GRAND HAVEN
MUNICIPAL POWER PLANT

To the citizens of Grand Haven, Michigan,

presenting

YOUR NEW POWER STATION

This is the newest and latest addition to YOUR municipal electric system. The building sets on a group of over 400 concrete piles on swamp river bottom land owned for many years by the City. It has ample water for cooling, space for growth and improves an otherwise favorable harbor and potential marine area.

Grand Haven's electric plant has had a long and interesting history. It was started back in 1896 with an initial investment of only $10,000. All subsequent improvements have been paid for out of net revenues.

The new station cost $5,000,000. It will be paid for entirely out of surplus electric revenues and NOT TAXES. In fact, it pays the City 2.7% of its gross revenues in lieu of taxes.

MUNICIPAL LIGHT • POWER

BOARD OF LIGHT and POWER


Nelson H. Fisher


Herman K. Johnson


J. P. Ledinsky


Donald M. Dykhouse


M. A. Erickson


J. Bryan Sims

In 1896 the City of Grand Haven of necessity entered into the electric power business to provide badly needed street lighting, power for water pumping and an adequate source of electricity for residents of the community.

The first plant was built with a $10,000 bond issue. From this humble beginning the service has grown to its present size.

In 1929-30 after turning down the offers of two power companies to buy the property, the City Charter was revised and an elected five man utility board set up to manage the affairs of the system.

Those members who have served you over the years are as follows:

John J. Mulder	1930-32
Edward L. Behm	1930-37
James H. Johnston	1930-34
O. T. Schubert	1930-40
Harry J. Swanson	1930-41
Hartger Jonker	1932-41
Hugh P. Mulligan	1934-40
Arthur G. Walter	1937-47
Adrian H. Ringelberg	1940-49
Abram J. Wessel	1940-56
Nelson H. Fisher	1941-to date
Clifford J. Walsh	1941-51
Hugh P. Mulligan	1947-57
Gerrit Schultz	1949-59
Herman K. Johnson	1951-to date
W. T. Newman	1957-58
A. W. Schuler	1957-61
J. P. Ledinsky	1958-to date
Donald M. Dykhouse	1959-to date
M. A. Erickson	1962-to date

Superintendents

Harry J. Badcon	1930-37
Edward L. Behm	1937
J. Bryan Sims	1937-to date

Clerk

J. Nyhof Poel	1930-to date

THE PRESENT . . .

Grand Haven's electric system consists of an older 3000 kilowatt, 3 unit, 150 lb., steam plant on Water Street. (A kilowatt will burn a 100 watt bulb for 10 hours.) Adjoining is a 9 unit, 18,630 KW Diesel engine plant burning heavy residual fuel and natural gas, one of the largest Diesel plants in the United States.

Located on the City owned island is your newest, up-to-date, modern, coal burning, 600 lb., 825° F, steam turbine generating plant with a capacity of 24,000 Kilovolt-amperes, 20,000 KW, 13,200 volts.

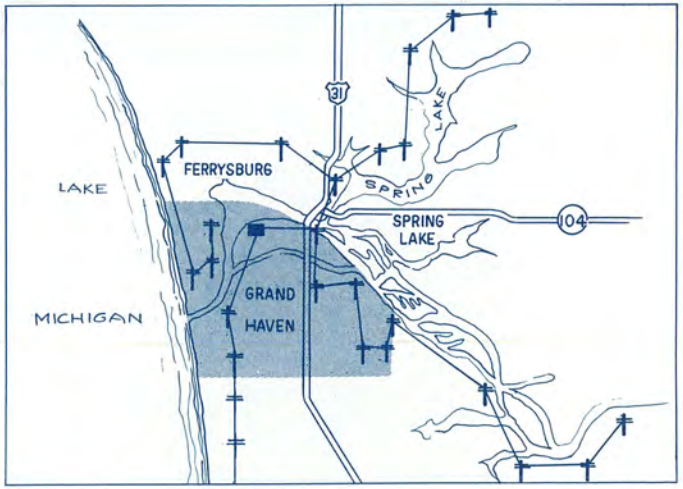
The three plants are tied together into the electric distribution system which utilizes a 13,200 volt double circuit loop through a new 20,000 KVA substation near the two older power plants. The new and more efficient steam plant carries the base load and the gas and oil burning Diesel plant takes the peak loads. This is an ideal combination, eliminating the necessity of banking fires in boilers. Due to the instant availability of the Diesel engines during sudden peak loads and their not using any fuel when shut down, the combination makes an unusually efficient operating system.

The modern colonial electric service building is located near the Diesel plant and the older steam plant on Water Street. It is heated by steam from waste heat boilers on the exhaust of the Diesel engines.

AND THE NEW

AREA SERVED

The system serves the Grand Haven Ferrysburg, West Spring Lake, North Shore and Mercury Drive areas using many miles of electrical distribution. Grand Haven has served those adjoining areas since the establishment of the plant and was a pioneer in rural service.



FROM COAL TO ELECTRICITY . . .

DOCK

Coal is the basic source of fuel for the new steam plant although the steam generators (boilers) are also equipped for burning heavy residual oil should the occasion arise. This fuel is obtainable from nearby refineries or from lake vessel shipment.

Coal arrives at the new municipal dock in approximate 10,000 ton loads by lake freighters, the cheapest transportation available, and is deposited onto the storage area by self unloading belts from the vessels.

The new one quarter million dollar dock is approximately 437 feet long and is designed to be ultimately lengthened to 1000 ft. as the plant is increased in size. It is designed for 21 ft. draft at present and for 27 ft. in the future.

COAL HANDLING

The present coal storage area can readily store 50,000 to 60,000 tons although the Board of Light & Power has, by city charter, been allowed space on the island for an ultimate 100,000 KW plant with adequate coal storage. A minimum of six months supply is carried through the winter. The coal is moved from the storage area by bulldozer to a reclaiming hopper onto an inclined belt to the crusher house where it may be crushed to a uniform size. The coal is carried to the top of the station by a 125 ton per hour, 24" wide belt, and then dropped onto a longitudinal belt. By means of gates the coal is dropped into each of the two 300 ton cylindrical bunkers.

Coal shutes carry the coal from the bunkers through individual automatic coal weighing scales to the feeders on the spreader stokers which with a paddle wheel action throws the fuel into the boiler furnaces over a traveling grate. Some of the fuel is burned in suspension, the remaining larger pieces are burned on the grate. The ash is automaticaly dropped into ash bunkers below the boilers.

CRUSHER HOUSE

Coal may be purchased previously sized by the mines or it may be purchased unsized and prepared by crushing by the equipment in the crusher house. Here it passes over an electro magnetic separator for removing any "tramp" iron.

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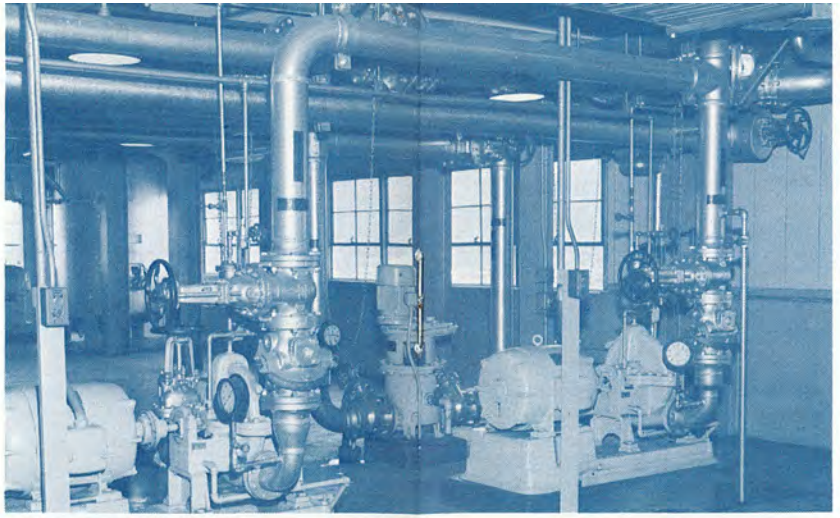
STEAM GENERATORS (BOILERS)

Two 700 lb. rated boilers are capable of producing 125,000 lbs. of steam per hour each, continuously. Water passing through the thousands of feet of tubes in these boilers is converted to steam at a pressure of 600 lbs. per square inch, 825° F and is used to drive the 12,500 KVA turbine generators. Each of the boilers is approximately 75 feet above the ground. At the top is a steam drum which weighs several tons with steam pipes to the turbines.

The boilers require 43,712 cu. ft. of air per minute furnished by forced draft fans, motor driven. Coal consumption averages approximately 100 tons daily for each unit.

Distilled water, used to make steam, is stored in two tanks with total capacity of 12,000 gallons. Evaporators convert steam to distilled water for the boilers. A very small amount of distilled water is required daily for make up.

All auxiliary equipment including boiler feed pumps is electric motor driven and a standby 1136 KW Diesel engine generator is available for emergency start up.



ASH HANDLING

Ash is removed from the collecting hopper by means of a hydraulic system. It is flushed by river water pressure through a pipe line to waste land adjacent to the plant and used to fill the swamp area. This is building new valuable waterfront property for future development.

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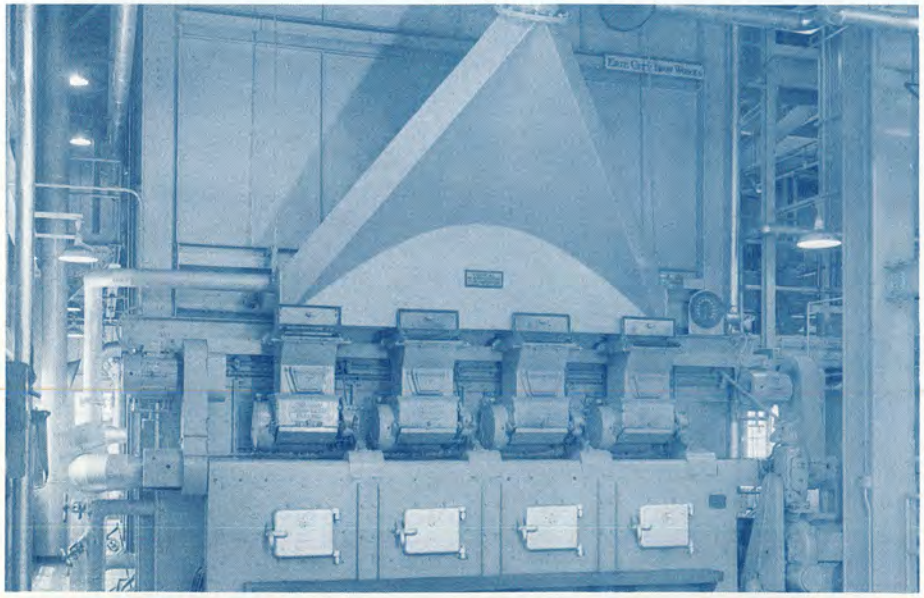
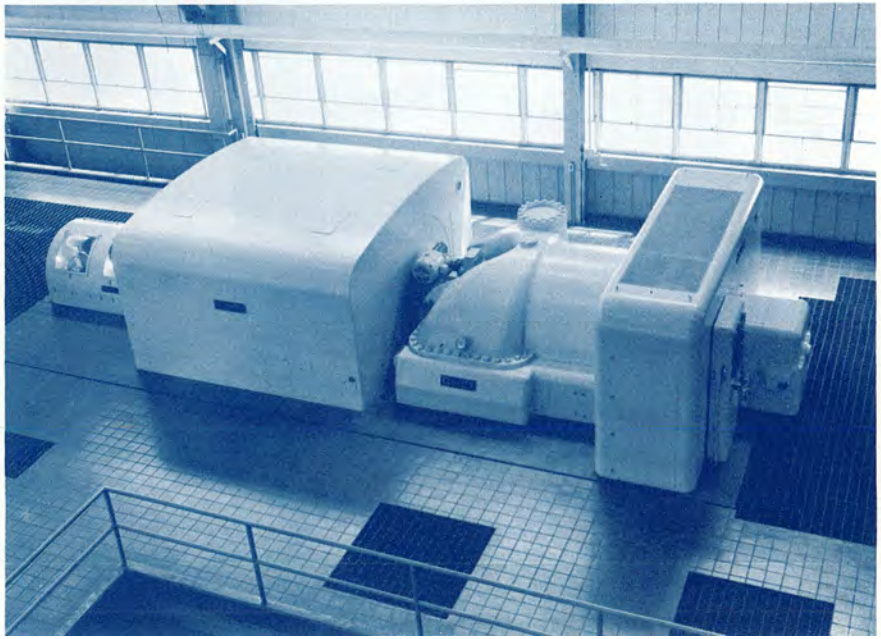
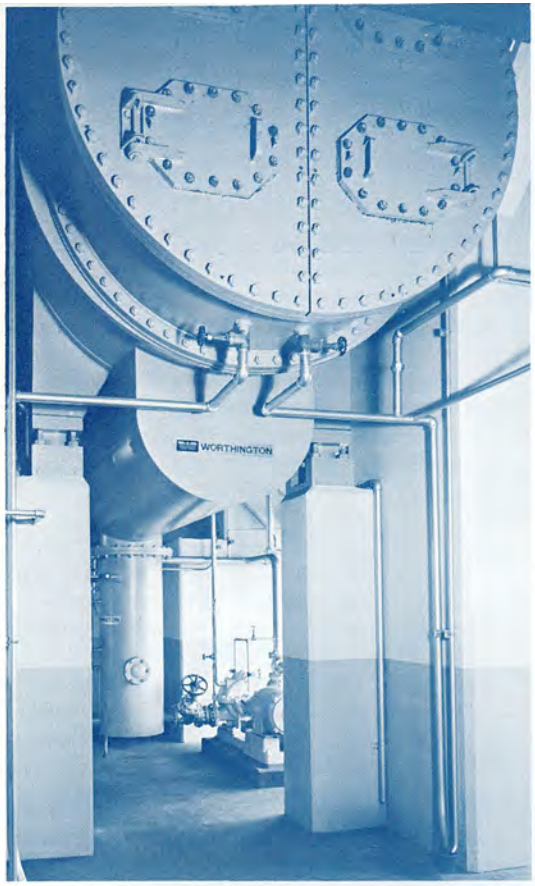
STEAM TURBINES

Two 10,000 KW, 12,500 KVA, steam turbine generators are perhaps the heart of the plant. Here heat energy from the steam is converted to mechanical energy. The powerful turbines rotate at 3600 revolutions per minute to turn the electric generators. Steam supplied from the boilers to the turbines at 600 lb. per square inch and 825° F, strikes thousands of steel vanes or "buckets". This tremendous force turns the turbines which are coupled direct to the generator rotors. The action of the rotor's magnetic fields moving past coils of wire in the generator stator or stationary part produces electricity at 13,200 volts for distribution to Grand Haven and area homes and factories.

The small direct current machines connected at the extreme end of the turbine generator and enclosed in an electric lighted housing, acts as an "exciter" to magnetize the larger 13,200 volt generators.



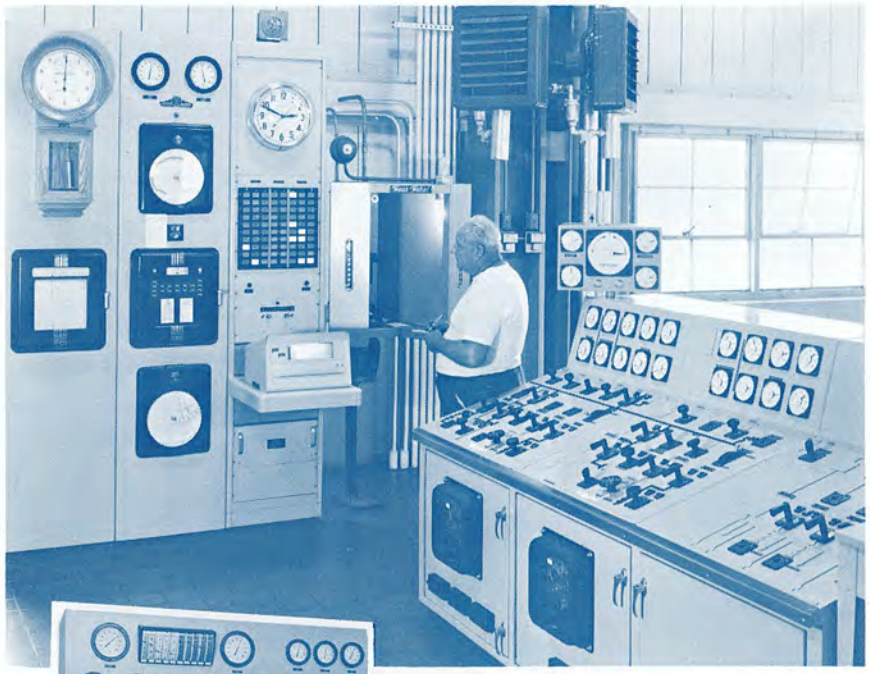


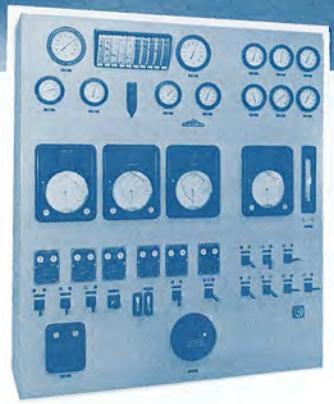


CONDENSERS

After the live steam has performed its task of turning the turbines, it passes through the 10,000 square feet steam condensers (under the turbines). These condensers cool and convert the steam back into water for recirculation through the boilers in a never ending cycle.

These steam condensers contain about 2000 copper tubes and are cooled by four vertical river water pumps located in the pump house on Grand River. The river water flows through traveling screens to clean it before it is pumped through the copper condenser tubes. The condensed water from the steam is returned to the boilers by four 250 gallon per minute boiler feed pumps driven by 200 hp electric motors.





CONTROL EQUIPMENT

At the control center, operating personnel direct plant operations by various automatic control devices and switches augmented by a very modern recording device and alarm system. Steam flow, pressures, and temperatures can be observed here and controlled. Automatic recorders give daily permanent records and charts.

Most of the automatic combustion control functions throughout the plant are performed by an air system furnished by four motor driven air compressors.

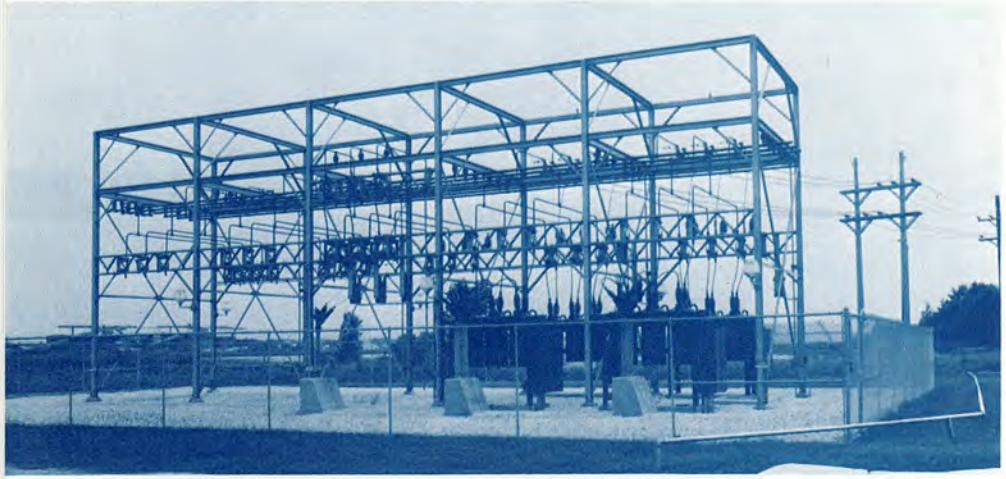
Due to automation, an unusually complete inter - comunication system, a passenger elevator, as well as centralized control and other important design features, only two operators are required per eight hour shift.

PUMP HOUSE

Four 75 hp, 5250 gallon per minute each, 30 ft. head, vertical pumps take river water from the river through self cleaning traveling screens and pump water to the condensers. A back flow pump with a 20" return pipe line is provided to recirculate the warmer discharge water to prevent needle ice from accumulating on the screens in the winter.

OUTDOOR ELECTRIC FACILITIES

Electricity flows from the generator under ground through large lead covered cables to the substation where the one million KVA interrupting capacity generator and outgoing feeder switches are located. It is distributed from there to the double circuit, 13,200 volt loop around the city.



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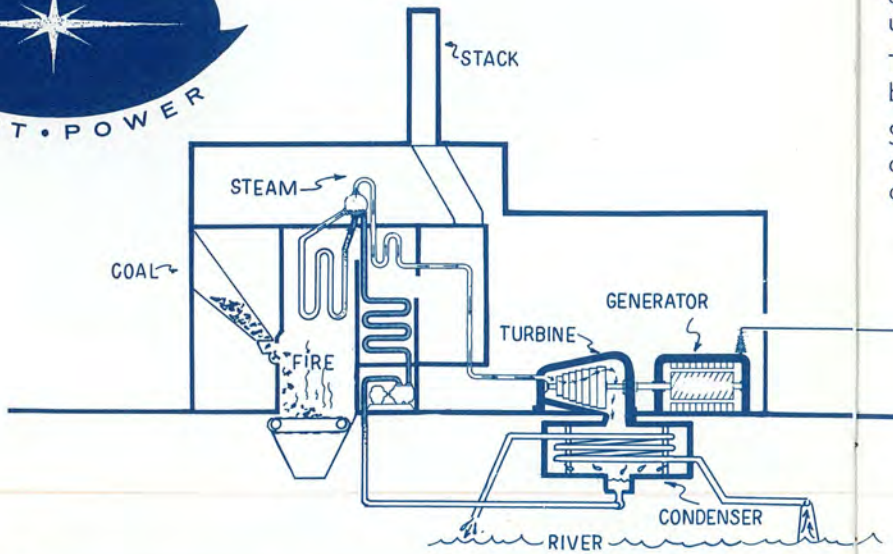


ELECTRIC DISTRIBUTION

Grand Haven has, like many other systems, gradually increased its generating voltage from 2400 volts to 7200 volts and now to the standardized 13,200 volts which most larger plants use.

The two new 12,500 KVA, 13,200 volt generators feed into the outdoor substation near the front of the building and from there distribute to a double circuit loop around Grand Haven serving industry, commercial and residential customers through transformers which step the high voltage down to voltage suitable for commercial and residential customers. This loop serves five substations in Grand Haven, West Spring Lake, Ferrysburg, and North Shore areas, stepping down voltage from 13,200 volts to lower voltage circuits. The loop ties into the substation at the Diesel plant. Loop feed allows sectionalizing during lightning trouble with fast electrically controlled 3 'shot' reclosers aiding in restoring service.

Close proximity of the load to the plant eliminates transmission line losses which are suffered by larger systems not having power plants in the center of their load.

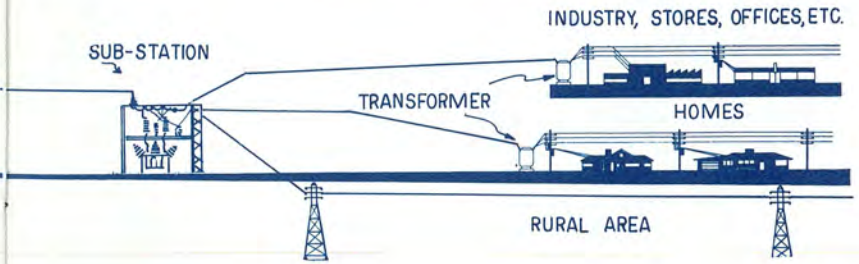
All standard commercial voltages are available to power customers and all transformers and substations are furnished at no cost to the customer.

A 69,000 volt interconnection with the Wolverine Electric will be completed soon for emergency exchange of power. Additional 13,200 volt feeder circuits are planned from the substation at the new steam plant as the need arises.

Electric distribution crews are continually rebuilding and adding to the system in order to render adequate service. Street lights, traffic lights, and part of the fire alarm system are maintained by this department and the meter section reads and keeps all electrical meters in order so that each customer may have an accurate account of current used.

Tree trimming crews constantly maintain proper clearance of all distribution wires to minimize outages to our customers during storms.

Since electricity is no longer a luxury but a necessity, the distribution department is on a twenty-four hour call basis. Due to the short distances to be traveled by crews, better service can be rendered.



MUNICIPAL LIGHT • POWER

ENGINEERING

Preliminary Design & Design Criteria
J. Bryan Sims

Soil Consultation
Professor Wm. S. Housel
Hanson, Collins & Rice

Soil Borings and Tests
Raymond Concrete Pile Co.

Detail Design, Specifications and Supv. Construction
Lutz & May Company
M. E. Borene, Project Engineer
Lee Seybert, Resident Engineer
Ello Emery, Ass't. Resident Engineer

CONSTRUCTION - CONTRACTORS

Substructure
Superstructure
Pump House ..... **Elzinga & Volkers**
Dock ..... **Getman Brothers**
Water Pipe Line ..... **Wm. Boeve & Sons**
Bridge Underpinning ..... **Erickson Trucking Co.**
Power Piping ..... **Industrial Piping Co.**
Electrical ..... **Hall Electric Company**

MAJOR EQUIPMENT

Boilers & Stokers ..... **Erie City Iron Works**
Turbine Generators ..... **Elliott Company**
Condensers ..... **Worthington Corporation**
Coal Handling ..... **Jervis B. Webb Company**
Boiler Feed Pumps ..... **Pacific Pump Company**

OTHER EQUIPMENT

Chicago Heater Company, American Standard, Griscom Russell Company, Johnson Pump Co., Panellit Co., Nelson Electric Co., Kirkhof Electric Co., Independent Electric Co., Gould National Batteries, Fisher & Porter, Bailey Meter Co., Northern Machinery Co., United Conveyor Co., United Elevator Co., Chicago Bridge & Iron Co., O'Brien Machinery Co., Gardner Denver Co., Johnston Bros., Inc.

RATES

Rates in Grand Haven are low. Listed hereto is a recent residential rate comparison as compiled from Federal Power Commission reports.

CITY	USAGE PER MONTH 25 KWH's	40 KWH's	100 KWH's	250 KWH's	600 KWH's
Adrian	$1.50	$2.12	$3.84	$7.20	$11.46
*Allegan	1.30	1.92	3.64	6.64	10.54
Alpena	1.04	1.66	3.85	8.04	15.06
Ann Arbor	1.36	2.04	3.88	8.05	11.94
Benton Harbor	1.30	1.98	3.97	7.44	11.02
Detroit	1.36	2.04	3.88	8.05	11.94
*Dowagiac	1.30	2.03	4.06	7.54	12.09
Flint	1.50	2.12	3.84	7.20	11.46
***Grand Haven**	**1.18**	**1.80**	**3.38**	**6.58**	**9.52**
Grand Rapids	1.50	2.12	3.84	7.20	11.46
*Holland	1.18	1.87	3.56	6.36	10.30
Hudsonville	1.50	2.12	3.84	7.20	11.46
*Lansing	.92	1.46	3.12	6.38	10.02
Muskegon	1.50	2.12	3.84	7.20	11.46
*Petoskey	2.08	3.02	5.20	8.84	14.30
*South Haven	1.30	1.92	3.72	6.84	10.40
*Zeeland	1.18	1.87	3.54	6.66	10.57
State Average				7.72	
National Average			4.21	7.75	

*Municipal Operated Electric System.

Bills include Michigan 4% Sales Tax.
Rates taken from Federal Power Commission Rate Book of November, 1961.
600 KW Hr. usage computed on applicable water heating rate.

This, then, is the new Municipal Power Plant . . . growing with Grand Haven and the Tri-City area to meet the needs of today and the predictable future. Built with net revenues of the system itself and operated to bring this community the best electrical service possible at the lowest possible rate.