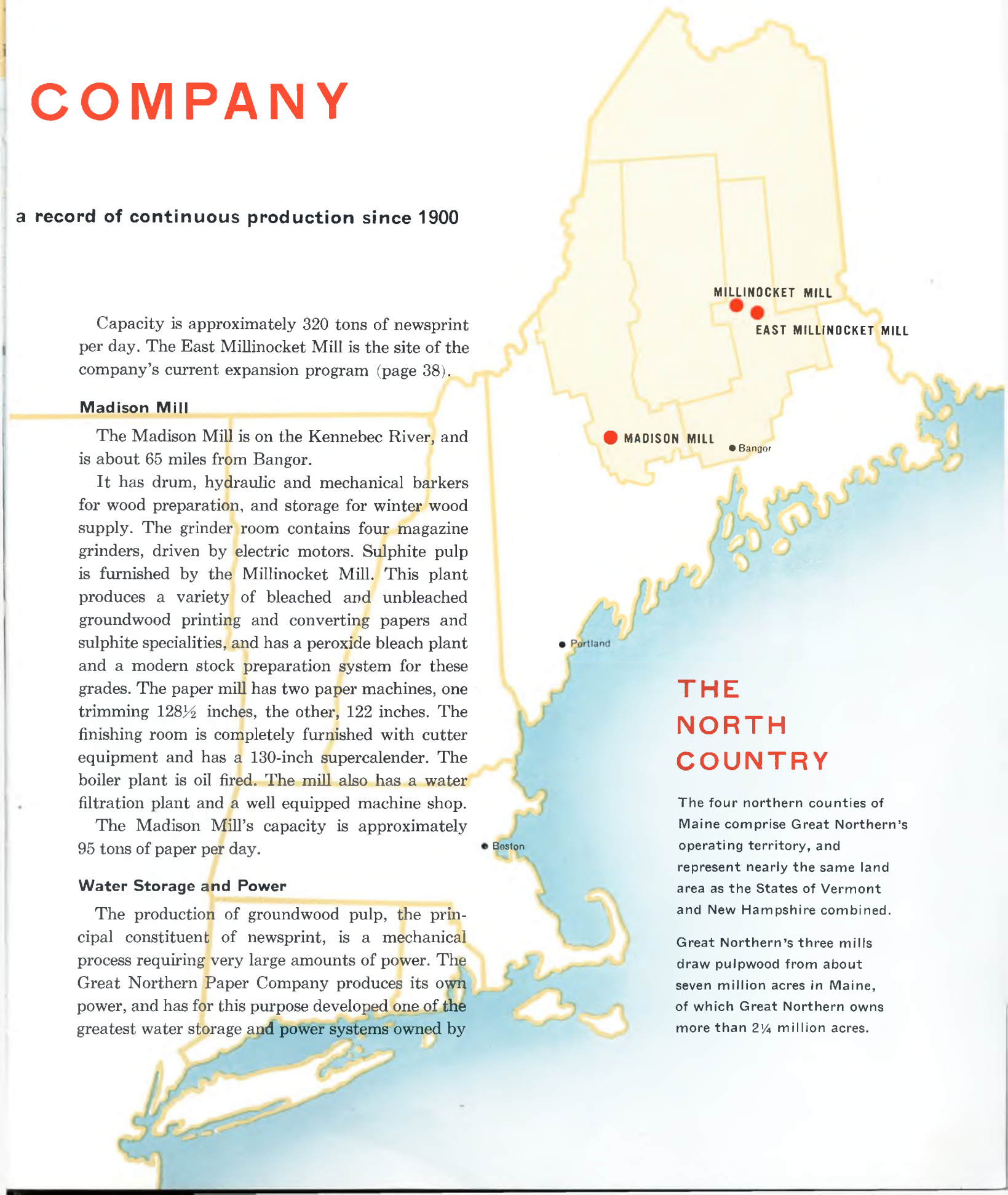
The Madison Mill is on the Kennebec River, and is about 65 miles from Bangor.

It has drum, hydraulic and mechanical barkers for wood preparation, and storage for winter wood supply. The grinder room contains four magazine grinders, driven by electric motors. Sulphite pulp is furnished by the Millinocket Mill. This plant produces a variety of bleached and unbleached groundwood printing and converting papers and sulphite specialities, and has a peroxide bleach plant and a modern stock preparation system for these grades. The paper mill has two paper machines, one trimming 128½ inches, the other, 122 inches. The finishing room is completely furnished with cutter equipment and has a 130-inch supercalender. The boiler plant is oil fired. The mill also has a water filtration plant and a well equipped machine shop.

The Madison Mill's capacity is approximately 95 tons of paper per day.

Water Storage and Power

The production of groundwood pulp, the principal constituent of newsprint, is a mechanical process requiring very large amounts of power. The Great Northern Paper Company produces its own power, and has for this purpose developed one of the greatest water storage and power systems owned by



THE NORTH COUNTRY

The four northern counties of Maine comprise Great Northern's operating territory, and represent nearly the same land area as the States of Vermont and New Hampshire combined.

Great Northern's three mills draw pulpwood from about seven million acres in Maine, of which Great Northern owns more than 2¼ million acres.

any North American paper company. Fifteen primary and four permanent main reservoirs on the West Branch back up the six Penobscot power developments (total rated capacity 134,700 hp) which serve the Millinocket and East Millinocket Mills. The company shares with others the water storage on the Kennebec River protecting the Anson station (rated 7,500 hp) which furnishes power to the Madison Mill. Steam and diesel auxiliary power installations at the mills add protection to the system.

Timberlands

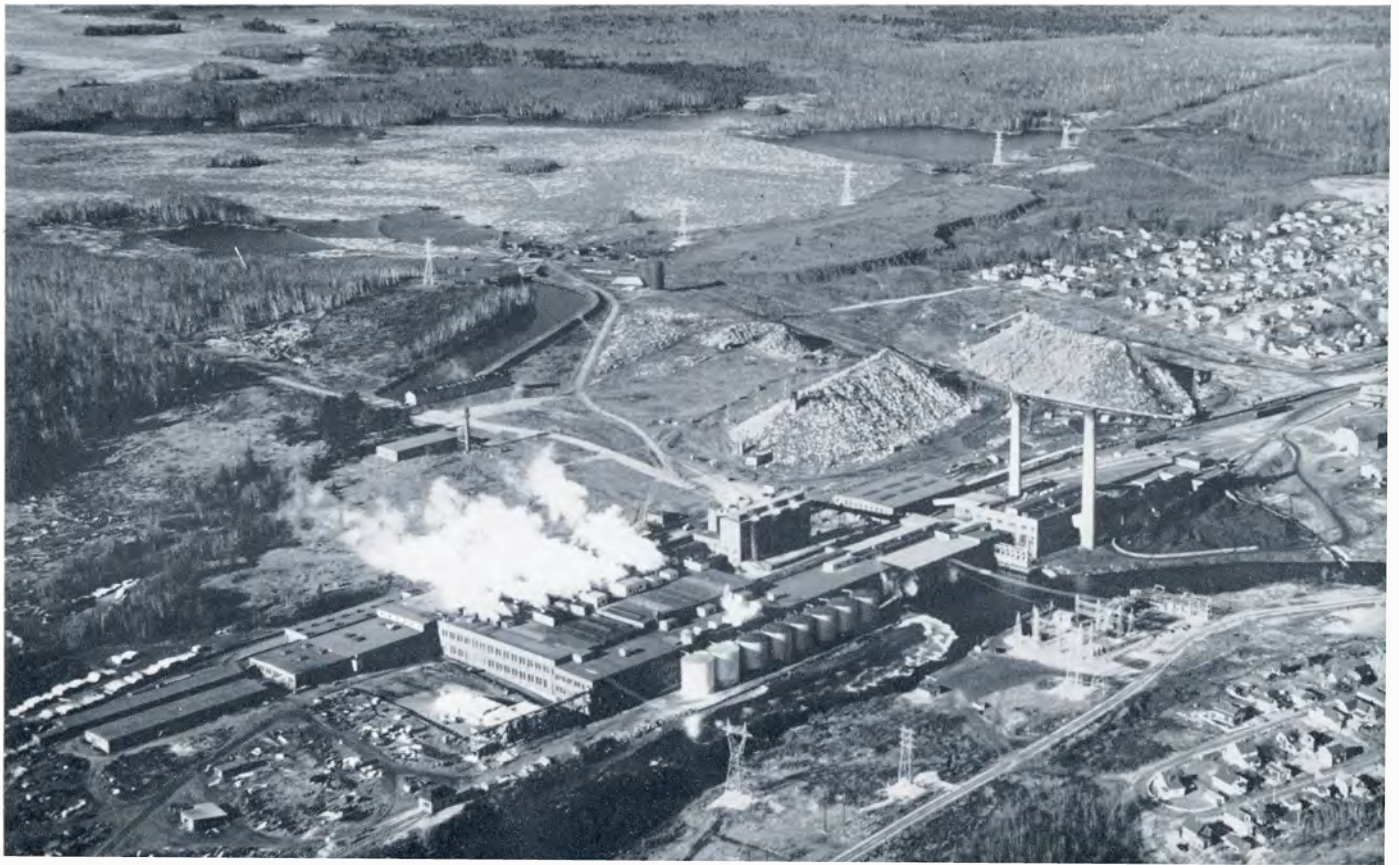
Great Northern owns 2,258,829 acres of timberland, all in the State of Maine, and practically all within 100 airline miles of Millinocket. These lands lie in the upper watersheds of the Penobscot, St. John, Allagash, Aroostook and Kennebec Rivers, and along the Bangor and Aroostook Railroad. They have been opened up by well-constructed roads for access to operations and for fire protection.

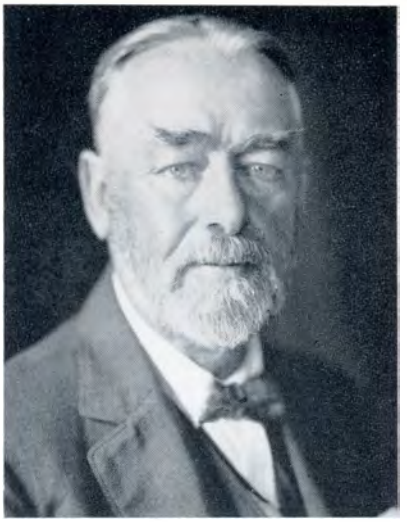
Organization

Under the President, the operation of the company is directed by four Vice Presidents in charge of Woodlands, Engineering and Research, Manufacturing, and Sales, respectively. The company employs about 2,000 people in manufacturing operations, exclusive of supervisory, administrative, technical and clerical personnel. Between 2,000 and 3,000 men, on the average, are employed in pulpwood operations with seasonal fluctuations. Mill workers and certain office and Woodlands Department employees are represented by eight AFL unions, with whom the company has maintained satisfactory relations for nearly half a century. Group Life Insurance, Sickness and Hospitalization and Retirement Plans are in effect for the benefit of the company's personnel.

Community Relations

The towns of Millinocket and East Millinocket grew up with the construction of the company's mills, which constitute their only important industry. The company's mill is also the major industry in Madison. The population of these communities is 5,900, 1,400, and 3,600, respectively. Cooperative effort has always been kept foremost in community relations, and the results are evident in the excellent facilities for education, fire protection, sports and recreation in these three towns.





Fabian Bachrach

Garret Schenck,
Founder and first President.

GROWTH OF A GREAT ENTERPRISE

Through more than 50 years, Great Northern has expanded and modernized, growing in size and stature to become one of America's major paper manufacturers.

This company came into being in 1899, through the efforts of Garret Schenck, one of the country's most successful paper mill builders and operators.

The original company, formed in 1897, was known as the Northern Development Company, but the name was changed to Great Northern Paper Company early in 1899, when construction of the eight-machine mill at Millinocket was started.

Site of the Millinocket Mill was an isolated farm, on the West Branch of the Penobscot River, deep in the northern Maine woods. At this point, a 110-foot drop in the river offered abundant water power, and the untouched spruce forest, extending for miles in all directions, provided vast supplies of pulpwood. The unusual possibilities of this site had been recognized by Charles Mullen, a Maine engineer and lumberman, who interested Mr. Schenck in its development.

In 1900, the Millinocket Mill began producing 240 tons of newsprint per day on eight paper machines. Today, modernized and expanded to 10 machines, this mill produces nearly 900 tons per day, and also makes sulphite pulp for the Madison and East Millinocket Mills. The woodpiles contain approximately 80,000 cords of pulpwood for winter use. In the background is Ferguson Pond, used for wood storage. The transmission line which brings power from the McKay Station can be seen coming in from the upper right.

Original Mills

To build the Millinocket Mill, thousands of tons of materials and equipment had to be transported into the Maine wilderness. Erection of buildings and installation of machinery, on so large a scale in so remote a location, was a tremendous undertaking for those times.

Design and construction were carried out under the direction of Hardy S. Ferguson, who later became one of the foremost paper mill engineers in the country.

During construction of the Millinocket Mill, the company acquired a mill at Madison, Maine, on the Kennebec River. This mill was quickly put in shape

Beginnings of Millinocket. Katahdin Avenue (left) and Penobscot Avenue (right) in 1899, shortly after construction of the Millinocket Mill was started.

to produce 55 tons of newsprint per day, and was the first plant actually to be operated by the Great Northern Paper Company.

On the night of November 1st, 1900, Mr. Schenck officially started up the Millinocket Mill by closing the switch that put the wood room machinery into operation. Eight days later, the mill produced its first roll of newsprint. Then, and for many years afterward, this was the largest newsprint mill in the world. Its original capacity was 240 tons of newsprint per day.

Fostered by the growing use of newsprint, the new company expanded rapidly. In 1907, it built another new mill, designed for four paper machines, at East Millinocket, Maine, ten miles below the Millinocket Mill. Construction included a power development to utilize a 25-foot fall in the river. A second power dam, to develop a 50-foot drop in the river was built at the same time at Dolby, about a mile upstream, and a grinder room and hydro-electric station were constructed at that point. The East Millinocket Mill began operation in August 1907, with three machines producing a total of 120 tons of newsprint per day. The fourth machine was added in 1913.

At the same time, production at the Millinocket Mill was being stepped up, and by 1913 the company's total capacity was 570 tons per day.

Twenty Years of Expansion

In 1914, the machine room at Millinocket was enlarged, and the historic ninth machine was installed. This was the first paper machine designed to run at a speed of 1,000 feet per minute. In 1916, a similar machine, No. 10, was installed, bringing the production of the Millinocket Mill to 430 tons per day. The high speed at which these machines were operated was made possible by the air devices for handling paper invented and worked out in the company's mills by C. Elmer Pope, a Great Northern engineer.

Also in 1916, to provide for its rapidly growing need for water storage, the company built the Ripogenus Dam at Ripogenus Gorge on the Penobscot. At that time, this was the largest storage dam ever built by a private corporation for its own use.

In 1923, the Madison grinder room was modernized, and the Anson hydro-electric station was built to provide power for that mill.

In 1926 and 1927, two of the original Millinocket

Katahdin and Penobscot Avenues as they look today. Penobscot Avenue is the principal business street of Millinocket. Population of the town is 5,900.

paper machines, Nos. 7 and 8, were replaced with higher speed equipment. Coupled with improvements to the remaining machines, this brought the capacity at Millinocket to 650 tons per day. By modernization, the East Millinocket machines had been made capable of turning out about 300 tons per day and the Madison Mill about 95 tons. Combined capacity of the three mills was over 1,000 tons per day.

Developments in the Thirties

In 1930, the Madison Mill was converted to the manufacture of specialty papers. The old 2-foot grinders at both Millinocket and East Millinocket were replaced by 4-foot grinders of a new type developed by the company, and the Dolby Groundwood Mill was converted into a hydro-electric plant. In 1934 and 1935, a new power station to operate at 28-foot head was built at the existing dam at North Twin Lake, five miles above Millinocket. Starting in 1936, several concrete storage dams were constructed on the West Branch of the Penobscot, replacing earlier structures. The Mattaceunk hydro-electric station was put into service in 1939, with two generating units in operation.

War and Post War

In 1940, the original No. 1 machine at Millinocket was replaced with modern equipment; and in 1941, Nos. 2 and 3 were replaced. A third generating unit was added at Mattaceunk in 1940, and a fourth in 1941. The modernization program was interrupted by World War II, but was resumed as soon as materials and machinery became readily available. In 1949, No. 4 and No. 5 machines were replaced. The Korean conflict, which again restricted materials, delayed replacement of No. 6 until 1952.

In the spring of 1953, the first generating unit at the new McKay hydro-electric station, constructed at the Ripogenus Dam, began operation, and the second generating unit followed two months later.

As this book goes to press, the total capacity of the three mills exceeds 1,300 tons of paper per day, of which over 90 per cent is newsprint. This capacity is protected by an adequate timberland reserve, all in the State of Maine, and by company-owned hydro power developments, which are backed up by ample water storage and auxiliary power generating equipment.

The company is one of the largest enterprises in the State of Maine.

NATURAL RESOURCES IN

A newsprint company is as strong as its wood and water resources.

Here is unusual strength, represented by a natural combination of both

in great abundance, in a compact geographical area.

Manufacture of pulp and paper is a natural resource industry, depending upon wood, the product of the forest, for its existence. All pulp and paper mills also require very large supplies of water, another product of nature, and this is especially true of those producing newsprint. While a few newsprint mills depend upon fuel for generating power and require water only for process use, the great majority are located close to, and depend upon, low-cost water power, because of the tremendous amount of power required per unit of product.

It is no accident that Great Northern has both wood and water in abundance, for its process and power needs. The foresight of its founders and the policies of its management have provided it with adequate acreage of growing woodland, which has been operated so as to protect not only future wood requirements, but also the flow of water into its complete and well regulated storage system. The forest is the greatest reservoir of all.

Famous Sporting Territory

The section of the State of Maine covered by the four northern counties is almost entirely forested, except for the farming country along the highways in the south and east. These four counties, Aroostook, Penobscot, Piscataquis and Somerset, are about equal in area to the States of New Hampshire and Vermont combined. The northern and western part of this area represents perhaps the greatest single block of timber reserves in the United States. For years the Mecca of thousands of hunters, fishermen and campers, this region is one of the most beautiful in the East, dominated by Mt. Katahdin the highest peak in Maine. Hardly a square mile of this country does not have a pond, lake, brook or river. Many of these still retain the ancient Indian names, like Ambajejus, Caucomgomoc, Munsungan, Pockwockamus, Umbazookskus and Wassataquoick.

Great Northern's timberland holdings in this area, amounting to 2,258,829 acres, are equal to nearly 11 per cent of the total area of the state.

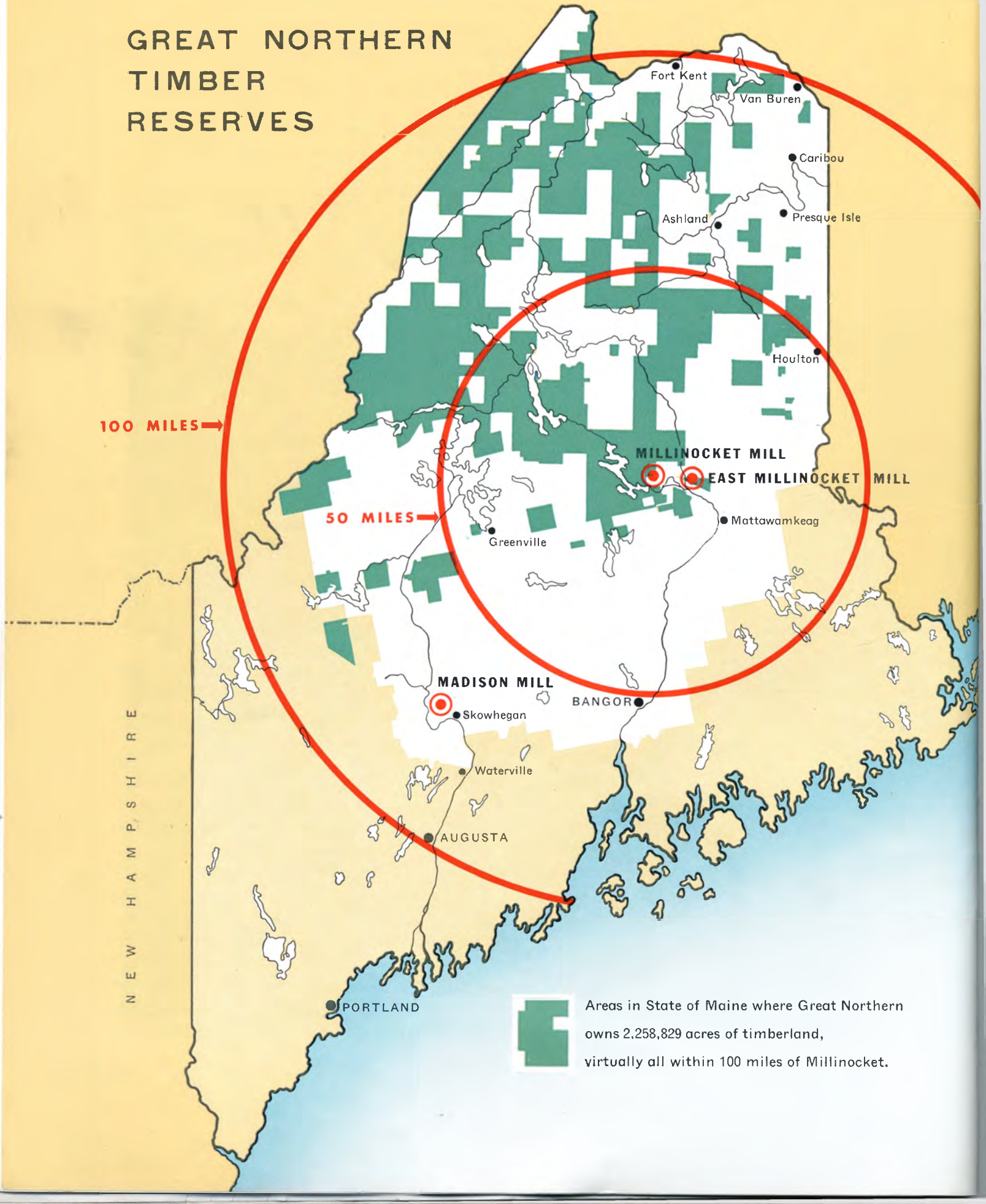
Forest Management

The company cuts pulpwood on a sustained yield basis, taking less from the forest than grows each year. It normally draws only part of its wood requirements from its own lands, which are carefully managed under good forestry practices. The remainder it obtains either through cutting on lands owned by others, under stumpage contracts, or through the purchase of pulpwood from dealers and small operators. In addition to drawing wood from its own lands, the company thus makes a market for pulpwood from about 5,000,000 acres of privately-owned timberlands lying in the same general area.

The wild lands in this large wood-growing territory are in general well managed by their owners.

PERPETUITY

River of wood. Water provides cheap transportation for much of the company's pulpwood. Owing to the unique water conveyor system at the Millinocket Mill, pulpwood put into streams at the headwaters of the Penobscot River can be transported to the mill, put through the barking plant, and delivered to the grinder, without mechanical handling.


GREAT NORTHERN
TIMBER
RESERVES
Fort Kent
Van Buren
Caribou
Ashland
Presque Isle
Houlton
100 MILES
MILLINOCKET MILL
EAST MILLINOCKET MILL
50 MILES
Mattawamkeag
Greenville
MADISON MILL
BANGOR
Skowhegan
Waterville
AUGUSTA
NEW HAMPSHIRE
PORTLAND
Areas in State of Maine where Great Northern
owns 2,258,829 acres of timberland,
virtually all within 100 miles of Millinocket.

Winter pulpwood storage at Millinocket. Since wood cannot be moved by water in winter, the mill accumulates large piles of barked wood during the late summer and fall for winter use. This pile is about 90 feet high and contains nearly 40,000 cords.

Great Northern makes its foresters available to educate and assist smaller farm woodlot owners in proper cutting practices. Considering only the softwood species which have been used hitherto in Great Northern production, the reserves represented in the timberlands from which it obtains pulpwood are regarded as adequate. These lands also grow hardwoods. Since Great Northern has developed hardwood pulp suitable for use in newsprint, the potential timber resources in its general operating region have been tremendously enlarged.

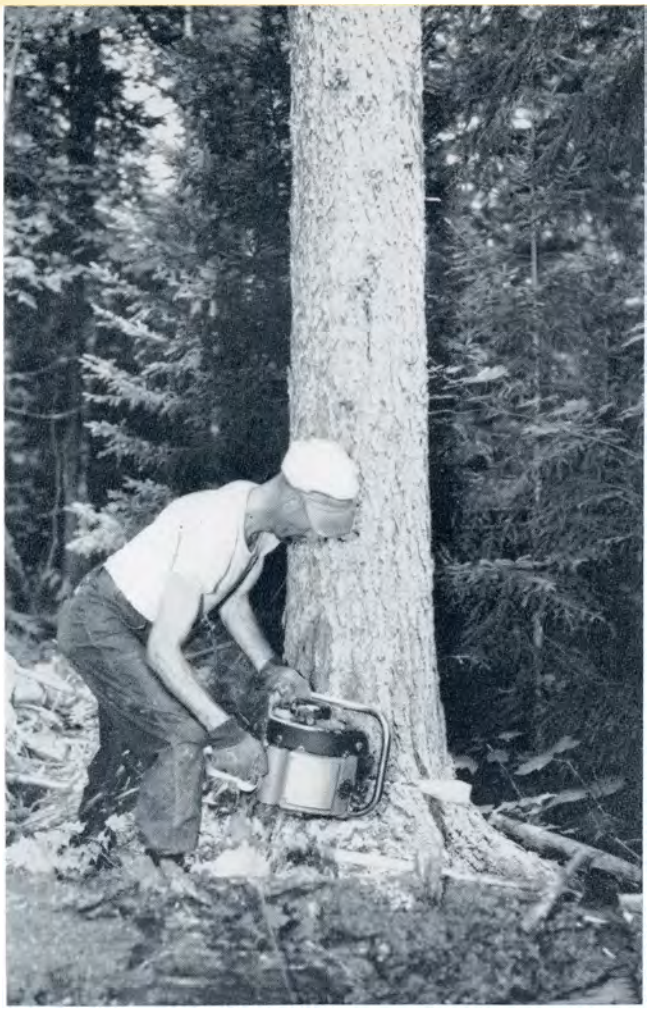
Conservation

Great Northern has been a pioneer and leader in forest conservation and fire protection. When it began operations at the turn of the century, it called upon the Federal Bureau of Forestry (predecessor of the United States Forest Service) to survey its timberlands and recommend procedures that would follow good forestry practice. Their report, published in 1904, has ever since been the company's guide in the management of its lands.

In 1909, timberland owners of the state, including the company, sponsored legislation creating the Maine Forestry District, which is responsible for protection of the forests of the state against fire. This was one of the earliest moves to combat this danger to the forest, and has resulted in one of the most efficient organizations of the kind in the United States. In addition to benefiting from this protection, the company maintains its own fire-fighting organization, with equipment located at strategic points in the state, and its foresters supplement the work of the state in detecting disease and insect infestations.

Water

The other great necessary natural resource, water, is abundant in this area in which Great Northern operates. The major portion of the pulpwood used by the mills is water-borne at some stage of its journey. Water drives the turbines that turn the grinders and generators, enters into the processes of making pulp and paper, and provides fire protection. The company has taken full advantage of its water resources. Its developments for water storage and power are described in the chapter on power (page 20).



First operation in making newsprint. Power saws, such as the chain saw used by this woodsman have practically replaced the hand saw in the woods.

GETTING THE

To cut and purcha

is an operation requiring a traine

North and west of Millinocket are the wild lands of Maine, millions of acres of timberland in which lies a network of streams, rivers and lakes. From this wilderness comes the greater part of Great Northern's wood.

Early Logging Methods

For nearly twenty years after the company started operations, pulpwood was cut and delivered to the mills in tree-length logs, all by way of river drives. Cutting operations were carried on only during the late fall and winter months, since woods roads were practically impassable for transporting supplies until the ground was frozen. Men walked long distances to get to the camps, and most of them stayed in the woods for months on end.

Camps were built of unpeeled logs, roofed with roughly split shakes or tarred paper. The typical woods camp was a long structure, with the bunk house or sleeping quarters in one end, the men sleeping in two-tiered double bunks ranged along the walls. The cook-shack was in the other end. The space between, roofed but otherwise open, was known as the dingle and was used for storage. Wood-burning stoves were used for heating and cooking. There was no refrigeration. A nearby hovel housed the horses, the only power available in the woods in those days.

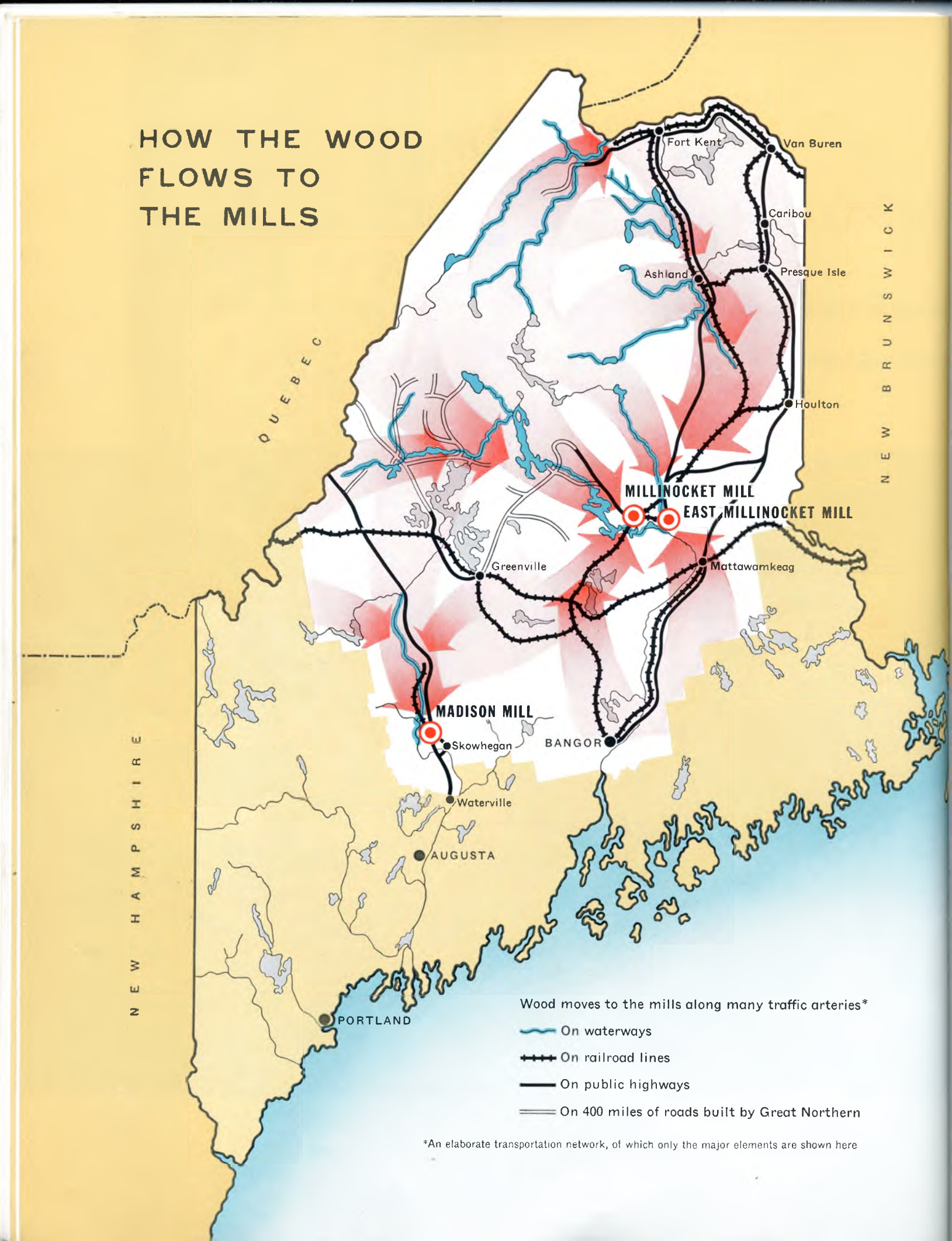
In 1910, the company began to build its road system, which is still being expanded. The first roads were built from rail or water transportation points to depots which served as storage and distribution centers for supplies for operations in the area. As good access roads were built from these depots into the woodlands, and better means of transportation became available, the character of the woods operations changed.

Towing a boom of pulpwood on Chesuncook Lake. To get the wood across a large lake, it is collected in log booms as it comes out of the river into the lake, and is towed by diesel tug to the dam at its outlet. There it is released again into the river to continue its trip to the mill. This boom contains about 4,000 cords.

WOOD TO THE MILLS

more than half a million cords of wood every year, and transport it to the mills,

varied, and highly mechanized organization.


HOW THE WOOD FLOWS TO THE MILLS
Fort Kent
Van Buren
Caribou
Ashland
Presque Isle
Houlton
QUEBEC
NEW BRUNSWICK
MILLINOCKET MILL
EAST MILLINOCKET MILL
Greenville
Mattawamkeag
MADISON MILL
Skowhegan
BANGOR
Waterville
AUGUSTA
NEW HAMPSHIRE
PORTLAND
Wood moves to the mills along many traffic arteries*
On waterways
On railroad lines
On public highways
On 400 miles of roads built by Great Northern
*An elaborate transportation network, of which only the major elements are shown here

Modern camps for woodsmen are a far cry from the log buildings of 20 years ago. Here is a typical Great Northern camp today. The buildings are portable, and are equipped with electric lights, shower baths, refrigerators. Left to right: scaler's camp, cook shack, bunk house, repair shed and office.

Modern Methods

Today's camp is a group of portable buildings, insulated, well ventilated, light and clean. Electric lights are provided by portable power plants. There is usually hot and cold running water. Men sleep in two-tiered single steel bunks. Food supplies are under refrigeration. Gas is commonly used for cooking, and oil for heat. Most camps can be reached by automobile roads, making it possible to carry on cutting operations during the greater part of the year. Trucks and tractors have almost entirely replaced horses.

A pulpwood operation starts with selection of the cutting area and location of camp sites. This is done by trained foresters, following the policies established by the management. Hauling roads are laid out, access roads are built, camp buildings are erected, and a cook and his helpers are installed. The crew is then assembled, and the cutting is started. Trees are cut with future growth always in mind, and care is taken to preserve all possible young stand. The tree, when felled, is trimmed of limbs. In some cases, this log is sawed into four-foot lengths where it lies, and the pulpwood is stacked in small individual piles. This is known as stump cutting. In other cases, the logs are yarded by horses or by tractor to a cleared space beside a bull-dozed road, and are there sawed up and made into large piles. Scalers measure the wood and credit the cutters with the amounts they produce.

In the long-log days, the axe was the principal cutting tool used. When the change was made to four-foot wood, felling and cutting-up operations were for many years performed by hand, with buck-saws or cross-cut saws. Today, the saw has been motorized, and practically all of the company's pulpwood is cut with light chain saws, driven by small gasoline engines. These chain saws are usually the property of the woodsmen. A financing plan offered by the company makes them easy to buy.

Transporting Pulpwood

The movement of pulpwood out of the forest is almost entirely a winter operation. During January

River drivers do a large part of their work from the bateau, which is handled with oars or a pole. For many years, this flat-bottomed, safe boat has been their mainstay, permitting them to reach wood that is stranded on ledges or sand-bars.

and February, ice and hard-packed snow convert roughly bulldozed roads into excellent hauling surfaces. In this short season, more than half a million cords of pulpwood (rough measurement) must be moved from operations scattered over the entire northern part of Maine to highways and rail lines, or to drivable streams. The type of transportation used depends upon conditions. Horses or small tractors may be used to haul from small operations, or to haul the scattered wood from larger cuttings. Trucks are used for longer hauls. Light tractors bring together sled-loads which are made up into tremendous trains for hauling by heavy tractors. By the early part of March, by one means or another, all the wood must be moved and piled along the bank of a stream, along a highway, on the ice of a lake, or delivered at a railhead.

Wood loaded on cars goes at once to the mills, where it is used immediately or unloaded into water storage, at points where current keeps the water open. At Millinocket, two hydraulic dumpers tip specially-designed pulpwood cars bodily to discharge their loads, and similar dumpers are provided for unloading trucks.

However, the bulk of the wood cut by the company is left along the waterways during the winter, ready for the spring drives. When the spring run-off starts, wood that has been landed on the ice of ponds and lakes begins to move. Piles on the banks of streams are pushed into the water by bulldozers. Water is released from small dams, some permanent, some built for a specific operation only, to flush the logs down the streams to the main rivers. The river men follow along, breaking jams and "taking the

rear," that is, putting back into the water the sticks left stranded by the receding current.

On the West Branch, the wood must pass through three large lakes on its way to the mills. At these points, it is collected in booms of long logs chained together end to end. These booms surround masses of floating pulpwood representing as much as 4,000 cords, and are towed by diesel tugs to the dam at the outlet of the lake, whence they are sluiced to the river below.

The West Branch drive is delivered directly into the mill holding-booms. Wood from the drives on the more northerly rivers is taken out on conveyors and loaded on cars for rail movement to the mill unloading points.

While the operated wood has been moving in from the deep forest, the purchased wood, bought by the company's buyers from hundreds of farm lots and small operations, is also being brought out to the highways and railroads.

Woods Organization

Operation of the company's Woodlands Department is a business in itself. It involves the purchasing and distribution to remote locations of immense quantities of supplies; the construction of roads, dams, telephone lines, bridges and buildings; and the operation and maintenance of a large fleet of motor vehicles, a radio communications system and a number of towboats. A staff of trained foresters estimates timber stands, lays out operations, measures wood and watches continually for insect damage and poor cutting practices. Central repair shops work steadily to keep the operating and fire fighting equipment in shape. Forest patrols keep unceasing watch during the fire season. It is an operation that runs all through the year, and before the last of one year's cut is delivered, the saws of the woodsmen are already busy with the next year's wood.

(Above) Special pulpwood cars can be dumped through the swinging side in five minutes. These cars, and the hydraulic tilting device, were designed jointly by the engineers of Great Northern and the Bangor and Aroostook Railroad.

(Below) Unloading truck wood in the easy way. The truck is backed on to the platform, is chained down, and five cords of wood are dumped in no time.

POWER TO MAKE PAPER

Paper making is one of the great power-using industries. It takes as much power to run this company's mills as it takes to supply a city of 200,000 people, including their industrial requirements.

Up to 1900, paper mills were built at water power sites, and were sized to the amount of power available at their immediate location. If groundwood pulp was produced, grinders were driven directly from water wheels, and power for process purposes was distributed by mechanical drives from line-shafts.

While in the original installation at the Millinocket Mill all the grinders were driven directly by water wheels, this was the first large paper mill to be provided with a complete electrical distribution system for process power load. The East Millinocket plant was similarly designed and equipped.

As production was increased, other water powers on the West Branch above and below Millinocket were developed as hydro-electric stations, water storage was enlarged, and part of the grinder equipment was electrified at both of these Penobscot River mills. The Madison Mill was completely electrified, a hydro-electric station taking the place of the original direct-connected development.

Water Storage

The entire water storage system on the West Branch of the Penobscot is owned and operated by the Great Northern Paper Company, and benefits all users of water on the river, in addition to providing excellent flood control. Primary storage dams are maintained on all important tributaries, and there are four main reservoirs: Canada Falls, Seboomook, Ripogenus, and North Twin. Total storage capacity amounts to about 57 billion cubic feet, enough to supply the entire water requirements of the City of New York for more than a year. This includes storage from an auxiliary reservoir, Millinocket Lake, with capacity of approximately two

Ripogenus Dam and McKay Station. This dam impounds 30 billion cubic feet of water in Ripogenus and Chesuncook Lakes. The power station takes water from the dam through a 4,100-foot pressure tunnel.

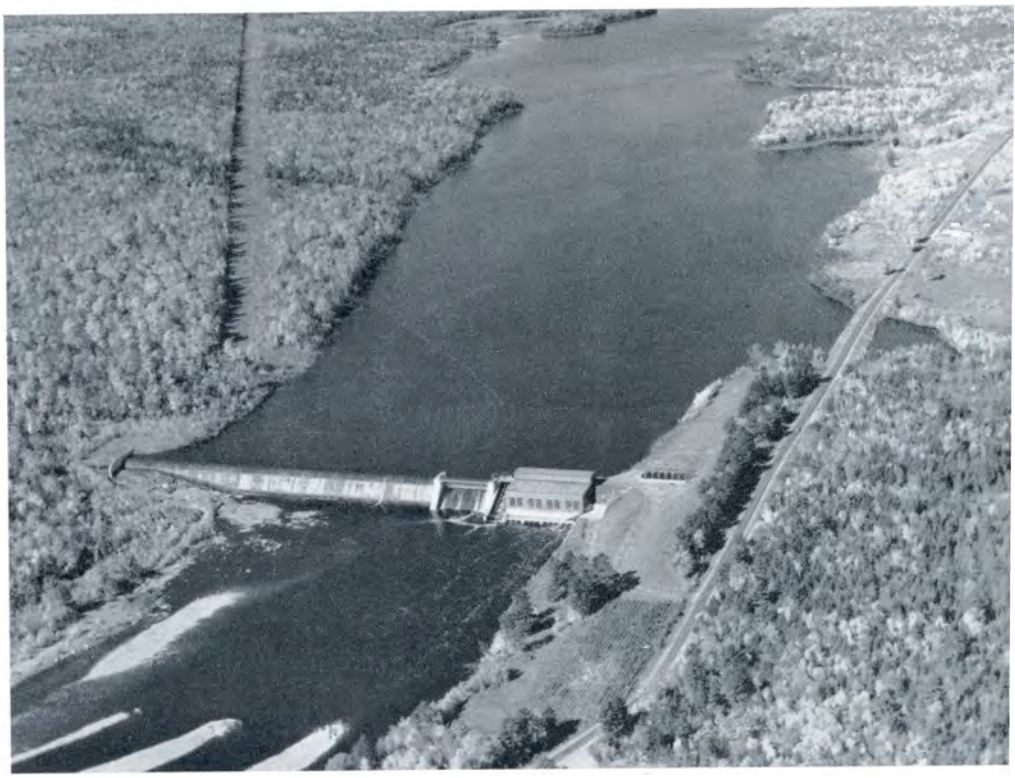
TYPICAL POWE
WATE

(Left) Seboomook Dam, near the headwaters of the West Branch of the Penobscot River, stores nearly five billion cubic feet of water for log driving and power purposes. This concrete dam was built in 1937.

(Below) North Twin hydro-electric station, four miles above Millinocket. The storage dam impounds 15 billion cubic feet of water in four lakes. The station was built at the existing dam in 1934. It is rated at 9,350 hp.

AND
STORAGE DAMS

(Right) Mattaceunk hydro-electric station, 20 miles below Millinocket on the Penobscot, began operation in 1939. This station, rated 24,300 hp, is connected to the mills by a 33,000-volt line.



(Below) Dolby hydro-electric station, originally a pulp mill, was converted to electric power generation in 1930, and is rated at 18,450 hp. Dolby Pond can store 100,000 cords of pulpwood for the East Millinocket Mill, two miles downstream.

billion cubic feet, which is available to the West Branch system through a pumping plant. The flow from the East Branch of the Penobscot River provides additional water for the Mattaceunk Station.

Seven Developed Water Powers

Power is developed by the company at six points on the Penobscot, all within thirty-five miles of Millinocket:

McKay Station: Rated 30,200 hp. Two hydro-electric units installed, with space for a third. Head, 184 feet.

North Twin Station: Rated 9,350 hp. Three hydro-electric units. Head, 28 feet.

Millinocket Mill: Rated 42,500 hp. Eight units — two hydro-electric, and six direct-connected to pulp grinders. Head, 110 feet.

Dolby Station: Rated 18,450 hp. Eight hydro-electric units. Head, 50 feet.

East Millinocket Mill: Rated 9,900 hp. Six units, direct-connected to pulp grinders. Head, 25 feet.

Mattaceunk Station: Rated 24,300 hp. Four hydro-electric units. Head, 39 feet.

Transmission from North Twin, Dolby and Mattaceunk Stations is at 33,000 volts, and from the McKay Station is at 115,000 volts.

Power is developed by the company on the Kennebec River for the Madison Mill as follows:

Anson Station: Rated 7,500 hp. Five hydro-electric units. Head, 22 feet.

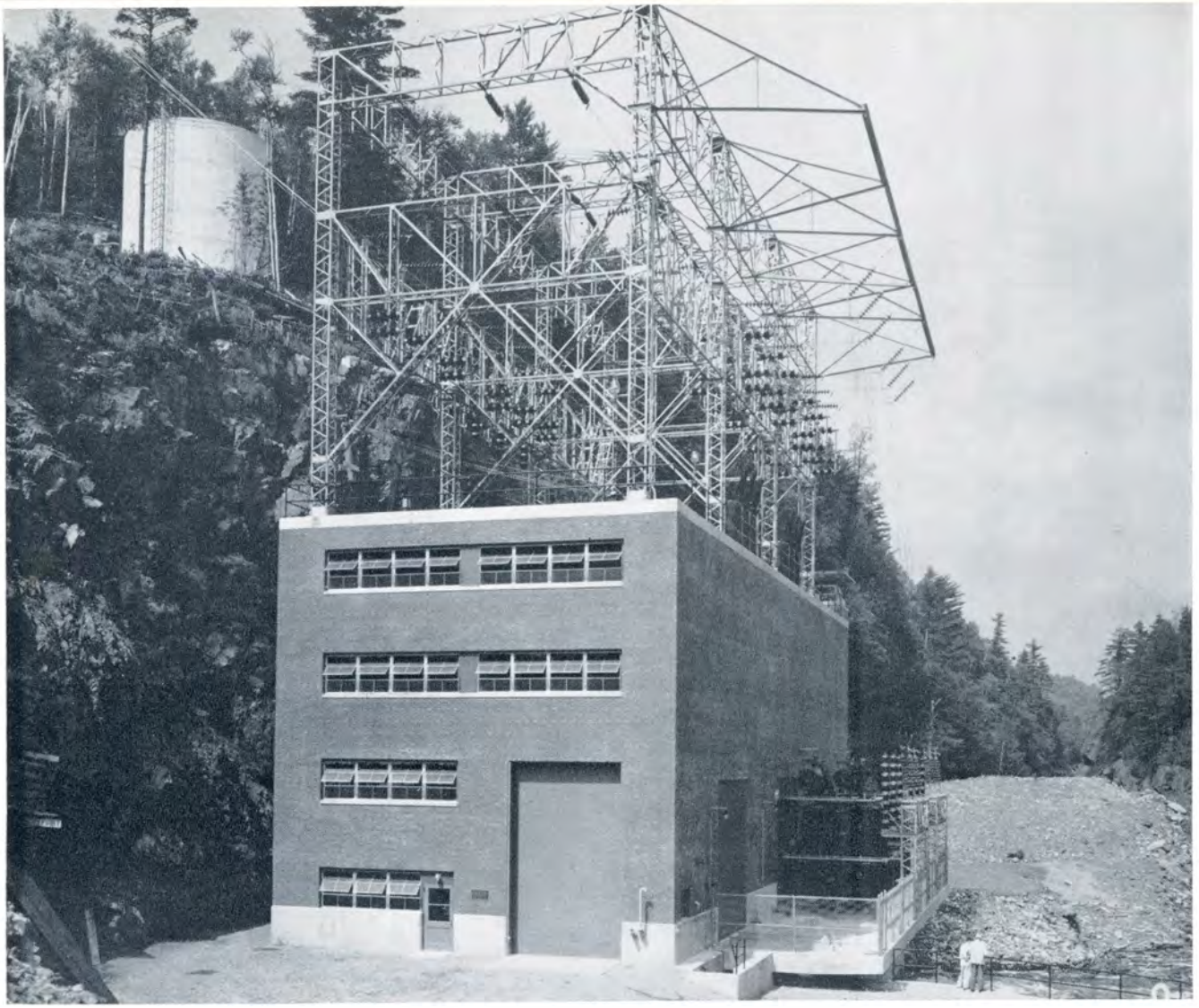
This station benefits from the extensive storage developed jointly with other water users on the Kennebec River.

The total rated installed capacity of all Great Northern hydro developments is 142,200 hp, enough to provide complete service to a city of 200,000 population with its industries.

Auxiliary Power

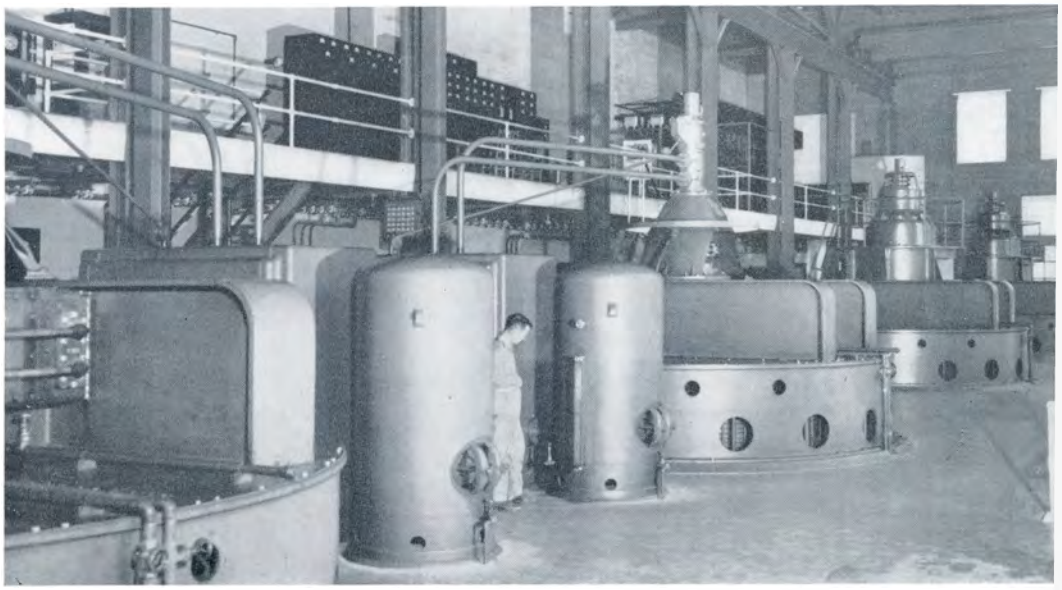
Existing back-pressure turbo-generators, operating as pressure reducers on steam for mill processes, add several thousand horsepower continuously to the system. Stand-by steam and diesel auxiliary generating units at Millinocket, East Millinocket and Dolby supplement the hydro power when necessary.

The expansion at East Millinocket provides the opportunity to utilize modern high-pressure boilers. In conjunction with substantial new steam turbo-generator capacity, this installation will supplement the existing system with additional electric power produced at favorable cost.

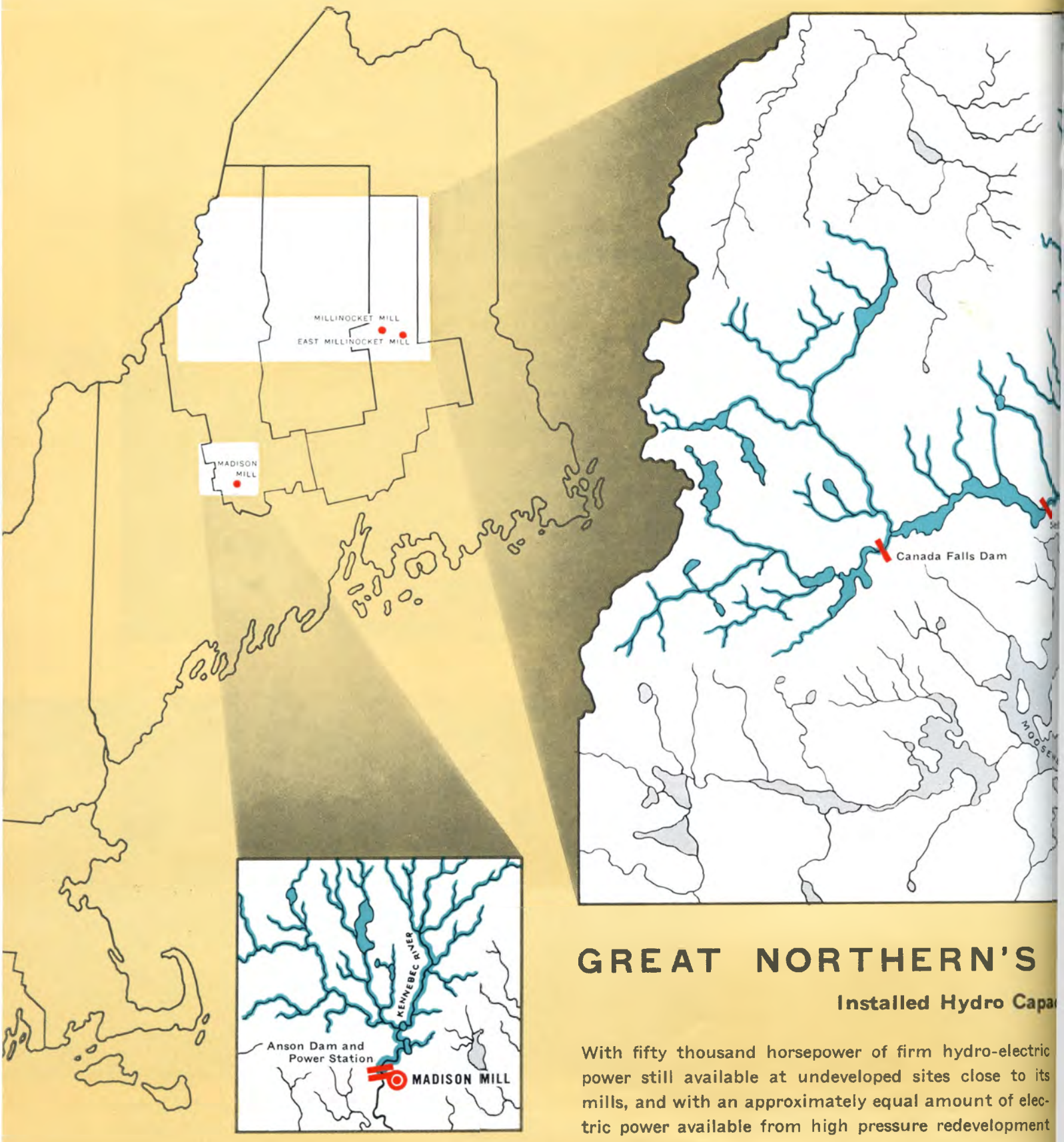


(Above) McKay hydro-electric station, which went into service in April 1953, is the latest addition to the Great Northern power system, and is rated at 30,200 hp. The present installation consists of two 15,000-hp vertical generating units.

Pressure tunnel connecting Ripogenus Dam and McKay Station was bored through solid rock. It is lined with concrete and has a finished inside diameter of 16 feet. Openings are shown at the left for 10-foot diameter penstocks leading to the individual hydraulic turbines below.



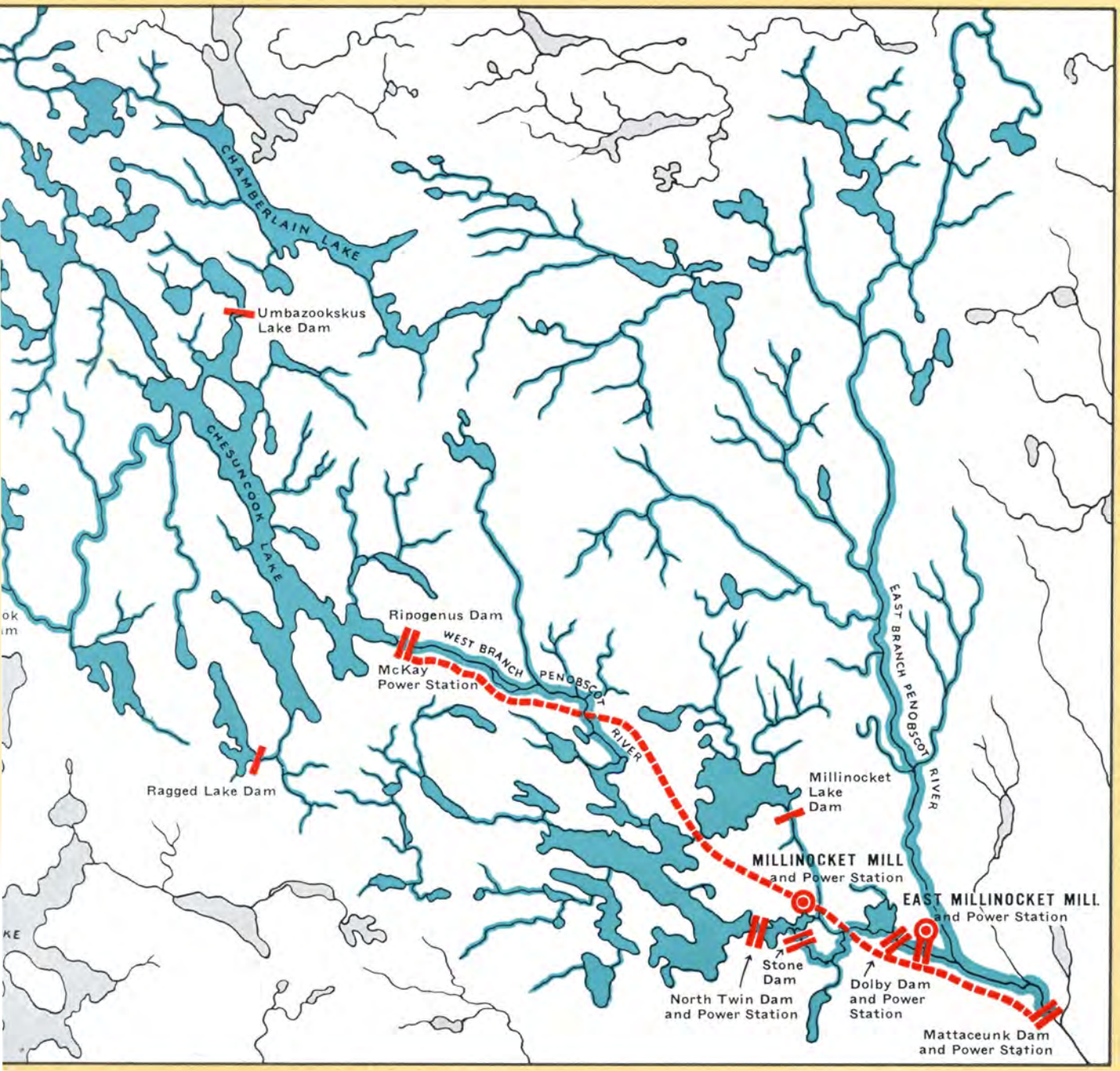
Mattaceunk hydro-electric station has four vertical generating units having capacity of approximately 6,000 hp each.



GREAT NORTHERN'S

Installed Hydro Capa

With fifty thousand horsepower of firm hydro-electric power still available at undeveloped sites close to its mills, and with an approximately equal amount of electric power available from high pressure redevelopment



OWER DEVELOPMENT

142,200 Horsepower

f steam plants, the Great Northern Paper Company as tremendous potential additional low cost power to rovide for further expansion of production and equally mportant protection against drought.

- Water used for Power System
- Power Dams
- Permanent Water Storage Dams
- Electric Power Transmission Lines

ENGINEERING AND RESEARCH ACTIVITIES

As this company has grown over the years, it has built up a highly trained and versatile organization consisting normally of 110 people who deal with the countless technical problems connected with its operations.

The Engineering and Research Department has two divisions: the Engineering Department, dating back to the start of the company's operations in 1899, and the Research and Control Department dating back to 1911.

Engineering

Reorganized and enlarged from time to time to meet the needs of the expanding plants, this department has made the studies, carried out the design and supervised construction and equipment installation on almost every major plant addition and improvement made by the company since its beginning. Included in this work were the Ripogenus and Seboomook storage dams; the North Twin and Mattaceunk power developments and redevelopment of the Dolby power; the rebuilding of the grinder rooms at the Penobscot Mills; and the installation and replacement of paper machines.

The nature of the problems involved in the Ripogenus hydro-electric development, with its pressure tunnel three-quarters of a mile long, made it necessary to engage outside engineering assistance. The basic studies for the development, however, and the design and construction of the transmission line, access road and bridge, were the work of the company's own engineers and construction crew.

Although the wide scope of the current expansion program at East Millinocket has again made it necessary to employ outside engineering on certain parts of the project, the major part of the design is being handled by the company's organization.

The Engineering Department has made many contributions to the industry. The Great Northern pulp grinder, the suction multipress for paper machines and the hydraulic pulpwood car dumper were developed by its designers. Many other improvements in pulp and paper mill equipment have resulted from studies and recommendations made by its engineers.

Competent engineering assures a well-designed, safe, and smoothly working plant. Here, field engineers discuss the progress of work on the steel frame of the new boiler house at East Millinocket.


STEELWORK
by
BETHLEHEM STEEL
COMPANY

Practically every phase of engineering is involved in the operation and maintenance of a newsprint mill. A large portion of the design for the new construction at East Millinocket is being handled by Great Northern's own engineering organization. This picture shows part of the engineering staff at work.

Its staff includes engineers qualified in all the principal branches of the profession. The keeping of meteorological records and the control of water storage and river flow are among their duties. They design machinery, make plant layouts and supervise installations. They measure bulk inventories, and assist the operating department in repair and maintenance work. Separate divisions, headed by the Electrical and Steam Engineers, aid in design in their special fields, and assist in operating problems.

Research and Control

This division, known originally as the Bureau of Economy and later as the Bureau of Tests, began as a small technical staff testing supplies and materials, making special tests as required, and conducting a training course for supervisory employees. Its scope was gradually enlarged to include process investigation and experimental work.

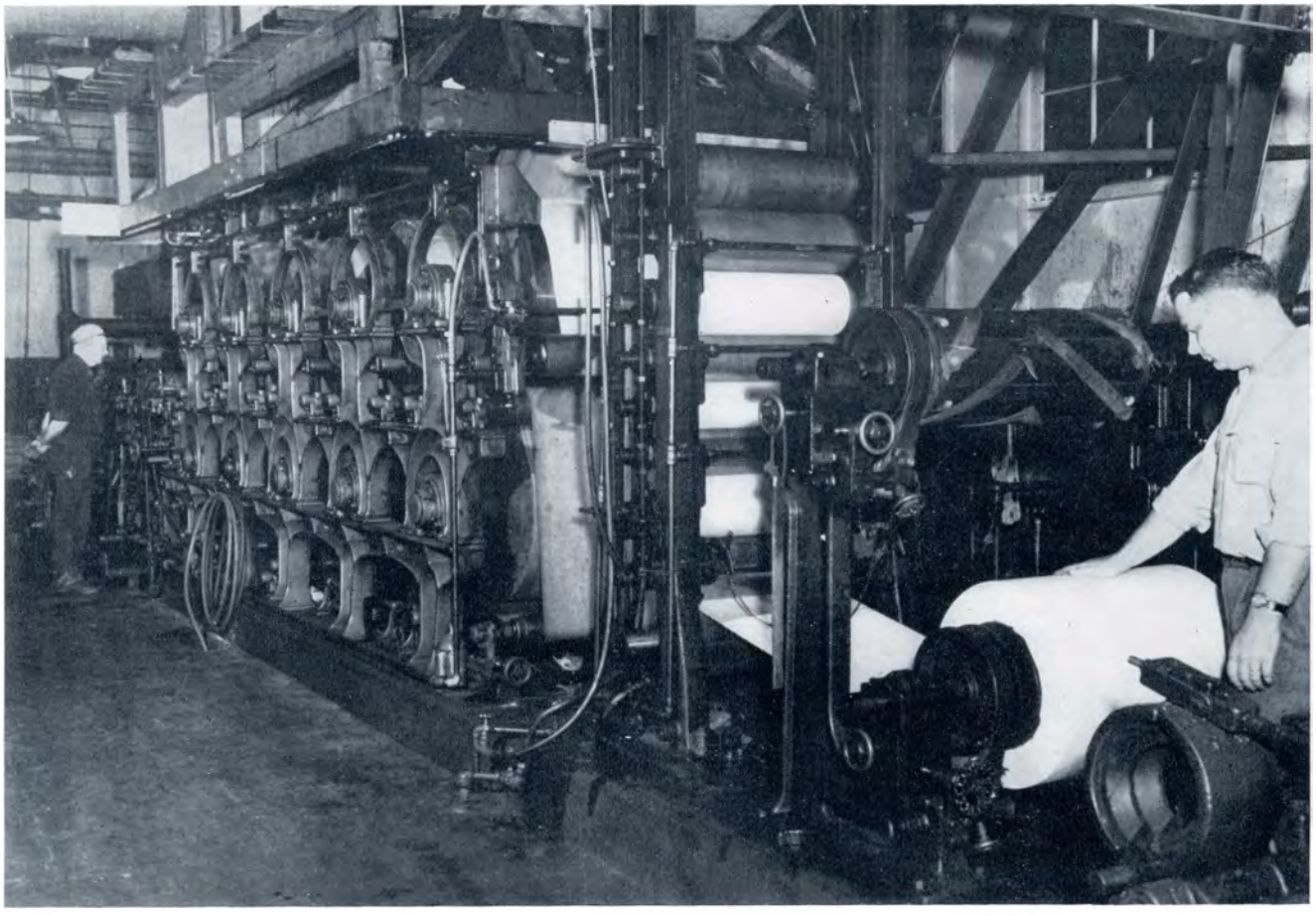
The present Department of Engineering and Research was established in 1950, placing the Engineering Department and the Bureau of Tests under one executive head. At this time, the latter was expanded to provide the company with a complete research, control and testing organization. Its duties are many and varied. Its trained staff tests incoming materials and supplies, to make sure that they conform to specifications. It continually tests the pulp and paper in various stages of manu-

facture, and immediately transmits the results to the operating personnel for close control of manufacturing operations. This department establishes and maintains complete specification manuals covering all grades of paper made by the mills, and checks product for conformance with these specifications. It keeps careful watch for new developments in the industry.

Technicians assist in developing colors, and in establishing stock formulae and pulp treatment for new grades of paper. They test samples of drinking water for woods camps, and guard against stream pollution. They check manufacturing processes for losses, and investigate the causes of operating difficulties. They keep records of system conditions to aid in maintaining uniform quality and improved production, and they keep complete photographic records of pulpwood operating, manufacturing and construction activities. Well-equipped chemical, water testing, photographic, and pulp and paper testing laboratories are maintained to assist in carrying on this work.

A special division deals with research. It has complete laboratory facilities for producing both ground-

Complete laboratories are essential to the modern paper mill. The company's facilities include a chemical laboratory, central pulp and paper testing laboratories, and an experimental laboratory, in addition to the pulp and paper control testing laboratories in the various mill operating departments.



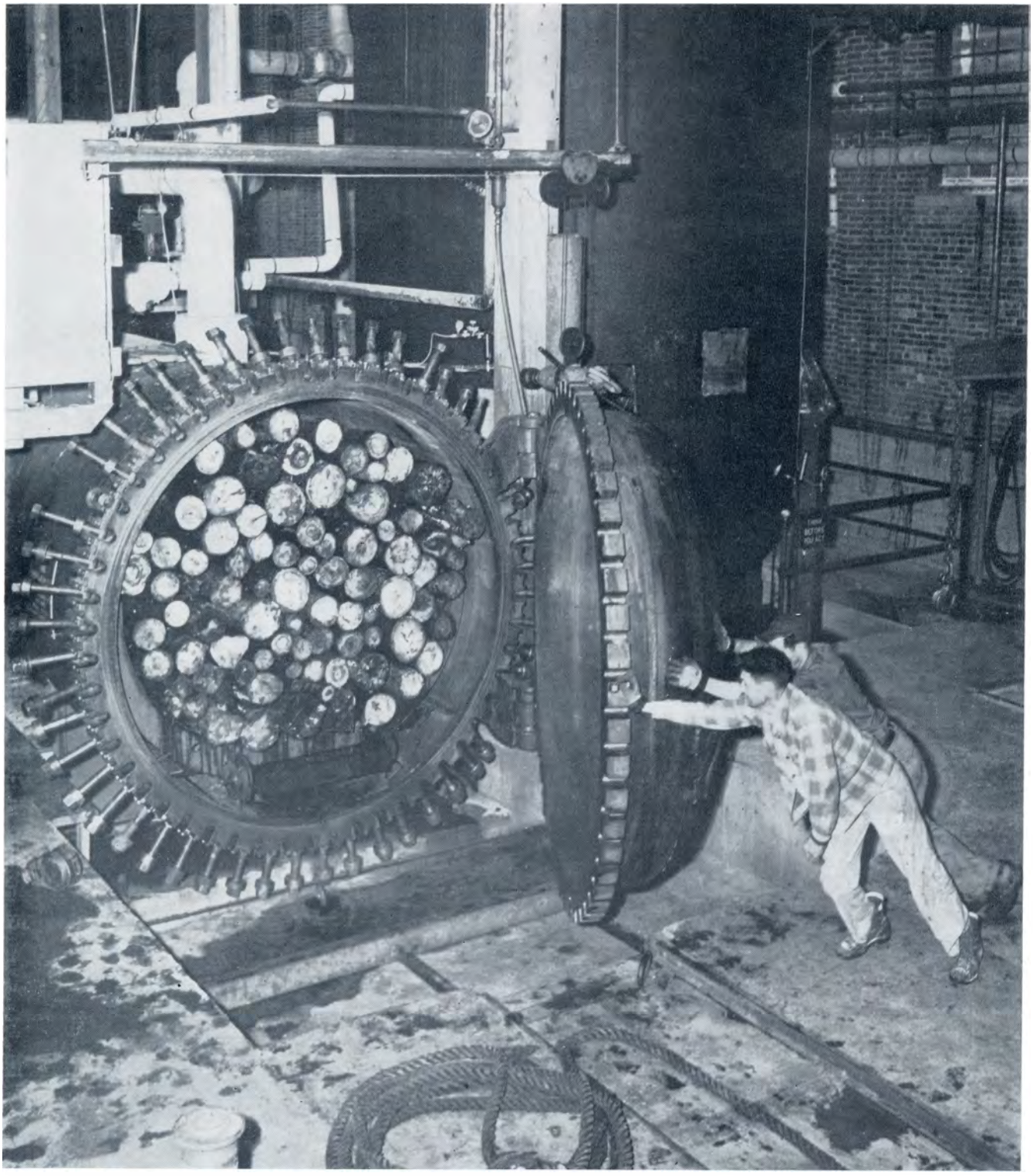
Experimental paper machine at the Millinocket Mill makes a sheet 22½ inches wide. Used in conjunction with the laboratory pulp-producing facilities, this small machine permits carrying experimental work completely through the pulp and paper-making process.

wood and chemical pulps on an experimental scale, including screening and refining equipment and a small paper machine which produces a sheet 22½ inches wide.

The research organization has concentrated its effort on the utilization of hardwood, with results of great importance to the company and to the industry. Its investigations, supplementing earlier laboratory work, were largely responsible for working out the commercial process of producing chemigroundwood pulp of newsprint grade from hardwood. This is one of the most important recent developments in the industry, and was a major factor in the company's decision to proceed with its expansion program.

Training

The department also administers the company's Apprenticeship Course. This course is designed to train young men, usually but not always technically trained college graduates, for positions in the company's supervisory staff, which is a balanced organization containing both technically-trained men and practical men selected from the operating personnel for ability and leadership. After they have received instruction in all phases of the company's operations, the apprentices are absorbed into the operating organization as assistant supervisors, taking their places beside the woodsmen, the machine tenders, the engineers and the salesmen in the Great Northern team.



The 50-ton commercial pilot plant for producing chemi-groundwood pulp from hardwood started operating in 1953 at East Millinocket. Hardwood sticks are treated with chemicals under pressure before being ground in the conventional manner. This picture shows one of the two 10-cord pressure vessels used for the cooking operation.

MANUFACTURING 1,300 TONS

Papermaking is a continuous and carefully controlled operation, dealing with millions of tiny wood fibres in such a way that after numerous steps in processing they come out as a sheet of paper.

It has been said that the process of making paper consists of mixing wood and water and taking the water out. In 1952, Great Northern put over 400,000 tons of wood pulp, mixed with 15 billion gallons of water, into the head-boxes of its paper machines. In making this amount of pulp, and in getting the water out again, it consumed more than 8,000 tons of sulphur, 11,000 tons of limestone, 150,000 tons of coal, 13,000,000 gallons of fuel oil and several good-sized trainloads of other supplies and materials, from steel I-beams to tiny parts for precision control instruments.

Barking

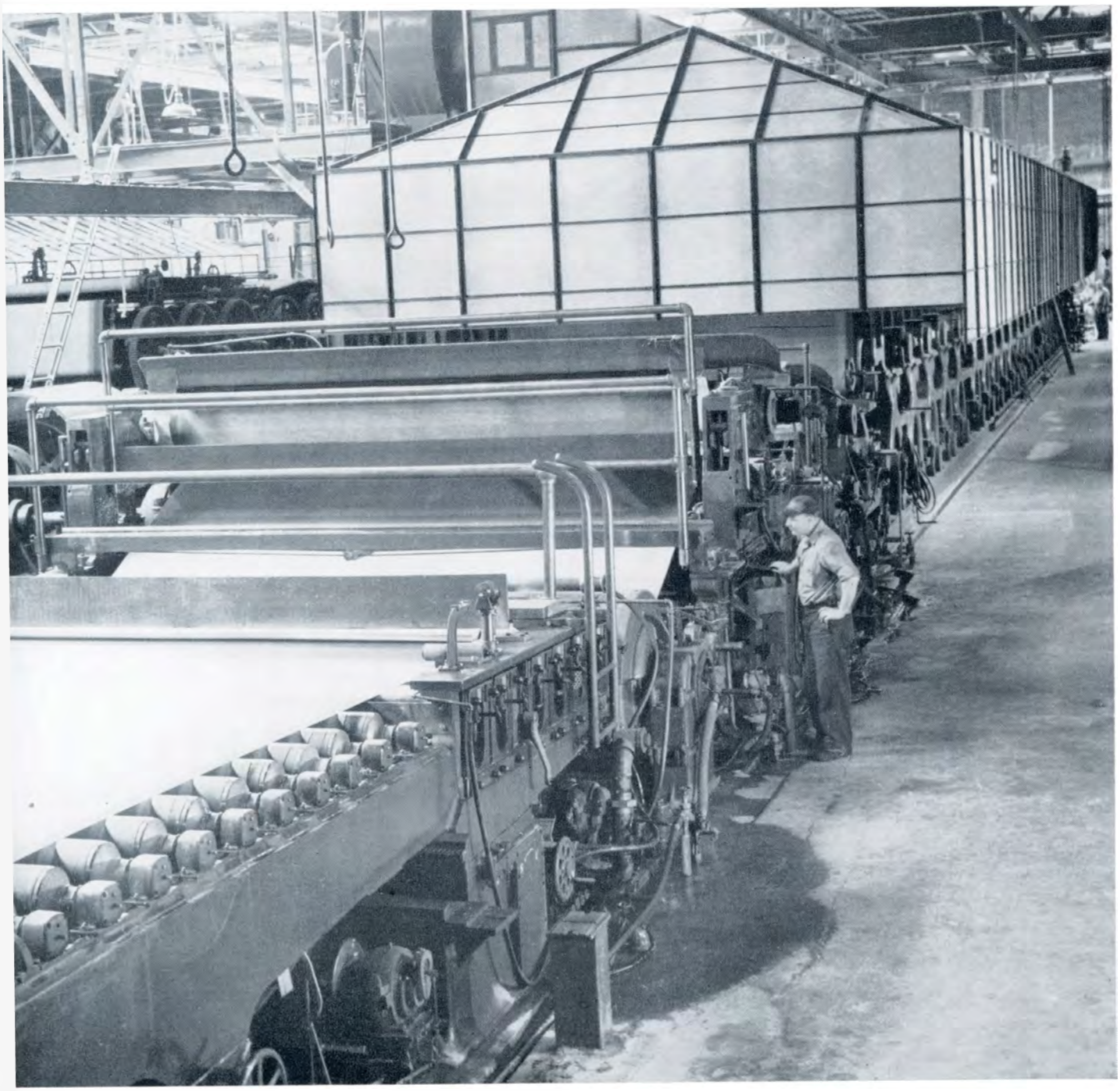
The first step in papermaking is the removal of bark from the wood by tumbling the four-foot sticks in huge revolving steel drums. As newsprint is made from a mixture of groundwood, or mechanical pulp, with sulphite, or chemical pulp, in the proportion of about 6 to 1, the barked wood coming from the drum is divided, part going to the grinders and part to the chippers.

Groundwood Pulp

A hydraulic pulp grinder, such as the Great Northern grinder, is essentially a heavy casing enclosing a revolving grindstone some 62 inches in diameter and 54 inches across the face, driven by a water wheel or an electric motor. On each side of the face of the stone, the casing opens into a pocket in which is a hydraulically operated plunger. Wood loaded into these pockets from the top is pressed by the plunger against the stone, under a spray of water, and is ground off in the form of pulp. As the pulp leaves the stone, "white water", which has already been through the system and contains fine pulp, is added. The mixture is pumped to a series of revolving screens, where it is passed through perforated plates to remove coarse fibres, which are mechanically refined and returned to the system. Part of the water is then removed by running the pulp into vats containing revolving cylinders cov-

One of the ten newsprint machines at Millinocket. This is the wet end. Pulp flowing onto the moving fourdrinier wire cloth in the foreground forms a continuous web as water drains out or is removed by vacuum. Carried on endless woolen felts through press rolls, about one-third of the water has been removed by the time the paper reaches the steam-heated dryer drums under the hood.

OF PAPER PER DAY



ered with a wire mesh, which allows part of the water to pass through, the film of pulp left on the wire mesh being blown or scraped off and dropped into agitated tanks, ready for use. The water which passes through the mesh is the white water previously mentioned.

Sulphite Pulp

The sticks of wood intended for sulphite pulp go to the chipper, in which knives set in a heavy rotating disc slice across the end of the log, reducing it to chips. The chips are then screened and are elevated to storage bins. From these bins the digesters are filled as required. Digesters are conical-ended steel pressure tanks, some 50 feet high and 16 feet in diameter, lined with acid-resisting brick. An acid, calcium bisulphite, made by passing the gas produced by burning sulphur through a water spray in a tower filled with broken limestone, is added to the digester full of chips. Steam is then admitted, and the chips are cooked for several hours, after which they are blown out of the digester under slight pressure. The resulting pulp is washed, screened and thickened and is then ready for use.

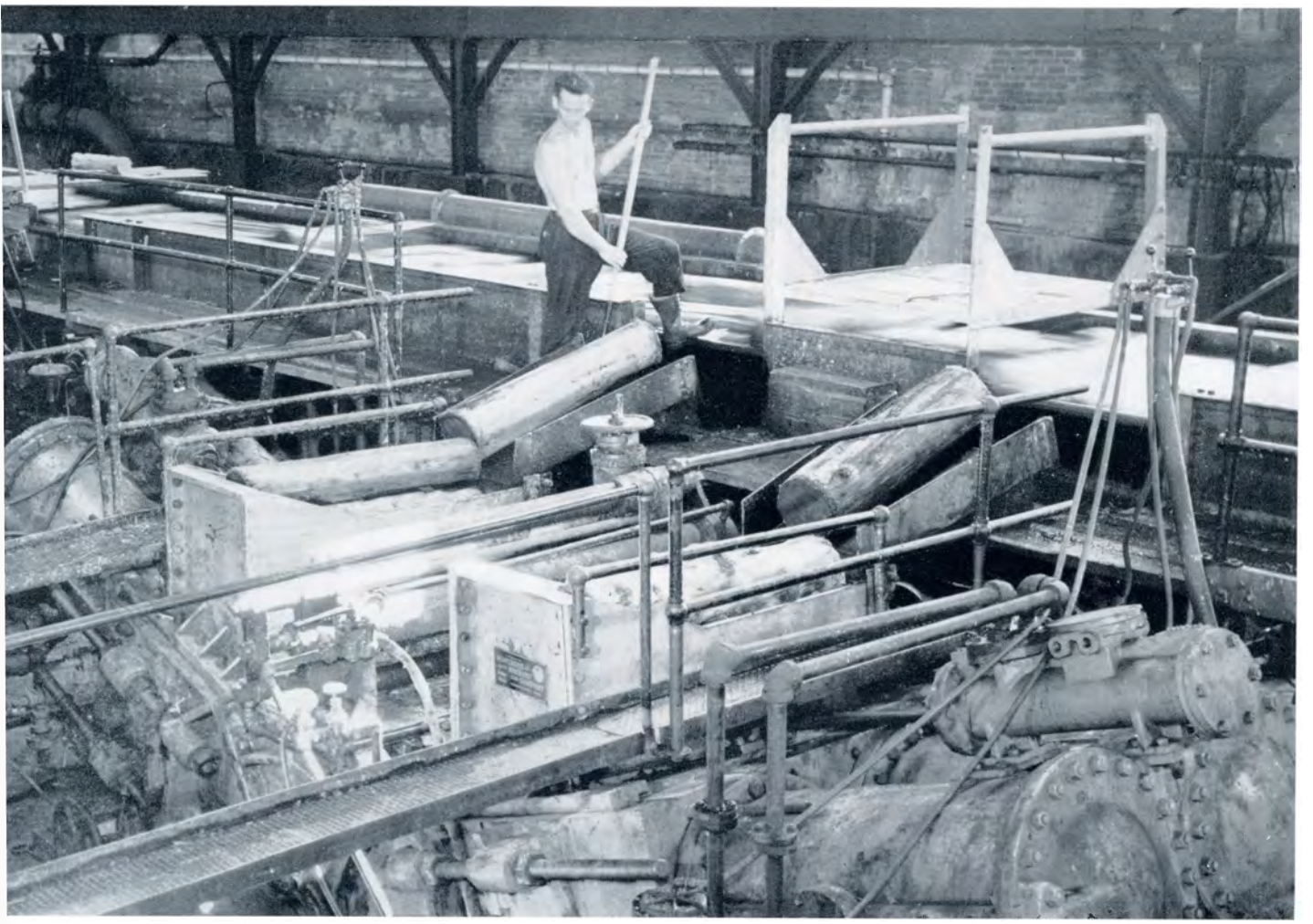
Making Paper

To make newsprint, the two pulps, groundwood and sulphite, are mechanically proportioned and mixed, and a small amount of blue dye is added to offset the natural yellowish color. The pulp mixture is carefully metered to the paper machine, and is again thinned with white water, which this time is water removed from the pulp made into paper on the machine just a few minutes before.

This diluted pulp is normally given a final screening, and is delivered into the head box of the machine. The head box in turn discharges it in a continuous film through the slice on to the fourdrinier wire, an endless belt of bronze wire mesh supported on a series of rolls and running continuously at high speed. Water, containing some fine pulp, begins to drain through the wire mesh immediately. This is the white water which is re-used for dilution of the pulp. The longer fibres in the pulp mixture begin at once to form a mat, catching and holding the finer fibres, and in this manner the sheet of paper is formed as the pulp travels along with the wire. As the sheet becomes dryer, more water is drawn out by the action of suction boxes under the wire, but at the point where it leaves the fourdrinier it is still hardly strong enough to support its own weight. It is therefore transferred to endless woolen blankets or felts which support and cushion it as it passes through a series of press rolls, designed to remove still more water. From the presses, the paper enters the dryer section of the machine, where it is held in close contact with the surfaces of a series of revolving steam-heated dryer drums by endless cotton belts or dryer felts. In this stage, approximately two tons of water are evaporated for each ton of paper produced. Upon leaving the dryers, the sheet is passed through the calender stack, a series of heavy, highly polished rolls which impart a smooth finished surface. It is then wound into a roll the width of the machine, called a reel. This reel of paper is transferred to a winder, on which the edges are trimmed, and the paper is slit and rewound into rolls of various widths and diameters. The rolls of paper are then moved into the finishing room, where they are wrapped and weighed, and they are then ready for shipment.

Magnitude of the Operation

No simple description such as this can convey an adequate impression of the mass of the equipment used, and the scope of the operations involved, in running a large newsprint mill. For example, a single Great Northern-Waterous grinder, such as now being installed at East Millinocket, weighs over 50 tons, the stone for it weighs about eight tons, and nearly 3,000 hp is required to drive it. Great Northern's new newsprint machine, now being built, is longer than a football field, and will turn out a continuous sheet of paper over 20 feet wide at the rate of more than a mile every three minutes. Operating in small and more or less isolated communities, Great Northern mills must carry parts in stock to repair practically any possible machine failure. Skilled mechanics make almost any repair. Highly trained technical staffs at the mills con-



Charging one of the 30 Great Northern pulp grinders at the Millinocket Mill. Each of these machines requires 1,800 horsepower and is capable of producing nearly 30 tons of groundwood pulp per day. This type of grinder was developed by Great Northern and is widely used in the industry.

stantly test pulp and paper for process control. Safety experts carry on a ceaseless campaign against accidents. Engineers design and supervise the installation of new machinery and equipment.

Specialty Papers

The manufacture of specialty papers at the Madison Mill includes all of the processes required to produce a newsprint sheet. In addition, it involves pulp bleaching, mechanical treatment of the pulp to produce special characteristics, coloring, addition of clay and other fillers to the machine furnish, and a variety of sheeting, converting and special finishing operations, including supercalendering to produce very high finishes.

New Chemi-Groundwood Pulp

In the expansion of production at the East Millinocket Mill, the company plans to make use of chemi-groundwood pulp made from hardwood. The operations involved are similar to those for spruce and fir groundwood, with the addition of pressure chemical pre-treatment of the wood before grinding. The new East Millinocket development will include the first full-scale commercial plant ever built for the production of this type of pulp.

EXPANSION PROGRAM

To add another 500 tons a day of newsprint production, increasing its total capacity about 40 per cent, Great Northern is investing approximately $38,000,000 in the greatest expansion in its long history.

The current expansion is being carried out at East Millinocket, where the capacity of the existing plant is being approximately tripled by the construction of what is practically a complete new pulp and paper mill. The program is planned for execution in two main steps, centering on the two new high-speed paper machines, the first of which will be in operation late in 1954, and the second late in 1955.

Wood Preparation

A new concrete wood-room building has been built, and a new 12 x 45-foot barking drum has been installed, together with a complete chain and belt conveyor system for wood handling and sorting for three barking drums. A 36-inch rubber-belt conveyor, approximately 1,300 feet long, on steel supports, has been installed to carry barked pulpwood from the wood room to a new double-arm stacker with 178-foot reach. All of this equipment

was in operation in the fall of 1953, and was used for piling the winter's supply of wood. The above conveyor, which is reversible, is also used during the winter to carry wood from the storage piles to the pulp mill. An additional 12 x 45-foot barking drum, plus the present drum and hydraulic stream barker from the existing wood room, are to be installed in the new building as the program progresses, making up the complete installation.

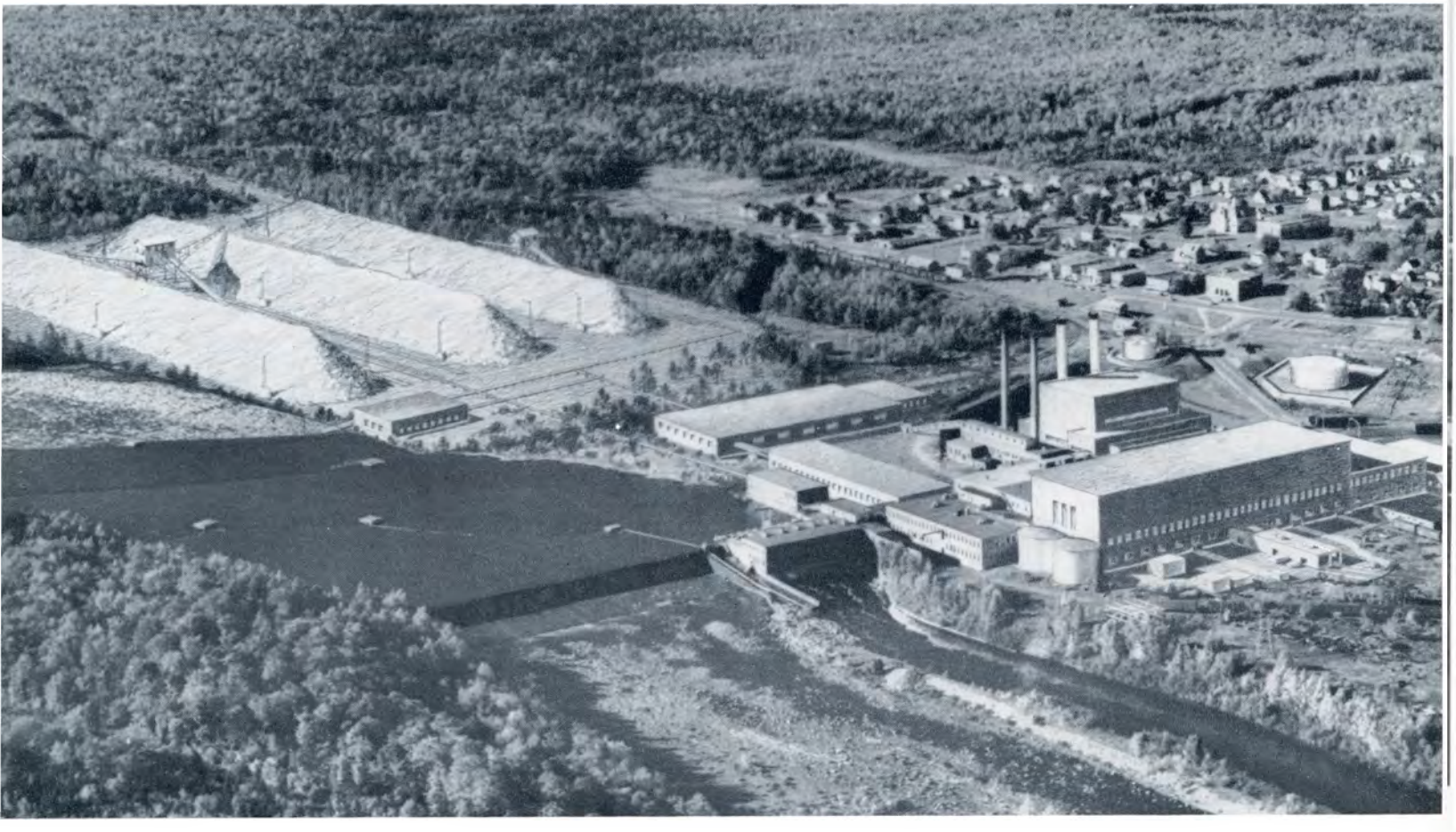
At left, is the East Millinocket Mill, before expansion. This mill produces approximately 320 tons of newsprint per day from four paper machines. Below is the mill as it will look when present construction is completed, the new buildings practically surrounding the present mill. The expansion will add two new fast newsprint machines, bringing total capacity to 820 tons per day.

Water Filtration

The old wood-room building is being rebuilt into a water-filtration plant, which will be equipped with completely new intake screens, raw water pumps, rotary filters and filtered-water pumps capable of handling 45,000 gallons per minute. New fire pumps, connected to the mill and wood pile fire protection system, will also be located in this building.

Grinder Room

An entirely new grinder room, of steel and brick construction, arranged for the eventual installation of 16 Great Northern-Waterous hydraulic pulp grinders, is being built north of the present grinder room, which will continue in operation. The initial grinder installation will consist of eight units, arranged to grind either softwood or hardwood. Each line of



two stones will be driven by a 6,000-hp motor. Complete new coarse-screening equipment, pressure pumps and stock pumps will be provided. Additional grinder units will be added with the installation of the second paper machine.

Hardwood Pre-treatment

A particularly interesting part of the new mill will be the plant for the pre-treatment of hardwood to produce hardwood chemi-groundwood pulp. This plant will be housed in an insulated steel building, adjacent to the new grinder room. The design is the result of nearly a year's operating experience with a 50-ton commercial pilot plant at East Millinocket. A separate hardwood unloading plant and storage pile will be connected to the new wood room and the pre-treatment plant by a conveyor system. This will elevate the four-foot sticks of hardwood pulpwood to a distribution point located above vertical steel pressure cookers, 10½ feet in diameter and 62 feet high, of which two will be installed in the first step. These cookers will discharge the treated logs through hydraulically-operated bottom doors into pits from which they will be transferred by mechanical means to conveyors feeding the new grinder room. The plant will include the necessary chemical storage, together with the cooking-liquor preparing, handling and reclaiming systems.

Screen Room

The present screen room will be remodelled and provided with the latest type of screening and vacuum-thickening equipment, with separate screening systems for the softwood and hardwood pulps, and new refiners for screenings. This work also will be done in steps, additional units being added as the program progresses.

Sulphite Pulp Handling

The East Millinocket Mill is supplied with sulphite pulp from Millinocket. Complete new unloading, repulping, screening and pumping facilities are being provided for handling sulphite.

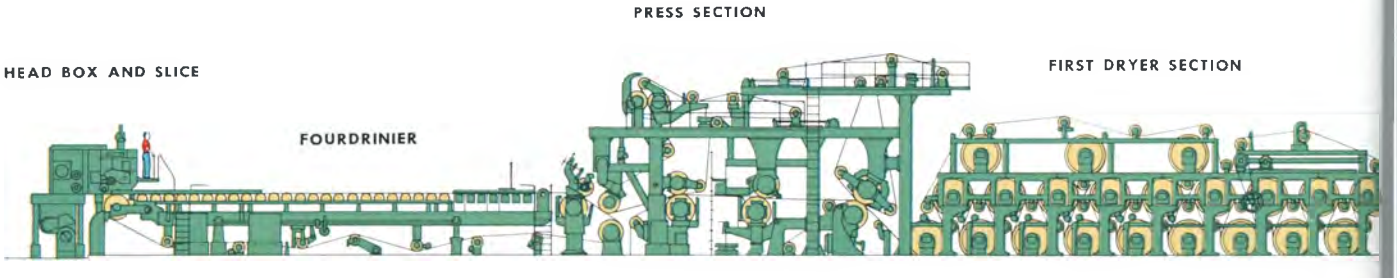
Steam Plant

The existing low-pressure steam plant is being superseded by a new high-pressure plant. The new building, now practically completed, is of steel-

NEW PAPER MACHINE

Diagram of 276-inch Beloit paper machine being built for installation at the East Millinocket Mill. The machine is equipped with a pressure-type headbox. The wire is 137 feet long. The suction couch, transfer, first and second press rolls are 44 inches in diameter. A suction pick-up will take the sheet from the wire. There are fifty-four 60-inch paper dryers. The calender stack is arranged for ten rolls. The reel and winder are of Beloit design. The drive is of the mechanical differential type, with a steam turbine prime mover.

The machine is approximately 375 feet long, weighs about 2,500 tons, and is mechanically suitable for operation at speeds up to 2,500 feet per minute.



frame and insulated aluminum panel construction. Two boilers, each rated 300,000 pounds of steam per hour at 1,250 pounds pressure, are being installed. These units are arranged for either oil or pulverized-coal firing. Steam will be passed through two 12,500-kilowatt back-pressure turbo-generator units, extracting at 200 pounds pressure and exhausting at 40 pounds pressure for process use. The first generating unit is part of the initial installation, the second is to be added later. Complete feed-water-treatment equipment and additional fuel-oil storage is included. The old steam plant will be retained as a stand-by unit.

Repair Shops

Adjoining the present paper-machine room, and connecting with the new machine-room building, a major addition to the repair shop is being constructed which will provide space for the large roll grinders, lathes and other machine tools required for maintenance of the new paper machines and process equipment. A new lubricating oil and paint-storage building, separated from the mill proper, has been completed.

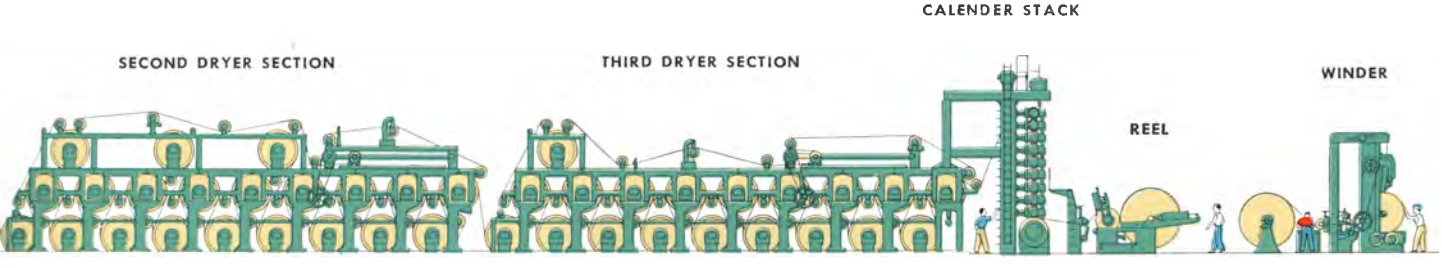
Paper Mill

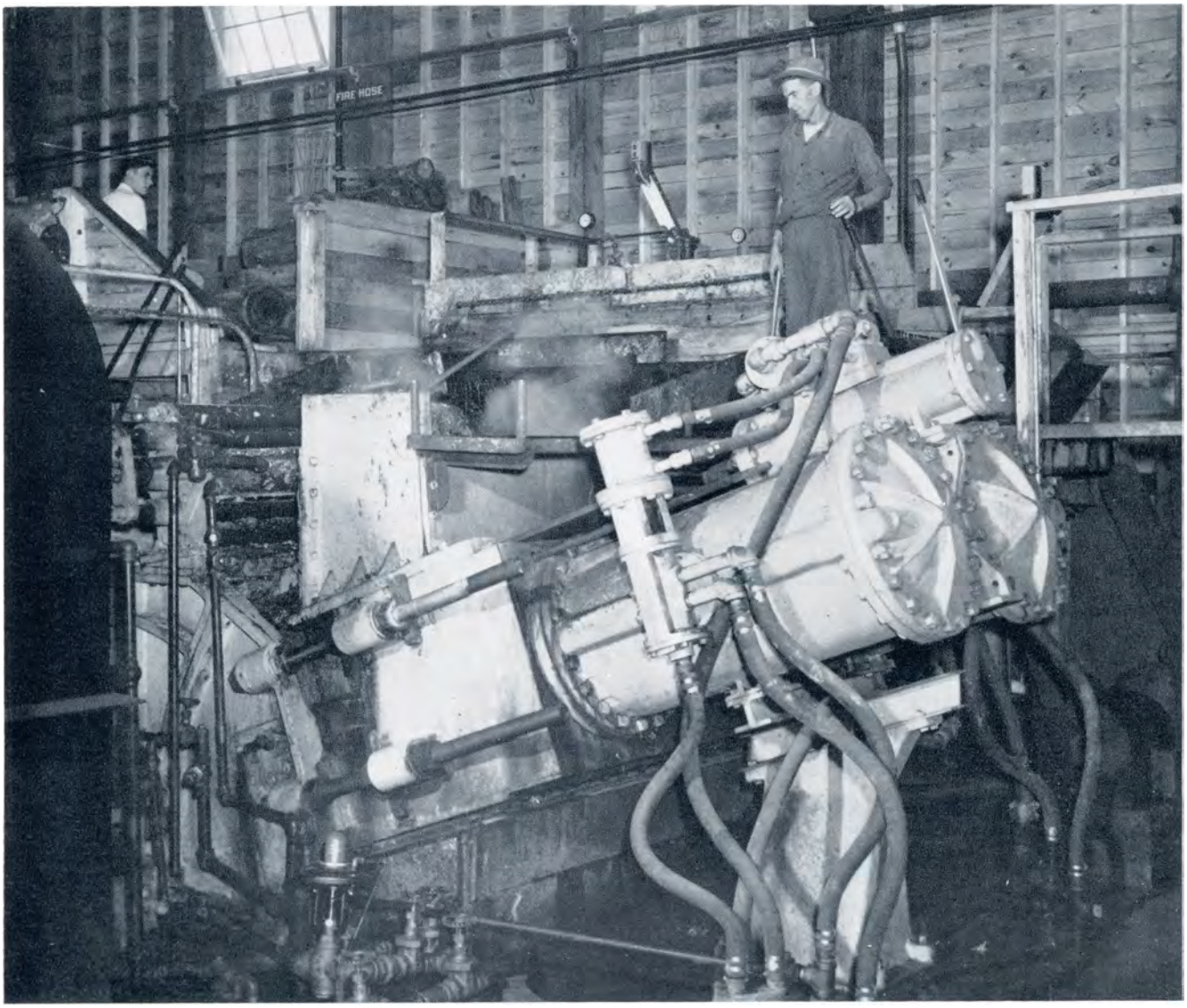
The new machine-room building, of steel frame, brick and glass-block construction, will be 500 feet long and 144 feet wide, and is located parallel and adjacent to the present machine room. Two new Beloit paper machines designed and balanced for operation at 2,500 feet per minute, will be installed. The first machine is rated at 276 inches wide and will produce a sheet trimming 256 inches wide. These are the widest, fastest and most modern newsprint-producing units ever built for operation in the United States. The machines are to be equipped with pressure head-boxes. The wire is to be 137 feet long, and the suction couch 44 inches in diameter. A suction pick-up, instead of the conventional air-jet device, is planned to transfer the sheet from the couch to the press section. The transfer press and the first and second suction presses are to be 44 inches in diameter, rubber covered. The 54 paper dryer rolls, each five feet in diameter, will be driven in three groups of 18, with top and bottom felt and Feeney dryers in all sections. The open-side calender stack is arranged for ten rolls. The reel and winder are of Beloit design, the latter being equipped with roll removing devices, core shaft puller and roll conveyor. The mechanical drive is to be of the Beloit differential type, with a turbine prime mover geared to a back-line shaft, and electric helper drives. The machines will be equipped with economizers and the latest type of totally-enclosed hoods. All operating mechanisms will be powered by compressed air or electricity, and every detail has been engineered with a view to safety and convenience in operation.

A completely new finishing room and trainshed will be built adjoining the new paper-machine room.

What This Expansion Means

Great Northern's new machines are designed to operate at speeds beyond any yet reached in the industry, and while tonnage figures have been cal-





Great Northern magazine grinder in the 50-ton chemi-groundwood pulp mill at East Millinocket. After the cooking operation, the hardwood sticks are ground on pulpstones. In this machine, the sticks are charged into the pockets of the grinder and pressed hydraulically against the revolving grindstone which reduces them to pulp.

culated for theoretical maximum production, the company prefers to base its estimates on a minimum of 250 tons per day per machine. This brings the total minimum daily capacity of the East Millinocket Mill to 820 tons. The company's new total daily capacity will be approximately 1,800 tons.

The expansion was undertaken only after several years of careful investigation of markets, market conditions, power possibilities and wood supply. Out of the study of the last item grew the company's commercial development of the process for producing hardwood chemi-groundwood pulp suitable for use in newsprint, at a cost which makes its use economically feasible. This new development, adding tremendously to Great Northern's timber resources, further assures that there will be wood in perpetuity to support this additional supply of paper for the newspaper presses of America.

New wood room at East Millinocket Mill, the first building to be put into use in the current expansion program. This building houses the drum barkers and hydraulic barking equipment.

Construction activity at the East Millinocket Mill: foundations for the new grinder room.

A number of popular magazines are printed on Great Northern's specialty printing papers.

SPECIALTY PRODUCTS

Development of practical methods for bleaching groundwood permitted mills making groundwood papers to produce high brightness grades economically.

Great Northern now offers both bleached and unbleached groundwood papers.

Groundwood pulp is the most economical of all the paper-making fibres produced from wood. It is the main constituent, not only of newsprint, but of a variety of papers with many end uses, included under the general classification of Groundwood Papers.

For 25 years, Great Northern's Madison mill has been devoted almost exclusively to making quality groundwood printing and converting specialty papers, in such diverse grades as Teletype, Book and Magazine, Box Lining, Hanging, Mimeograph, Hosiery Insert and Drawing.

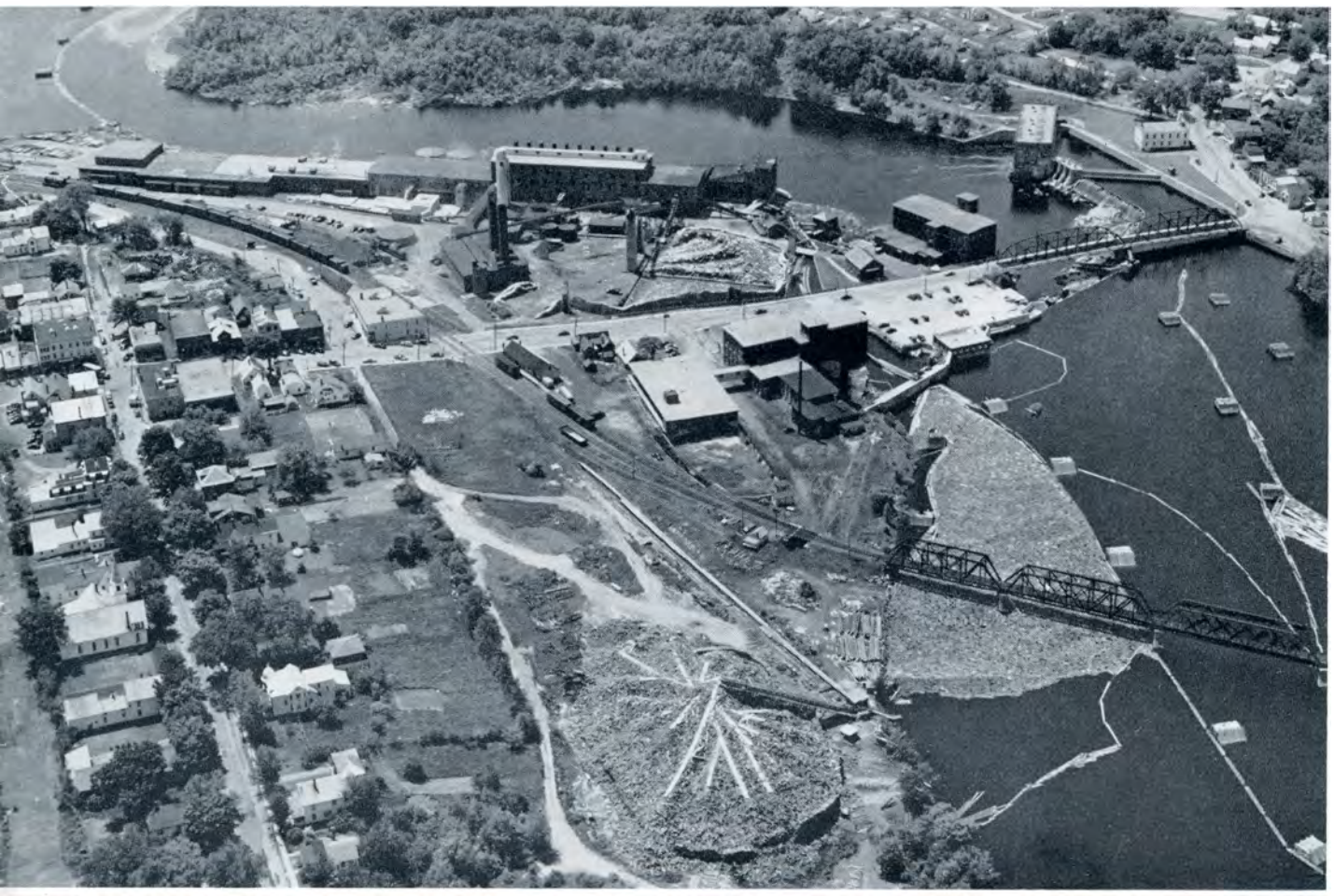
With the improvement in quality brought about by careful control of manufacturing processes, and with the development of techniques for economical bleaching of groundwood pulp, the use of ground-

wood specialty papers has increased greatly. Many magazines and periodicals, which formerly used more expensive papers, have found it possible to use groundwood grades at a saving in production cost, without sacrificing printing quality. The total consumption of groundwood printing and converting papers has almost tripled since 1935, and the trend continues upward.

Equipped with a modern groundwood bleaching plant, the Madison Mill produces bleached printing papers marketed under brand names and used in all types of graphic reproduction: letterpress, rotogravure and offset. Its stock-preparation system has been modernized for the economical production of not only printing grades but of many groundwood papers used for converting purposes. It also produces a moderate volume of papers classed as Sulphite Specialties.

Great Northern's interest in the specialty field is evidenced by its extensive program of technical control and development work, enabling the company to produce papers that are tailored to specific end uses. These are offered in an unusual variety of furnishes, finishes, and machine trims. With its completely integrated operations, and its tremendous resources of wood and power, Great Northern is a stable and reliable source of supply to users of its specialty products.

The Madison Mill produces about 95 tons per day of bleached and unbleached groundwood printing and converting papers; also sulphite specialties.



NEWSPRINT FOR THE AMER

The company has steadily increased its production, at times throug

Today, more than half of Great Northern's business comes from customers o

When the Town of Millinocket celebrated its 50th anniversary, this display showing some of the newspapers printed on Great Northern newsprint indicated the scope of this company's service to the American press.

CAN PRESS

periods which were extremely discouraging.

more than 25 years standing.

For more than half a century, the Great Northern Paper Company has been supplying publishers in this country with newsprint made in the United States from American pulpwood with American power.

Fundamental Strength and Policies

Having great growing stands of spruce and fir pulpwood, now augmented by the hardwoods which its research has made usable, and large water power resources, it is particularly suited to the economical production of newsprint and other papers containing a substantial proportion of groundwood pulp. Its fundamental strength lies in these natural advantages, both presently developed and potential. Over the past 54 years, the company has increased its production four-fold without departing from the groundwood paper field, or endangering its resources for the future.

Accumulation of adequate timberland reserves, careful forest management, sustained-yield cutting, ownership and operation of its own power system, thorough maintenance of plant and constant modernization of production equipment have always been basic policies.

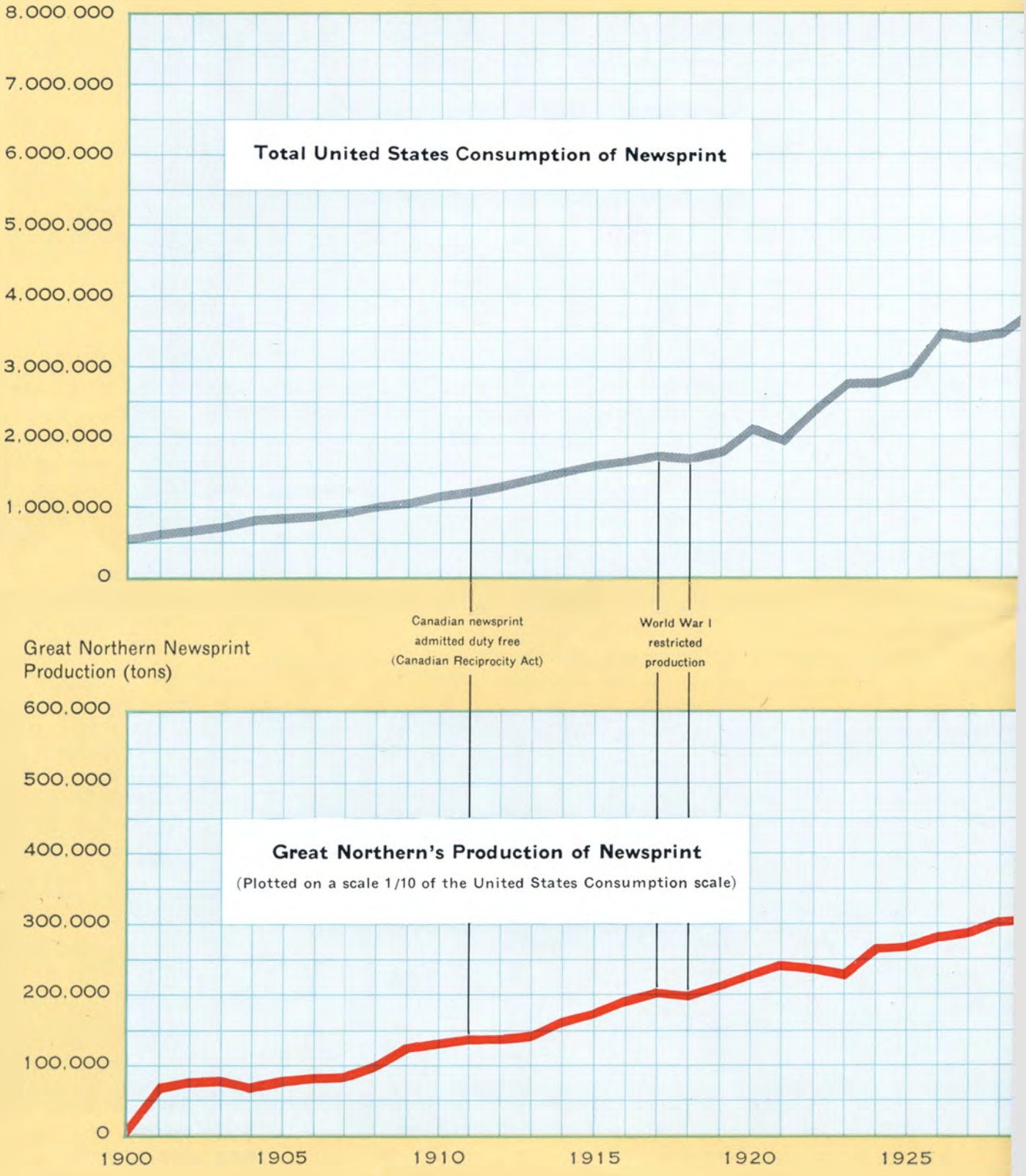
Great Northern recognizes the importance of building confidence upon these fundamentals. It

Out of every 100 copies of U.S. Newspapers:

6 are printed on	15 are printed on	79 are printed on
GREAT NORTHERN PAPER	OTHER U.S. PAPER	CANADIAN PAPER

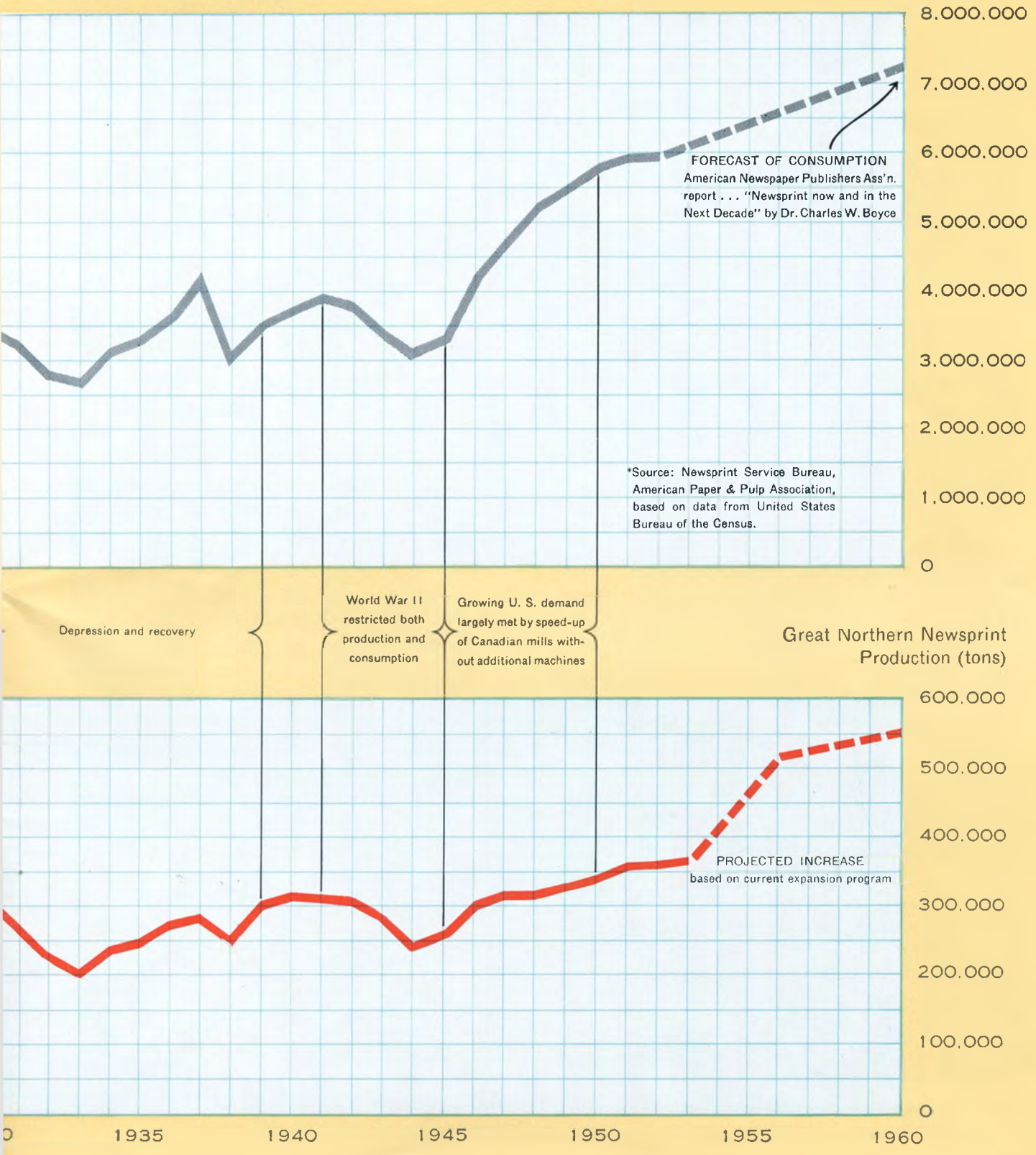
GROWTH IN GREAT NORTHERN'S N

Compared with Total



WSPRINT PRODUCTION, SINCE 1900

ted States Consumption*



GREAT NORTHERN'S NEWSPRINT CUSTOMERS IN ANNUAL TONNAGE GROUPS

endeavors to supply complete and dependable service, along with technical assistance, to its customers. As far as possible, it markets its products so that its customers may be competitive insofar as their own operations are concerned, and it believes that low-cost manufacturing and economical marketing will play an important part in increasing the overall consumption of any commodity.

Adherence to these principles, together with the natural advantage of plants located close to wood supply, yet within easy reach of major markets, keep the company in a favorable competitive position and establish a solid foundation for rendering dependable service.

River man poling wood through a sluicing boom to the gate of a driving dam.

Performance

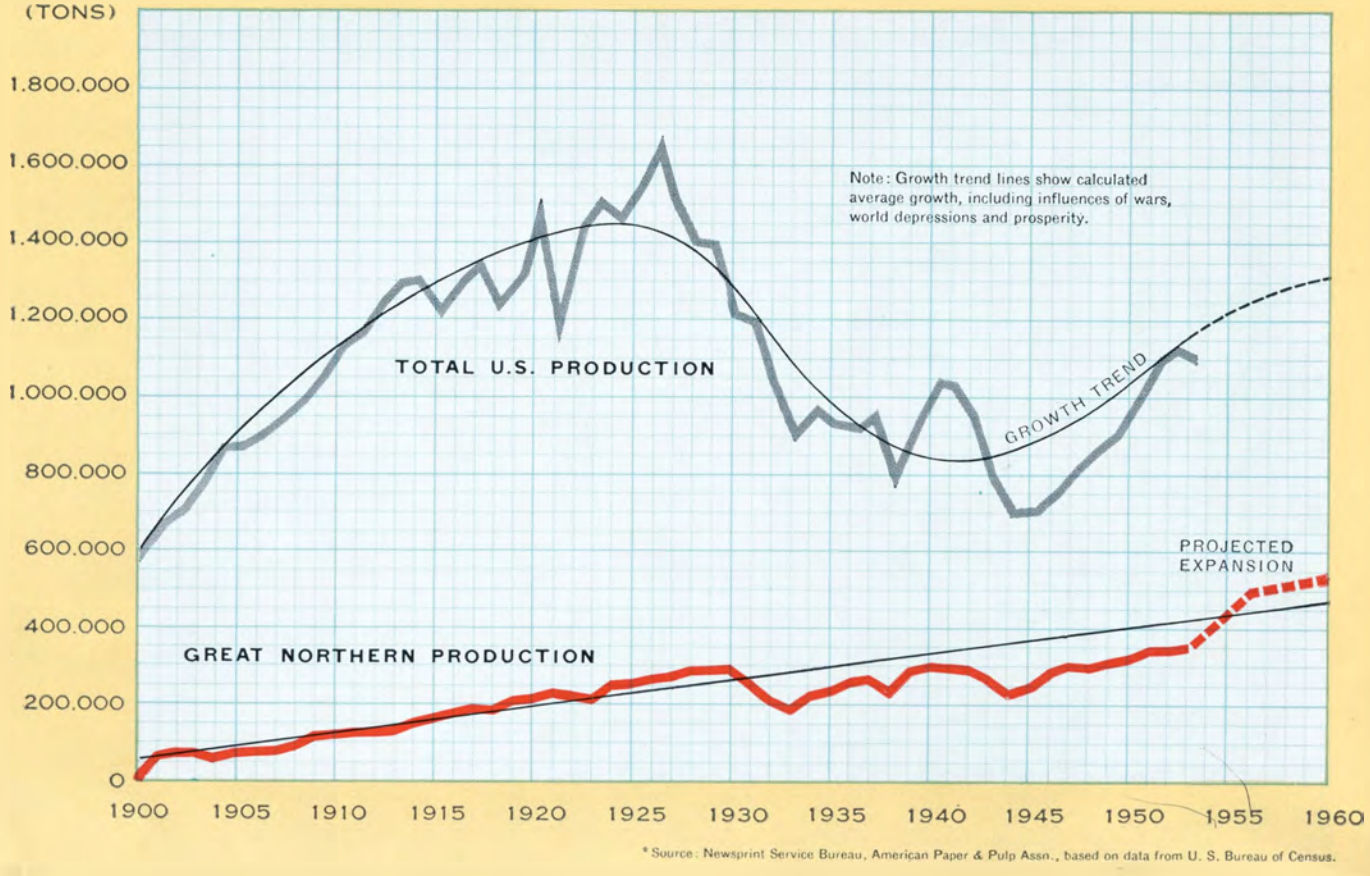
Success can only be measured by accomplishments. The charts which are presented here graphically demonstrate Great Northern's performance in the past, and indicate to present and future purchasers of its products what it is equipping itself to do in the future.

The first chart (see preceding pages) compares the company's production of newsprint to United States consumption of this paper. The company's production curve follows very closely the demand for newsprint, as measured by actual consumption. The consumption curve traces the history of newsprint demand since 1900, reflecting the influence of legislation, wars, depressions and prosperity. Since its first year of operation, Great Northern's production has increased by over 350 per cent, about equal to the growth in total United States per capita consumption in the same period.

Although the company now produces about one-third of all the newsprint made in the United States, its policy has always been to serve all customers alike, large and small. As indicated in the chart above, about two-thirds of Great Northern's customers buy less than 500 tons of newsprint per year from the company. About one-fourth of its customers buy more than 1,000 tons per year.

Spruce stand along a woods hauling road on Great Northern land. The man is using an instrument to measure the height of the trees.

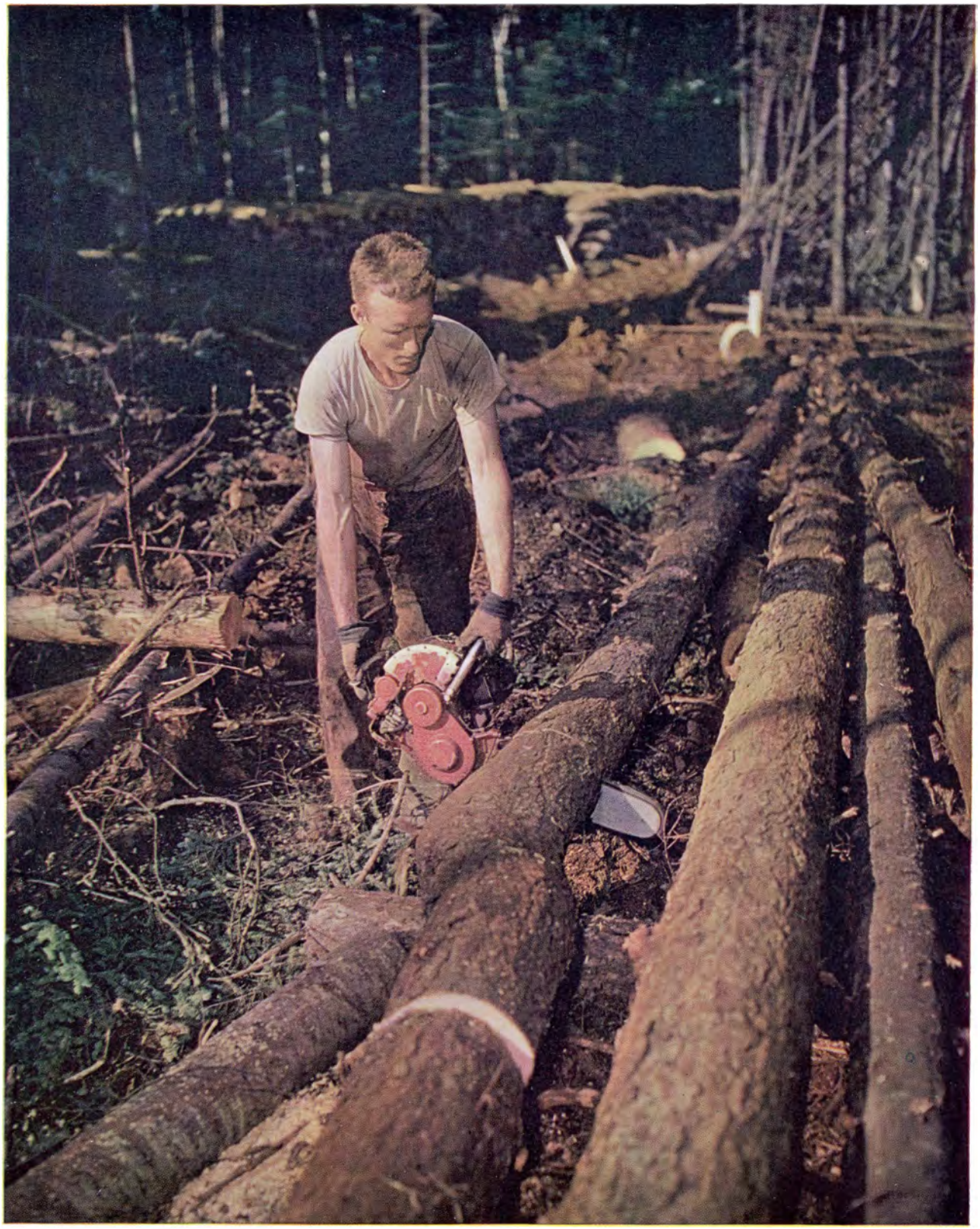
GREAT NORTHERN'S PART IN U.S. NEWSPRINT PRODUCTION*



* Source: Newsprint Service Bureau, American Paper & Pulp Assn., based on data from U. S. Bureau of Census.

The chart on this page compares the company's production of newsprint since 1900 with total United States newsprint production. Trend lines have been drawn through these curves, which include the effect of wars and world depression. From 1900 to 1925, most of the newsprint consumed in the United States was made by domestic mills. The year 1925 marked the point where imports of newsprint produced by the Canadian industry, which grew rapidly in the period after World War I, equalled United States production. It also marked the point at which United States production, the trend of which was steeply upward from 1900, began to decline, continuing until after World War II, when the United States output began to move forward again. During this entire period, Great Northern's growth trend, in the face of the decline in overall United States production, was constantly upward. Its present expansion program continues this trend, adding substantially to the supply of paper for United States publishers.

To protect its natural resources; to make the best possible paper at the lowest possible cost, and sell it fairly; to be a dependable source of supply to its customers; to give work and opportunity to its employees and to grow with the demand for its products: these are the aims of the Great Northern Paper Company.



Woodsman sawing yarded pulpwood into 4-foot lengths with a chain saw.

GREAT NORTHERN PAPER COMPANY