REPORT

OF THE

Chief Engineer and Committee of Construction

OF THE

WATERWORKS,

CONSTRUCTED BY THE

National Waterworks Company,

OF NEW YORK,

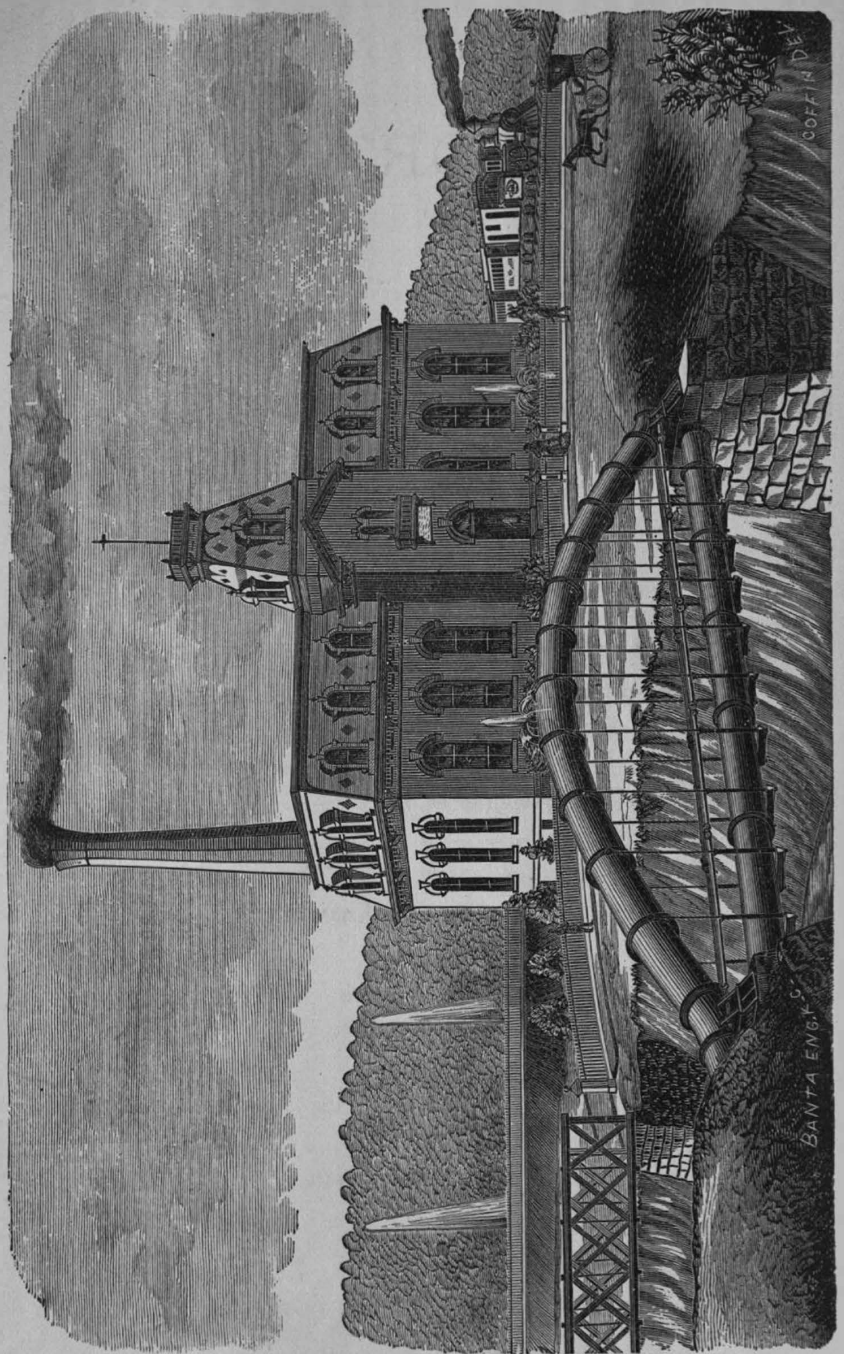
AT

Kansas City, Missouri,

FOR THE YEAR 1874, AND UP TO APRIL 15TH, 1875.

KANSAS CITY, MO.:
RAMSEY, MILLETT & HUDSON, PRINTERS.
1875.

Respects of G W Parsons esq



WATER WORKS, KANSAS CITY, MO., 1875.

Pumping-House and Pipe-Bridge over Turkey Creek.

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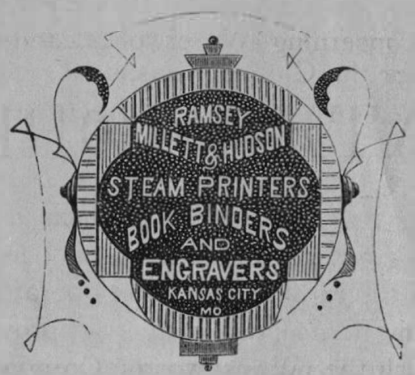


AN ACT

CONCERNING

WATER-WORKS.

AN ACT concerning Waterworks, and a supply of water for the City of Kansas.

Be it enacted by the General Assembly of the State of Missouri, as follows:

* * * * * * * * * *

SECTION 22. The City of Kansas is hereby empowered to grant to any person or persons or any corporation the right to erect and operate such waterworks, as the first section of this act provides for, and to accomplish the purpose therein mentioned, on such terms and conditions as may be agreed on in a contract therefor; *provided*, that such grant shall only be made by or in all respects pursuant to ordinance which shall not be valid till the same be approved by two-thirds of the qualified electors of the city, voting on the matter at a general election, or special election ordered and held for the purpose, when the matter of the approval of such ordinance shall be submitted to such electors, the power to order, hold and declare the result of any election requisite to being hereby conferred on the city to be exercised by or pursuant to ordinance; and, *provided further*, that no grant so

made shall confer the right to operate the waterworks for any period beyond twenty years from the time of approval of the ordinance as aforesaid, but the grant may be renewed by or pursuant to ordinance approved as aforesaid, during the last of such twenty years for another term not exceeding twenty years, on terms and conditions specified in the ordinance for the renewal of the grant; and, *provided further*, that in making such grant or renewing the same the city shall reserve to itself the right, at its option, and at any time, to acquire and become sole owner of such waterworks, including all extensions and enlargements thereof, and everything of every nature and description belonging and pertaining thereto, on such terms as may ba provided and agreed on between the parties at the time the grant is made, or if no such right is expressly reserved, or the city cannot, according to any reservation, purchase and become sole owner as aforesaid, then the city may, at any time, at its option, acquire and become sole owner of such waterworks, including all enlargements and extensions thereof, and everything of every nature and description belonging or pertaing thereto, on paying therefor the fair and equitable value thereof, to be ascertained, if the parties cannot agree thereon, by the Circuit Court of said county, on the petition of the city, the property and subject of purchase to be transferred and belong to the city on payment therefor; and, *provided further*, that at the expiration of the twenty years, if the grant be not renewed, the city shall purchase and become sole owner of such waterworks as aforesaid, and pay therefor a price agreed upon by the parties or ascertained as they may agree, or if the price cannot be thus fixed, then the city shall pay the fair and equitable value of the whole works, to be ascertained by said court, on the petition of either party, filed for the purpose; and, *provided further*, that the city may furnish any party to whom such grant may be made, real estate and right of way for use in constructing and operating such waterworks according to such agreement as may be made in the premises, and guarantee that the works shall earn a certain amount annually, to be specified in the grant, and guarantee clear, over and above current expenses, taxes, and assessments, and may secure by a proper deed or agreement for the purpose, to the party to whom such grant is made, the control and possession of any real estate and right of any condemned or acquired, in the exercise of the right of eminent domain for use during the time such party may need the same under any such grant.

SEC. 23. The Common Council shall, in case a grant is made to any person or persons or corporation to erect and operate waterworks in the City of Kansas, and in case the city shall guarantee to such person or persons or corporation, that the works they may erect shall earn a certain sum of money, and if it becomes necessary to pay any portion of such guarantee out of the public treasury, levy and collect a tax on all the property fronting on the street where the supply of water pipes may be laid, not less than five cents per front foot, nor more than twenty-four cents per front foot, for the purpose of paying such sum of money guaranteed.

SEC. 24. This act shall take effect from and after its passage.

Approved March 24, 1873.

AN ORDINANCE

CONCERNING THE ERECTION OF

WATER-WORKS.

AN ORDINANCE authorizing the National Waterworks Company to construct, operate and maintain Water Works in the City of Kansas.

Be it ordained by the Common Council of the City of Kansas:

SECTION 1. That the National Waterworks Company of New York, a corporation duly organized under the laws of the State of New York, be, and it is hereby authorized, subject to the limitations hereinafter or by law provided, to establish, construct, maintain and operate waterworks in or adjacent to the City of Kansas, in the State of Missouri; to receive, take, purify, store, conduct and distribute, in and throughout the said City of Kansas, pure, well-settled and wholesome water; to lay down pipes and extend aqueducts and conductors through the streets, avenues, lanes, alleys or public grounds of the said City of Kansas; to erect and maintain all necessary buildings, machinery and attachments, of any description, necessary and proper and suitable for such works, and to supply to said city, and the inhabitants thereof, such water by said waterworks; and for the

purpose of laying down pipes, and constructing aqueducts and conductors, and repairing the same during the continuance of this franchise, may enter upon any street, avenue, lane or alley under the control of said city; to take up the pavement or sidewalks upon such streets, avenues, lanes or alleys, and make such excavations therein as may be necessary; and to have the right to lay, keep and maintain pipes below the surface of such streets, avenues, lanes or alleys for conducting and distributing water as aforesaid: *Provided*, that said pavements or sidewalks shall be taken up and said excavations shall be made in such manner as to give the least inconvenience to the inhabitants of said city, and to not interfere with the vested rights of any person or persons or corporation in or upon any of said streets, avenues, lanes or alleys for other purposes than the construction and operation of waterworks, and that said pavements or sidewalks and excavations shall be replaced and repaired in as good condition as before, with all convenient speed, by and at the expense of said Waterworks Company.

The rights hereby granted to continue twenty years from the date of the approval of this ordinance by a vote of the qualified voters of the City of Kansas, subject to provisions hereinafter mentioned as to purchase of said waterworks by the city, and renewal of grant to the company, and any other limitation of this ordinance and of law. It is expressly understood and agreed that said company, in constructing, repairing and operating such waterworks, and in doing everything necessary, and convenient to that end and object, shall use the same precautions and care to avoid and prevent loss, damage and injury to persons and property, especially in carrying on its work and opera-

tions in, on and along streets, avenues, lanes, alleys public highways and public grounds of the city, and keeping the same in repair and safe for use, that the City of Kansas would be bound to use were it owner of and engaged in constructing, repairing and operating such waterworks. The city reserves to itself the right, at all times, to make and enforce all reasonable and proper regulations as to the place where pipes may be laid in streets, avenues, lanes, alleys and public highways, and the conducting of all operations thereon and therein by said company.

SEC. 2. The works and operations of said company shall be so constructed and managed as not to affect the comfort and health of the citizens of the City of Kansas prejudicially, nor conflict with the vested rights of any person or persons, or corporation in said city, and nothing in this ordinance shall be so construed as to absolve said waterworks company from any legal liability and proceedings to restrain or abate any nuisance arising from their operations, nor from liability for any injury to persons or property resulting from the negligence or fault of said Waterworks Company, or of any of its employes, when such employes are working under the directions of said company, nor to render the City of Kansas liable to any person or persons or corporation for damages caused by the construction or operations of waterworks by said company, and said company shall indemnify the City of Kansas against, and save it harmless from all loss, damage, cost and expense resulting from the construction, repairs and operation of such waterworks, and from all carelessness and neglect of duty to the city, to persons, property and corporations, on the part of

said company and its agents, servants and employes, except as otherwise provided in this ordinance and contract.

SEC. 3. That if any person shall wilfully or carelessly injure or destroy any portion of the works, fixtures or other property of the company, such person shall be deemed guilty of a misdemeanor, and upon conviction thereof, shall be fined in any sum not less than fifty dollars nor more than five hundred dollars.

SEC. 4. The City of Kansas hereby reserves to itself the right, at its option, and at any time, to acquire and become sole owners of said waterworks, including all extensions and enlargements thereof, and everything of every nature and description belonging and pertaining thereto, on paying thereafter the fair and equitable value thereof, to be ascertained, if the parties can not agree thereon, by the Circuit Court or other court of record of the county of Jackson, at Kansas City, upon the petition of the city, and in such manner as the court may determine, *provided*, that said petition shall be served upon said company at least fifteen days before the same shall be presented to said court. If, at the expiration of twenty years from the time this grant shall take effect, the same shall not have been renewed, or the city shall not have become owner of said works, the city shall then be required to purchase and become sole owner of said waterworks as aforesaid, and pay therefor a price agreed upon by the parties, or ascertained as they may agree, or if the price cannot be thus agreed upon, then the city shall pay the fair and equitable value of the whole works, to be ascertained by said circuit or other court of record as aforesaid, in such manner as

said court shall determine on the petition of either party for the purpose: *Provided*, that the party presenting, such petition shall have served a copy thereof upon the other party, at least fifteen days before the day of such presentation; and *provided*, also, that if upon examination, it be found that such works are not in all respects in good condition and of first class and sound materials, then the city shall not be required to purchase the same at any time nor at any price.

In case of purchase of said works by the city the said company shall be required to make, execute and deliver good and sufficient conveyance of title to said works to the city, clear of all incumbrances or liens: *Provided*, that if any such incumbrance or lien shall be left thereon by said company, then the full amount of such incumbrance or lien shall be deducted from the amount of the full price to be paid by the city to the company for said works, and the city shall pay the incumbrances or liens then on the works and save said company harmless therefrom.

It is also agreed that the company shall not incumber said waterworks by liens beyond ninety-five cents on the dollar upon their value when completed and in operation, and in no event shall the city, if it should determine to purchase said works, assume to pay liens exceeding ninety-five cents on the dollar of the actual value of said works. And in case the city shall purchase said works at any time after they are in operation, their value at the time of purchase shall be deemed their then completed value; and it is further agreed that should the city purchase said works it may, from the time of fixing and ascertaining the value thereof, have one year to pay the price fixed or agreed upon; but the company shall retain possession

and continue to operate said works until payment is made. Said valuation is to be the actual value on the works, and not upon the stock of the company.

SEC. 5. The City of Kansas hereby undertakes and agrees to rent from the said company one fire hydrant for every three hundred feet of distributing main pipe that may be laid down in the streets of the city by said company within the limits of the city, to the number not exceeding three hundred hydrants, and as many more, from time to time, as, in the judgment of the common council, the interests of the city may require: *Provided*, however, that the city does not agree or undertake to rent fire hydrants on parallel mains nearer to each other than three hundred feet, unless the city directs them to be put in; *and provided further*, that when the city rents hydrants on parallel mains, it does not agree to rent hydrants located on mains laid across the space between such parallel mains, unless the extent and importance of the space between the parallel mains in which hydrants are rented should, in the judgment of the city authorities, demand it, or the distance on any cross main should exceed three hundred feet, in which case one hydrant shall be located for every three hundred feet of such cross main; *also provided*, that the connecting pipes between the main pipes and hydrants, on or by the sidewalk, shall not be measured in the estimate of length of pipe requiring the city to rent hydrants, neither shall cross mains of less length than three hundred feet be counted in such estimate.

Each fire hydrant rented by the city shall have two openings, or outlets, and if, at any time, the city deems it necessary to remove a hydrant from one lo-

cation to another it shall have the privilege of doing so, at its own expense.

SEC. 6. The City Kansas, by its authorized agent or agents, shall have the right to designate on what streets, avenues, lanes or alleys water pipes shall be laid and fire hydrants placed, and the places at which the said hydrants shall be located, but said company shall not be required to lay pipes on any street, avenue, lane or alley on which the grade shall not have been established, and the places for the location of hydrants shall be designated by the city as aforesaid at such times and in such manner as not to impede or interfere with the laying of pipes by the company.

SEC. 7. The company agrees to furnish all fire hydrants, valves, and connections for same, as fast as needed, and place them in position ready for use, and keep the same in good repair and working order, and shall also make connections with the public cisterns, if any there be, as rapidly as possible, and supply them with water free of charge; but the city shall keep the public cisterns in good repair.

SEC. 8. The company agrees and guarantees that the fire hydrants rented by the city shall at any time, with fire pressure in the pipes, throw twelve streams of water through as many different hydrants in any part of the city at the same time, each stream to be through fifty feet of hose and a one-inch nozzle, to the height of one hundred feet, or eight streams as aforesaid, each through fifty feet of hose and an inch-and-a-quarter nozzle, to the height of one hundred and twenty-five feet, or four streams as aforesaid, each

through fifty feet of hose and an inch-and-a-half nozzle, to the height of one hundred and fifty feet. In each case the height to be reckoned from the end of the nozzle, and that the hydrants shall at all times be available and efficient in case of fire.

SEC. 9. The city hereby agrees to pay to said company during the continuance of this franchise in said company, an annual rent on each hydrant herein agreed to be rented by the city of one hundred and twenty-five (125) dollars for each of the first three hundred (300) hydrants, and of one hundred (100) dollars for each additional hydrant between three hundred (300) and four hundred (400), and eighty (80) dollars for each hydrant in excess of four hundred (400). Said rent to be paid by the city in semi-annual payments, and that the city may use water from the fire hydrants on streets curbed and guttered for the purpose of washing and flushing the gutters and sewers on such streets whenever the city authorities or city physician shall deem it necessary, upon giving previous notice to the company, and the same shall be without charge; and also, without further charge, use and take from such hydrants all water necessary and convenient for putting out fires whereever they may occur in the city, and supplying the cisterns of the city with water for like use and the wants of the fire department of the city generally, and the rent of each hydrant shall commence from the time the same is put in and completed ready for use, with an adequate supply of water: *Provided*, that the city shall not be required to pay rent on hydrants until their capacity to throw the streams of water as guaranteed in section eight of this ordinance, shall have

been shown to the satisfaction of the chief of the fire department, and the city engineer of the City of Kansas.

It is further stipulated that the water company is to supply water free of charge for all public buildings and offices of the city; also for any fountains the city may hereafter erect on the public grounds; also for any drinking places the city may choose to erect in any portion of the city, and for basins for watering stock from waste water out of such fountains: *Provided*, however, that such watering places for stock shall not be used by omnibus, street railway or other companies who use large numbers of horses.

SEC. 10. When the city shall become the owner of said water works and the property belonging thereto, then the obligations of this ordinance upon said company and between said company and the city shall cease and be of no further effect from that time, except so far as may be necessary to carry out the contract of purchase of the works by the city.

SEC. 11. The city agrees to furnish and donate the use of the necessary real estate not exceeding six acres for the erection of distributing reservoirs of said water works, and to secure the use thereof to said company during the continuance of this franchise in them, by sufficient deed or deeds of conveyance: *Provided*, that the fee simple title to such lands shall remain in said city, and if, at any time, the city purchase said works, the price or value of such real estate, or any part thereof, paid for by the city shall not be included in the estimation of the purchase price to be paid by said city for said works.

The city also to furnish the right of way free of

cost to said company for all pipes necessary to be laid in obtaining water and conducting the same from the works to and through the city. Such real estate and right of way to be furnished in time so as not to delay the progress of work in the construction of said water works; *Provided*, that if delay shall be caused thereby, as aforesaid, then the said water works company shall be entitled to additional time for the completion of the works, equal to the time of such delay, in addition to the time of such completion otherwise limited in this ordinance, and the city shall not be otherwise liable for damages by reason of such delay.

The real estate aforesaid to be furnished at such places as shall be suited and neccessary in the erection and maintenance of said water works, to be designated by said company, after the place of obtaining the supply of water shall have been decided upon; *provided*, that the cost of the lands so furnished shall not exceed twelve hundred dollars per acre, to be paid by the city, and if there be any excess of twelve hundred dollars per acre in the cost thereof, the said company shall pay such excess. In case of inability of the city to pay for such real estate when purchased, the said company agrees to advance the money to pay for the same, and the city shall refund to said company within one year the sums so advanced to the amount of not exceeding twelve hundred dollars per acre of principal, together with interest thereon from date of its advancement until paid; *provided further*, that the city shall not be bound to expend more than three thousand dollars for right of way for laying pipes in or across private property, or property other than that owned by the city, or held by it for public use; and when the city shall have paid or become legally

bound to pay for right of way the sum last aforesaid, said company shall pay for all additional right of way, it being expressly agreed and understood that in no event, or under any circumstances, shall the city directly or indirectly pay, or become bound to pay for real estate, including right of way for laying and repairing pipes, to be furnished to said company for use in constructing or operating such water works over ten thousand, two hundred ($10,200) dollars; and, also, that the city shall not be bound directly or indirectly to furnish or donate to said company any real estate or right of way whatever for use in constructing and operating such waterworks, except such as the city can or may acquire for such purpose and use for twelve hundred dollars per acre, or less, for real estate, and for three thousand dollars, or less, for right of way, said company to pay for all other real estate and right of way needed or acquired by it; but in no event or any circumstances, shall the city receive any compensation or make any charge for right of way, for laying and repairing pipes in streets, lanes, alleys, avenues or public highways of the city or real estate owned by the city in fee. The city shall not be bound to furnish any particular real estate or right of way sooner than it can reasonably do so by private contract or by and through legal proceedings for the purpose.

SEC. 12. The work to be commenced in the spring of 1873, and completed ready for operation within the year 1874, unless prevented by unavoidable circumstances, in which case the time of completion shall be extended one year longer, and in case of failure to complete within such extended time, the franchise of said company shall be thereby forfeited. It is further agreed that as much work as possible shall be done this fall and winter on the storing and distributing reservoir, and that the laying of pipe through the streets shall be commenced as early in the spring of 1874 as pipe can be delivered on the ground.

SEC. 13. The said Waterworks Company stipulate and agree that the amount of current expenses of operating, including repairs of every kind, salaries of officers and engineers, and all other operating expenses to be deducted from the gross earnings of the company, in ascertaining the net earnings of the same, shall not exceed the sum of twelve thousand (12,000) dollars per annum. Neither the cost of any enlargement or extension of the works after said guaranty takes effect, nor any amount paid or payable by said company on the principal or interest on any debt, or on account of any neglect of duty or negligence of said company, shall be deducted from gross earnings in ascertaining the net earnings of the works for any year in respect of said guaranty, and the company shall be liable to the city or its inhabitants for any and all damages that may happen by the bursting of the mains or pipes and the flooding of the cellars or houses of the citizens or any public building in consequence of the bursting of such mains or pipes.

SEC. 14. Said Waterworks Company binds and obligates itself during the continuance of the franchise, to furnish at all times a full and sufficient supply of good, pure, well-settled and healthful water for all public and private use of said city and the inhabitants thereof, such water to be suitable for domestic purposes.

The private water rates to be agreed upon between said company and the agent or agents of the city, which rates shall not be higher than the average charge of St. Louis, Missouri; Louisville, Kentucky; Memphis, Tennessee; and Quincy, Illinois, subject to a revision of such rates by the company and agent or agents, as aforesaid, every three years.

It is further agreed that at any time the city shall have reason to believe that the water is not of the quality stipulated it may apply to the circuit court of Jackson county, by petition, setting forth the fact, and the said court may thereupon appoint three analytical chemists of experience to anylize the water furnished by said company, as aforesaid, and to report thereupon in triplicate in such time as the court may direct, one copy to be furnished to the city, one to the company and one to be filed with the clerk of the court aforesaid, and said report shall have the force and effect of an award of arbitrators between the city and said company from which either party may appeal in the same way as from an award of arbitrators, under the laws of Missouri, to the courts of competent jurisdiction, and if, by such report, or by final determination in court, if the same be appealed, the water shall be found to be not of the quality stipulated in this ordinance, then said company shall be liable for all damages caused by such water to any person or persons or to the city, in addition to other remedies that may be afforded by this contract or by law. Ten days' notice shall be given to the company of such application to the court, and the appeal provided for shall be taken within twenty days after the making and filing of such award. It is also further agreed that in case of final determination of such arbitration

or report against the company, then the city shall not be bound to make up to said company during the time the water shall be not of the quality stipulated in this contract any amount of net earnings herein otherwise guaranteed.

SEC. 15. The City of Kansas agrees and binds itself to enforce all ordinances legally enacted for the preservation and protection of said waterworks within the limits of said city or within its jurisdiction, from injury or damage from the acts of evil disposed persons during the continuance of the franchise, and to enact and enforce ordinances for the prevention of waste of water by the officers and employees of the city and the citizens of the same; *provided*, that said company shall cause notice of the violation of any such ordinance to be given to the proper executive officer of the city, and that, in no case, shall the city be liable for loss, injury or damage not done or caused by the direct act or acts of said city, nor be liable for loss, injury or damage resulting from failure to enact ordinances, or to enforce ordinances or laws, for the preservation and protection of said waterworks from injury and damage from the acts of evil disposed persons.

SEC. 16. The City of Kansas agrees and hereby guarantees that the net earnings of said Waterworks Company, while kept in good working condition and capable of furnishing an adequate supply of water for all public and private uses of said city and citizens thereof, shall, over and above all current expenses and taxes, amount to the net sum of fifty-six thousand dollars ($56,000) per annum, and if the net earning of said works, while so operated and maintained in good condition, amount annually to less than

said sum of fifty-six thousand dollars, then said city agrees and binds itself to pay annually to the treasurer of said Waterworks Company such deficiency, and binds itself to levy and collect the same, under the provisions and power conferred by the act of the General Assembly of the State of Missouri, entitled "An Act concerning waterworks and a supply of water for the City of Kansas," approved March 24, 1873, or any amendment thereto that may be made, or any other law that may be passed; and for the purpose of ascertaining the net earnings of said Waterworks Company from all sources, its books during all business hours, shall be open for the inspection of said agent or agents, or any agent or agents appointed by the City Council to examine the same, and, if required, semi-annual reports under oath of the earnings and incomes of said waterworks shall be made to the City Council, for the purpose of enabling them to determine the amount of such deficiency, if any, and to levy and collect a tax to pay the same in the manner provided by the act aforesaid, or amendments thereto, or other law.

SEC. 17. The said Waterworks Company agree and guarantee that their machinery and works shall be of the most durable material and first-class in all respects; that there shall be one or more suitable engines for lifting or pumping the water from where it shall be obtained to one or more reservoirs, where it shall be settled before being distributed, and if necessary to settle said water near the point of obtaining the same, which will be the case if the water be obtained from the Missouri River, then said pumping engines shall be of sufficient capacity to lift said water

from the settling reservoirs to one or more storing reservoirs for distribution; and the reservoir or reservoirs from which the water shall be distributed shall in any case be on an elevation of at least one hundred and seventy-five feet above the city directrix of said City of Kansas, and the water therefrom shall be distributed by the Holly system throughout the city; and the said company guarantee that said waterworks shall be of sufficient capacity to, and that they shall at all times, furnish an adequate supply of water to the City of Kansas and its inhabitants until said city shall have attained a population of two hundred thousand people; and that they shall be capable of extension and enlargement when necessary, and that the reservoirs from which the water is distributed shall be of sufficient capacity to contain at one time at least ten days' usual supply of water for said city and its inhabitants, and said company shall at all times, after the works are put in operation, keep on hand in the reservoirs water enough so that in case of breakage or accident, preventing the further supply for the time being of water from the source or sources whence it may be taken, there shall be in the reservoirs at the time such breakage or accident occurs water to supply the wants of the city and the inhabitants thereof for ten days, using water at the then usual and customary rates or quantities. The said company further guarantees that the waterworks buildings to be erected by them shall be of substantial and first-class character and not inferior in any respect to the waterworks buildings at Memphis, Tenn., which cost $45,000. And it is further agreed between the City of Kansas and the National Waterworks Company that none other but iron pipes or material as du-

rable shall be used in laying down mains and laterals in the city.

SEC. 18. It is expressly agreed and understood that the whole amount payable by the city for rent of fire hydrants shall be always taken and deemed to be net earnings of said waterworks within the meaning of section sixteen aforesaid in determining how much shall be payable under the guarantee in said section, so that in no event nor under any circumstances, shall the city be bound or liable to pay on account of said guarantee, including the rent of all fire hydrants, over fifty-six thousand pollars per annum net earnings. The guaranty contained in said section sixteen shall not be binding and operative until said company shall construct and put such waterworks in successful operation, with at least twelve miles of main distributing pipe laid and operating as part of the works, not counting as part of such pipe any pipe for carrying water from such main pipe to fire hydrants, or into public buildings or private premises, the whole works to be constructed in accordance with the terms of this ordinance, and liability under such guaranty continue for the time after the works are so constructed and put in operation, and kept thereafter in successful operation, whenever the net earnings of said waterworks, including the rental of fire hydrants, exceeds fifty-six thousand dollars for any one calendar year, said guaranty shall determine, and shall not thereafter be binding nor be renewed.

SEC. 19. Within twenty (20) days after the approval of this ordinance by the qualified voters of the City of Kansas, as hereinbefore provided, the Common Council shall provide by ordinance for the appointment of a board of one or more persons to be

known as Water Commissioners, or they may be known as agents of the city, who shall represent the city in the matters in this contract provided to be done by such commissioners or agents; the qualifications, tenure of office, time and manner of subsequent appointment or election of such commissioners or agents, and their compensation to be such as may be provided by law and ordinance; such other duties may also be assigned to said commissioners or agents on the part of the city, pertaining to the waterworks, as may be provided by law or ordinance; *provided*, the same shall not conflict with any provision in this contract; without the consent of the Waterworks Company. It shall be among the special duties of said commissioners to see that the provisions of this contract and ordinance are complied with by the Waterworks Company, as well as by the city, and that the water furnished by the works of said company is at all times such as stipulated, that is, pure, well-settled and wholesome and suitable for all domestic uses.

SEC. 20. The use of the fire hydrants rented by the city shall be under the supervision and control of the chief of the fire department of the city, or such other officer or person as the Common Council may designate, and such chief or other officer or person shall have the right to provide for the opening and using of such hydrants at any time in case of fire, or other use authorized by this ordinance and contract.

SEC. 21. The said Waterworks Company by its duly authorized officer shall signify its assent to, and acceptance of, the terms and conditions of this ordinance and contract by the 14th day of November, 1873, by a written agreement signed by such officer,

and attested by the Secretary of the Company, with the seal of the company affixed, if they have a seal, and accompanied by the proper evidence of the authority of the officer signing the said agreement of acceptance, to do so, which agreement and accompanying evidence shall be filed with and recorded by the City Clerk of the City of Kansas; and within the same time said company shall file a duly authenticated copy of their articles and charter of incorporation, or other proper evidence of incorporation of said company, with the names of the incorporators and the officers of said company, with the City Clerk of said city; whereupon all the provisions herein shall be binding and obligatory upon the said company and the city, subject to the approval of this ordinance by the qualified voters of the said City of Kansas, as provided; and if said company shall fail to file its agreement of acceptance as aforesaid, or to file the evidence of its incorporation, with the names of the incorporators and officers thereof, as aforesaid, within the time limited herein for such purposes, then this ordinance shall be void. When this ordinance shall have been submitted to a vote of the qualified voters of said city, and shall have been approved by the requisite number of voters, then each of the parties hereto shall be liable to the other in damages for the breach of any of the conditions hereof, as in other cases of contract, except as herein limited.

SEC. 22. The matter of the approval of this ordinance shall be submitted to a vote of the qualified electors of the City of Kansas, at a special election, to be held for that purpose on the Saturday, the fifteenth day of November, A. D. 1873, at which, if two-thirds of the qualified electors of the City of Kansas votign

at such election shall approve of the same, it shall be valid and binding, and if not, then this ordinance shall not be valid. The manner of holding and conducting such special election and ascertaining and declaring the result thereof to be as provided in chapter 11 of the ordinance entitled "An ordinance in revision of the ordinances governing the City of Kansas," approved October 14, 1871, except that notice of such election shall be published in the several daily newspapers published in the city.

The ballots deposited by those voting at such election in favor of this ordinance shall have written or printed thereon the words "For Waterworks Ordinance," and the ballots of those voting against this ordinance shall have written or printed thereon the words "Against Waterworks Ordinance."

Approved October 27th, 1873.

E. L. MARTIN, Mayor.

Attest: A. MAYER, City Clerk.

OFFICERS.

F. M. MAHAN . . . . . PRESIDENT

G. E. TAINTOR . . . . . VICE PRESIDENT

G. B. VOORHES . . . . . SECRETARY

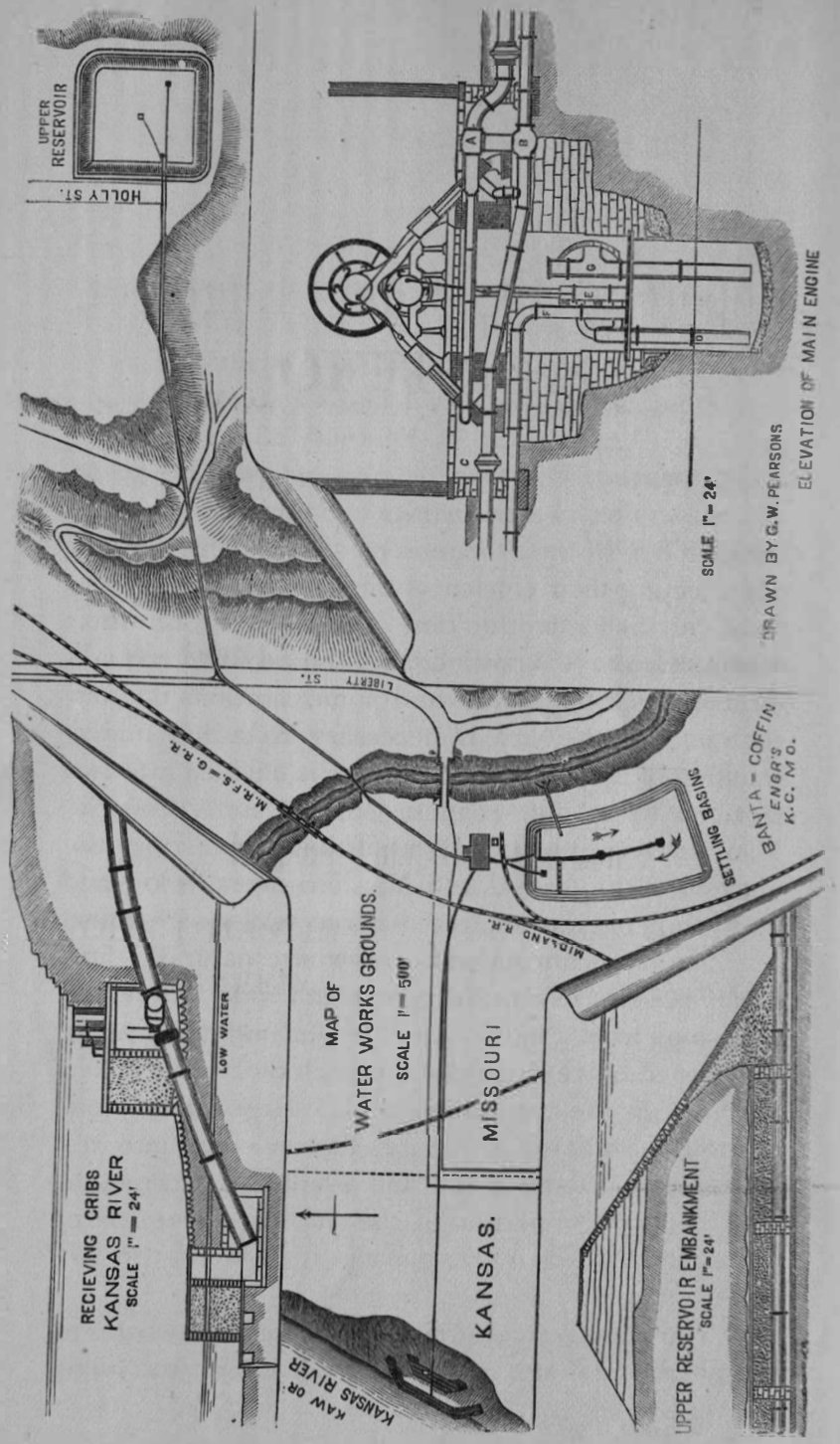
R. W. DONELL . . . . . TREASURER

Kansas City Organization.

JOHN J. MASTIN . . . . . FINANCIAL AGENT

AMOS GREEN . . . . . ATTORNEY

B. F. JONES . . . . . SECRETARY



Report of the Chief Engineer.

OFFICE OF THE NATIONAL W. W. CO.,
OF NEW YORK, AT KANSAS CITY MO.,
February 28th, 1875.

F. M. Mahan, President:

SIR: The water works at this city being completed with the exception of some minor details, not affecting their efficiency, the close of the present fiscal year is made the time for my report on their construction. A knowledge of the peculiar requirements of its topography, and some portions of your contract with the city is necessary to a full understanding of the subject. The city is divided into two portions by a hill, running southwesterly from the Missouri river; the western portion, containing the junction of the Kansas and Missouri rivers, is low and level, and contains an area of about two square miles.

The hill is abrupt and everywhere naturally difficult of ascent, except on the south side where the hills slope from their greatest height in the city to the water-shed of O K creek, a branch of Turkey creek, which forms the natural sewer of a large part of upper town, discharging through Turkey creek into the Kansas river, about a mile and a half above its mouth.

The eastern portion of the city is a succession of ridges and hollows, varying in elevation from 75 to 260 feet.

The Kansas river drains the country between the Arkansas and Platte rivers, heading nearly 500 miles

west from here, it pursues a general easterly course, at its mouth turning abruptly north and skirting along the bluffs forming the western boundry of the bottom lands. The State line between Missouri and Kansas leaves a portion of Kansas on the east side of the Kansas river at its mouth ; this is known as Kansas City, Kansas.

On the bluffs west of the Kansas and skirting on the Missouri is the city of Wyandotte.

So far as general business and espcially water supply is concerned the three places are naturally one and the same.

This irregularity of surface in the city and the difficulty of obtaining ground for reservoirs high enough to flow the whole city, with the great pressure required to be sustained constantly by the mains in the low ground if so supplied, made the study a complex and difficult one.

Mr. F. O. Marvin, City Engineer, being thoroughly acquainted with the topography of the city, was of eminent service in the studies required for the contract between it and the company, and I fully approve of the requirements therein contained, though at the time your company considered some of them onerous and severe.

In pursuance of the water works ordinances, his Honor Mayor E. L. Martin, by action of the City Council, commissioned James E. Marsh, W. P. Moores and Charles M. Ferree, a board of water commissioners to represent the city during the construction of the works.

The terms of the contract required that twelve miles of pipe should be laid during the year 1874; the company intended exceeding this to such an extent as they might be able to do in connection with their other work. Accordingly the first studies of the commissioners were made to determine the relative importance of different streets, with a view to having the first lines cover those most densely built up, and extended to the location of some twenty-two miles of mains.

Some analyses had been made of the waters of the Missouri and Kansas rivers previous to the contract. This left the choice of supply with your company, subject to the guarantees therein contained as to quantity and quality.

These two sources of supply were available, and public opinion was divided between them, generally inclining to the use of the Missouri. The near correspondence of these waters, shown by the analyses already made, with the extreme difficulty of freeing the water of the Missouri of the great quantity of sedimentary matter held in suspension, together with the danger of accident to mains crossing the Kansas river for the supply of this city, with other reasons which will appear in their proper connection, induced your company to continue the studies which resulted in the the choice of the Kansas river as the source of water supply.

The Missouri, navigable for more than three thousand miles, and bearing water enough for the supply of a continent, by comparison, dwarfs the Kansas. Both derive their supply from similar sources, and the various analyses, taken at different seasons of the year, show that, with the exception of the far greater quantity of sedimentary matter carried by the Missouri, they are practically alike.

The Kansas is itself a much larger stream than generally supposed, being one of the principal tributaries of the Missouri. Its water shed contains about thirty-three millions of acres, some fifteen times that which supplies the city of London ; it is so large that the supply required for this city bears no appreciable comparison to its volume, and years must escape before even the rapid growth of this country can line its banks with a population that will sensibly affect the purity of its waters.

The rainfall of this region is unknown; passing through a portion of what is known as the rainless district, its average is doubtless less than that of any recorded area east of it. During the past year, one of unusual drouth, I judge its average outflow to have been about two hundred millions of gallons per hour. Its minimum during the extreme drouth was not far from that amount per day. On a fuller examination of the waters of the Kansas, the location of the works was determined, with a basis of supply from that stream.

The question had been raised in the meantime of locating the works themselves in the State of Missouri, it being considered important to the interests of this city that they be so located if practicable.

This had not before been considered, and could not have been done had the water been taken from the Missouri, as not only the analysis but public opinion was decidedly against using the water of that stream in the vicinity of or below the great slaughter houses which make it a sewer to carry away their offal. A like objection lies against the Kansas river below Turkey creek ; accordingly the works were located above the mouth of that stream.

Another characteristic of the different water. is that the Missouri, though depositing the greater part of its sediment rapidly, leaves a residue which imparts a decided color to the water, and which it retains for so long a time as seldom to be free from it when used. The amount of sediment is so great as to add a very serious item to the cost of operating works using it. In connection with the color of the water after subsidence, the experience of St. Louis, which city practically uses the water of this stream, is such that the question is raised of abandoning the present source of supply and endeavoring to procure one from a source less objectionable. The Kansas river carries but about one-fifth of the sediment carried by the Missouri ; it subsides in about two-thirds of the time required by that water and becomes quite clear. The practical result of this is that, the same provisions being made for subsidence that would have been necessary in case of using the waters of the Missouri, the water is in perfect condition for use as it leaves the works, and the upper reservoir is necessary for storage only.

I have examined both waters and weighed all the evidence I could reach concerning them ; have used the water of the Kansas for drinking during the greater part of the past year, and fully believe that your company have made a proper choice between them. With regard to the so-called alkaline character of the water, it is evident that the alkaline character of some of the upper tributaries of both streams would be soon lost by coming in contact with water bearing the carbonates of lime, and the resultant of the analysis shows this to be the case, both rivers bearing considerable salt, which is about all there is

left of their alkaline character, and being generally about equal in hardness. The various analyses, by different chemists and differently expressed, but, giving results as nearly parallel as the different seasons of the year at which the tests were made would indicate that they should be, are here given:

In August, 1872, three samples of water were taken from the Missouri river. No. 1 was taken at the bridge; No. 2 near the mouth of the Kaw; No. 3 above Wyandotte. These were analyzed by Theodore Fay, chemist, St. Louis, with the following results:

No. 1.—Solid matter separated by filter, 76 grains per gallon; hardness, 7 grains; oxydizable organic matter, .672 grains; sewage contamination, very decided.

No. 2.—Solid matter separated by filter, 76 grains per gallon; hardness, 7.35 grains; oxydizable organic matter, .560 grains; sewage contamination, slight.

No. 3.—Solid matter separated by filter, 68 grains per gallon; hardness, 9.75 grains; oxydizable organic matter, .714 grains; sewage contamination, none.

This test was made principally for the purpose of detecting sewage contamination.

Analysis of six samples of water from the Missouri and Kansas rivers, made by Theodore Fay, analytical chemist, of St. Louis, March, 1873:

NO. OF SAMPLES.....	1	2	3	4	5	6
Solid matter separated by filter, grs	16	16	72	112	64	104
Degree of hardness..... "	10.20	10.50	10.50	10.50	12.95	9.45
Oxydizable organic matter..... "	2.80	3.15	2.45	2.10	2.45	2.80
Sewage contamination..... "	None	Slight	None	None	None	None
Carbonate of lime..... "	7.70	7.70	6.65	5.95	8.75	5.60
Carbonate of magnesia..... "	1.50	1.47	1.76	1.47	.29	2.05
Carburetted alkalies..... "	3.71	3.71	3.71	3.71	3.71	3.71

The solid matter separated by filtration only shows the amount of sand, clay, etc., held in suspension before settling, not detrimental to the water.

The hardness shows the lime, magnesia and carbonic acid gas. The less the hardness the better the water for domestic purposes.

The oxydizable organic matter is decayed leaves and other decayed vegetable matter which is continually changing in quantity. Water generally contains more in the spring than in the fall. All these waters, after filtration, were bright and clear.

Sample No. 1, Kaw river, above Turkey creek; No. 2, Kaw river, at 17th street; No. 3, Missouri river, at pivot pier; No. 4, Missouri river, at Holmes street; No. 5, Missouri river, at mouth of Kaw; No. 6, Missouri river, above Wyandotte.

As a further study of the waters of the Kansas river, different samples were sent, from time to time, to Dr. Theo. Fay, of St. Louis, and in answer to questions relating to the Kansas river as a source of water supply, based on analyses of these and the previous analyses, he made the following communication:

710 WALNUT STREET, ST. LOUIS, MO.,
May 16th, 1874.

GENTLEMEN: I herewith respectfully report that I have carefully examined the water sent me from the Kaw or Kansas river at the point where you propose drawing for the use of the city. I also answer the following questions which you requested, viz:

First—Is it wholesome water?

Yes.

Second—Are there any mineral or other foreign substances contained in it in such proportions as to

render it unpalatable or unhealthy for drinking purposes?

No.

Third—Is it suited for domestic purposes?

Yes.

Fourth—How will it answer for making steam and for manufacturing purposes?

Good.

Fifth—Compare it with the water used in St. Louis and other leading cities in regard to the amount of soluble alkalies, such as lime, magnesia, etc., and decomposable matter, contained in 100,000 parts of water.

Tabulated from records in my possession:

	Soluble Alkalies.	Decomposable Matter.
New York	5.66	1.67
Brooklyn	3.91	1.43
Boston	4.12	1.22
Philadelphia	4.97	1.08
Chicago	9.63	1.81
London	25.36	1.78
Paris	17.73	3.50
These are the average amounts:		
St. Louis	18.92	3.72
Kansas City	22.60	3.

The saline or alkali in the Kaw river in 100,000 parts is 4.32 parts. To consume that amount you would have to drink nearly 14½ pints of water, while at each meal you consume at least ten times that amount from the salt cellar.

Sixth—Can you recommend the water from the Kaw river as wholesome and suited for domestic purposes?

Yes.

Seventh—What variance would there probably be in the water at different seasons of the year, and for wholesomeness and domestic purposes?

I cannot give a definite answer to this question, not having made sufficient experiments to ascertain the facts. In the Mississipi, at St. Louis, we have water no two months alike, varying in solid contents and organic matter. I believe these changes would be the same in the Kaw river. For wholesome water, ten to twelve degrees of hardness (the measure of the salts of lime and magnesia) is considered by physicians as necessary to health. The lime for the formation of bones is principally derived from the water which we drink, bread and animal food containing but a very small quantity. For domestic purposes, such as cooking, it is good; for washing it is less servicable than water containing five degrees of hardness or under—the only difference is that it wastes a little soap.

Eighth—Does it contain any sewage contamination?

On careful examination, I find none.

I remain, gentlemen, respectfully yours,

THEO. FAY, M. D., CHEMIST.

From the records of the Water Commissioners:

KANSAS CITY, MO., May 30th, 1874.

GENTLEMEN: In compliance with your request, I give you below the results of some tests made by myself a few months since to ascertain for my own satisfaction the difference between the Missouri and Kansas rivers, more especially as to the comparative amounts of alkali salts and organic matter present in each.

Without detailing the process adopted in the analysis, I will say that I found—

First—No free acids or alkalies present in either sample.

Second—A faint trace of sulphate of lime (gypsum) in both, but rather more perceptible in the Missouri than in the Kansas river.

Third—Very clear evidence of chloride of sodium (common salt) in both specimens, more marked, however, in the Kansas river water.

Fourth—The amount of lime (carbonate, probably) was about equal, so that there is very little difference in the hardness of the two streams.

Fifth—The amount of organic matter and sediment was far greater in the Missouri than in the water of the Kansas river.

The samples tested by me were said to have been taken by Capt. H. L. Marvin respectively from the Kansas river above Turkey Creek and from the Missouri above Wyandotte.

While the analysis was not a strictly quantitive one, it was sufficiently careful to satisfy me that there is no material difference between the two rivers, and that both are as pure and wholesome as the average of water furnished by other cities.

Yours truly, THEO. S. CASE

The choice of water by your company having been made known to the Water Commissioners, the following communication on the subject was received from them as dated:

OFFICE BOARD OF WATER COMMISSIONERS,
KANSAS CITY, MO., June 6th, 1874.

F. M. Mahan, President of the National Waterworks Company of New York:

SIR: Your communication to this board, officially notifying us that you have, on the part of the National Waterworks Company, after making the most careful and thorough examinatior of the waters of the Kansas and Missouri rivers, determined to take the supply of water for this city from the Kansas river at a point on said river above the mouth of Turkey creek, has been received, together with the tests and chemical analyses of the waters of both streams, which you have had made, and requesting this board to examine the same and ascertain whether from such scientific and other tests and evidences, presented by you to the board, the water from the Kaw or Kansas river is healthful and suitable for domestic purposes and complies with the requirements of your contract made with the city. In answer to your requests, and in accordance with our duties as prescribed, we make this answer and consent, namely: That, from a careful examination of the tests and analyses, and evidences furnished us by your company, and from the best means of information at our command, we are of the opinion that the water you propose to furnish is of the kind stipulated in your contract with the city, and when well settled will comply with the terms of your contract.

And we hereby consent, on the part of the city, to the selection of such point designated and adopted by you, from which to take water for the supply of the city and its inhabitants, subject to the provisions of the waterworks ordinance in relation thereto, under which the waterworks are being constructed and operated.

Signed by the Board of Water Commissioners.
J. E. MARSH, PRES'T.
W. P. MOORE.
CHAS. M. FERREE, SEC.

From the report of the Water Commissioners.

On the 25th day of August, 1874, a committee of the Common Council took samples of water from the

Kansas river at the point where the receiving cribs of the waterworks were to be located, and sent them for analysis to the Hon. Riland S. Brown, of Indianapolis, Indiana, the object being to further satisfy themselves and the people as to the quality of the Kansas river water.

The following is the result of the analysis:

MEDICAL DEPARTMENT INDIANA UNIVERSITY,
INDIANAPOLIS, January 2nd, 1875.

A. Mayer, Esq., City Clerk:

I herewith submit the result of an analysis of two bottles of water forwarded to me from Kansas City, Mo., for that purpose:

The packages arrived in good condition, with the seals unbroken. There was a deposit of insoluble sediment in each bottle, amounting in all, when dried at 212 F., to 27.34 grains. As this was deposited from a fraction more than a gallon of water (143.21 fluid ounces), the precipitate in the form of sediment will be a little less than this per gallon.

This sediment consisted of 64 per cent. silicious matter (sand) in a state of very fine division, and 36 per cent. of alumina (clay).

An American gallon (58.372 grains) gives solid matter, 21.778 grains, consisting of, organic matter, 1.235 grains; calcic carbonate (lime), 8.726 grains; sodiac chloride (common salt), 4.505 grains; aluminic sulphate (alum without potash), 1.113 grains; magnesiac sulphate (Epsom salts), 1.033 grains; silicic acid (soluble silica), .421 grains; ferric phosphate (phosphate of iron), .821 grains; sodiac carbonate (sal soda), 2.132 grains; potassic carbonate (potash), .881 grains; loss, .011 grains.

I have reduced the French decimal weights of

the labaratory to English grains and decimals, supposing that it would be more generally understood in that form. To express the relative properties of pure water and of solid matter held in solution by it, we present this formula: Water absolutely pure, 58,350.322 grains; mineral matter, 20.543 grains; organic matter, 1.235 grains.

The amount of organic matter is not greater than is common in our western rivers and springs at this season of the year; it will probably be somewhat increased during the spring months when the rains are washing the products of the decaying grass and leaves into the streams. In the mineral matter there is nothing remarkable except the large proportion (20 per cent.) of salt (chloride of sodium). This amount of 4½ grains to the gallon will not be perceptible to the taste nor injurious to the healthfulness of the water. If used for steam purposes, it will require the boilers to be "blown out" occasionally. Though the water is not absolutely soft, yet the 8¾ grains of lime per gallon is much less than is found in hard waters generally, yet for washing purposes the lime will be objectionable. When the streams are flush in the spring the proportion will be reduced. In the form of a carbonate it will not incrust boilers as badly as it would if it were in the form of a sulphate, yet it will probably, to some extent, deposit lime on the boiler surfaces. The remaining mineral substances are in small quantities and unimportant. The large amount of insoluble sedimentary matter will require a reservoir where the water may remain quiet till this sediment is deposited.

On this account it will not be wise to attempt the

use of this water by the Holly system of pumping it directly into the mains.

To sum up in a practical view the result of my examination, I may say that I find nothing in the water which will be injurious to health, and that for manufacturidg purposes generally it has no properties that will be very objectionable. Woolen manufacturing will be an exception to this remark. For washing purposes I would not recommend it when rain water can be had. I am, respectfully,

R. S. Brown, M. D.,

Late Chemist-in-Chief of the Department of Agriculture, Washington, D. C.

The quality of water supply being really first in importance in the construction of waterworks, and an effort having been made to show that your company have not given the subject proper study—with the impression which exists in the minds of many that the waters of the Missouri are the better—more space has been given to the setting forth of the full facts regarding this than would otherwise have been necessary

SYSTEM OF WORK ADOPTED.

The elevation of a large part of the city to so great a height above the lower portion made considerable study necessary to determine the best arrangement of parts. The contract required the upper reservoir to be 175 feet above city directrix (low water mark in the Missouri). This was higher than necessary for the supply of lower town, but not high enough to supply upper town by gravity, nor lower town for fire pressure.

To give open communication between the lines of mains in the two portions of the city, would subject

the mains in lower town to undue and dangerous strains if continued. It was, therefore, determined to place the upper reservoir as high as possible. Its flow line was finally fixed at 232 feet. This enabled the upper reservoir to give sufficient pressure in lower town for fire purposes and to fill all the main lines in upper town, thus practically supplying almost the entire city by gravity, in case of a stoppage of the machinery. The system of mains in upper and lower town was, therefore, kept separate, a connection being made, however, by which they could, at any time, be joined by the opening of a single stop-valve. The reservoir supplying lower town with sufficient pressure for fire purposes, made it unnecessary to provide further in this direction; it remained to furnish upper town with the necessary additional pressure required for domestic supply and fire purposes.

The additional power required for domestic supply in upper town was very small; for fire purposes, however, a power was needed about equal to that required for filling the upper reservoir. The first studies were directed to two pumping stations—one at the source of supply, for filling the upper reservoir; the other at the upper reservoir, for distribution and fire service.

A large set of machinery would therefore be required at the upper reservoir, while the use of it would be generally very small, and it would be subject to the usual necessity of raising additional steam for additional power.

On the other hand, by concentrating the machinery at a single station, the steam required for filling the upper reservoir would always be instantly available for fire purposes, and a considerable saving

effected in fuel and engineers' attendance—the whole plant being under a common supervision.

The adoption of this plan required so much additional large pipe as to be the most expensive in construction. Its evident superiority in operating expenses and in the fact of steam by this means being always in readiness, decided the company to adopt it. Its practical operation will be given with the detailed description of parts. As a matter of convenience, the page of small diagrams and map is appended, and the description will commence and follow the water-flow.

THE RECEIVING CRIBS.

The Kansas river, at the point where these cribs are located, is shallow, with a hard, sandy bottom. Following the direction of the stream, a coffer-dam was built, extending about fifty feet into the water, which, for some distance above and below this locality, is deepest on this side of the stream. It was built by driving a double row of sheet piling about two hundred feet in length in the direction of the stream. This was then filled with clay and pumped out, the mud covering the sand on the shore removed, and the sand excavated to a level, on which a platform of plank, resting on heavy timbers, was laid. Under the center of this, a cross-trench was made of heavy timber, doubled and caulked, so as to exclude any infiltration of sand to the spyhon pipe, which, by means of this cross trench, receives the water from the crib.

The platform of plank was also doubled for the same purpose, great care being taken that no crevices be left by which any seipage of water from the shore side could reach and carry sand into the cross-trench or crib. The crib was now built of yellow pine timber, in sizes of from "6x12" to "9x12." The manner of

building was by framing, in the manner of an ordinary pier or wharf—the longitudinal timbers of the outside and centre having three-inch spaces between, making two compartments extending the length of the crib, which is about 175 feet long in the direction of the stream. The ends are filled in solid, so that no sediment can be driven into it by the force of the stream, the water being received at the side only, where no impact of water takes place, and nothing can remain lying against the side of the crib, it being constantly swept by the current. The outer compartment is filled with broken stone five feet in thickness, through which and the retaining walls of the crib, which are left open for the purpose, it passes to the inner compartment, which forms the water-way which conducts it to the cross-trench, whence it is taken by the syphon.

As the water in a running stream, especially in stages of high water, carries the most sediment near the bottom, another crib like the first was built above and inshore from it, and the syphon-pipe in the pocket of this is provided with two stop-valves, one for closing or opening each compartment, so that in high water the lower one can be closed, and be thus less liable to become stopped by sediment, while the upper one, in water carrying less sediment, would furnish the supply for the time. The syphon is so arranged that a reversed flow of water from the lower reservoir can be passed through it into either of the cribs, thereby flushing any sediment which may collect in them back into the stream, thus keeping them free from obstruction. It is laid with a gradual rise from the river to the building, for the purpose of allowing any air which might enter the pipe to pass on with the water-flow and be taken out by the air pump, which main-

tains a vacuum in it. Where it enters the well it is sixteen feet above low water mark. It is laid partly in a tunnel and partly (between the railroad and river) in earth, having been carefully tested by pressure before being covered in. This syphon, twenty-four inches in interior diameter and 1,300 feet long, is, so far as I am aware, as regards size and use, a new way of obtaining a large water-flow. The distance of the works from the river and the character of the ground making a trench or tunnel at the requisite depth impracticable, the action of the syphon was preferred to that of a suction pipe of that length, on the ground of entirely doing away with the pulsations of the pumps in this pipe. Its perfect action justifies the plan adopted.

THE RECEIVING WELL

Is located directly under the main engines. The syphon, which enters its side, is vertical in the well, reaching within one foot of the bottom, which is seven feet below low water mark, and above the syphon at the top, forming a vacuum chamber. Reducing the water in this well below that in the river, therefore creates a current in this pipe. Observations on the water level indicate that each inch which the water in the well is lowered below that in the river is equivalent to a water-flow of about one million of gallons per day, within the limits to which the flow has been tested; and the full capacity of the syphon is not less than eight millions of gallons per day.

THE WELL

Was first excavated to about half its depth, where the ground became insecure by saturation. A wrought-iron caisson, fourteen feet in diameter and eighteen

feet high, was put together in the well, having been previously prepared. This was ribbed inside with angle iron and painted with red lead before being sunk.

The excavation being now carried down inside, the tube was allowed to sink by its own weight; this was insufficient to carry it as far as needed, and was increased by loading with stone. Being sunk to place, the well was continued one foot below it at the sides and about three feet in the centre. The bottom was now put in of two and a half feet of concrete, made with Louisville cement and broken stone, without sand, but with courses of heavier stone laid in between courses of cement and broken stone.

The sinking of the tube was made difficult by its passing through a strata of about four feet of mud and quicksand on one side, while the other side was in very hard clay. Before reaching the bottom, however, the clay, which had every appearance of being an old river bank, took the whole size of the tube, and made a firm and secure bed for the concrete bottom. While putting this in, a small tube was placed so as to extend above the concrete, thereby allowing the water to rise over it without disturbing it while setting. In this manner, the setting of the concrete was perfectly successful, making, with the closing of this tube, a water-tight bottom, effectually preventing any seipage of water into it.

The tube being in place, a series of cast iron anchors were bolted to the outside near the top, the soft earth removed and filled in with concrete made with clear cement.

On this the wall of the well and engine foundations was started and carried to the surface of the basement excavation. At the bottom, this wall was three feet thick; after rising above the tube, it was extended under and made the base of the engine foundations It was built of stone of from ten to sixteen inches bed, each course being cut to a level on top before the next course was laid, and the interior of the wall, everywhere, built with the same thoroughness and care as the outside. No small stone were built into this wall except as filling between th of the large ones, and the large stones, in every part of the wall, were carefully set, both as regards bedding and breaking joints with the course on which they rested. No lime was used in any of the well or other underground works; the cement was used with sand, varying from one of sand to one cement at the bottom to two and one-half of sand to one of cement above ground.

The value of this care in construction was put to a proof as severe as it was unexpected. During the preliminary working of the machinery, a water pipe burst in the basement of the building, letting the water into it through a six-inch opening, with the terrible force given by the head of the upper reservoir (over two hundred feet). Before the water-flow was stopped, it had torn up the earth in the basement around the well and engine foundations in places to the depth of twelve feet and over, carrying the sandy soil into the well in large quantity, the floor of the well not having been concreted at the time. Steps were immediately taken to guard effectually against any recurrence of the accident, and it was found that

neither the well walls or engine foundations had been damaged, while the syphon had carried the earth washed into the well harmlessly back into the river, except the heavier portions which had settled on the platforms and bottom of the well. The upper course of masonry, at the level of the basement floor, is of large stone, cut both in bed and build, those passing under the engine beds being three by ten and a half feet in size and one foot thick. The holding-down bolts of the engines pass through holes drilled in these, from two to five feet into the masonry below, where they are secured by heavy cast-iron anchors.

The well is thirty-one feet below the floor of the basement, and thirty-nine feet deep from the engine floor.

The remainder of the engine foundations is of hard-burned stock brick, laid in cement and sand, equal parts, the joints broken throughout in every course, and every course grouted full separately. The brick work is capped with cut stone the full size of the piers and twelve inches thick.

THE BUILDING.

The foundations of the building are, at the bottom of the basement, five feet thick, resting upon a bed of concrete six feet wide. The foundations of the small engines and pumps are built in the same manner as the larger ones. The smoke stack stands upon a bed of cement two and a half feet thick and twenty-two feet square. The masonry foundation is eighteen feet square at the base, stepping back by courses to ten and a half feet square at the surface of the ground. The water-table of the building and chimney is of cut stone, extending the whole breadth

of the brick wall. The stone work of the well and basement, taken throughout, is a job which the contractors (Dowling Brothers) can refer to with pride, as it has also been a source of satisfaction to myself to note the value of their skill, gained by practical work with eminent engineers in Great Britain.

The building is fifty by ninety-four feet; the basement eight feet high; the engine story twenty-five feet in the clear; the Mansard portion fourteen feet; the tower about sixty-five feet above ground. The walls are twenty-one and a half inches thick. No soft brick were used in the building. The outside is of hard pressed stock brick, laid in blind bond every fifth course. The wall is bonded throughout every fifth course, and everywhere thoroughly filled with mortar.

The chimney is ten feet square at the base. At the level of the main cornice of the building it changes to an octagon. Its whole height is one hundred feet. It is built with double walls, the outer one twenty-one and a half inches, the inner seventeen inches, at the base, both diminishing by steps to the top, where they are eight and a half inches thick. Up to the point where it receives the smoke-pipe, the inner and outer walls are joined by cross-walls; above this, the outer walls carry buttresses enclosing but not binding the inner tube. The top is expanded into bell shape, and covered with a cast-iron cap, resting on the outer walls.

The brick were furnished by Stumph & McClellan, and laid by Bishop and Adair. The material and workmanship is first-class in all respects.

All the wood wook at the building and river was done by day's labor, P. S. Gidley and G. L. Brown foremen, both thoroughly efficient and reliable men.

The timber of the Mansard roof is of yellow pine. The truss stringers are fifteen by fifteen inches, fiinshed on the bottom and sides. The ceiling between them is made in narrow, fine stuff, with heavy mouldings, forming a large pannel of each space. The roof is strong enough to bear a train of cars.

The engine room is finished with floor of narrow clear yellow pine; the sides are wainscotted with oak and black walnut, finished in oil, the walls hard-finished. The Mansard roof is lined between the outside studding with brick.

The cut stone window caps and sills were furnished by McDaniels & Dunlap. The galvanized iron cornices, Mansard windows, slating, and tin roof, was done by Sweet & Butler.

The building was designed by myself, in accordance with the requirements of the machinery, being so arranged that the capacity of the machinery can be doubled in the present location without destroying work already done. The detail drawings of the galvanized iron cornices and windows were made by A. J. Kelly. The windows, doors, frames, and material for inside finishing, were furnished by G. W. Lovejoy.

The whole work was done under my personal superintendence, and I am pleased to accord the credit to the various contractors and workmen, which they have faithfully earned by good work.

THE LOWER RESERVOIR

Is constructed to serve the purpose of a series of settling basins and clear water well, the small amount of sediment in the Kansas river not requiring frequent removal, and the upper reservoir holding ample supply for the time required for cleansing. It is irregular

in form, being curved on the sides to conform to the railroad grounds on one side and the bank of Turkey creek on the other; covers about two acres: has six acres of land in the rear suitable for extension when needed.

Experiments with glass tubes ten feet in length gave clear water their whole height in about twenty-four hours. The water varies in depth, from the slope given the bottom and trenches for cleansing into Turkey creek, from ten to thirteen feet. Capacity, 6,785,000 gallons.

The water is flowed into the east side of the reservoir, being distributed its whole breadth by a cross-trench. It then flows in an even body around the centre wall, which extends nearly to the south end of the basin. Returning on the west side, it passes through a filter-wall of finely broken stone, similar to those in the receiving cribs at the river. In the compartment made in the west side of the reservoir by this and the centre wall, the water enters the suction pipes of the main engines through a fine grating of cast iron, standing vertically, so that any substance coming against the grating can settle below it.

As the time required for the water in the reservoir to make the circuit of the wall is sufficient for its subsidence, the water, as it reaches the clear water compartment, is fit for use, and can be, if wished, delivered to the city from this as well as from the upper reservoir, thus practically giving the works the advantage of the capacity of both reservoirs.

In building the reservoir, the surface earth was first removed, and the sandy loam, forming about eighteen inches of the excavation, was placed in the outer portion of the embankment.

Under this, was a strata of tough, clayey loam, making good puddle. This was from two to three feet in depth, and was used for this purpose, being placed in the inner part of the embankment, thoroughly wet, rolled and pounded down, in layers of about six inches, to the thickness of from twenty to twenty-four inches. A wall of the same material, put down in the same manner, was built on this above the flow-line of the reservoir in the interior of the embankment.

The concrete bottom of the reservoir, which is from eight to twelve inches in thickness, is laid on and covers the puddle. Above this, the inner slope of the embankment is lined with hard-burned brick, set on edge, in a bed of cement mortar. The concrete was made with Fort Scott cement, the tests indicating it to be well adapted to the purpose. It was used in the proportion of one of cement to three parts of coarse, sharp-grained sand from the river bed of the Kansas, this showing double the strength with the same cement as the finer and more loamy sand from the Missouri.

THE UPPER RESERVOIR

Is best described in connection with the lower. It is located on Jarboe's Hill. The ground is of the heavy, retentive clay overlying the limestone bluffs, in depth from nothing to fifty or sixty feet.

The elevation was from 216 to 224 feet. The limited size of the reservoir made considerable depth necessary, and it was excavated to an elevation of 211 feet, the excavation forming the embankment, and considerable surplus, which was carried into the adjacent depresssions. The size is 330 by 380 feet;

depth, twenty-five feet; capacity, about double that of the lower one. The bottom was concreted in the same manner as the other, the cement extending nearly half-way up the sides. Above this it is paved with limestone from twelve to twenty inches thick. The top is covered with broken stone.

In the centre of the reservoir is a fountain. There are also two in the lower reservoir or settling basins.

There are two mains reaching the reservoir, one through a tunnel at the level of the bottom, so arranged as to either feed or take water from the reservoir; the other, passing over the bank, is for inflow only. The tunnel was made with a bottom of concrete; upper portion, brick covered with concrete. After the pipe was laid, cross-walls were built, inclosing it, and the spaces packed with puddle. The outflow pipe in the reservcir is guarded with fine cast-iron grating.

The excavation of the reservoirs and pipe laying was done by Thomas Corrigan; the trenching and rock cutting, by himself and brothers. The concrete was put in by Sheppard & Craig; the rock work, by the Dowling Brothers.

THE MACHINERY.

Was built by the Holly Manufacturing Co., of Lockport New York. It was constructed to meet, and does meet, effectually, the following requirements:

First, to raise the water to the settling basins.

Second, to take it thence and elevate it to the upper reservoir.

Third, to receive it again from the upper reservoir and send it with such pressure added to that derived from the gravity of its descent from the upper

reservoir to the pumps, as will enable it to again climb the bluffs with sufficient force to give either domestic supply or fire protection on the highest ground in the city.

Fourth, to be able to do the same work, if needed, without the help of the upper reservoir.

Fifth, to do all this with good economy both in fuel and attendance.

The reason of these requirements has been given; it remains to explain how they are met.

The main engines are four in number, with steam cylinders twenty-two inches in diameter by thirty inches stroke. They stand at an angle of forty-five degrees with the horizon, at each corner of the massive frame work of Iron which spans the well; bearing on its top the balance wheel and cranks by which they are all connected in such a manner that each pair takes steam like the cylinders of a locomotive, four times during the revolution, while the opposite engines take steam between these, thus taking steam, when all are working together, at eight equal parts of the revolution.

They are so connected that steam may be admitted to all alike, or to one only, and from this to the other three, thus compounding the engines; or all can receive the exhaust steam from the small engine which will be described hereafter.

All the engines can be used with either high or low pressure, and the change is made by simply opening and closing the necessary valves provided for the purpose and requiring but a few moments. The general position of these engines will be understood more readily by referring to the small diagram of their elevation: with their location over the wells.

Six pumps are driven by these engines. Two in the well, of fifteen and a half inches diameter by thirty inches stroke are driven by cranks on each end of a shaft under the main shaft, and deriving its motion from it by means of a moveable gear which can be readily used or allowed to stand still while the engines are in action.

These pumps, having to take the water furnished by the syphon, and which at times, is more or less charged with sediment, are so arranged as to be easily packed, and when the cylinders become worn, easily replaced without disturbing other parts of the machinery. All the pump valves are so made as to be easily removed and replaced.

The other four pumps ten and a half inches in diameter by thirty inches stroke, are driven by the extended piston rods of the engines, being coupled to them with keys so that they can be readily attached and let go.

They receive the water which the lower pumps have raised to the east side of the reservoir: on its return by the west side, as shown in page of diagrams, or by opening the stop valve in the connection of the upper reservoir they may receive their supply from that source with all the aid of its pressure.

In turn they force it to the upper reservoir (as in the first case) or to the city as in the second, the valves being controlled by the engineer in the building with the same readiness as the steam valves.

The location of the mains in the building is shown in the diagram, the lower pipe reaching to the upper reservoir, the upper one to the city; on the left of the engine is a check valve permitting water to flow from the lower reservoir to the pumps, but closing with the pressure from the upper reservoir, which thus takes its place when the lower valve on the right of the pump is opened. A vertical pipe connects the upper and lower lines as shown, this is closed by another piston valve like the first; when opened the water passes through the vertical pipe into the lower or reservoir line; when closed it passes through the upper line to the city.

These are double poppet valves like those used in low pressure engines of large dimensions; they are opened and closed by water pistons, driven by admitting water from the mains through a small pipe controlled by a four way stop and waste valve, the changing of which is all the engineer has to do to change the direction of the water flow.

An additional main not shown in the diagram, connects the small set of machinery in like manner. The engines have slide valves of uniform movement, the steam passages in the valve chambers are no more than sufficient for the proper flow of steam, the amount admitted is controlled by poppet valves on the top of the steam chests, which are raised by cams on a revolving shaft extending across the frame from engine to engine; these shafts are moved endwise by the action of the governor; the cams are excentric and tapering; resting on them are steel wheels in the ends of the arms which raise the poppet valves; the shafts make two revolutions to one of the engines, the cut off depending upon the position of the cams, which are fast to the shafts.

The governor is entirely different in its action from those in use in ordinary engines, having no relation to the speed of the engine so far as relates to regular movement; its action is derived from the press-

ure of water in the mains, any deviation from the pressure to which it is adjusted being by it immediately communicated to the cams.

For example, the engines are running at some motion which the governor has by adjusting the cut off cams to their proper position for balancing the pressure; given them the proper motion to maintain without increase or diminution; more openings are now made in the mains, which by increased water flow with the same supply, would diminish the pressure; but the governor, sensitive to the slightest fluctuation, immediately lets on more steam, thus constantly balancing the variable outflow with variable motion.

The cut offs vary the amount of steam admitted from one-eighth to seven-eighths of the stroke, and the motion of the engines has a very wide range, running easily and steadily at four or five revolutions per minute, and just as readily at thirty or forty: as any number of pumps from one to four may be in use at a time, the greatest capacity of the machine is not less than forty times that of its least.

Testing the mains was also a test of the power of the engines to give high pressure without the aid of the back flow from the upper reservoir, it being desirable in these tests to close that line so that in case of accident to the machinery or mains in the building that flood of water should not be let loose upon us; accordingly the mains were tested to a pressure of 240 pounds per square inch at the Works entirely by the direct power of the engines, thus proving their ability to dispense with the use of the upper reservoir, at the same time we were guarding ourselves against accident from it while making the tests.

Besides the six water pumps driven by these engines there are two air pumps for the condenser, one air force pump for keeping the various air chambers supplied with air under pressure, one exhaust air pump for maintaining the vacuum in the great syphon (which also has a connection with the condenser air pumps), and two boiler feed pumps, making in all, twelve pumps driven by these engines.

The water valves are worthy of special mention; they are made of cylinders of hard wood filled and capped with iron; they rest in a bed having the shape of a segment of a cylinder, the water port being long and narrow; a perforated brass cap prevents their displacement, permitting them to rise and fall freely on their seats. They are put in in nests, the aggregate area being from half to two-thirds that of the pistons, their action is remarkably easy and they have proved very durable; a whole set can be taken out and replaced in a few minutes by merely unscrewing the caps over the end of each cylinder.

The engines, like the pumps, can be run in pairs or altogether.

There are three boilers five and a half feet in diameter by sixteen feet long, with fifty-two three and three-quarter inch flues in each, steam domes three by five feet.

The grates are forty-two inches below the boilers; the bridge wall in front, has two feet clear space, reduced to eighteen inches at the rear of the boiler; this unusual distance not only of the grates but of the bridge wall from the boiler is the result of careful experiments, and proves in practice to give excellent results in combustion, apparently from the large amount of room given for the products of combustion

to mingle before passing into the flues, and by the even heat distributed over the bottom of the boiler.

The smaller set of machinery is, like the larger one, complete in itself, and combines all the requirements of that except the running of the deep well pumps.

It is high or low pressure at the will of the engineer (as are also the large engines), or the steam from this can be admitted to the large engines and drive them by this novel mode of compounding. It has one poppet-valve horizontal engine, sixteen by twenty-eight, driving by means of a pinion two feet in diameter, a gear of ten feet in diameter, which swings on top of a frame work like that over the well, and drives by means of cranks at each end of the shaft, four pumps eight by twenty-two inches, located in the places corresponding to the steam cylinders of the large set. It is also furnished with governor, water and air pumps like the larger set.

The gears are all cut, and the workmanship and action of the engines throughout do substantial credit to their builders.

The large set of machinery raises eighty-eight gallons per revolution, allowing for the loss in seating the valves, which is very small.

At twenty-four revolutions per minute the amount raised is a little over three millions of gallons per day.

At thirty-two revolutions, which is a speed easily maintained, the flow is over four millions of gallons.

The smaller set of machinery raises thirty-eight gallons per revolution, and is designed for running regularly at an extremely low motion ; the pumps can be run at less than two revolutions per minute, and

up to twenty as readily, giving a capacity of from 100,000 gallons to one million of gallons per day.

For fire purposes the machinery can be readily run up to a rate of six millions of gallons per day, or over, while the range of its capacity for regular use is from one hundred thousand gallons to five millions of gallons per day—the extreme minimum being given to enable constant action of the small set of machinery when as in the night time it has only a small duty to perform.

The building is so arranged as to admit two more boilers and another large engine without change, and by placing the boilers in a wing in rear of the main building, the capacity of the works can be more than doubled without destroying work already done.

TURKEY CREEK BRIDGE

Shown in the frontispiece, needs little further description. In starting the lines from the building both have to cross this stream, as shown in the engraving, which was copied from a photograph. The bottom of this stream is soft and insecure, and the length of time that it is filled with back water from the Kansas river would make the underrunning of it with pipe not only difficult at first but troublesome to repair in case of accident in high water ; it was therefore decided to build it as shown.

The upper arch of twenty-inch flanged pipe, sustained by two double wrought-iron chords, carries the water flow to the upper reservoir, and sustains the lower line, which communicates with the city. It is unprotected from the frost, the constant motion of the water in the mains not giving it time to freeze in crossing. During the past winter some trouble was had

while the machinery was stopped for repairs of defects during the first tests, but, after regular action was begun, no further trouble was experienced. The abutments of the bridge are of heavy masonry, resting on beds of concrete, several feet below the bed of the stream.

The ironwork of the bridge was made by D. M. Jarboe & Co., who also furnished the special castings for the pipe distribution.

The climbing of the hill with two twenty-inch mains was the next item of interest in construction. The surveying and levelling was mostly done by my assistant, Mr. W. R. Freeman, who also assisted in the reservoir work and at the building.

A trench was cut up the steep incline of the bluffs, wide enough to admit both pipes, and varying in depth with the irregularity of the hill. The rise is composed of alternate strata of limestone and clay shale, which, from its slippery, treacherous character, is generally called soap stone. Many slides have occurred on the hill side by the movement of this while wet, and much care has been necessary in choosing a line where the solid rock could be found and the lines guarded from this liability.

The bottom of the trench was filled with broken stone from one to two feet in depth, forming a drain to keep the surrounding material from becoming saturated, and, at each ledge of rock, heavy anchors were attached to the pipe and imbedded in masonry built in the rock excavation.

The hill was so steep that the pipe had to be handled to their places with tackle, and the work was necessarily slow. The rest of the pipe laying was of

the usual character, except as regards an unusual amount of rock cutting and deep trenching.

The extreme cold of the winter having delayed the tests which it was desired to notice in this report —besides which, it was desired to know something of the practical working of the system adopted, and of the ability of the works to furnish clear water during the spring rise in the rivers—the closing of this report has been delayed for that purpose.

A review of the work will assist in placing it before the mind in a more condensed form.

The combination of the reservoir system with the "Holly" or direct pressure system, where all the water has to be elevated by steam power, is new. Some cities have supplemented their reservoir supply by additional separate lines for high pressure, but none, so far as I am aware, have obtained the benefits of both systems of supply from the same source and by the same power.

Some cities have been obliged to procure their supply from a distance, and the limited amount obtained has made other supplies necessary for other than domestic purposes. New York, Boston, Chicago, and other cities, are now considering the supplementing of their domestic supply, to aid in the efficiency of their fire departments, and otherwise husband their supply of good water.

Rochester, N. Y., at an expenditure of some four millions of dollars, has the nearest approach to our system of any I know, having a reservoir supply for domestic use and a separate line of mains, with the Holly machinery, for fire protection, using water from the Genessee river, not suitable for domestic supply. Here, with the exception of a few buildings on the

high ground, the whole city is supplied by the upper reservoir, when the machinery is stopped, and no changes in the source of supply affect the quality of the water. The use of steam for the reservoir supply necessarily keeps the power for fire protection always available, a result not elsewhere obtained. It has also aided essentially in obtaining good economic results in fuel and attendance. As this is a matter of importance to the general public, it will not be out of place to close this part of the report with a short article on this subject.

It is usual among hydraulic engineers to estimate the economic value of machinery by the number of pounds of water which can be raised one foot by the burning of one hundred pounds of coal.

It is easily understood that careful experiments by competent engineers may result in much greater economy of fuel than the usual practice, as, during such trials, the motion of the machinery is kept nearly uniform, and all parts of the work so done as to secure the largest returns from the fuel consumed.

Engines have been built which, on such trials, have raised over one hundred millions of pounds of water one foot high with one hundred pounds of coal, but such results have never been attained in continuous working.

The number of millions of pounds so raised is denominated the "duty" of the engines. While several are claimed to do a regular duty of from sixty to eighty "millions," the average results of some of the most expensive engines in the United States range as low as twenty to thirty millions. To reduce this to plain language: Each "million" of duty claimed for an engine is the equivalent of pumping nearly twenty-

four thousand gallons of water one hundred feet high with one ton of coal, or for a duty of—

"20 millions," 479,000 gallons per ton.
"40 millions," 959,000 " "
"60 millions," 1,439,000 " "
"80 millions," 1,919,000 " "

The usual practice has been to pump into reservoirs or stand-pipes, from which the water is distributed by gravity. The engines are usually massive, using large pumps with slow motion, and requiring a high degree of skill on the part of engineers to operate successfully.

The motion provided for being uniform, and its intermittent character making it impracticable to increase it materially without subjecting the pipes and machinery to concussion, the question of "duty" has been a governing one, the quantity raised depending upon the time the machinery is in use.

In the "Holly" system, the pumps are smaller—either rotary, to provide even flow at all speeds, or in sets of piston pumps, giving, in the aggregate, a like uniformity of stream.

In the earlier use of this system, water-power was made available as a motor, and economy of power was not so important as cost of construction and operating expenses. The value of the increased pressure of water in the mains for fire purposes, first used by towns having suitable water-power to enable them to avail themselves of it, soon made its advantages so apparent as to be called for and used in many places where the other systems were not deemed sufficient, and, while its use has been extending, the continued studies of the company having it in their hands, have resulted in eliminating much of what was

objectionable in their earlier efforts, and even in taking high rank in economy of operating expenses, notwithstanding the constantly varying duty their engines are called on to perform. The tests of the machinery here have not been sufficient to determine what it is really capable of doing. A "duty" of fifty "millions" has been made with Fort Scott coal, which would probably be equal to a duty of sixty millions with Pittsburgh or anthracite coal. Other engines of like size and construction have given duties ranging from sixty to seventy millions, which, while not the highest that has been attained, is a remarkable result for machinery constructed to meet such varying requirements. A like degree of improvement has been made in the workmanship and durability of their machinery.

April 30th, 1875.

The action of the works during the month of January was intermittent, there being no consumers on ground not supplied by reservoir pressure, and the principal requirement being the testing of the mains, which was mostly finished on the main lines about the 17th of that month. Some streams were thrown with low pressure, and some washing out of mains done, but the annoyance caused by making ice on the streets hindered much work in this direction. On the 1st of February, the main lines having been tested to full pressure so far as laid, with the exception of a portion of Main street, between 13th and 16th streets, the engines were put in constant action, and the supply has been constant since that time.

The extreme cold weather making tests difficult, besides being an annoyance to the public, and the fire department, by order of the council, making no

use of the hydrants for fire purposes, except to fill the cisterns—which has been done from the mains since the first starting of the works—no further tests were made until the 24th day of February.

On this day, four streams were thrown from 1½-inch nozzles, with fifty feet of hose each. Two were at the public square, and two at the intersection of Main and 9th streets. One of these was measured by the City Engineer, E. O'Flaherty, and myself. Its height, from the nozzle, was a little over 170 feet.

March 24th, a test was made for concentrating streams. Ten streams were brought to the public square by lines of hose from hydrants at the square and on Delaware street. One other stream was thrown from the corner of Main and 3d streets, not having hose enough to reach the square.

The twelfth stream was a failure, by reason of the bursting of hose, which, in this line, was mostly old. Five sections were burst in succession on this line, which was then discontinued. The height of these streams was not measured. They were judged to be from 120 to 130 feet.

It was afterwards found that the valve on the main line supplying these hydrants had been accidentally left closed, and the water supply had been fed by a single long line of eight-inch pipe.

As this water supply was but one-fourth of the whole, and the full contracted capacity of the works was practically filled by this line alone, I consider this test (although accidentally so) the most valuable of any that have been made, demonstrating the large excess in the capacity of the mains over their requirements. During this test, the speed of the large

pumps was twenty revolutions per minute; the small set made eighteen—but little over half the capacity of the machinery.

April 2nd, 11 a. m., four streams from 1½-inch nozzles were thrown at the public square and court-house. Two of these were measured by myself. The heights were respectively 177 and 179 feet.

April 2nd, 2 p. m., eight streams, from 1¾-inch nozzles, with fifty feet of hose each, were thrown on 9th street from Wyandotte to Locust. Two of these were measured by the City Engineer, and Mr. Campbell, their measurement giving a rise of 129 feet.

The levelling of the ground showed the vertical circle of the transit to be out of adjustment when the angles were taken. The correction of this showed the elevation of the streams to be over 137 feet.

At 4 p. m., twelve streams, from one-inch nozzles, with fifty feet of hose each, were thrown on Main street, from 9th street to 16th street. The average height of these, as taken by the City Engineer and myself, was 114 feet.

At 6 p. m., one stream, from a 1¾-inch nozzle, fed by two lines of hose, was thrown at the Mastin Bank. It rose to the height of 207 feet, 9 inches None of the streams, as yet, have had the advantage of still air, much of the time being badly blown down, and the spray drifting in clouds to considerable distance, making the measurements considerably smaller than they would have been in a calm day.

Thirteen and one-fourth miles of pipe were laid before the first of January. The present amount and location is given in detail, with hydrant and valve locations.

QUALITY OF WATER.

During the winter, the consumption of water being quite limited, and wholly from the upper reservoir, where it suffered from contact with the new cement lining of both reservoirs, besides being drawn from under the ice of the river, the extreme cold, by freezing which, also added to its hardness, showed a greater degree of hardness than can occur again, but still not nearly so great as the supply derived from the wells and springs.

Expecting that the water would be somewhat hard, the boilers were made with reference to facility of cleansing, but, contrary to our expectations, over four months' constant use has, as yet, deposited no scale in them, the boilers being yet clean and bright inside.

The flushing out of the mains and filling of the reservoirs with new water has eliminated this hardness, and the water is now in excellent condition and giving better satisfaction to consumers, many of whom have testified their satisfaction with it, while, so far as I can learn, no consumer who has used the water since the refilling of the reservoirs has found any fault.

While the result in this direction has been unexpectedly gratifying, and consumers are being rapidly added to the list—even before the season is far enough advanced to make such applications the work of necessity—a like gratifying result has attended the use of the settling basins.

While St. Louis is having serious trouble from the imperfect subsidence of the water used there, there has been no time when there was sufficient color in the water, as delivered from the subsiding basins here to hinder seeing through a glass of it clearly.

LOCATION OF MAINS.

In the Water Commissioners' report of pipe distribution, the data for which had not been collected and arranged at the time of their making the notes for their report, some errors occurred, which are here corrected.

TWENTY-FOUR-INCH MAINS.

Syphon pipe, from river to building	1,320 feet.

TWENTY-INCH MAINS.

Lower reservoir connections	255 feet.
Upper reservoir force lines	2,390 "
City force lines, to 16th street on Catharine street	5,467 "
	8,112 feet.

FIFTEEN-INCH MAINS.

From twenty-inch lines on Liberty to 17th street	2,000 feet.
On Catherine, Mulkey, Summit, and 13th streets to Penn street	1,854 "
Waste to settling basins	130 "
	3,984 feet.

TWELVE-INCH MAINS.

Liberty street, 17th to 13th	1,960 feet.
13th, Liberty to Hickory	280 "
Hickory, 13th to Union avenue	1,380 "
16th, Catherine to Main	3,373 "
13th, Penn to Main	2,375 "
10th, Penn to Wyandotte	1,530 "
Wyandotte, 10th to 9th	489 "
9th, Wyandotte to Main	685 "
Main, 5th to 13th	3,518 "
Penn, 13th to 10th	1,500 "
	17,080 feet.

TEN-INCH MAINS.

Hickory, Union avenue to 9th	660 feet.
Penn, 10th to Washington and 6th	5,308 "
9th, Main to Campbell	3,015 "
12th, Main to Grand avenue	670 "
16th, Main to Grand avenue	670 "
Main, 13th to 16th	1,490 "
Main, 5th to 4th	365 "
	9,178 feet.

EIGHT-INCH MAINS.

Union avenue, Hickory to angle	1,031 feet.
Genessee, 12th to 14th	592 "
14th, Liberty to Genessee	640 "
6th, Broadway to May	230 "
May, 5th to 6th	304 "
5th, May to Main	1,265 "
5th, Walnut to Locust	1,030 "
Missouri avenue, Main to Walnut	404 "
Independence avenue, Locust to Holmes	667 "
Locust, Independence avenue to 9th	1,495 "
9th, Campbell to Forrest avenue	1,110 "
12th, Grand avenue to Locust	966 "
Broadway, 12th to 13th	473 "
Wyandotte, 11th to 13th	790 "
Wyandotte, 5th to 9th	1,520 "
Grand avenne, 12th to 16th	1,960 "
Flow-line, upper reservoir	1,070 "
16th, Grand avenue to Locust	966 "
	16,523 feet.

SIX-INCH MAINS.

Union avenue, from angle east	899 feet.
9th, Santa Fe to Hickory	850 "

12th, Liberty to Genessee	755 feet.
Wyoming, north from 14th	630 "
4th, Delaware to Walnut	744 "
Delaware, 3d to 5th	570 "
Main, 2nd to 4th	555 "
Walnut, 4th to Missouri avenue	720 "
Missouri avenue, Delaware to Main	344 "
5th, Locust to Charlotte	960 "
Charlotte, 5th to Missouri avenue	348 "
Missouri avenue, Charlotte to Holmes	348 "
Holmes, Missouri avenue to Independence avenue	611 "
6th, 7th and 8th, off Main	430 "
Wyandotte, 10th to 11th	510 "
Central, 10th to 11th	510 "
11th, Central to Wyandotte	400 "
Central, 14th to 16th	958 "
Penn, Lykins and Jefferson, 13th to 16th	1,360 "
Locust, 9th to 16th	3,230 "
8th and 10th, off Penn	660 "
12th, Locust to Cherry	345 "
Washington, off 10th	330 "
Short branches with stop-valves, for extension, off various lines	1,120 "
	18,187 feet.

FOUR-INCH MAINS.

Santa Fe, off 9th	330 feet.
Liberty, north of 13th	330 "
7th, off Penn	400 "
8th, off Wyandotte	545 "
McGee, off 9th	765 "
Walnut, off 12th	890 "
Cherry, off 12th	860 "

Short lines, with stop-valves and hydrant connections	4,026 "
	8,146 feet.

Making a total of 82,720 feet; or, 15 miles, 3,520 feet.

There is on hand and located for present laying about 3,000 feet of four-inch pipe, which will be placed in a few days.

Of the above, the syphon, reservoir, flow-lines and hydrant connections comprise 6,801 feet, which does not count in location of hydrants, leaving for the amount of pipe subject to measurement for that purpose 14 miles, 1,999 feet.

The 3,000 feet of four-inch pipe and some larger short lines being of the stock of pipe already on hand are not included in the lines proposed to be laid during the present season.

2,160 feet of smaller distributing pipe is now laid in connection with the mains, and about 4,000 feet more will be laid immediately, making, with some lines of pipe already laid but not yet joined to the water service, about 17½ miles of pipe outside of service lines.

VALVES.

134 stop and check valves are set at the various intersections of the main lines and in connection with the various requirements of the machinery in the syphon and flow-lines. Their particular location being of interest only to the company and employees, and requiring considerable space if enumerated here, is omitted.

LOCATION OF HYDRANTS.

Hydrants are located as follows, each having two openings for the attachment of hose:

Southeast corner Second and Main.
Southwest " Third and Delaware.
Northwest " " and Main.
Northeast " Fourth and Delaware.
Northeast " " " Main.
Northeast " " " Walnut.
Southwest " Fifth and May.
Southwest " " " Central.
Southeast " " " Wyandotte.
Southwest " " " Delaware.
Northwest " " " Main.
North of Fifth, on Walnut.
Southeast corner Fifth, on Grand avenue.
Northeast " " on Oak.
Northeast " " on Locust
Northwest " " on Cherry.
Northeast " " on Holmes.
Northwest " " on Charlotte.
Northeast " Missouri avenue, on Delaware.
Southwest " " on Main.
Southeast " " on Walnut.
Southwest " " on Holmes.
Northwest " " on Charlotte.
Southwest " Independence Av., on Locust.
Southeast " " on Cherry.
Southeast " " on Holmes.
Between Missouri and Independence avenues, on Holmes.
Northwest corner Sixth and Washington.
Northwest corner Sixth and Broadway.
Northeast corner Sixth and May.

Southwest corner Sixth and Wyandotte.
Northeast corner Sixth and Delaware.
Southeast corner Sixth and Main.
Northeast corner Sixth and Locust.
Northwest corner 7th and Jefferson.
Southwest corner 7th and Penn.
Southwest corner 7th and Washington.
Northwest corner 7th and Wyandotte.
Southeast corner Seventh and Delaware.
Southwest corner Seventh and Main.
On Locust, between Sixth and Eighth. (Two.)
Northwest corner Eighth and Jefferson.
Northwest corner Eighth and Penn.
Northeast corner Eighth and May.
Northwest corner Eighth and Wyandotte.
Northwest corner Eighth and Main.
Northwest corner Eighth and McGee.
Northeast corner Ninth and Penn.
Northwest corner " and Wyandotte
Southwest corner " and New Delaware.
Northwest corner " and Delaware.
Southeast corner " and Main.
Northeast corner " and Walnut.
Southeast corner " and Grand avenue.
Northeast corner " and McGee.
Southeast corner " and Oak.
Northwest corner " and Locust.
Southwest corner Ninth and Cherry.
Northwest " " and Holmes.
Southwest " " and Charlotte.
Northwest " " and Campbell.
Southwest " " and Harrison.
Northwest " " and Troost.
Southwest " " and Forest Ave.

Northwest corner Tenth and Jefferson.
Northwest " " and Penn.
Northwest " " and Washington.
335 feet north of " on Washington.
Northeast corner " and Broadway.
Southwest " " and Central.
Northeast " " and Wyandotte.
Southeast " " and Main.
Northwest " " and McGee.
West side Main, between 9th and 10th.
Southwest corner Tenth and Locust.
Northeast " Eleventh and Penn.
Southwest " " and Central.
Between 10th and 11th, east side Central.
Southwest corner Eleventh and Wyandotte.
Southeast " " and Main.
Southwest " " and Main.
Between 10th and 11th, west side Main.
Southeast corner Eleventh and Walnut.
Northeast " " and Locust.
Southeast " " and Cherry.
Southeast " Twelfth and Broadway.
Southeast " " and Wayndotte.
Southwest " " and Main.
Southwest " " and Walnut.
Between 12th and 13th, east side Main.
Northeast corner Twelfth and Grand Ave.
Southeast " " and McGee.
Northeast " " and Oak.
Northeast " " and Locust.
Southwest " " and Cherry.
Between Twelfth and Thirteenth, east side Penn.
Southeast corner Mulkey and Catherine
Northwest corner Thirteenth and Summit.

Southeast corner Thirteenth and Penn.
Southwest " " and Washington.
On Thirteenth, north side, between Washington and Broadway.
On Broadway, north of Thirteenth, east side.
Northwest corner Thirteenth and Central.
Northwest " " and Wyandotte.
Northwest " " and New Delaware.
Southeast " " and Main.
Between Thirteenth and Fourteenth, east side Main.
Northeast corner Thirteenth and Grand Ave.
Between Twelfth and Thirteenth, west side of Grand Ave.
Between Thirteenth and Fourteenth, west side Grand Ave.
Between Twelfth and Thirteenth, west side Locust.
Northeast corner Thirteenth and Locust.
Northwest " " and Cherry.
West side Catherine at Lykins.
North side Lykins, at Little Jefferson.
Southwest corner Lykins and Penn.
Southwest " Fourteenth and Central.
Southwest " " and Main
Southeast " " and Grand Ave.
Between Fourteenth and Fifteenth, west side Grand Ave.
Northwest corner North Fourteenth and Locust.
Southeast " South Fourteenth and Locust.
West side Catherine, between Sixteenth and Lykins.
Southeast corner Sixteenth and Catherine.
Northwest " " and Summit.

Northeast corner Sixteenth and Little Jefferson.
Between Sixteenth and Lykins, on Little Jefferson.
Northeast corner Sixteenth and Milton.
Southwest " " and Washington.
Northeast " " and Broadway.
Northwest " " and Central.
Southwest " Fifteenth and Central.
Between Fourteenth and Fifteenth, east side Main.
Northwest corner Fifteenth and Main.
Southeast " " and Grand Ave.
Southwest " " and Locust.
Northwest " Sixteenth and Wyandotte.
Northwest " " and New Delaware.
Between Fifteenth and Sixteenth, east side Main.
Northwest corner Sixteenth and Main.
Southwest " " and Walnut.
Northwest " " and Grand Ave.
Northwest " " and McGee.
Southeast " " and Oak.
Northeast " " and Locust.
300 feet south of Sixteenth, west side Catherine.
600 " " " " "
Northeast corner Seventeenth and Catherine.
Southeast " " and Jarboe.
Northwest " " and Holly.

LOWER TOWN.

Northeast corner Eighth and Santa Fe.
Northwest " Ninth and Santa Fe.
Southeast " " and Mulberry.
Northeast " " and Hickory.
Northeast " St. Louis Ave. and Hickory.
On Union Ave., 980 feet east of Santa Fe.

On Union Ave., 680 feet east of Santa Fe.
On " " 379 " " "
On " " 99 " " "
Southwest corner Union Ave. and Santa Fe.
Northeast " " and Mulberry.
Union Ave., 140 feet east of Hickory.
Southeast corner Tenth and Hickory.
Northeast " Twelfth and Hickory.
Southwest " Thirteenth and Hickory.
Southwest " Twelfth and Liberty.
West side Liberty, at Thirteenth.
Southeast corner Twelfth and Wyoming.
Southeast " " and Genessee.
Between Twelfth and Fourteenth, on Genessee.
Northeast corner Liberty and Joy.
Northwest " Joy and Hickory.
Northwest corner Fourteenth and Genessee.
Southwest " " and Wyoming.
Northwest " " and Liberty.
On Liberty, 332 feet south of Fourteenth.
On Liberty, 632 feet south of Fourteenth.
On Wyoming, 330 feet south of Fourteenth.
On Wyoming, 630 feet south of Fourteenth.

Several hydrants which had been located were omitted, as being at present unnecessary. The northern part of Main street has as yet only one-half the hydrants placed which were originally located for it. Bran ches have been placed in the mains, to admit of setting more hydrants when required, and the hydrants are on hand for that purpose.

The extreme cold of the past winter did serious injury to waterworks mains in many of the northern cities, and fears were entertained that we should suffer in the same manner here, as the depth to which the

frost penetrated the ground was greater than before known. With the exception of a few hydrants which were set in cold weather and covered in with frozen earth, no trouble was had in this direction, and no mains were frozen. The laying of the mains has been under the immediate supervision of Street Superintendent, M. G. Riley, who has done his duty thoroughly and efficiently in all respects, and been of eminent service both to myself and your company, during the construction of the works.

The pipe was tested at the foundry by your inspecter, A. T. Chartrand, and not a pipe which passed his inspection has failed. Some breaks occurred in the smaller pipe from Philadelphia, but all were owing to cracks which had been made in handling, and not discovered before laying, by reason of it having been done in bad weather when they could not be so closely examined.

In conclusion, permit me to express my obligations to the members of your company, and to citizens of this city for courtesies received during the construction of these works.

Respectfully submitted,
G. W. PEARSONS, Chief Engineer.

RESOLUTION.

At a meeting of the Local Board of Managers of the National Waterworks Company, of New York, having charge of the construction of the works at Kansas City, Mo., held May 1st, 1875, the following resolution was unanimously adopted:

Resolved, That the company tender to G. W. Pearsons, Chief Engineer, under whose supervision the works were planned and constructed, its thanks for the able and efficient manner in which he has discharged his duties; and the Local Board express their confidence in his ability and experience as an engineer, and cordially commend him to all who may desire his services as one among the most experienced, valuable and efficient hydraulic engineers of the country.

JOHN J. MASTIN,
AMOS GREEN,
B. F. JONES,
} Local Board.

Report of Water Commissioners.

OFFICE BOARD OF WATER COMMISSIONERS,
KANSAS CITY, MO., May 3d, 1875.

To the Honorable Common Council of the City of Kansas:

The Board of Water Commissioners beg leave to submit the following report of their action, and the condition and progress of the water works from date of last reports to this date:

Since our last report there has been laid distributing pipe on the following streets:

On Grand avenue, betwen Twelfth and Sixteenth streets.

On Twelfth street, between Main and Cherry streets

On Cherry street, between Eleventh and Thirteenth streets.

On McGee street, between Eighth and Tenth streets.

On Walnut street, between Eleventh and Thirteenth streets.

On Eighth street, between Wyandotte and May streets.

This, in addition to the pipe already laid, makes 83,214 feet, or, 15 miles and 4,214 feet of pipe. Of this there are 1,320 feet of twenty-four-inch suction pipe between the machinery building and the river, 1,020 feet of twenty-inch main pipe between the two

reservoirs, and 4,000 feet of four-inch pipe connecting mains and hydrants, and other short lines, that is not estimated as distributing main pipe, which leaves 76,874 feet of distributing main pipe, or, a little over fourteen and a half miles on which, by the terms of the ordinance contract, the city agrees to pay rent for one hydrant for every three hundred feet. On the fourteen and a half miles of distributing pipe the city will have to pay for 256 hydrants. By instruction of the Common Council, we have not placed a hydrant on an average of every three hundred feet, but have located, and there are now set and ready for use by the fire department, 182 hydrants—74 hydrants less than the city is entitled to on the pipe now laid.

The dimensions of the pipe now laid are as follows:

24-inch suction pipe	1,320 feet.
20-inch main pipe	8,112 "
15-inch "	3,854 "
12-inch "	19,995 "
10-inch "	6,358 "
8-inch "	16,345 "
5-inch "	19,414 "
4-inch "	5,815 "
4-inch pipe connecting mains and hydrants	4,000 "
Making a total of pipe laid, about	83,214 "

All of which is iron pipe.

The location of 182 of the hydrants already set have been approved by this board, and by the two reports of City Engineer O'Flaherty, dated February 25th and April 2nd, 1875, their capacity to throw the streams as guaranteed in section eight of the contract ordinance, has been satisfactorily proven.

The City Engineer reports that the test streams thrown at various times were, by measurement, ascertained to be as follows, viz.: The four stream test measured 170 feet in height; the eight stream test measured 129 feet in height; and the twelve stream test measured 114 feet in height, which, in each case, is considerably above the height required.

The board have not accepted the hydrant set on Locust street between Twelfth and Thirteenth streets, and the two hydrants set on Locust street between Sixth and Eighth streets are counted as one hydrant. In several places, the engineer of the Waterworks Company reported that there was no present necessity for setting a hydrant where one had been located, and we have had them left out. The specials being in the ground, a hydrant can be set in these locations when needed. It was found impossible to set the hydrants uniformly on each side of the streets alternately, owing to sewers in some cases; in others, the nature of the ground would render it inexpedient. We have, in all cases, taken into consideration all the contingent circumstances, and located each hydrant as was deemed best, as a hydrant is just as effective, within the limit its fire protection extends, on one side of the street as on the other. In all cases, however, when practicable, we have placed them alternately on each side of the street.

The size and capacity of the main and distributing pipe, as above given, are, we find, two and a half times the average size of those of Detroit, Michigan, and twice the size of the water pipes of Chicago, and larger than the average size of water pipes of most cities in the United States.

In Trautwine's Engineering (a standard work)

we find that a twenty-inch pipe, with a fifty-feet head, will supply 34,000 consumers, calculating sixty gallons to each consumer per day. The Holly system claims to supply twice that amount through a twenty-inch pipe by added pressure. We are satisfied from the above facts, and from the opinion of the best civil engineers that we could obtain that the capacity of the pipes is large enough, and that the works have been so constructed that they are capable of enlargement and extension, when necessary, so that they can at all times furnish an adequate supply of water for the city and its inhabitants until the city has two hundred thousand inhabitants.

By the Board of Water Commissioners,

CHARLES M. FEREE, Secretary.

I, A. Mayer, City Clerk of the City of Kansas, do hereby certify that the above is a true and correct copy of a report of the Board of Water Commissioners of the City of Kansas to the Common Council of said city, submitted May 3d, 1875.

In testimony whereof, I have hereunto set my hand and affixed the seal of the City of Kansas, this 5th day of May, A. D. 1875.

[SEAL.] A. MAYER, City Clerk.

Report of Special Election.

REPORT OF THE CITY CLERK AND TWO JUSTICES OF THE PEACE OF KAW TOWNSHIP ON THE SPECIAL ELECTION HELD NOVEMBER 15, 1873.

To the Honorable Common Council of the City of Kansas:

The undersigned, having this day canvassed and verified the results of the late special election for waterworks, held on the 15th day of November last, beg to report the following result, to-wit:

FIRST WARD.

Total number of votes cast	380
For waterworks ordinance	369
Against waterworks ordinance	11
Majority for waterworks ordinance	358

SECOND WARD.

Total number of votes cast	517
For waterworks ordinance	507
Against waterworks ordinance	10
Majority for waterworks ordinance	497
Rejected votes	3

THIRD WARD.

Total number of votes cast	431
For waterworks ordinance	409
Against waterworks ordinance	22
Majority for waterworks ordinance	387

FOURTH WARD.

Total number of votes cast	276
For waterworks ordinance	264
Against waterworks ordinance	12
Majority for waterworks ordinance	252

FIFTH WARD.

Total number of votes cast	435
For waterworks ordinance	418
Against waterworks ordinance	17
Majority for waterworks ordinance	401

SIXTH WARD.

Total number of votes cast	357
For waterworks ordinance	355
Against waterworks ordinance	2
Majority for waterworks ordinance	353

GRAND TOTAL.

Number of votes cast	2,396
For waterworks ordinance	2,322
Against waterworks ordinance	74

A. MAYER, City Clerk.
HENRY ROSE, Justice of the Peace.
A. W. ALLEN, Justice of the Peace.

Kansas City, November 22, 1873.

I, A. Mayer, City Clerk of the City of Kansas, do hereby certify that the above and foregoing is a true and correct copy of a report on the special election held in the City of Kansas November 15th, 1873, submitted to the Common Council November 24th, 1873, as the same appears on record in my office.

In testimony whereof, I have hereunto set my hand and affixed the seal of the City of Kansas, this 6th day of May, 1875.

[SEAL.] A. MAYER, City Clerk.

Reports of City Engineer.

KANSAS CITY, MO., February 25, 1875.

At the request of and under instructions from the City Council of the City of Kansas, I caused the distributing main pipes which the National Waterworks Company had laid up to January 1st, 1875 to be measured, and found that up to that date 65,860 feet of distributing pipe had been laid, making 12 miles and 2,500 feet; also, that 130 hydrants had been set ready for use.

On the 24th day of February, 1875, at the request of the Waterworks Company, I attended and witnessed the throwing of four 1½ streams. Two of the streams were thrown at the intersection of Ninth, Main and Delaware streets, one at the intersection of Fifth and Main streets, and one at the intersection of Fourth and Main streets. Each stream was thrown through fifty feet of hose and a 1½-inch nozzle, and all four at the same time. I measured a stream at Fourth and Main streets, which appeared to be the shortest stream. The height was 170 feet. As an engineer, I am satisfied the hydrants have the capacity to throw the fire streams as provided in section eight in the ordinance contract, and of their availability in case of fire. From a careful examination of the machinery and works and

the material used in their construction, and the plan of construction, that they are, in all respects, first-class and in conformity with the requirements of the contract of the company with the City of Kansas.

EDMUND O'FLAHERTY, City Engineer.

KANSAS CITY, MO., April 2, 1875.

At the request of the National Waterworks Company, I aided its engineer, G. W. Pearsons, in measuring streams thrown by its works in Kansas City. There were eight streams thrown at the same time, on Ninth street, from Wyandotte east to Locust street; each stream thrown through a 1¼-inch nozzle, and to the height of 129 feet. The streams were permitted to play about three-quarters of an hour.

There were twelve one-inch streams thrown at the same time, on Main street, from Ninth to Sixteenth street, the average height being 114 feet.

Four 1½-inch streams were thrown earlier in the morning, which were measured by Mr. Pearsons, and one 1¾ stream later in the evening, of which I took the approximate height, which was 187 feet. I will say that at one time this stream was much higher than when I measured it, and must have reached an altitude of over two hundred feet.

EDMUND O'FLAHERTY, Civil Engineer.

Statistics of Kansas City.

POPULATION.

1855	478
1860 (United States census)	4,047
1861	5,000
1866	16,000
1870 (United States census)	32,260
1871	33,746
1872	40,115
1873	45,000
1875 (about)	48,000

VALUATION OF PROPERTY.

1865	$1,922,460
1866	3,578,875
1867	3,710,813
1868	5,978,068
1869	8,408,111
1870	9,629,455
1871	10,191,910
1872	10,957,250
1873	12,748,290
1874	12,910,320
1875	15,120,000

TRADE.

Jobbing trade of 1874	over $ 25,000,000 00
Retail trade	8,130,000 00
Amount of bank deposits	132,000,000 00
Discounts	18,991,815 66
Exchange	42,431,804 65
Cattle received	356,000 head.
Hogs received	560,000 "
Hogs slaughtered	290,000 "
Cattle slaughtered and packed	48,000 head.

POPULATION OF ENVIRONS OF KANSAS CITY.

Kansas City, Kansas	2,500
Wyandotte	5,000
Woodlawn and Westport	2,000
Total	9,500

Annual Water Rates.

ALCOHOL—For each barrel manufactured	$ 1 0
ALE CELLAR	20 00 to 50 00
BAKERY—Each barrel of flour manufactured daily	5 00
BARBER SHOP—First chair	10 00
" " Each additional chair	3 00
BATH—Private	5 00
" Each additional tub	2 50
" Public, not less than	15 00 to 35 00
BEER—Each barrel brewed	05
BEER HOUSE	20 00 to 50 00
BILLIARD SALOON—Each table	3 00
BOOK BINDERY—Not less than	10 00
BRICK WORK—Per thousand	10
BRICK YARD—Special rates	
CHURCH	5 00 to 15 00
CANDLE MANUFACTORY—Special or meter rates	
CANDY MANUFACTORY	15 00 to 75 00
CIGAR MANUFACTORY—Per hand	2 0
COFFEE SALOON	15 00 to 30 00
CONFECTIONERY	15 00 to 75 00
COW	1 00
DISTILLERY—For each barrel distilled	10
DRAM SHOP	25 00 to 100 00
DYEING AND SCOURING	25 00 to 100 00
DRUG STORE—Special or meter rates	
FORGE	5 00
FOUNTAIN—1-16 inch jet for seven months, running not more than four hours per day	15 00 to 150 00
HALL—Special or meter rates	
HAT MANUFACTORY	30 00 to 100 00
HOSE—For private stables, not less than	5 00
" For livery or sale stables, not less than	50 00
" For sprinkling street, including sidewalk and yard, per front foot	25
HOTEL—Special or meter rates	
ICE CREAM SALOON	15 to 50 00 00
LABARATORY	10 00 to 200 00
LAUNDRY	20 00 to 300 00
MALTING—Per bushel	01
OFFICE OR BANK	5 00 to 30 00
PACKING HOUSE—Special or meter rates	
PHOTOGRAPH GALLERY	20 00 to 40 00
PLASTERING—Per square yard	0½
PRINTING OFFICE—Special or meter rates	
RECTIFYING WHISKY—Per barrel	10
RESIDENCE—Per room	1 50
" For yard hydrant on premises, per room	1 50
" No connection made for less than	6 00
RESTAURANT	25 00 to 100 00
SCHOOL—For every 25 scholars	5 00
SLAUGHTER HOUSE—Special or meter rates	

SOAP MANUFACTORY—Special or meter rates	
SODA " Special or meter rates	
SPRINKLING—Private garden, with hose, for six months, per square foot	0½
" Public garden, with hose, for six months	25 00 to 150 00
" Streets, with sprinkling cart, special or meter rates	
STABLE—Livery and sale, per head	2 00
" Private, per head	3 00
STARCH MANUFACTORY—Special or meter rates	
STEAM BOILER—Special or meter rates	
STOCK YARD—Special or meter rates	
STONE WORK—Per perch	05
STORE	5 00 to 40 00
TOBACCO MANUFACTORY—Per hand	3 00
URINAL BASIN	10 00 to 40 00
VEHICLE—Private	2 00
VINEGAR—For each barrel manufactured	05
WATER CLOSET—Private residence, each set	5 00
" Hotels and public houses, special or meter rates	
WASHING BOTTLES—Special or meter rates	
" MEAT—Special or meter rates	
WINE CELLAR—Special or meter rates	

METER RATES.

When the quantity averages per day	1,000 to 2,000	gallons,	per	100	gallons		05¼
" " " "	2,000 to 3,000	"	"	"			05
" " " "	3,000 to 4,000	"	"	"			04½
" " " "	4,000 to 5,000	"	"	"			04¼
" " " "	5,000 to 6,000	"	"	"			04
" " " "	6,000 to 7,000	"	"	"			03½
" " " "	7,000 to 8,000	"	"	"			03¼
" " " "	8,000 to 10,000	"	"	"			03
" " " "	10,000 to 20,000	"	"	"			02¾
" " " "	20,000 to 30,000	"	"	"			02½
" " " "	30,000 to 50,000	"	"	"			02¼
When the quantity exceeds 50,000 gallons per day							02

NOTE.—Licenses may be transferred with the approval of the President of the Water Company. Licenses must be renewed within six days after their expiration; otherwise the water will be shut off. The Water Company reserve the right to put meters on any premises.

Rules and Regulations.

1. The tapping of main pipes and supplying service pipes for carrying water to the premises of consumers shall, in all cases be done by the agent of the Company, except when special permit is granted to plumbers for that purpose, and the size of the connection with the mains shall, in all cases, be determined by the Company. Applicants will be charged from the center of the street for all service pipe.

2. The Company will furnish service pipe, and charge the applicant a sum sufficient to cover the cost of the same and the labor of putting the same in the ground. The Company will furnish the corporation cock, and insert the same in the main, and charge as follows: ⅜-inch, $2.50; ½-inch, $2.75; ⅝-inch, $3.25; ¾-inch, $4.00; 1-inch, $5.00.

3. Either lead or iron service pipe may be used, at the option of the applicant; and where lead is used, in the street or for inside plumbing, it must be that designated as "extra strong;" and all iron pipe to sustain a pressure of not less than 250 pounds to the square inch; and at the point of connection with the street main between corporation cock and the coupling in the iron service pipe, there must be at least eighteen inches of lead pipe to relieve the rigidity of the iron pipe. A brass coupling must be used for connecting the lead with the iron pipe.

4. All service pipe must be laid at least three feet below the surface of sidewalk or pavement, and kept in good repair at the expense of owner; a suitable brass stop-cock, with round waterway, must be placed in the service pipe, to allow the Company to control the flow of water through said pipe, located inside the curbstone, and as near thereto as practicable, with a cast-iron box or pipe reaching from the stop to the surface, of suitable size to admit a stop key for turning on and off the stop.

5. Said pipe or box to be securely protected from being filled up or obstructed, and covered with a cast-iron cover having the word "water" cast thereon; and if, by any means, it becomes

filled up, so as to make it necessary to dig it up to procure access to the stop-cock, it shall be at the expense of the applicant.

6. There shall likewise be placed in the service pipe, within the wall of the building supplied, a brass stop and waste cock, easily accessible to the occupants, in enabling them to turn off the water in case of leaks, and to drain the pipes inside to prevent freezing, etc.

7. When the plumbing is completed and ready for use, application must be made at the office of the Company by the owners of the premises or parties who are to use the water; said application to state in writing the uses to which it is to be applied, fully and without reserve or concealment, and be signed by the persons or parties making the application; payment to be made for tapping the main pipe, furnishing service pipe and putting in the corporation cock, and in advance for the use of water, at established rates, to the next regular collection day of the company.

8. The above requirements being complied with, in cases where the work is done by a plumber under special permit, a permit will be issued and placed in the hands of the Inspector of the Company, who shall examine the plumbing, fixtures, etc., and finding said work and fixtures to correspond with the permit, and the work completed in accordance with the requirements of the Company, shall turn on the water and place the permit in the hands of the plumber having done the work, as evidence of the examination of the work by the Inspector, and that it is done in accordance with the rules of the Company.

9. If the Inspector shall find, on examination, that the water is to be applied to uses not enumerated in the permit, he will refuse to turn on the water and withhold the permit until the applicant corrects the application at the office.

10. The water cannot be turned on to any premises except by the Inspector or authorized agent of the Company, only as it may be turned on by the plumber to test the work, to be turned off immediately after the test is made.

11. No extension or alteration of any service pipe or fixtures can be made without written permission from the office of the Company.

12. No consumer shall supply water to other persons or families, or suffer them to take it, except for use on the premises for purposes specified in the application, nor after water is introduced into any building, or upon any premises, shall any person make,

or employ any plumber or other person to make any tap or connection with the works upon his premises, for alterations, repairs, extensions or attachments, without the written permit from the Water Company, specifying the particular change or addition to be made, and also the plumber authorized to make the same.

13. Where more than one supply is made through one service pipe, and under control in the street of one stop cock, one person must make applications for all said supplies, and the bill will be made to said applicant for all the parties so supplied.

14. All leaks in service pipes in the streets, and in and upon all premises supplied, must he promptly repaired by the owner or occupant, and on failure to make such repairs with reasonable dispatch, the Company will turn off the water from the premises until necessary repairs are made, and charge $1.00 for turning on again.

15. All willful waste of water, or waste through neglect of servants or agents, or by fixtures out of order, or by allowing water to be taken from premises by peasons having no right to its use, will be a sufficient cause for stopping the supply to any premises, and forfeiture of amount of bill paid in advance, or the withholding the supply for such time as the Company may decide.

16. No persons or parties supplied can allow any water to be taken from their premises without writtten permission from the officers of the Company.

17. Street or yard sprinklers cannot be converted into jets or fountains, or be allowed to run to waste in the gutters of the street or upon lawn or in yards; but must be kept closed, except when used for sprinkling as intended. Sprinklers will not be allowed where parties do not pay rates for their whole premises.

18. All water bills will be paid monthly in advance, at the office of the Company, and the supply of water will be stopped from all premises failing to comply with this requirement; and, when turned off for non-payment of bills, $1.00 will be added to the bill for turning on again.

19. All persons taking water shall keep their own service pipe, stop cocks and apparatus in good repair, and protected from frost, at their own expense, AND SHALL PREVENT ANY UNNECESSARY WASTE OF WATER; and it is expressly stipulated by the National Waterworks Company that no claim shall be made against them or the city by reason of the breakage of any service cock or service pipe.

20. No hydrant will be permitted on the sidewalk, or on the front area, neither will they be permitted to be kept running when not in actual use; taps at wash basins, closets, baths and urinals must be kept closed in like manner.

21. It is expressly agreed and understood that the National Waterworks company reserve the right at any time to shut off the water in their main pipe for the purpose of repairing the same, making connections or extensions to the same, or for the purpose of cleaning the same.

22. *The Inspector or any authorized agent of the Company must have access at all reasonable times to all premises supplied, to examine fixtures, manner of using water, etc.*

PLUMBER'S CONNECTIONS.

Pipes must be extra strong, and wiped with heavy joints into brass connections; in no case must lead be soldered to iron. Length must be not less than 18 inches for ½-inch pipe, 2 feet for ⅝-inch pipe, 2½ feet for ½-inch pipe, 3 feet for 1-inch pipe, four feet for 1¼ inch pipe, 5 feet for 1½-inch pipe. In all cases the pipe must be bent in **S** or other form, to allow for movement in the iron pipe. No pipe must be less than ⅛ inch larger than the corporation cock. ½ inch pipe will do for ⅜ inch cock—⅝ inch is better. ¾ inch pipe for ½ inch cock. 1 inch pipe for ⅝ and ¾ inch cock. 1¼ inch is as small as will do for inch corporation cock—1½ is better.

SECTION 3d. City Ordinance, in regard to waterworks says: That if any person shall willfully or carelessly injure or destroy any portion of the works, fixtures, or other property of the Company, such persom shall be deemed guilty of a misdemeanor, and, upon conviction thereof, shall be fined in any sum not less than fifty dolars nor more than five hundred dollars.

23. The right is reserved to amend or add to these rules and regulations, as experience may show to be necessary.

F. M. MAHAN, President.

Kansas City, Jan. 1, 1875.