A STUDY OF THE DEVELOPED WATER POWER SITES IN THE STATE OF MICHIGAN

Thesis for the Degree of B. S.

Paul Blake

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A study of the
DEVELOPED WATER POWER SITES
in the state of
MICHIGAN

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Michigan's place in the industrial world is well know by us all. Her factories, her means of transportation, her natural resources, have all combined to make her one of the biggest centers for the production of wealth. We live in a quickly moving, age, an age that gives us little chance to sit down and wonder at the how and the wherefor of all this hurry and scurry and tremendous production of goods. Prominent industrialists, both within our own country, and from foreign shores, have studied the situation and made attempts to analyse the results. Invariably they come to the same conclusion, that our production is increasing at a much greater rate than our population. The reason is obvious, machines are taking the place of men. More machinery is being used today than ever before. In the last quarter of a century we have increased our manufacturing employment 65%, and during the same time our production has increased 170%.

The advent of cheap mechanical power in large quantities, is as responsible for this revelution in industry, as the inventive genius that made the machines possible. We may stop to wonder at the source of all this energy, and in our investigations we find that electricity forms a large share of this energy. Commercially, electrical energy is derived from two sources, that of fuel combustion and waterpower. Of the 27,000,000 KW installed in the United States, 9,200,000 KW are developed by waterpower. In the state of Michigan we find a total installed capacity

of generators to be 1,223,298 KW, or 4.5% of the total power in the United States. 286,000 KW, or 23.4% of this amount is produced by water power. The above figures were obtained from data furnished by the United States Geological Survey and refer to public utility plants of a 100 horse-power or more.

The United States Geological Survey and the Bureau of Census have compiled reports and surveys of the power situation in the various states and sections of the country. However, they have not seen fit to publish detailed information in connection with the various states, so that their reports are of a very general nature. For some time the need of this detailed information has been apparent, and in the winter of this year (1928) the Land Economic Survey Division of the Department of Conservation took steps to compile such information inorder that they would be able to tell where water power was being generated, how much was being generated, where this power was used, and the route which it took in getting to the consumer. As the first step in the collection of this data, the writer went into the files of the Public Utilities Commission. They contained no information concerning those plants that were municipally owned, nor those commercial projects which used all the power they developed in their own processes. To obtain this information the Survey sent out circular letters to the Chamber of Commerce of the principal city of each county. In those counties, where there were no such bodies, letters were sent to the County Clerk. The results were very grat-

ifying, as a large amount of information was collected from this source. The data on the transmission lines was compiled from the records in the Engineer's office of the Pulic Utilities Commission. Some of the lines were taken from the report of the National Electric Light Association published December 1, 1925. The writer also wishes to acknowledge the assistance given him by the Consumers Power Co. in locateing their transmission lines and those of the Southern Michigan Light and Power Co. The surveys of several rivers in the state, prepared by Mr. Wisler of the Univ. of Michigan, were also of great assistance.

To aid the reader in the analysis of the data herein contained, we find a map of the state showing the dams, their capacities, and the transmission lines. All of the towns served by the various companies are not shown on the map. To save confusion, just the principle towns have been shown, and enough of the others to give some idea where the lines run. Also for the sake of simplicity, the country distribution lines have been omitted. In the case of the Detroit Edison Co. only their principle lines are shown. It is their good fortune to have a large amount of power used within a small territory. It is the belief of the writer that this is one of the primary causes for the success of that company.

In the writer's opinion this paper has its chief value as compilation of statistics. It is more or less of a difficult matter to draw conclusions from the material presented unless the material is approached with

some form of argument to begin with. In this latter case there is much to be obtained therefrom. However, there are certain points that have been brought to the writer's attention which might be some value to note here.

Comparing the map contained in this thesis with that published in the report of the National Electric Light Association Report of December 1925, one of the striking features is the increase in the amount of transmission lines. These lines are not only extensions of the former systems, but there have also been lines to interconnect the various companies. Two cases are especially noticeable; one being the interconnection of the Detroit Edison Co. and the Consumers Power Co., and the other being the consolidation and interconnection of several companies in the northwestern part of the state. This latter consolidation makes one system of the various companies extending from Cheboygan on the north, to a point some ten miles north of Muskegon on the south. The power developed by this system is comparatively small, still it covers quite a large amount of territory.

In the National Electric Light Association Report, the system of the Consumers Power Co. is noticeably "U" shaped. Beginning with the developments on the Manistee River and running south thru Grand Rapids and Kalamazoo, east to Battle Creek, Lansing, and Jackson, north to Owosso, Flint, Bay City, and thence up to the developments on the AuSable River. As the western half of the system is on ~~the~~

30 cycles, this is to be expected. More recent information shows that the central part of the "U" is being filled in, from the eastern, or 60 cycle, side.

The Consumers Power Co. system is typical of the present day industry as compared with the industry of twenty-five years and more ago. At that time it was necessary for the industry to go where the power was located. Now the power is developed and brought to the point where the industry may best be located from the point of other factors. The Consumers Power Co. developes nearly half of their power in those stations along the Manistee and AuSable Rivers, and each system is brought in over some hundred miles of transmission line before it is turned into distribution channels.

In the southern peninsula there is a noticeable strip running northeastward from Newaygo County thru Roscommon, and on up to Presque Isle, where the distribution of power is very scanty. This is to be expected, as a map showing the distribution of population will show that in that belt the average population is 1 to 20 persons per square mile. The same in true in the upper peninsula, the development follows the population as it should.

In the earlier history of our industrial development many small plants were put in operation, notably thru the southern part of the state. These plants are giving away to the larger ones, as it has been found that they can not compete with other sources of electrical energy. In these small plants the mechanical power offered by the water was used direct. Some are still in operation

in their original capacity, while others have been converted to small hydro-electric stations. It is the feeling among the operators of public utilities that, due to the present economiss that may be had in steam generation, it is not economical to develope water powers of 4000 KW to 5000 KW or less. For this reason many of these small early plants have gone out of existense. The small plants in a large system may net some return on the investment they represent. In this state the cost per kilowatthour for steam and water power are so nearly equal that it takes a mighty fine water power site to compete with the steam. 69.3% of the dams in this state fall below the 4000 KW class, and they represent 30% of the total power developed. All of the municipal and commercial plants are in this class.

We find the following facts in our study of the data. The total power developed by the stations coverin in this survey is 290,854 KW. Of this 95.23 % is developed by the public utilities, 1.67% is developed by the municipal plants, and 3.1% by the commercial plants. A total of 156 dams were reported. 75% of these were owned by the public utilities, 14.1% by commercial concerns, and 10.9% by municipalities.

An item of prime importance in the operation of a generateing plant is the load factor, not only of the plant itself, but also the system in general. By the term load factor we mean the ratio of the average kilowatthour over the period of a year to the kilowatthour output for a half an hour at the peak of the load curve. Systems must

be designed to take the peak, and to operate efficiently the average should be maintained as close to this peak as is practicable. Creager and Justin in their "Hydro-electric Handbook" state that for small plants the load factor may drop to as small as 20%, and that with large, well regulated, concerns this factor runs up to 80% and in rare cases to 90%. We find from an investigation of the statistics that nearly all of the plants in Michigan operate at a factor which varies from 30% to 50%. Of these we find that a large share of them operate at between 30% and 35%, and an equal number between 45% and 50%. No statistics are at hand on the municipal or commercial plants but in all probability they operate around 30% or less, unless they are interconnected with some utility that is equipt to take care of their peak demand. At first, one would think that in a large interconnected system such as the Consumers Power Co. that the load factor would be high, but on investigation we find that their steam plants operate on the base of the load curve and at a high load factor, while the hydro-electric stations carry the peak on a load factor that is considered quite poor. We find that within the state we have plants operateing on as low a factor as 18.6%, and as high as 67.9%. However, these cases are exceptional.

We find in the territory lying along the border between Michigan and Wisconsin some 57,000 KW of developed water power. It would be interesting to know whether this power is being used in this state, or in

Wisconsin. The transmission lines on this side of the border are few, but the writer has no idea as to the amount of power that may be used by the mining companies concentrated in the area covered by these transmission lines.

It would appear from the information that has been obtained that there is no use of water power in the copper district of the upper peninsula.

The writer regrets that time did not permit him to gather more information on the transmission lines in the upper peninsula. The most prominent cases are those of the Cliffs Power and Light Co. and the Northern Electric Co. It is also felt that some of the systems shown in the southern peninsula have changed since the information shown was compiled.

In reviewing the data covering the period of the past few years, one is constantly reminded of the state of flux that exists in the electrical industry. Smaller companies are being absorbed by the larger ones. Old properties are changeing hands. Thru interconnections and consolidations the southern peninsula is becoming one big network, with the ownership being divided among a few big companies. This does much towards the improvement of the service rendered. In an attempt to keep pace with this changeing state of affairs, the Land Economic Survey is to continue to add information to this report as fast as that information is made available. The writer wishs to call attention to this fact so that anyone who may have occasion to refer to this paper may know where the original inform-

ation is to be found and where any new information is liable to be filed.

The following is an index and supplementary table to be used with the enclosed map. In the one table the dams have been listed alphabetically, in the other the companies have been listed in a similar manner. In the list of companies we will also find the developments that each company owns.

INDEX BY STATIONS

Station	Company	River	Sec. Town. Rng.	K.W. Capacity
Ada	Lower Pen. Power Co.	Thornapple	7N 10W	2500
Albion	Consumers Power Co.	Kalamazoo	16 3S 3W	150
Alcona	" "	AuSable	15 25N 5E	8000
Alpena	Alpena Power Co.	Thunder	Alpena	960
Allegan	Consumers Power Co.	Kalamazoo	33 2N 13W	400
Argo	Detroit Edison Co.	Huron	2S 6E	1075
Athens	Athens Mill & Power	Nottawa	4S 8W	50
Atlanta	No company	Thunder	30N 2E	30
AuTrain	Cliffs Pow.& Lt.Co.	AuTrain	46N 20W	1000
Baldwin	Baldwin Power Co.	Pere Marq.	17N 13W	45
Barryton	Consumers Power Co.	Chippewa	16N 7W	50
Barton	Detroit Edison Co.	Huron	2S 6E	1500
Berrien Springs	Indiana & Mich. Electric Co.	St.Joseph	Berrien Springs	7200
Betsy River	Lower Pen.Power Co.	Betsy	2 25N 15W	1010
Beaverton	Wolverine Power Co.	Tobacco	17N 1W	950
Big Rapids	Consumers Power Co.	Muskegon	15N 10W	520
Black River	Mich.Pub.Service Co.	Black	37N 1W	1000
Bayne City	" " "	Boyne	32N 5W	300
Boyne Falls	" " "	"	32N 5W	75
Brown Bridge	City of Trav.City	Boardman	26N 10W	800
Brule	Wis.-Mich.Power Co.	Brule	41N 31W	5832
Buchanan	Ind.& Mich.Elec.Co.	St.Joseph	Buchanan	4100

Station	Company	River	Sec-Town-Rng	K.W. Capacity
Callam	Consumers Power Co.	Tobacco	19N 4W	
Cambria	Ind.Elec.Utilities	St.Joseph	7S 3W	55
Carp River	Cliffs Pow.& Lt.Co.	Carp	48N 25W	5600
Care	Mich.Electric Co.	Cass	12N 9W	450
Cascade	Lower Pen.Power Co.	Thornapple	6N 10W	2000
Ceresco	Consumers Power Co.	Kalamazoo	2N 6W	600
Centerville	Centerville Water & Electric Co.	Prairie	6S 10W	
Chalk Hills	Northern Elec.Co.	Menominee	36N 28W	9000
Chappel	Gladwin Lt.&Pow.Co.	Cedar	19N 2W	450
Chandler Falls	Escanaba Power & Traction Co.	Escanaba	25 40N 23W	2500
Cheboygan	Union Bag & Paper Corporation	Cheboygan	38N 1W	1500
Constantine	Mich.Gas & Elec.	St.Joseph	7S 12W	1200
Cooke	Consumers Power Co.	AuSable	15 24N 7E	9000
Creswell	Mich.Sugar Co.	Black	10N 16E	
Crystal Falls	City of Cr.Falls	Paint	43N 32W	600
Croton	Consumers Power Co.	Muskegon	12N 11W	9000
Dead River	Cliffs Pow.& Lt.Co.	Dead	48N 26W	2000
Deer Creek	E.Jordan Elec.Light & Power Co.	Deer Creek	32N 7W	160
Edenville	Wolverine Pow.Co.	Tittabawassee	17N 1W	3000
Elk Rapids	Mich.Pub.Service Co.	Elk	29N 9W	625

Station	Company	River	Sec-Town-Rng	K.W. Capacity
Ferry	Mich.Pub.Service Co.	North Br. White	14N 16W	75
Five Channels	Consumers Power Co.	AuSable	24N 6E	6000
Flat Rock	Escanaba Power & Traction Co.	Escanaba	7 39N 22W	1800
Foote	Consumers Power Co.	AuSable	24 24N 8E	9000
Ford	Ford Hydro-Elec.Co.	Menominee	40N 31W	6200
Four Mile	Alpena Power Co.	Thunder	31N 8E	1800
Frankenmuth		Cass	11N 6E	
Frembrook	City of Portland	Grand	5N 5W	250
French Landing	Detroit Edison Co.	Huron	3S 8E	3000
Freeport	Freeport Elec.Co.	Thornapple	5N 9W	85
Geddes	Detroit Edison	Huron	2S 7E	1000
Gerard	City of Gerard	Br.of St.Jos.	5S 6W	
Gladwin	Jos.Schulz Jr.	Cedar	18N 2W	225
Goodrich	Goodrich Elec.Co.	Kearsley Cr.	6N 8E	58
Grand Rapids	Consumers Power Co.	Grand	7N 12W	400
Groos	Escanaba Power & Traction Co.	Escanaba	35 40N 25W	3200
Grayling	Mich.Pub.Service Co.	AuSable	26N 4W	125
Greenville	Consumers Power Co.	Flat	9N 8W	300
Hamilton	Hamilton Elec.Lt. & Power Co.	Rabbit	3N 14W	110
Hart	City of Hart	Pentwater	15N 17W	720
Hartford	Anderson Bros.	Paw Paw	Hartford	350
Hankey	Hankey Milling Co.	Bear Cr.	34N 5W	50
Hesperia	Mich.Pub.Service Co.	White	14N 14W	300

Station	Company	River	Sec-Town-Rng	K.W. Capacity
Hersey	Frank McIntyre	Hersey	17N 10W	75
Hillman	Paul Klowski	Thunder	31N 4E	90
Hodenpyl	Consumers Power Co.	Manistee	25N 12W	18,000
Hodunk	Vill.of Hodunk	Hog Creek	5S 7W	
Homer	Homer El.Lt.&Pow.Co.	Br.of Kalamazoo	4S 4W	90
Hubbardston	Consumers Power Co.	Fish Creek	8N 5W	240
Ingalls	Menominee & Marinette Lt.&Trac.Co.	Menominee	34N 27W	6500
Junction	Consumers Power Co.	Manistee	31 22N 15W	18,000
Kalamazoo	Bryant Paper Co.	Kalamazoo	2S 11W	
Keystone	City of Traverse City	Boardman	26N 11W	600
LaBarge	Consumers Power Co.	Thornapple	15 5N 10W	600
L'Anse	Village of L'Anse		50N 35W	150
Langston	Consumers Power Co	Flat	11N 8W	
Leetsville	Antrim Light & Power Co	Rapid	28N 7W	
Leland	No.Mich.Public Service Co.		9 32N 12W	240
Loud	Consumers Power Co.	AuSable	24N 6E	4000
Lowell #2	King Milling Co.	Grand	6N 9W	
Lowell #1	Consumers Power Co.	"	34 7N 9W	600
Lower	No.Mich.Public Service Co.	Boardman	27N 11W	640
Lyons	City of Lyons and Consumers Pow.Co.	Grand	7N 5W	75

Station	Company	River	Sec-Town-Rng	K.W. Capacity
Main Street E.	Consumers Pow.Co.	Kalamazoo	2S 7W	200
Maple	Mich.Pub.Service Co.	Maple	36N 4W	225
Marion	Consumers Power Co.	Br.of Muskegon	20N 7W	60
Mancelona	Antrim Lt.&Pow.Co.	Cedar	30N 7W	120
Manton	Vil.of Manton	Br.of Manistee	25N 9W	
Marshall		Kalamazoo	2S 6W	
Mayfield	H.R.Sargent	Mayfield Cr.	26N 10W	35
McClure	Cliffs Pow.& Lt.Co.	Dead	48N 25W	10,000
McManus	George McManus		34N 5W	315
Mio	Consumers Power Co.	AuSable 12	26N 2E	5000
Milford	Detroit Edison	Huron	2N 7E	360
Monroe St.	Consumers Power Co.	Kalamazoo	2S 7W	150
Mt.Pleasant	" "	Chippewa 16	14N 4W	350
Mottville	Mich.Gas & Elec.Co.	St.Joseph	8S 15W	1600
Morley	Western Hydro-Electric Co	Little Muskegon	15 N 9W	188
Moores Park	City of Lansing	Grand	4N 2W	1000
Newaygo	Consumers Power Co	Muskegon 24	12N 15W	1600
Nickel Plate	J M Spurrier	Prairie Cr.	7N 6W	50
North Branch	Emil Klowski	No.Branch of Thunder	33N 6E	
Norway Point	Alpena Power Co.	Thunder	31N 8E	4000
Oliver	Oliver Company	Menominee	39N 30W	
Ortonville	Paulding Milling Co.	Kersley Cr.	5N 9E	35
Otsego	Consumers Power Co.	Kalamazoo 17	1N 12W	1500

Station	Company	River	Sec-Town-Rng	K.W. Capacity
Paper Mill	Detroit Edison Co.	Huron	3S 7E	950
Penn Iron	Penn Iron Co.	Menominee	41N 30W	
Pine	Wis.-Mich.Pow.Co.	Pine	Wisconsin	4000
Plainwell #1	Consumers Power Co.	Kalamazoo 19	1N 11W	900
Plainwell #2	Low.Pen.Power Co.	Kalamazoo	1N 11W	600
Portage	Mich.Gas & El.Co.	Portage	7S 12W	210
Petoskey	City of Petoskey	Bear Creek		150
Raisinville	River Raisin Hydro-Electric Co.	Raisin	6S 7E	100
Ravenna	Consumers Power Co.	Crockery Cr.	9N 14W	340
Reed City	Consumers Power Co.	Heney Br.of Muskegon	17N 10W	
Rockford	" "	Rouge	9N 11W	
Rodmans	Asa J Rodman	Silver Creek	25N 8E	
Rogers	Consumers Power Co	Muskegon 16	14N 10W	6750
Sanford	Wolverine Power Co	Tittabawassee	15N 1W	
Saranac		Lake Creek	6N 8W	
Sault Ste.Marie	Edison Soo Electric Co.	St.Marys	47N 1E	2365
Saxon Falls	Lake Superior Dis. Power Co.	Montreal	48N 48W	1250
Secord	Wolverine Power Co.	Tittabawassee	19N 1E	1500
Shiawassee	Consumers Power Co.	Shiawassee 1	5N 5E	150
Smallwood	Wolverine Power Co.	Tittabawassee	18N 1E	1500
Smyrna	Consumers Power Co.	Flat	8N 8W	240
Stronach	" "	So.Branch of Manistee 24	21N 13W	800

Station	Company	River	Sec-Town-Rng	KW Capacity
Sturgeon	Wis-Mich.Pow.Co.	Menominee	39N 29W	1000
Stone	J.G.Krauth	Ocquoce	35N 3E	
Superior	Detroit Edison Co.	Huron	3S 7E	1325
Superior Falls	Lake Superior Dist. Power Co.	Montreal	48N 49W	1650
Tekonsha	Vill.of Tekonsha	Br.of St.Jos.	4N 6W	
Thorns	John Thorn	Rifle	22n 2E	90
Tower	Onaway Elec.Lt. & Power Co.	Black		450
Trowbridge	Consumers Power Co.	Kalamazoo	11 1N 15W	1500
Twin Falls	Wis-Mich.Pow.Co.	Menominee	40N 30W	6250
Upper	No.Mich.Public Service Co.	Boardman	27N 11W	420
Upper		Lake Creek	6N 8W	
Union City	Vil.of Union City	St.Joseph	5S 7W	
Valley City	Valley City Milling Co.	Lookinglass	6N 5W	150
Vassar	Hart Bros.Elevator Co.	Cass	11N 8E	300
Wagar	Consumers Power Co.	Grand	29 7N 5W	450
Webber	" "	"	4 6N 5W	3000
White Rapids	Northern Elec.Co.	Menominee	36N 28W	9000
Wolf Creek	Otto Klowski	Wolf Creek		
Wolverine	Mich.Pub.Service Co.	Sturgeon	33N 2W	60

Station	Company	River	Sec-Town-Rng	K W Capacity
#1	Menominee & Marinette Paper Co.	Menominee	31N 27W	3500
#2	Menominee & Marinette Paper Co.	"	31N 27W	3000
#1	City of Charlevoix	Intermediate	30N 8W	375
#2	City of Bellaire	Cedar	30N 8W	125
	Mich.Northern Power Co.	St.Marys	47N 1E	40,000
	PrairieCreek Milling Co.	Prairie Cr.	7N 6W	50

PUBLIC UNILITY PLANTS

Company	Dam
Alpena Power Company	Alpena
	Four Mile
	Norway Pt.
Anderson Bros.	Hartford
Antrim Light & Power Co.	Leetsville
	Mancelona
Athens Mill & Power Co.	Athens
Baldwin Power Plant	Baldwin
Centerville Water & Electric Company	Centerville
Cliffs Power & Light Co.	AuTrain
	Carp River
	Dead River
	McClure
Consumers Power Company	Albion
	Alcona
	Allegan
	Barryton
	Big Rapids
	Callam
	Ceresco
	Cooke
	Croton
	Five Channels
	Foote
	Grand Rapids
	Greenville

Company	Dam
Consumers Power (Cont'd)	Hodenpyl
	Hubbardston
	Junction
	LaBarge
	Langston
	Loud
	Lowell #1
	Lyons
	Main St.E.
	Marion
	Mio
	Monroe St.
	Mount Pleasant
	Newaygo
	Otsego
	Plainwell
	Ravenna
	Reed City
	Rockford
	Rogers
	Shiawassee
	Smyrna
	Stronach
	Trowbridge
	Wagar
	Webber

Company	Dam
Detroit Edison Co.	Argo
	Barton
	French Landing
	Geddes
	Milford
	Paper Mill
	Superior
East Jordan El.Light & Power	Deer Creek
Edison Sault Electric Co	Sault Ste.Marie
Escanaba Power & Trac.Co.	Chandler Falls
	Flat Rock
	Groos
Ford Hydro-Electric Co.	Ford
Freeport Electric Co.	Freeport
Gladwin Light & Power Co.	Chapel
Goodrich Elec.Co.	Goodrich
Hamilton El.Lt.& Pow.Co.	Hamilton
Homer El.Lt.& Power Co.	Homer
Indiana Elec.Utilities	Cambria Homer
Indiana & Mich.Elec.Co.	Buchanan
	Berrien Springs
Lake Superior Dist.Pow.Co.	Superior Falls
	Saxon Falls
Lower Peninsula Pow.Co.	Ada
	Betsie River
	Cascade
	Flainwell

Company	Dam
McIntyre, Frank	Hersey
Mich.Nor.Pow.Co.	Sault Ste.Marie
Michigan Electric Co.	Caro
Michigan Public Service Co.	Black River
	Boyne City
	" Falls
	Elk Rapids
	Ferry
	Grayling
	Hesperia
	Maple
	Wolverine
Michigan Gas & Elec.Co.	Constantine
	Mottville
	Portage
Menominee & Marinette Light & Traction Co.	Ingalls
No.Michigan Public Service Co.	Lower
	Leland
	Upper
Northern Electric Company	Chalk Hills
	White Rapids
Onaway El.Light & Power Co.	Tower
Paulding Milling	Ortonville
Penn Iron Company	Penn Iron
River Raisin Hydro-Elec.Co.	Raisinville
Sargent, H.R.	Mayfield
Spurrier, J.M.	Nickel Plate

Company	Dam
Schuls, Joseph, Jr.	Gladwin
Thorn, John	Thorn's
Western Hydro-Elec.Co.	Morley
Wisconsin-Michigan Power Co.	Brule
	Pine
	Sturgeon
	Twin Falls
Wolverine Power Co.	Beaverton
	Edenville
	Secord
	Smallwood

MUNICIPAL PLANTS

City	Dam
Bellaire	Bellaire #2
Charlevoix	" #1
Crystal Falls	Crystal Falls
Girard	Girard
Hart	Hart
Hodunk	Hodunk
Lansing	Moore's Park
L'Anse	L'Anse
Lyons	Lyons
Manton	Manton
Petoskey	Petoskey
Portland	Frenbrook
Tekonsha	Tekonsha
Traverse City	Brown Bridge
	Keystone
Union City	Union City

COMMERCIAL PLANTS

Company	Dam
	Atlanta
Bryant Paper Company	Kalamazoo
Klowski, Emil	North Branch
Klowski, Otto	Wolf Creek
Klowski, Paul	Hillman
	Frankenmuth
Hankey Milling Co.	Hankey
Hart Brothers	Vassar
King Milling	Lowell #2
Krauth, J.G.	Stone
	Marshall
McManus, George	McManus
Menominee & Marinette Paper Co.	Menominee #1
	Menominee #2
Mighigan Sugar Co.	Croswell
Oliver Company	Oliver
Prairie Creek Milling	Prairie Creek
Rodman, Asa J.	Rodman's
Union Bag & Paper Co.	Cheboygan
Valley City Milling Co.	Valley City
	Saranac
	" Upper