GENERAL DESCRIPTION

OF THE

SEWAGE TREATMENT WORKS

AND OTHER IMPROVEMENTS

CONSTRUCTED BY THE

SYRACUSE INTERCEPTING SEWER BOARD

SYRACUSE
N. Y.

This publication is not intended as a technical report of the Syracuse Intercepting Sewer Board. Rather it endeavors to describe in non-technical language and with simple illustrations some of the more interesting features of its work and to discuss some of the perplexing problems which have required the consideration and earnest application of the Board and its Engineers.

1925

I. C. S. FORM NO. 19

SYRACUSE INTERCEPTING SEWER BOARD

COMMISSIONERS
JACOB AMOS
GILES H. STILWELL
WILLIAM W. WIARD

ROOM 104, CITY HALL

GLENN D. HOLMES
CHIEF ENGINEER
HARRY J. HAMLIN
SECRETARY

SUBJECT

SYRACUSE, N. Y., June 1, 1925.

TO THE INTERESTED CITIZEN:-

This publication is sent to you for perusal and examination. You will find in it a simple-and we believe, attractive-story of some of the extensive works already constructed by the Intercepting Sewer Board.

We hope you will find something therein of interest, and that you will glean therefrom some idea of the vitally important problems to which we, and our Engineering Organization, have earnestly and conscientiously applied ourselves.

Respectfully submitted,

Jacob Amos Jr
Chairman.

Giles H. Stilwell
Commissioner.

W. W. Wiard
Commissioner.

Sewer Board Commissioners Generously Serve Community

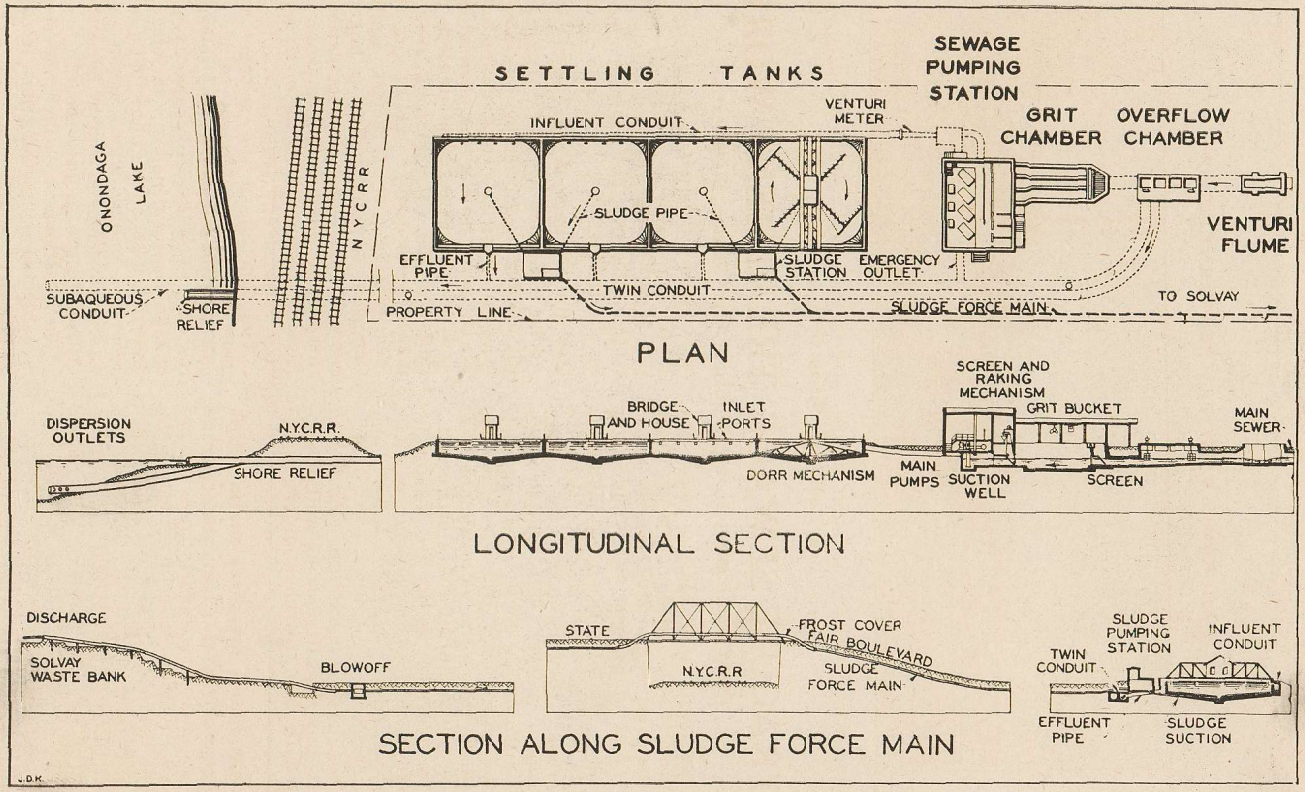
The Sewer Board consists of three commissioners who gratuitously serve the interests of the city of Syracuse.

The city has been exceedingly fortunate in having had the services, at different periods, of the following men who have acted, upon appointment by the Mayor, prior to the appointment of the present Commissioners: Henry C. Allen, John H. Barr, Edward Joy, Thomas H. Mather, John D. Pennock, Lyndon S. Tracy and Osgood V. Tracy.

The present Board consists of Jacob Amos, chairman, Giles H. Stilwell and William W. Wiard. These three men have each been on the Board from nine to eleven years.

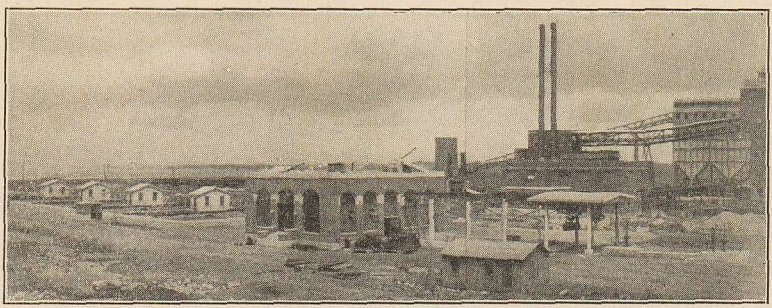
Harry J. Hamlin has been Secretary of the Board since its organization.

SYRACUSE SEWAGE DISPOSAL WORKS



Constructed by the Syracuse Intersepting Sewer Board

PANORAMIC VIEW OF TREATMENT WORKS



Settling Tanks Pumping Station Grit Chamber Overflow Chamber
Gas Company Plant in Background

SYRACUSE SEWAGE TREATMENT WORKS

Plain Sedimentation and Dilution with Sludge Sterilization

The main intercepting sewer, extending along Onondaga Creek, which drains most of the city, crosses under the creek at Spencer Street, is joined by the Harbor Brook intercepting sewer at Hiawatha Street; from this junction it then extends to the sewage treatment works. This sewer brings to the works the domestic sewage flow of the entire city with which is combined surface water entering the sewerage system during times of storm.

The treatment works are designed to handle 27.5 million gallons per day, the estimated 1940 average dry weather flow.

They have a maximum capacity of twice this quantity, or 55 million gallons daily, for treatment during storm flows.

Venturi Flume Measures Storm Flows

Inasmuch as the main intercepting sewer during extended and severe storms, is likely to bring down to the Works volumes up to a maximum rate of 130 million gallons per day, an OVERFLOW CHAMBER has been constructed wherewith all flows in excess of 55 M. G. D. are directly admitted to a shore relief conduit instead of passing through and overloading the treatment works.

Before passing through the overflow chamber the sewage passes through a VENTURI FLUME arranged, after calibration, to serve as a means for measuring the entire sewage volume prior to its entry into the overflow chamber or the treatment works.

Gas and Garbage Works Adjoin Plant

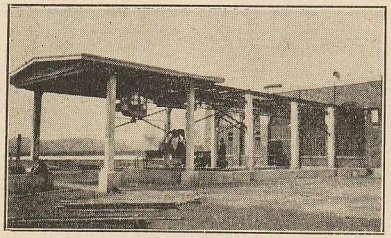
The treatment works are located on the filled-in area occupied by Onondaga creek prior to the construction of the Barge Canal Harbor and channel north of Hiawatha Street, and in close proximity to the City garbage reduction plant. Immediately east of the treatment works the Syracuse Lighting Company is constructing a huge gas works. The close concentration of these three more or less noisome utilities is advantageous as well as of civic interest and aesthetic value.

The function of the sewage treatment works is treatment rather than complete purification of the sewage of the city. The digestive capacity of Onondaga Lake furnishes a physical and financial asset in municipal housekeeping economy whose great value was not overlooked and which is being utilized to the fullest extent.

The treatment to which the sewage is subjected comprises the following features:

COARSE BAR SCREENING to remove large floating solids. The bars are spaced 2½ inches in the clear and

GRIT REMOVAL EQUIPMENT



Hoist, Cab and Bucket

under actual operation retain floating objects which find entrance into the sewerage system, sometimes inexplicably. The coarse bar screens located at the entrance to the grit chamber are hand-raked every few hours.

Grit Obtained by Checking Flow

GRIT REMOVAL is effected by passing the sewage through a three-compartment grit chamber wherein its flow velocity is checked to a rate of about one foot per second, for a period of about 40 seconds. During this time the sand, cinders, macadam surfacing material and other heavy inorganic street surface debris that have entered the sewers have an opportunity to settle to the bottom of the grit chamber. The velocity is sufficient to maintain in suspension organic matters of sewage origin.

A clean grit, inoffensive and non-odorous, is obtained. It is removed without unwatering by clam-shell bucket and electric traveling hoist, operating from an overhead track system controlled by an attendant in a cab integral with the hoist equipment. This grit is an excellent filling material that will serve admirably for surfacing walks and driveways and for filling the low spots around the treatment works.

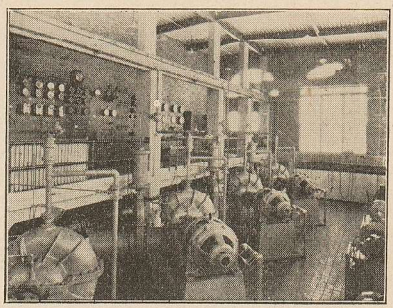
MECHANICALLY RAKED SCREENS form the next stage in treatment. Each of the three grit chamber compartments is prolonged to form a screen compartment in which is located the bar screen having ½-inch clear spacing. The function of this screen is to strain out only such objects which, on account of size, might seriously interfere with the further stages of treatment and disposal. The sewage flowing between these bars leaves upon the screen surfaces substances and materials larger than the passageway between the bars. These consist largely of rags, cotton waste, vegetable debris, leaves and a very small amount of uncomminuted fecal matter.

Screens Cleaned Twice a Minute

To prevent the undue accumulation of material upon the screen, which because of blinding of the screen surface would occur in a very short time under even ordinary flows, the rejecta are rapidly removed by mechanically propelled rakes. These are chain operated and elevate the screenings into hoppers conveniently located. The hopper bottoms are open and their contents discharge into steel cans, which, when filled, are emptied into a wheel barrow and thence taken to low areas near the works where the screenings are buried under a layer of grit removed from the grit chamber. Thus the screenings are disposed of effectively in an inoffensive, inexpensive and yet helpful manner.

Since the screens are not intended to serve as other than as protective devices, any straining action due to blinding would remove much material that could otherwise pass freely through the bar spaces. The mechanical rakes were, therefore, designed to pass over the entire screen surface twice every minute, assuring a prac-

MAIN PUMPING STATION



INTERIOR VIEW

tically clean screen at all times. The prior and unintentional removal of substances best handled in the settling tanks is thus prevented and the volume of screenings produced kept down to a practical minimum.

Pump Discharge Automatically Equals Inflow

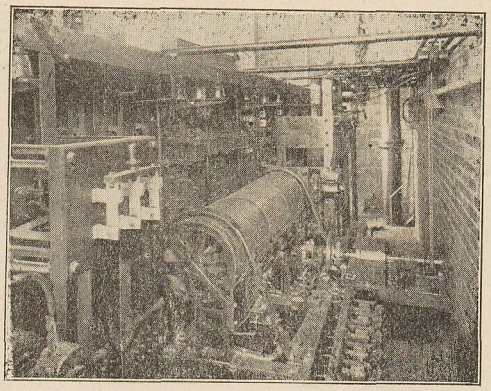
After passing through the bar screens the sewage enters the suction well of the main sewage pumping station. Each of the three screen compartments discharges into a common well located directly under the main sewage pumps.

The MAIN SEWAGE PUMPS are housed in the sewage pumping station as are also the screens, the control apparatus, auxiliary equipment, and the various service rooms, including shop, lavatories and laboratory. The four main pumps are the Morris 24-inch horizontal shaft centrifugal type, direct coupled to Westinghouse 75 H. P. slip-ring motors. Variable speed control, producing pump delivery in accordance with the volume of the inflowing sewage, is obtained through a float-actuated master control equipment which functions automatically. By means of this control the velocity in the grit chamber is maintained at the optimum point without the very expensive loss of head common to most grit chamber installations. This effects a continuous saving in electric power charges of about ten dollars per day.

Venturi Meter in Force Main

The pump discharge pipes are joined into a common cast iron force main, increasing from 24 inches to 48 inches in diameter, which after leaving the building, is joined to a 48x24 VENTURI SEWAGE METER for measuring the quantities pumped. The meter is placed in a concrete vault contiguous with and accessible from the pumping station, with piezometer connections to the indicating-recording device located on the control floor of the station.

REAR OF CONTROL BOARD



Showing Master Controller Drum

Within the pumping station are placed as auxiliaries, two motor-operated vacuum priming pumps, either unit being capable of priming a 24-inch pump in about 35 seconds. Adjacent thereto is located the 10 K. W. motor-generator set which produces the direct current required for the operation of the grit cleaning mechanism. A 6-inch sump pump of the vertical submerged centrifugal auto-controlled type for handling drainage and seepage, is also located inside the station in a deep sump well.

The CONTROL BOARD located on the mezzanine floor of the main pumping station is especially worthy of comment. The panels contain equipment for controlling the motors for all of the machinery employed in the treatment works; also the hydraulically operated discharge valves on the main pumps; also numerous indicating and recording gauges and supervisory operation charts. Within the compass of one board, almost 40 feet long and containing thereon over 200 pieces of equipment and apparatus, are located the controls for the entire works. One operator serves the board. Additional attendants are, of course, required for the complete functioning of the plant.

The INFLUENT CONDUIT receives

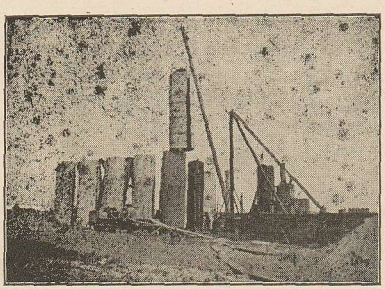
the discharge of the venturi meter and conducts the flow to the settling tanks. The conduit is largely built integral with these tanks of reinforced concrete, and has twenty-four 16-inch square sluice gate controlled ports, which feed the tanks. The cross-section of the conduit is gradually reduced from 4 feet 6 inches x 4 feet, closely in proportion with the diminishing sewage flow, until the conduit is 18 inches square at the blow-off end.

Tanks Provide One Hour Detention

The SETTLING TANKS, of which there are four, are of the square type, about 71 feet by 71 feet in plan at the water level and a depth to the center of the sloping bottom, exclusive of the small sludge cone at that point, of 10½ feet. The effective capacity of the tanks is sufficient to provide one hour detention for the average flow. The sewage enters each tank through six ports placed uniformly across the inlet end, and flows after baffling, more or less directly across to the outlet weir, extending the full length of the tank. An effluent channel conducts the flow from the weir to the tank effluent chamber. Each of the four effluent chambers is connected by a 30-inch cast iron pipe to the deep water conduit extending along the effluent end of the tanks.

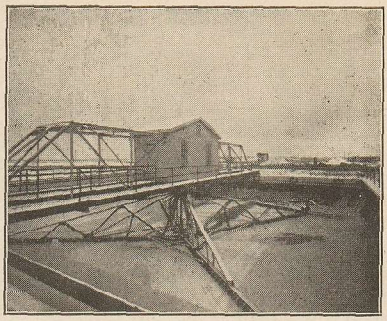
The DEEP WATER CONDUIT starts at the overflow chamber and continues as a part of the twin conduit on land (the other half of the twin conduit being the SHORE RELIEF.

60 Inch Pipe—20 Foot Lengths



Making Subaqueous Pipe

Settling Tank and Bridge



Sludge Sweeping Mechanism

terminates at the shore) until the water's edge is reached. Beyond that point the deep water line continues as a 60-inch reinforced concrete subaqueous pipe for a distance of about one-third of a mile and to a depth of about 25 feet below normal lake level.

Effluent Dispersed by Dilution

Several 24-inch openings in the sides and the end of this conduit serve to disperse the effluent over a large area at the outlet end of the pipe, which is carried on piles and is surrounded by a mass of protective rip-rap. After the effluent leaves the deep-water line, it is intermixed with the waters of Onondaga Lake, whose digestive capacity and oxygen self-replenishment ability is adequate for the burden likely to be placed upon it during the next 20 years.

Having disposed of the effluent, let us return to the settling tanks and follow the path of the solids which settle on the bottom of the tanks during the one hour average detention of the sewage therein. The principle established in Syracuse several years ago in the demonstration plant that high sedimentation efficiencies are obtainable with short settling periods, provided continuous sludge removal is practiced, dictated the design of these settling tanks.

Dorr Mechanisms Concentrate Sludge

The SLUDGE REMOVAL MECHANISMS used in the settling tanks are the Dorr clarifier type so successfully

applied in industrial work and more recently to municipal utilities. The plow blades of this mechanism are mounted upon four trussed arms suspended from a heavy, central, vertical shaft rotating at a speed of about four revolutions per hour. They slowly sweep the deposited sludge in a spiral path to the central cone of the tank, from which point the sludge flows through a submerged 4 inch suction pipe into the sludge pumping station piping.

Two of the four arms of the tank mechanism are equipped with articulated units, hinged and arranged to sweep the corners of the tank beyond the normal range of the radius arms. By means of these auxiliary arms it is possible to sweep over the entire bottom area. To prevent accumulations in the very corners of the tanks, these spaces—about 3% of the tank area—were filled with concrete, the exposed face of which was smoothly troweled to a pitch of 1.6 on 1.

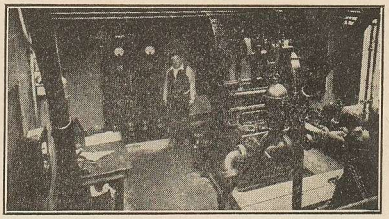
Each of the mechanisms is motor operated, provided with overload indicator and alarm, and is equipped with a shear pin which will snap in case of overload. The central shaft and drive mechanism is supported by a light structural steel truss bridge, spanning the entire tank.

Triplex Pumps Remove Sludge

Two SLUDGE PUMPING STATIONS are provided, each station serving two tanks. Within these stations are placed 6 in. x 10 in. Goulds triplex plunger stuff pumps, one for each tank, interconnected and piped to permit great flexibility of operating control. The pumps are specially designed for handling sewage sludge, are driven by Westinghouse 15 H. P. slip-ring, variable speed motors and are designed for a working pressure of 700 feet hydrostatic head. Pressure relief and sludge sampling valves are provided.

In each station the sludge pump pistons and other appropriate parts are continuously washed during service with city water, furnished by a small auxiliary triplex pump at high pressure. As this pressure exceeds the

SLUDGE PUMPING STATION



TRIPLEX PLUNGER PUMPS

water pressure in the city main, the piping arrangements were designed to completely preclude the possibility of any polluting matters backing up into the city main due to this excess pressure. The four sludge pumps are all connected to the 5-inch sludge force main.

Sludge Conveyed Hydraulically

The SLUDGE FORCE MAIN extends a distance of about 12,000 feet from the sludge pumping stations and is made of 5-inch, genuine wrought iron pipe, carefully coated externally with special bituminous compound to protect it from the corrosive Solvay Process Company wastes that largely constitute the terrain in this territory. To provide accessibility to the interior of the pipe line, in the event of clogging, cast iron hatch boxes are placed in brick chambers at about 500 foot intervals in the pipe line.

At such points where the earth cover is less than four feet over the pipe, and at all points where the pipe is exposed to the weather, the line has been carefully insulated with four layers of 1-inch hair felt, adequately waterproofed and protected. Injury to the pipe during interruptions of flow occurring during freezing weather is thereby prevented.

The main is built of extra heavy pipe with drive-pipe couplings, so that adjoining lengths butt together, providing a smooth bore throughout the entire length of the line. At angle points the pipe was specially mill bent to a radius of 10 feet, to permit the passage of sewer cleaning rods in the event of need.

Forty to One

Relative Proportions

Sludge Mixed with Waste Liquors

The pipe line terminates at the outlet end of the Solvay Process Company waste pipes. These have been discharging spent lime, acids and other industrial chemical wastes continuously for over 35 years. The volume of the deposited Solvay wastes which settle in their lagoons is about forty times that of the Syracuse sewage sludge and the sterilizing capacity of the Solvay waste liquors is sufficient for complete sterilization of about ten times the Syracuse sludge production.

The unique opportunity afforded by the close proximity of the Solvay Process Works and the Syracuse Sewage Treatment Works was recognized by the Intercepting Sewer Board engineering staff and taken advantage of through the courteous co-operation of the Solvay Company, has served to save the City of Syracuse many thousands of dollars in construction expense and many thousands of dollars in annual operating expense, that would otherwise have been necessitated by the construction of sludge digestion and drying works. Through this method of mixing the Syracuse sludge with the Solvay waste, the sludge is buried inconspicuously, inexpensively and inoffensively and the discharge of such supernatant liquids as finally enter Onondaga Lake from the waste lagoons are completely sterilized.

Summarizing, it may be stated that at the treatment works the sewage is elevated by devices effecting extensive operating economies, treated in settling tanks equipped with continuous sludge removal equipment in an efficient and economical manner, and the sludge disposed of at a cost vastly below that of any other large city in the United States. This has been accomplished as a result of conscientious endeavor and earnest application to the sewage disposal problems of the City of Syracuse on the part of the Engineering Staff of the Syracuse Intercepting Sewer Board.

Testing Stations Operated to Develop Design Data

Before establishing the final designs for the Treatment Works, the Sewer Board constructed and operated for a period of more than one year a Sewage Testing Station in which various types of treatment applicable to Syracuse conditions were continuously under observation during that time.

As a result of the data obtained it was concluded that a satisfactory degree of purification of the sewage could be obtained for discharge into Onondaga Lake which would involve much simpler methods of treatment than had been previously thought advisable. It was found that sedimentation for about one hour would be sufficient provided the deposited sludge was continuously removed.

Following the necessary interlude imposed by the War, the Board constructed a demonstration tank in which sedimentation in the above manner was practiced from Sept. 21, 1920, to Dec. 1, 1920. The data developed in this intensive study proved very satisfactory and were used as the basis of final works design.

The small expense involved in the operation of the testing station has been but a minute percentage of the huge sums saved to the City by the use of the data developed from this excellent piece of practical scientific research.

Sanitary Specialists Designed the Syracuse Treatment Plant

The Syracuse treatment works involve numerous radical departures from previously established sewage disposal practices. These changes and innovations have been developed and designed by specialists in sanitary engineering who are well grounded and thoroughly familiar with the field of sewage treatment. Because the engineers engaged on this work were specialists and were permitted to give sufficient and intensive study to the multiplicity of problems involved they found it possible to evolve new methods, appliances and practices which have advanced the art of sewage treatment and effected savings of Syracuse funds very considerably in excess of one million dollars.

Glenn D. Holmes, Chief Engineer of the Intercepting Sewer Board since its creation, has devoted a large part of his long professional career to sanitary engineering problems. Mr. Holmes is a member and director of the American Society of Civil Engineers, a member of its Sanitary Division and of the Syracuse Section of the Society; also a member of the American Society of Municipal Improvements. Every detail of the works design and construction passed through his hands.

J. X. Cohen, Designing Engineer, has been specializing in the sanitary engineering field for the past 18 years, the latter half of this time being devoted to the work of the Board. He is a member of the American Society of Civil Engineers and of its Sanitary Division; is past-president of the Syracuse Section of the Society and is a member of the American Public Health Association, the American Association Advancement of Science and the American Association for Promotion of Hygiene.

Main Sewage Pumps Purchased on Strict Efficiency Basis

The selection of the type of variable speed electric motor to drive the 24-inch centrifugal pumps in the main pumping station was considerably complicated by the fact that the high priced units were more efficient. After much study the choice was finally narrowed down to two alternatives: brush-shifting and slip ring A. C. motors.

The brush-shifting motor, as developed by the General Electric Company and the Westinghouse Electric & Mfg. Company, obtains speed variation by changing the relative positions of brushes operating over a commutator. A very large number of steps in speed can be obtained by this means, without any loss of efficiency and with maintenance of high power factor. This motor is exceedingly expensive in first cost, though it makes possible lower operating costs.

The slip-ring motor, with cast iron grid resistances in circuit, provides a limited number of steps in speed variation, ample, however, for the special local application and at a considerably lower installation cost. This type has lower power factor and lower operating efficiency.

An additional complicating feature of the problem was the two-charge schedule of the Syracuse Lighting Company, with bonus and penalty for power factor correction.

It was finally concluded that the specifications should provide for alternative bids on both types of motors, with the provision that each bidder be required to guarantee annual current charges. These charges were to be based upon an assumed hourly fluctuation in sewage volume and pumping head and upon the local power rate schedule.

The bidder's price for the machinery was equated at its annual amortized value, on the basis of 4% compound interest and 20-year serial bonds. The sum of the annual amortization expense and the bidder's guaranteed annual current charges

was used in canvassing the bids. The bidder with the lowest sum was awarded the contract. Thus was determined the "actual" annual expense for both types of variable speed motors in a definite and unequivocal way.

For the particular conditions existing at the Syracuse main sewage pumping station the slip ring motor with phase wound rotor and grid resistance proved the most economical and was therefore selected.

Considerable interest was excited among the bidders on the contract for the main pumping station machinery and equipment by the above mentioned unusual provisions. All were agreed upon the inherent fairness of the procedure for canvassing the bids and the scientific method of settling the perplexing problem of selecting the most economic variable speed motors for the 24-inch main centrifugal pumps.

UNIQUE FEATURES OF SYRACUSE WORKS

1. **Venturi Flume**
   Measures entire flow.
2. **Grit Chamber Automatic Control**
   Avoids excessive losses of head.
3. **Mechanically Raked Screens**
   Avoid screen "blinding".
4. **Main Pumps Simple Connections**
   Avoids fittings and losses of head.
5. **Check Valves Omitted**
   Reduces cost and avoids loss of head.
6. **Continuous Sludge Removal**
   Increases tank efficiency.
7. **Sludge Disposal by Mixing with Solvay Wastes**
   a) Avoids cost of digestion works.
   b) Avoids cost of drying beds.
   c) Avoids high operation costs.
   d) Buries sludge completely.
   e) Sterilizes sludge completely.
   f) Sterilizes sludge "effluent".

Many Contractors Engaged in Building Treatment Works

The sewage treatment works were built by the construction forces of more than a dozen contractors engaged on the different portions of the works.

The venturi flume, overflow conduit, shore relief and effluent conduits were built by Charles T. Hookway and the subaqueous conduit by the T. A. Scott Co. John Young built the grit chamber, main and sludge pumping stations and the settling tanks.

The Union Structural, Inc., built and installed the screens and screen raking mechanisms. The machinery and equipment in the main pumping sattion were furnished and installed by the Roberts Filter Mfg. Co. The Dorr Company fabricated and installed the cleaning mechanisms for the settling tanks and I. N. Beeler furnished and erected the sludge pumping stations piping and machinery. The sludge force main was constructed by Charles T. Hookway.

Several other contractors installed the miscellaneous electrical, plumbing and heating work in the various parts of the work.

Works Operating Labor Costs

The complete personnel required for the operation of the Sewage Treatment Works includes a superintendent, four operators, five attendants and five laborers.

The operators—skilled electricians are stationed in the main pumping station. The attendants, with power plant experience, look after the sludge pumps, the settling tank mechanisms and other machinery. The laborers attend to the screenings, the grit removal and general plant policing.

Operating schedules provide for 8-hour shifts and relief from duty every seventh day.

The total operating payroll will amount to $27,760.00 annually. As the design capacity of the plant is 27.5 million gallons daily, the labor cost will be approximately $2.77 per million gallons of sewage pumped and treated.

Sewer Board Activities Continually Expanding

The Syracuse Intercepting Sewer Board was created by a special Act of the State Legislature—Chapter 356 of the Laws of 1907—authorizing and empowering the Board to construct intercepting sewers for the removal of sewage from Onondaga Creek and Harbor Brook, traversing the city. The Act also provided for the construction of other miscellaneous sewerage work in the city and especially called for the improvement of the channels of the above mentioned streams sufficiently to permit efficient operation of the new intercepting sewer systems.

From that time on the originally authorized construction work was progressed to completion. During this construction period many amendments to the Act were enacted into law whereby the duties and powers of the Board were increased to a considerable degree. Notable among these are the construction of sewage treatment works for the entire city, the improvement of Furnace Brook and the construction of a storm relief sewer in the bed of the old and abandoned Erie Canal.

More recently the State Legislature, in response to an emergency message of the Governor, enacted an amendment to the Board's basic law whereby it is directed to make a study and prepare a general plan for drainage and sewerage systems for all territory contiguous with the City of Syracuse and within three miles outside of the city limits.

The same amendment also provides that the Board shall engage in and make a comprehensive study, with plans and estimates, of the necessary means to be employed for the protection of the city from major flood flows likely to develop upon the drainage areas tributary to the streams which course through the city.

Even from this brief summary it is easily obvious that the original duties and responsibilities of the Board have been very greatly expanded. Technical problems facing the Board have also become increasingly complex, calling upon the highest type of professional engineering service for their adequate solutions.

The State Legislature and the municipal legislative bodies have clearly recognized the increasing scope of the Sewer Board's work, as evidenced by their increase of the bond issues made available to the Board from the original $500,000.00 to the present total of $4,350,000.00.

Numerous Recording Gauges Chart Plant Operation

To assist in the supervision of the operation of the plant, which of course is in continuous service, the equipment includes two electric operation recorders. One is a 12 pen Foxboro direct current low voltage instrument and the other an 8 pen Bristol alternating current low voltage instrument.

The pens record on 7 day, 12-inch circular charts the in-and-out service of the four main sewage pumps, the three grit chamber gates, the three screen raking mechanisms, the sump pump, and the A. C.-D. C. generating set. The 8 pen unit records the operations of the four Dorr sludge mechanisms and the four sludge pumps.

Other recording charts give a continuous record of the volume of sewage pumped and treated, the elevation of sewage in the suction well and grit chambers, the elevation of sewage above the coarse bar screens and the pressure head on the sludge force main.

Indicating gauges show the amount of vacuum in the pump priming system, the pressure heads against which each of the main pumps are discharging, the rate of sewage pumped, the voltage and amperage of electrical input and the pressure heads against which the triplex sludge pumps are discharging.

Novel Screening Equipment Protects Treatment Machinery

The method of sludge disposal adopted for Syracuse, whereby the solids retained in the settling tanks are pumped through a long pipe line of small bore, necessitated the development of a device which would protect the plunger pumps and piping from stoppages by large foreign objects.

After considerable study it was concluded that the best plan would involve screening the sewage through ½-inch openings. Any objects passing such a screen would be unlikely to create difficulty. Experience with sewage screening indicated, however, that such a comparatively fine screen would quickly mat. This mat would then serve as a strainer or filter, retaining a large volume of solids much smaller than the screen opening. These solids or screenings would be troublesome to handle and far more difficult to dispose of in this form, as compared to the hydraulic conveying of the sludge from the settling tanks to the Solvay waste lagoons.

Furthermore, the matting or "blinding" of the screen surface would cause considerable loss of head, with erratic fluctuations in water level as the screen surfaces were raked.

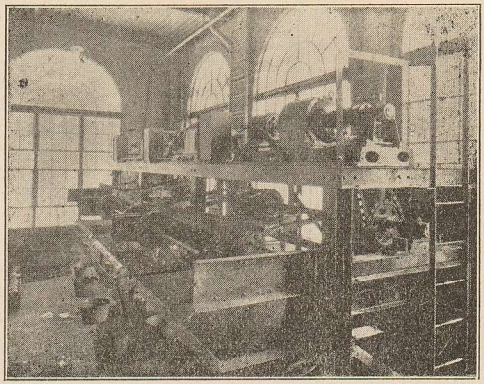
Since excessive loss of head was objectionable on the ground of extra power costs, as well as interfering with the main pump controls, it was felt that mechanical cleaning was essential.

Closely Spaced Bars Used

Several types of screens were then studied. Choice finally settled upon the ordinary bar screen as best adapted to the local conditions, with mechanical raking as practiced at the main sewage pumping station at Toronto, Ontario, Canada.

The mechanisms at Toronto were carefully studied *in situ*, many excellent suggestions being obtained from their operation. Detailed designs, considerably modified from the Toronto practice, were then prepared and submitted to prospective builders for criticism.

SCREEN RAKING MECHANISM



Showing Drive and Hoppers

The final design provides for ½-inch steel bars spaced precisely 1 inch on centers and rigidly locked into position in the screen chamber. These bars are combed by malleable iron rake fingers stretching the full width of the screen and moving upward from the bottom of the screen, traversing the entire submerged screen surface.

The ends of the bars carrying the rakes are attached to heavy steel chains, which pass over sprockets and idler wheels that serve to bring the rakes about six feet above the upper screen floor. At this point, the rake bars, which have been held horizontal, are brought into the vertical position. Most of the screenings drop into the hopper-shaped receiver, falling thence into the can placed at the open bottom of the receiver. Such rags and miscellanies which wrap around the rake fingers are removed infrequently by an attendant, as occasion warrants.

Screens Cleaned Continuously

The screen raking mechanisms, of which there are three, are each operated by a 3 H. P. constant speed motor. A spur gear speed reducer and chain drive connections bring the speed down so that the screen surface is completely raked about every 30 seconds.

This operates to keep the screen practically clean at all times. As a result there is practically no loss of head through the screen, making the master controller on the main sewage pumps accurately respondent to the grit chamber water level above the screen.

In addition the screenings consist almost exclusively of large objects, all small solids passing through to the tanks for settling and handling as sludge.

The actual operation of the screens and their raking equipment has proved most satisfactory.

Offense to Sight and Smell Avoided in Plant Design

Particular pains were taken in the design of the treatment works to avoid any offense to sight or smell. From the aesthetic point of view, such action was most desirable, as laymen critics are readily influenced when judging plant operation by superficial conditions.

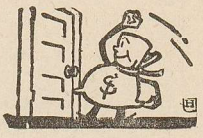
Throughout the entire design, pockets, corners, re-entrant angles and other places likely to accumulate solids were carefully avoided. Undesirable septicization has thereby been avoided, thus maintaining the sewage in its original "fresh" condition, for dissolved oxygen is always present in the influent.

The Syracuse practice of continuous and prompt removal of the deposited sludge inhibits gasification. Hence no odors can arise from the tank surface. Neither do gas-lifted particles of sludge rise from the tank bottom to foul the tank effluent. The tank surfaces are also frequently skimmed for removal of grease and other floating scum.

The sludge is removed through a closed piping system, at no time being exposed to sight, except at the discharge end of the sludge force main, over two miles distant from the sewage treatment works.

The operation of the works has definitely demonstrated that the care bestowed upon the design has resulted in complete freedom from offense.

Lake Absorption Worth Over Million to City



Onondaga Lake is about 4½ miles long, varies in width from ¾ to 1⅓ miles, has a depth of from 50 to 70 feet and covers an area of about 4½ square miles. Considered as a storage basin the lake has a capacity at normal low water stage of about 5,300,000 cubic feet.

The lake is a part of the State Barge Canal System. The harbor and terminal constructed about one mile inland is connected to it by a dredged channel. Onondaga creek discharges into the lake through this channel. The lake outlet joins the Seneca River, which is also a part of the canal system.

Due to the small flows from the streams which discharge into the lake, and the latter's comparatively large storage volume, any sewage discharged into it will be oxidized before the waters of the lake can reach the Seneca River, and will necessarily be disposed of completely in the lake itself; that is, complete digestion must take place in the lake.

The dissolved and suspended solids will draw upon the oxygen dissolved in the lake waters, depleting them to a considerable degree during the summer months. Oxygen is absorbed from the atmosphere by the oxygen-depleted waters, replenishing the supply of dissolved oxygen. Onondaga lake by reason of this re-aeration capacity is a tremendously valuable asset to the city as a means of sewage disposal.

Metcalf & Eddy, consulting engineers, who were engaged to review the work of the engineering staff of the Board, in their study of the replenishment of oxygen by re-aeration of the sewage-depleted waters of Onondaga lake, estimated that about 1200 pounds of oxygen would be needed for each million gallons of sewage discharged into the lake.

After a consideration of the dis-

solved oxygen originally present in the waters of the lake—as determined by analyses of samples taken from established locations at stated periods—and the additional quantities of oxygen introduced by the streams feeding the lake, it was concluded that offensive and objectionable conditions could be prevented from developing in the lake up to at least the year 1940—and possibly for some time thereafter—by sedimentation of the sewage prior to discharge into the lake.

Sedimentation was therefore approved as the means of sewage treatment, with disposal of the effluent in the oxygen-bearing and oxygen-replenishing waters of Onondaga lake.

As a matter of fact, utilizing the digestive capacity of Onondaga lake in this manner has avoided the necessity of constructing additional stages of treatment. The saving resulting thereby is conservatively estimated at about $1,500,000. In addition thereto considerable annual charges for the operation of advanced treatment processes have also been avoided.

State Authorities Approved Sewage Disposal Project

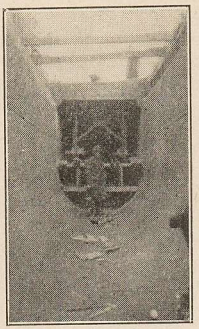
Pursuant to the provisions of the State Public Health Law and other governing enactments the projects of the Sewer Board for treating and disposing of the city sewage were referred to the State Engineer and to the State Department of Health. In addition, as the State Conservation Commission has jurisdiction over the waters of Onondaga Lake, the proposed plans and details were also referred to it for consideration.

After extended study and deliberation of the matter, the various governmental authorities approved the project and granted the necessary permission for the construction of the treatment works and the discharge of the effluent into Onondaga Lake.

Metcalf & Eddy, Consulting Engineers, reviewed the methods of treatment proposed, before submission to the State authorities. They endorsed the project, declaring that it was practical and could be adopted without fear of creating objectionable conditions.

Storm Relief Sewer Built in Abandoned Erie Canal

CANAL SEWER



Showing Forms

The Sewer Board is now constructing a large storm sewer in the bed of the abandoned Erie Canal, which traverses the city in an easterly and westerly direction. This sewer, in addition to draining the easterly section of the city, will relieve the old sewers receiving the drainage from the University Heights and James Street districts. The city has grown and expanded so rapidly that many of these sewers are now of inadequate capacity and are very much overloaded during time of storms. The new sewer, when completed, will extend from the eastern limits of the city to Onondaga creek.

The work of construction is being advanced as rapidly as possible in order that the old canal may be filled in and a boulevard constructed over the old waterway. The section from Onondaga creek to Pine Street, one and one-half miles in length, will be completed early this summer, as will also the connections with the Washington Street trunk sewer, the outlet of the University Heights section.

Westerly of Crouse Avenue this sewer has an interior "U" section 7½ feet wide and 10½ feet high; as the sewer continues to the east the size and capacity will be decreased in proportion as the tributary drainage areas diminish.

Works Construction Costs Listed in Detail

The construction costs of the various elements of the sewage disposal works are given below. These costs are, in part, approximate as the several structures were built under contracts that segregated the work under physically advantageous units different than the financial groupings listed below.

CONSTRUCTION COSTS SEWAGE DISPOSAL WORKS

Storm Overflow Works	
Venturi Flume	$ 4,200.00
Overflow Chamber	5,000.00
Shore Relief Conduit	38,952.00
Total Overflow Works	**$ 48,152.00**
Treatment Works	
Grit Chamber and Pumping Station	$ 74,645.00
Machinery and Equipment	76,100.00
Mechanical Screening Equipment	18,200.00
Total Pumping Station	**$168,945.00**
Settling Tanks	$115,032.00
Sludge Removal Equipment	37,987.00
Total Settling Tanks	**$153,019.00**
Sludge Pumping Stations	$ 7,822.00
Sludge Pumping Equipment	20,436.00
Sludge Force Main	64,600.00
Total Sludge Removal	**$ 92,858.00**
Transformer Substation	$ 3,391.00
Feeder Cables and Conduits	1,800.00
Exterior Lighting	4,919.00
Total	**$ 10,101.00**
Total Treatment Works	**$424,932.00**
Outfalls Works	
Relief Conduit to Lake Shore	$ 38,953.00
Subaqueous Conduit to deep water	66,490.00
Total Outfall Works	**$105,443.00**
Grand Total Sewage Disposal	**$578,527.00**

The design population capacity being 200,000, the per capita construction cost for sewage disposal is $2.90, which is a remarkably low figure especially in consideration of the "inflated" existent unit construction costs.

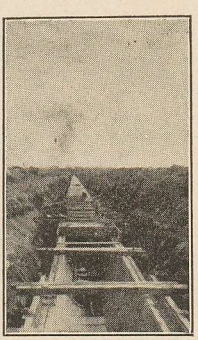
Sanitary Necessities Impelled Construction Intercepting Sewers

Prior to the construction by the Sewer Board of the several intercepting sewers built parallel to Onondaga creek and Harbor brook the various sewers discharged into these streams all of the sewage wastes, street washings and other polluting materials of the entire city. The sanitary conditions of these streams became progressively worse as the city grew until the offenses were overbearingly noxious, particularly through the built-up sections of the city.

Especially was this the case during the dry summer months, when the stream flows from their respective drainage areas dwindled to an extent that provided woefully inadequate volumes of clean upland diluting waters. At such times the stream banks with their foul deposits were exposed, extremely offensive gases arising from the putrefying masses. These nauseating stenches encompassed areas far beyond the immediate vicinity of the streams, giving rise to justifiable public clamor for relief.

The program of the Board provided such relief by the construction of intercepting sewers to keep the sewage out of the streams.

A MILE OF SEWER



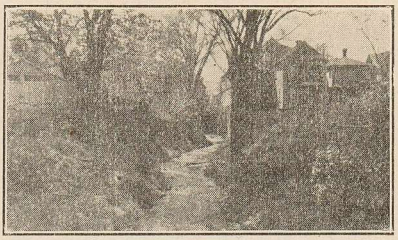
"U" Type

Principal Projects Expenditures Listed

Since the creation of the Sewer Board it has carried on an enormous volume of construction work, embracing such features as storm water and intercepting sewers, stream improvement and sewage disposal.

The expenditures on the principal projects up to May 1, 1925 are given below.

FURNACE BROOK



Showing Necessity for Regulation

EXPENDITURES ON PRINCIPAL PROJECTS TO MAY 1, 1925

Onondaga Creek Improvement	$614,760.00
Main Intercepting Sewer	848,060.00
Harbor Brook System	232,460.00
West Street System	11,100.00
Northeast Storm Water Outlet	38,100.00
1st and 2nd Wards Storm Water System	60,900.00
Relief Sewer Abandoned Erie Canal	201,070.00
Sewage Disposal Works	547,020.00

Furnace Brook Construction to Eliminate Flooding

Furnace Brook is a tributary of Onondaga crek, entering the latter between Colvin Street and Elmhurst Avenue. It has a drainage area of about three square miles, with a channel for quite some distance west of the creek of insufficient capacity. During times of excess storms it is readily subject to bank overflow, causing much damage and inconvenience.

The stream during flood flows erodes its bed and banks, because of the high velocity and the soil structure of the channel. This detritus lodges in the creek and interferes with free flow through the creek channel.

Following the 1915 flood, and more particularly after the disastrous cloudburst flood of 1922, an insistent demand for relief was presented by residents of the flooded areas. The Sewer Board having been finally authorized to proceed with the work and the several delays incident to obtaining rights-of-way from certain obstructive property owners having been cleared up, it is certain that work will start on the improvement this summer.

The improvement involves the construction of a low intake dam at Elmwood Park and a continuous enclosed concrete channel from thence to Onondaga creek. This channel will join the various existing street crossing culverts along its route, several of which will be enlarged and remodeled to meet the hydraulic requiremetns for increased capacity.

When completed this improvement should serve to protect the Furnace Brook "flood district" from the menace of flood flows up to about 1000 cubic feet per second, an amount in excess of the maximum recorded flood. The plans and specifications for this work are complete. The Engineer's estimate for the undertaking is $125,000.00.

Sewer Board Acquired 141 Parcels of Land

In carrying out the work of the Sewer Board it has been necessary to acquire land, easements and rights-of-way for construction purposes by gift, purchase and condemnation. In all 141 parcels have thus been acquired.

Materials Testing Laboratory Maintains Quality Standards

Coincident with the initiation of construction work on the earliest of the Board's contracts, it established a Materials Testing Laboratory for testing the cement, sand, gravel, stone and other miscellaneous materials entering into the work.

All Board contracts specify in detail the nature, quality, strength and other characteristics described in the materials to be offered by contractors for incorporation into the structures they are building. The interests of the city are carefully considered in the drafting of these specifications, but without laboratory tests it would be impossible to insure that the standards set are being observed and maintained.

It is no unusual event for the Engineering Organization to reject materials offered by contractors because they are sub-standard; frequently these materials are already at the site of the work and have to be removed after condemnation.

The reputation of the Board's technical policies, however, is now so well established that the percentage of rejections due to unsatisfactory materials being offered is gratifyingly low. Nevertheless, vigilance is not relaxed, as occasionally defective materials are submitted through unanticipated circumstances.

Considerable operating economy has followed from the establishment by the Sewer Board of its own laboratory. The practice of submitting samples for tests and analyses to private laboratories which operate for this purpose would have caused the expense to very greatly exceed the costs of maintaining a Board laboratory, conducted entirely by men on the regular engineering staff.

During the history of the Board the Laboratory has dealt with:

Materials	Number of Samples.
Cement	980
Sand	320
Gravel	30
Stone	50
Miscellanies	50
Total	1430

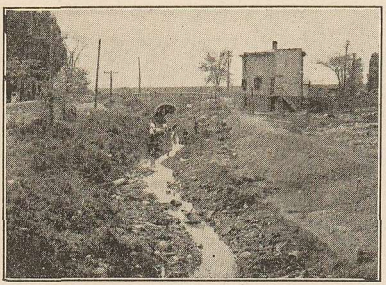
The tests of cement governed the use of 118,000 barrels (nearly one-half million bags) of cement, all of which was incorporated in the masonry structures built by the Board to date.

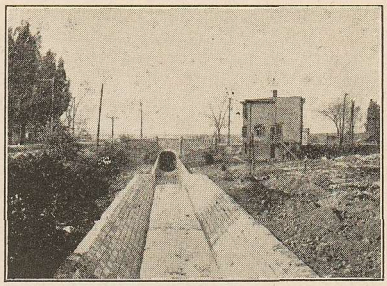
The work of the Laboratory is in direct charge of Girard M. Parce, Asst. Engr., whose service record with the Board started Oct. 31, 1907, and to whom much credit is due for the excellence and high order of the results obtained.

SALIENT ELEMENTS OF SYRACUSE SEWAGE WORKS

1. **Venturi Flume**
   Measures total flow.
2. **Overflow Chamber**
   Relieves excess storm flows.
3. **Grit Chamber**
   Removes inorganic solids.
4. **Mechanical Screens**
   Removes objects larger than ½".
5. **Sewage Pumps**
   Elevate sewage above lake level.
6. **Venturi Meter**
   Measures volume treated.
7. **Sedimentation Tanks**
   Retain settleable solids.
8. **Dorr Sludge Mechanisms**
   Concentrate sludge at tank bottoms.
9. **Effluent Conduit**
   Discharges settled sewage.
10. **Subaqueous Outfall**
    Disperses effluent into lake.
11. **Sludge Pumping Stations**
    Removes concentrated sludge.
12. **Sludge Force Main**
    Conveys sludge 12,000 feet.
13. **Sludge and Waste Mixing**
    Commingles both at outlets.

HARBOR BROOK





Before and After Improvement

Harbor Brook Improvement Helps Sanitary Conditions

The drainage area of Harbor Brook being only about 10 square miles, the normal volume of brook flow was insufficient to adequately dilute the sewage discharged into it by the numerous tributary sewers and manufacturing establishments. As a result, the brook was a vile, foul-smelling stream.

Its course was quite meandering, and its bed full of pockets and holes in which lodged all manner of unsightly debris and filth.

The plan adopted of deepening, straightening and lining the channel of the brook transformed the unsightly and unsanitary watercourse into a clean stream.

Sewers which had previously discharged into the brook were connected to the intercepting sewer constructed parallel to and in conjunction with the brook improvement. Deepening the brook made the interceptors effective and operative. To preserve the channel from erosion the sides and bottom were lined with concrete masonry.

The entire system as constructed has proved of inestimable benefit to the territory served.

The present tendency of some abutting owners to dump rubbish wastes therein should be discouraged by a rigid patrol of the stream.

Intercepting Sewer System Related to Flood Abatement

The intercepting sewers designed by the Board were designed to carry "double" sewage, that is, an amount of storm surface water equal to the volume of sanitary sewage. This first flush of storm water carries the foul street washings entering the sewers shortly after the start of a rainstorm. Such washings are so grossly polluted that treatment before discharge into the lake is advisable and warranted.

Ordinarily, the entire flow of the lateral sewers connected to the intercepting sewers is discharged directly into the latter, but when the rate of flow reaches "double" sewage, the intercepting sewer is filled to capacity. At this stage the valves installed in the appurtenant regulating chambers automatically close to prevent the surcharge of the interceptor. The excess is then discharged into the stream through the terminal outlets of the lateral sewers.

The outlets of the old lateral sewers were below the normal surface of the water course, so that backwater extended up these sewers to a point beyond the location of the interceptor. To prevent water from the stream entering the interceptor, to the exclusion of sanitary sewage flow, and to permit proper functioning of the regulating valves it was necessary to deepen the

contiguous watercourse.

Onondaga creek was improved from near its northern terminus at the Barge Canal Harbor to South Avenue with the above policy as a basis of design. The sanitary improvement effected was tremendous and complete relief was obtained.

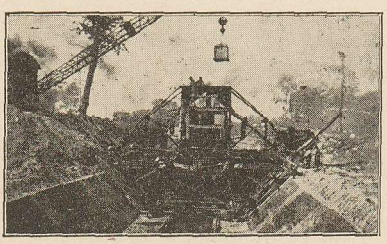
To maintain the dimensions and capacities of the regulated channels it was necessary to line their sides and bottom with concrete masonry. Otherwise the sand and gravel constituting the soil structure of the stream would have quickly eroded, nullifying the work performed. At first small precast concrete blocks were used. Most of the work, however, was lined with monolithic concrete cast in position.

Efficient plant, machinery, and ingenious forms were developed by the contractor on the latest portions of the creek improvement, whereby excellent work was obtained with a minimum of manual labor and a maximum of construction progress.

As already stated, in its early work the Board was authorized to make only such improvements to the watercourses as were necessary for the efficient operation of the intercepting sewer system. It was not the primary object to reduce the height of flood waters in the creek, although this followed as a natural consequence of the deepening and improvement of the channel.

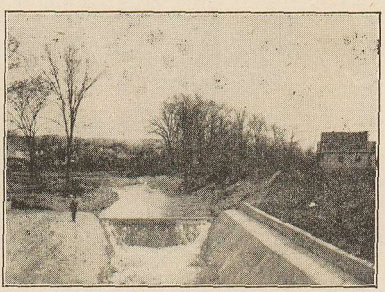
The excessive rainfalls during the summer of 1915, followed by the record breaking storm of Sept. 12 and 13, 1915, caused such a tremendous runoff from the Onondaga creek drainage basin, that the volume of flow reached

TRAVELING FORMS



ONONDAGA CREEK CHANNEL

ONONDAGA CREEK CHANNEL



Terminus of Improvement

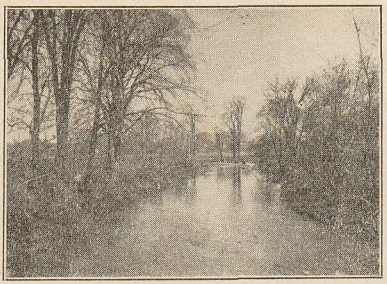
5,500 cubic feet per second, or fifty per cent in excess of any previously recorded flood flow. Much damage resulted.

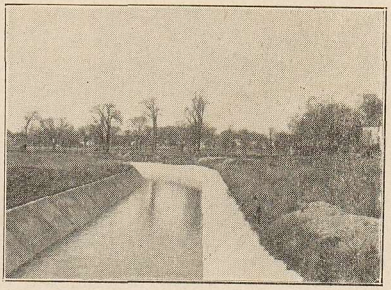
A Flood Commission appointed by Mayor Louis Will, after an investigation of the related problems of creek improvement and flood damages, recommended amendments of the Sewer Board Act whereby the remainder of Onondaga creek would be enlarged to provide for flood flows equal to the maximum recorded.

The amendment recommended was enacted and a larger channel has been built from South Avenue to the south city line with a capacity of 6000 cubic feet per second.

It was necessary to construct a larger channel above South Avenue because the smaller section used below this point would have been inadequate, inasmuch as the original stream bottom was much shallower above South Avenue. The hydraulic area outside the small improved channel available for carrying flood waters without topping the banks was, fortunately, considerably larger up to South Avenue than upstream from that point. It was this consideration which contributed to the necessity for a greater masonry lined flood channel to the city line.

ONONDAGA CREEK IMPROVEMENT





Before and After Construction of Flood Channel

Flood Control Problem to Be Studied by Board

Until recently a general misapprehension was current that the work of the Sewer Board was planned in part for the prevention of damages from flood flows in Onondaga Creek. The fact is that it was not until after the study of the 1915 flood that the Board was authorized to construct the creek channel improvement adequate for an established maximum flood flow. At this time the creek work was complete to South Avenue.

In the limited period available for the studies then made it was clearly perceived that any increase in channel capacity above this maximum was not economically feasible. The stream through the heart of the city was so closely confined by costly abutting buildings that channel enlargement was practically prohibitive.

Few in the city appreciated the flood menace arising from the possibilities of "cloudburst" rainfalls upon the drainage area. The public in general placed too much dependence—if the matter was at all considered—upon the work already accomplished by the Sewer Board. This situation existed despite the general effort by the Board's Chief Engineer to impress upon such as were interested that there existed serious possibilities of floods exceeding greatly in magnitude the capacity of the existing flood channel.

Engineering Society Holds Symposium

Late last February the Syracuse Section of the American Society of Civil Engineers conducted one of its periodic symposiums devoted to technical municipal problems facing Syracuse. The engineers discussed protection from Onondaga Creek floods, with the Chief Engineer and Designing Engineer of the Board as participants on the program.

At this public meeting, which was held under the auspices of the Syracuse Technology Club, with which the Section is affiliated, the dangers of the existing situation were so clearly portrayed that a resolution was unanimously adopted calling upon the proper public authorities to take prompt steps for the initiation of a complete study of the situation and the development of plans for elimination of the flood menace. This resolution was endorsed by the Board of Governors of the Technology Club, which also appointed a committee of its members as an advisory body.

This meeting sought to help properly mould public opinion whereby disaster and tragedy could be averted by early action. They recommended a careful technologic study of Onondaga Creek, its drainage area, its run-off idiosyncracies, and the probabilities of intense excessive precipitation and the flood flows likely to result therefrom. In this effort the Syracuse Section A. S. C. E. Engineers were very greatly assisted by the

48 FOOT CONCRETE FLOOD CHANNEL

Comparative Creek Cross-Sections

cooperation of the newspapers, in particular the **Syracuse Herald.** The able campaign conducted by this newspaper enlisted the aid of many public spirited citizens and officials, with the result that the State Legislature passed a bill enlarging the scope of the duties of the Board to include a study of the flood menace.

Flood Records Given

Prior to the creation of the Sewer Board, the largest flood recorded occurred in Dec., 1901, at which time a maximum rate of 3500 cubic feet per second was attained. The record states that this rate was the greatest during the preceding 30 years. The earliest high flood mentioned occurred in 1836, but unfortunately no data was available as to the rate. In March, 1865, occurred a flood designated on the old records as the greatest since 1836; quantity also unrecorded, though it appears that it was not as great as the 1915 flood volume.

The following flood records have been noted by the Board within recent years:—

Date of Flood	Flow in Cu. Ft. Per Second
March 26, 1913	3,250
March 27, 1914	3,600
Sept. 14, 1915	5,500
March 13, 1920	6,000
Feb. 11, 1925	5,500

All except the 1915 flood were spring floods due to the melting of the previous snowfall accumulations going off with warm rains. The 1915 flood was due to excessive rainfall.

The above flood records cover a period of about 89 years.

A brief outline of the causes contributing to the maximum recorded flood—March 13, 1920, of 6,000 c. f. s.—may be of interest. At the end of February, 1920, the depth of snow on the ground was 22 inches. During March twelve more inches fell. The temperature then rose, averaging 44 degrees Fahrenheit and reaching 58 degrees as a maximum for the three days preceding March 11, on which day 0.12 inches of rain fell, followed by 0.34 inches the next day. The combination of thaw and rainfall brought about the peak flood flow.

Story of 1915 Flood

The 1915 flood, occurring September 14, with a peak rate of 5500 cubic feet per second also has an interesting history. A heavy rainfall (1.6 inches) on June 30 was followed by an unusally heavy precipitation during the entire month of July. More than double the normal rainfall (3.68 inches) was recorded, amounting to 7.37 inches. The high precipitation rate continued during August, amounting to 164 per cent. of the normal of 3.33 inches, or a total of 5.45 inches for the month. More or less rain continued during the early part of September, keeping the drainage basin continuously saturated. An unusally heavy fall on September 12 and 13 resulted in what was by far the greatest flood in the Onondaga Creek drainage basin recorded up to that time.

"Cloudburst" precipitations are the most potent factors contributing to a serious flood menace. This territory was visited by two such deluges in June of 1922, centralized over the Furnace and Harbor Brooks drainage areas. Their occurrence was one of the impelling motives which governed the inclusion of these two watersheds in the recent Amendment providing for a study of flood menace eliminations. On the other hand, the possibilities of such an enormous rainfall rate extending over the Onondaga Creek area contributed to the realization of the dangers lurking in an unregulated runoff from Onondaga Creek.

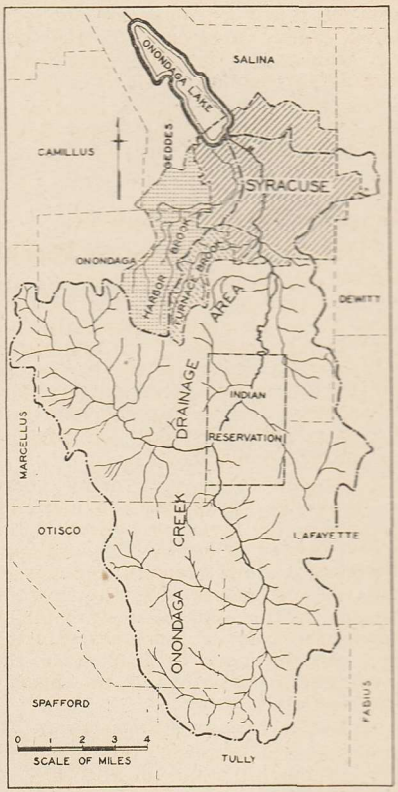
The two June, 1922, cloudbursts resulted in floods in Furnace Brook and Harbor Brook of such magnitude and destructiveness that all previous records were completely dwarfed.

1922 Rains Most Intense

The most severe rainstorm of record since 1902, the date of the establishment of the Syracuse station of the United States Weather Bureau, occurred on June 11, 1922. Higher intensities of rainfall for short periods of less than 20 minutes had been recorded, but nothing approached the magnitude of this storm, which lasted for 70 minutes. It was followed on the 17th of the month by another storm of unprecedented intensity and duration. This second storm continued for 140 minutes, in which 4.57 inches of rain fell, completely eclipsing not only all local records but those of any other station in this vicinity.

Peculiarly, both these June storms travelled over the city from west to east in a comparatively narrow belt centering over the two watersheds mentioned. The property bordering the two brooks suffered most severe damage. No serious flood flow occurred in Onondaga Creek, though the creek channel was damaged somewhat near the Furnace Brook junction

DRAINAGE AREAS



STREAMS TRAVERSING SYRACUSE

by the raging waters of that swollen stream. Had the cloudburst area, in its vagaries, exceeded the area delimited by the Indian Reservation on the south and Cicero on the north—outside of which territory little or no rain fell at this time—the damages to the lower stretches of the creek would have been enormous.

It is quite evident, from even a cursory examination of the data available, that provisions for the elimination of flood menace from Onondaga Creek cannot include any effective amount of channel enlargement. The possibilities, and probabilities as well, of intense precipitation runoff are

such that the channel cannot be enlarged to adequate capacity except at prohibitive cost. It appears at present that the construction of some form or forms of detention or regulating works upstream of the city will constitute a more practicable program of flood control.

The study of the entire problem is now in the hands of the Sewer Board and its engineering organization.

Leaping Weirs in Sewers Divert Low Flows to Works

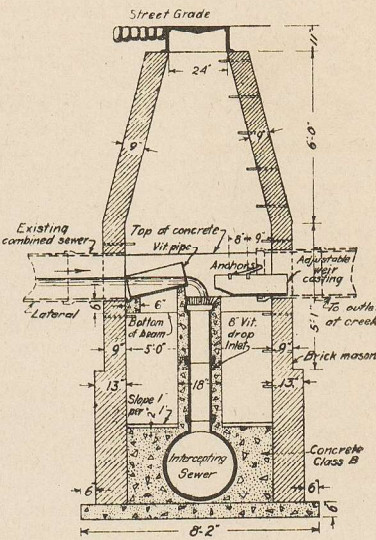
Most of the sewers in Syracuse are of the "combined" type, that is, they carry a combination of domestic sanitary sewage and storm surface water. Where these lateral sewers cross the intercepting sewer some device must be provided for passing the flow into the interceptor without surcharging the latter's capacity.

A scheme in use for many years in sewerage practice provides an opening in the invert or bottom of the lateral sewer whereby the ordinary sewage flow falls through and passes into the interceptor. As the flow increases in the lateral sewer during storms the velocity increases, causing most of the flow to leap over the opening and pass on to the nearby watercourse.

When the Board's engineering organization approached this problem, it was tackled in the typical S. I. S. B. fashion, for it was found that little definite data were available on the quantitative results obtained by this scheme. Extended experiments were, therefore, made and a device evolved whereby the desired "double" sewage flow could definitely be passed to the interceptor.

This is accomplished by tilting a channel pipe to form the inlet spout lip and by providing a sliding weir trough casting adjustably spaced beyond it, leaving an opening larger than the old method provided through which the low flows drop. This larger opening lessens the liability of clogging. The adjustable trough is so placed that all of the flow is caught by it as it leaps the gap except the

LEAPING WEIRS



INTERCEPTING CHAMBER

predetermined volume of "double" sewage which drops through the gap and enters the interceptor.

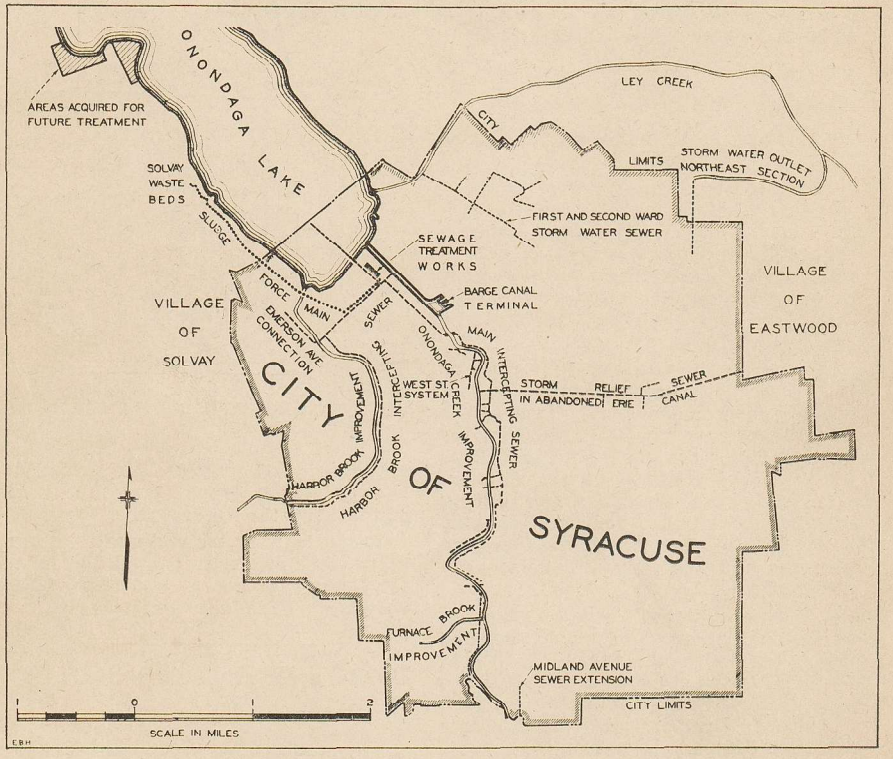
These leaping weirs have now been in use in Syracuse, in modified forms, for over 15 years and have been rendering excellent service.

Board's Engineering Staff Plans and Supervises Work

The work of the Board is being carried forward under the direction of Glenn D. Holmes, Chief Engineer, assisted by the following staff: J. X. Cohen, Designing Engineer; Girard M. Parce, Joseph D. Kieffer, Earl F. O'Brien and Earl B. Hardy, Assistant Engineers; Robert Yale, Helper; Elva A. Wagner, Stenographer; Thomas L. Webb and Samuel S. Whidden, Inspectors.

William P. Gyatt is Superintendent of the Sewage Treatment Works.

OUTLINE MAP OF THE CITY OF SYRACUSE, N. Y.



Showing Improvements Constructed by the Syracuse Intercepting Sewer Board