REVISED ORDINANCES

OF THE

CORPORATION OF LYNCHBURG,

TOGETHER WITH

A DIGEST OF THE ACTS OF THE GENERAL ASSEMBLY,

RELATING TO THE

TOWN OF LYNCHBURG.

PUBLISHED BY ORDER OF THE COMMON COUNCIL.

REVISED BY ROBERT J. DAVIS.

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THE REPORT, &C.
TO THE COMMON COUNCIL

OF THE

CORPORATION OF LYNCHBURG.

The Watering Committee, in presenting their Annual Report to the Common Council of Lynchburg, cordially felicitate your honorable body and our fellow citizens generally, on the successful completion of the important work with which they have been entrusted —and believing it will be be acceptable to the Council, as well as to their fellow-citizens generally, they now present a detailed account of the nature of the work, its value, and its cost.

There is nothing, perhaps, more requisite and indispensable for the health, comfort, and safety of cities and towns than an adequate supply of wholesome water—hence it has always been considered desirable to procure this necessary article, even at great expense and labor. The enormous aqueducts of Rome, and other ancient cities, bear ample testimony to the care and solicitude felt even in early times, on this subject. Since the invention of improved machinery, this desirable object is attained at much less cost of time and money; and, guided by the safe precedent of successful experiment, and the experience of scientific and practical engineering, we may look forward to an extension and wide distribution of the blesssings and comfort of an abundant supply of water in our sister towns.

The rise, progress and completion of those extensive, efficient, and elegant works, by which the city of Philadelphia derives her supply of water, and which will remain to be a monument of the enterprise, wealth, and perseverance of her citizens, have already excited a proper emulation in her sister cities, and enriched our common country with valuable experience in a work of real utility and benefit. May not the Corporation of Lynchburg, by the successful achievement of this important public work, so highly conducive to the health, happiness and safety of her own citizens, not only point the way to her sister towns in Virginia, to the attainment of similar blessings, but also arouse the dormant energies of our State to give that improvement to our water courses and our roads, which modern science, and well directed public spirit, make so easy, and which will so largely contribute to the prosperity of our much loved Virginia?

A supply of water other than the continually diminishing quantity afforded by wells, had long been a desideratum with the citizens of Lynchburg, and the increasing conviction of the public mind, that the health, comfort and safety of the town were intimately connected

with a copious supply of good water, induced the Council in the summer of 1827, to create a Committee, denominated the Watering Committee, directing their attention seriously to this important subject.

After various examinations and surveys, the plan now adopted was proposed.

The great elevation to which the water had to be raised, being 245 feet, a greater lift than had been hitherto known, requiring a length of raising main of upwards of 2000 feet, induced strong doubts in the minds of many of our citizens, as to the practicability of the proposed plan; but relying on the information and calculations afforded by Mr. Albert Stein, Civil Engineer, a gentleman of science and practical knowledge, and under whose direction and superintendance the work was commenced and completed, the Council determined to move forward, and accordingly authorised a loan of $40,000, the estimated cost of the work. The excavations for the canal and pump house were commenced on the 1st of March, 1828. The Corner Stone of the pump house was laid on the 23d of August, of the same year; and the water successfully raised into the Reservoir on the 18th day of July, 1829.

The Committee have the satisfaction to present herewith a detailed Report of their Engineer, Mr. A. Stein, giving a minute description of the various parts of the work:

JOHN VICTOR, ESQ.

Chairman of the Watering Committee—

SIR—The Water-works being finished, so far as it is contemplated at present, to extend them, I will endeavor to give you a detailed account of the work.

The width of the Little River, at the site of the dam, being 140 feet, the bank of a sandy soil, the bed coarse gravel, and the depth of water, at an average, two feet, we commenced our operations in order to fix the foundation of the dam, with clearing and levelling the bottom across the river, to an extent of 150 feet in length, and 30 feet in breadth. After the bottom had been thus prepared, the whole space was covered with a layer of fascines of about 2 feet in thickness, which was secured by anchor fascines and stakes, and covered with small stone and gravel.—Upon this layer of fascines, 150 feet by 30, a wooden platform was laid, the cross sills of which were 4 feet apart from centre to centre, and extended between the abutments 11 feet below the lower line of the dam, to be united with the tumbling bed. This foundation received the wooden frame of the dam, made of two parallel rows of white oak timber, united by diagonal ties. The frame is 150 feet long, and at bottom 18 feet in breadth, which breadth was decreased at the upper side, or front of the dam, by steps at every new layer of timber, so as to leave a breadth of 5 feet 10 inches at top; the lower side of the dam has been carried up perpendicular. The layers of timber which constitute the dam are well framed and properly fastened together.—The inside of the frame has been carefully filled with stone, and the front and top covered with white oak plank. Each end of the frame of the dam

rests 25 feet in length aggainst the abutments, which are 100 feet apart, and confine the overfall of the water to that distance. The height from the tumbling-bed to the top of the dam is 8 feet 2 inches. The tumbling-bed, which prevents the water from tearing up the bottom below, is 10 feet 6 inches wide, and 100 feet long, built of stone and timber down to the natural rock.

The stone abutments extend 17 feet down stream, and 20 feet in the bank, sunk to the natural rock, and built 2 feet above the highest known water-mark.—Above and below the dam, wing-walls have been erected to prevent the washing of the banks; and to prevent leakage of the water beneath the ground, under the dam, a sufficient quantity of clay has been carried in front of the dam, which has been covered with stone to prevent washing.—In order to preserve the tumbling-bed and foundations of the dam, the necessary precaution should be taken to keep the surface of the water below the dam always higher than the top of the tumbling-bed.

The Canal, or head race, which conveys the water from the dam to the pump house, is 20 feet wide at the surface of the water, 8 feet wide at bottom, and the depth of water 4 feet at the dam, and 5 feet near the pump house.

The Canal is 2160 feet long; the depth of the excavation about 15 feet, and the slope of banks 1 1-2, so that the width of the Canal at the top is about 53 feet. The ground through which the Canal has been carried, is not liable to be overflowed, and therefore the wheel may sometimes be impeded by the tail-water, and a high flood stop it completely, without an injury to the works. The water enters the Canal at the dam through a culvert of 60 feet long, and 36 square feet water way, which can be opened and shut by two gates.

The top of the culvert has been raised with clay above the highest known watermark, and affords a communication from one side of the Canal to the other, for horses and waggons.

The water which comes down the Canal passes through a culvert, under the road near the pump house, of 80 feet in length, and affords a waterway of 24 square feet, and is provided with 2 gates.

The Waste Gate at the side of the pump house, through which the water is discharged into James River, is 3 feet wide, and when the upper gates of the culvert, near the dam, are shut, the water can be drawn off to the bottom of the Canal for repairs. The forebay in front of the pump house is 40 feet long, and 12 feet wide, and surrounded by a stone wall. The bottom of the forebay has been puddled, and covered with plank, and is lower than the openings to the Forebay-Chamber in the pump house, in order to retain the sand which may come down the Canal.

The Pump House is of stone, 54 feet long, and 32 feet wide, and is divided into two apartments, one for the pump, and the other for the water wheel. The pump and forebay chamber is arched with brick, and kept perfectly secure from the inclemency of the winter by a stove. In front of the arches a platform has been erected, to which leads a stair-case from the floor of the pump-room, and on the platform, in front of the water wheel, is placed the gear-

ings for raising and lowering the gate of the wheel. In order to use the water in the most advantageous manner for a breast wheel, it is proper to divide the fall of water, so that the breast may be as high as possible, and that so much only should remain as will be absolutely necessary for the construction of the race, and discharge of the water, which will require a wheel of great length and slow motion, and which may answer very well, where the desired velocity of the working-point is obtained by gearing; but this regulation of the fall, to obtain the greatest mechanical momentum, cannot be applied with advantage, where pumps are worked by a crank on the axis of a water-wheel, as this requires a great velocity of the floatboards, in order to obtain the required number of strokes, and which also enables the wheel to overcome the irregularities of motion by its inertia, or the great quantity of motion inherent in it. In this consideration, and guided by local circumstances, we have taken

The height of water above the top of the breasting,	2	feet	6	inch.
The height from the top of the breasting to the middle of the first impinger floatboard,	0	do	6	do
The height from the middle of the first impinged floatboard to the middle of the lowest one,	3	do	5	do
Half the depth of the shrowding, - - - -	0	do	7	do
The useful fall, - - - - -	7	do	0	do

The breast of the wheel is built of masonry and timber; the front of the breast and the forebay-chamber have been well secured by puddling and planking, to prevent the water from leaking and blowing up the foundation of the race. The timbers of the breast are hewn, and planked to an exact arch of a circle, so that the wheel passes as near as possible to the circular sweep without touching it.

The water runs upon the wheel over the top of the breasting; the efflux from the forebay-chamber is regulated by a gate which is placed in a direction of a tangent to the wheel, and is provided with racks and pinions, by which it can be drawn up, so as to make any degree of opening, and admit more or less water to flow on the wheel. The top of the breasting or crown, is rounded off to a segment of a circle. The lower edge of the gate when put down, is made to fit to this curve, so as to make a tight joint; and in consequence, when the gate is drawn up, the water runs between the lower edge and the crown in a stream into the first bucket that presents itself, nearly in the direction of a tangent to the wheel.

The WATER-WHEEL is built of wood, with iron shafts, and three iron sockets. The diameter of the wheel is 17 feet 6 inches to the points, or 16 feet 4 inches to the centre of the floatboards, and its length 9 feet 2 inches, from out to out, or 7 feet 10 1-2 inches between the shrowdings. The diameter of the shaft is 9 inches, and the sockets round which the arms of the wheel are fastened 30 inches by 10. The number of buckets 40—the length of the floatboards has been ascertained by the velocity of the water-wheel, and the quantity of water required in a certain time.

Nothing contributes more to the perfection of a machine than uni

formity of motion. By enlarging the moving matter, the motion will become more uniform, and consequently, the quantum of power required for producing a certain effect, lessened in proportion—and as the moving matter should be applied to that part which possesses the greatest revolving velocity, we have attached to the shrowdings of the water-wheel as much as was necessary to overcome the irregularities of action which arise from the intermitting motion of the crank.

The following articles were received from Mr. Wm. Kemble, agent of the West Point Foundry Association, New York;

One Water Wheel Shaft, 14 feet 2 inches long, with journals 9 inches in diameter.

Three Sockets for Water Wheel, 30 inches square and 10 inches deep, with projections for hoops.

Two Plummer Blocks, with brasses and bolts, complete for Water Wheel Shaft.

Two Wall Plates for the Plummer Blocks, 5 feet long, and 18 inches wide.

One Crank Wheel, 6 feet in diameter, rim 3 1-2 inches broad, by 5 inches deep, with holes bored for crank pin, to give 5 feet, 4 1-2 feet, 4 feet and 3 1-2 feet stroke.

One Screw Wrench.

One Set Stocks and Dies.

The Sockets and Crank Wheel were fitted to the shaft.

The cost of the above articles is eleven hundred dollars, delivered in Richmond.

The DOUBLE FORCING PUMP, adopted for the works, which raises water by the ascent and descent of the piston, was first proposed by de la Hire, (memoire pour la construction d' une pompe qui fournit continuelment de l' eau dans le reservoir—Mem de l' acad. de Paris annu, 1716,) and is the most proper for a Water Wheel. It has the advantage of raising nearly twice the quantity of water with the friction of only one piston; the valves also admit of being made of sufficent size to allow the passage of the water without any unnecessary resistance, and can be conveniently examined and repaired. The clack-valve, which is the most proper one for this pump, seems also by experience, the most perfect of all valves that are used for pumps. The valves are hung almost perpendicular to the line drawn through the centre of the pump-barrel, and made sufficiently strong to resist the great pressure to which they are exposed, and that they afford a sufficient water way, and do not allow much water to go back, while they are shutting. The valve-seat has two openings in the form of a half circle of 8 inches diameter.

The VALVES are made of brass, without the use of any hammered iron, which is liable to corrode in the water.

The VALVE SEATS are of cast iron. In order to replace at any time a Valve that may become defective, there is always kept an extra set of Valves for that purpose.

The DIAMETER of the pump-barrel is 9 inches, in the clear, and all the passages for the water to and from the barrel, with the excep-

tion of the Valve openings, are made of the same area as that of the pump-barrel.

The PISTON is packed with plated hemp in the same manner as the Piston of Steam Engines.

If the water is suffered to rest at every successive stroke of the Piston, the whole mass must again be put in motion through all the length of the ascending-main.

This requires a useless expenditure of power over and above the force which may be necessary for raising the water to its destination. By employing an air-vessel, we remove this imperfection, because it keeps up the motion in the intervals between the strokes of the Piston.

The AIR-VESSEL of the pump has a diameter of 2 feet in the clear, and a mean height of 4 feet, or a cubic contents of 12.56 cubic feet.

The thickness of the metal of the pump is 1 1-2 inches. Between the air-vessel and ascending-main is a Valve, and near this, in the side of the pipe, a stop-cock for drawing off the water from the ascending-main.

As a moderate decrease of the diameter of the ascending-main to that of the pump barrel does not cause a very sensible increase of resistance, particularly when the pump is not worked too rapidly, we have taken the diameter of the ascending-main, 7 inches in the clear.

The pump has been placed in an inclined direction, and is fed from the forebay-chamber.

In order to prevent the heavy matters from entering into the pump, the suction pipes are placed above the floor of the forebay-chamber.

A wooden box has been attached to the front of the suction-pipe, the mouth of which is provided with a brass wire net, to prevent floating matters from entering the pump, and to keep the floating wood, &c. from the forebay-chamber. The gates opening in front of it, have been surrounded by lathes closely put together.

The abovementioned manner of supplying the pump with water, may be considered the most perfect, because, in this case, the pump is always filled with water, and no air can remain—a disadvantage generally connected with a perpendicular forcing pump, especially where the Piston does not reach the bottom of the barrel.

The pump is worked by a crank at the end of the shaft of the breast wheel attached to a pitman connected with the Piston at the end of the slides. This mode of working the above double-forcing pump, and supplying it with water, was, I believe, first proposed by R. C. Langsdorf, (Handbuck der hydraulick, Altenburg, 1794.) The cost of the pump, complete, including connecting-rod, slides, &c. is nineteen hundred dollars.

The height to which the water is raised from the pump to the reservoir, is 232 feet. The lowest point of the ascending main in Black Water Creek, is 240 feet below the surface of the water in the reservoir.

The height of water in the reservoir (taken in the line of the as-

cending-main,) is above 4th street 12 feet, above 3d street 70 feet, above 2d street 105 feet, and above 1st street 140 feet.

The weight upon the Piston may be calculated (when the pump is at work) at 8,000 lbs.

The Pipes for the ascending-main are 9 feet long and 7 inches bore. The distance from the pump to the reservoir, say 2100 feet, has been divided into three parts, each of 700 feet in length. The first part, from the pump across Black Water Creek, the thickness of the metal of the pipes has been taken 3-4 of an inch—the next 1-2 × 1-16, and the next to the reservoir 1-2 inch. The pipes are carried under the bottom of Black Water Creek, which is 240 feet below the surface of the water in the reservoir. On the summit level between the pump and Black Water, we have placed an air cock. The pipes were proved at the furnace, and no pipes were received that had defects, particularly in the hubs. The ascending-main has about 3 feet clear distance between the surface of the ground, and the top of the pipes, and therefore no danger is to be apprehended that the water will freeze in it during the winter, or the joints be disturbed by heavy carriages. The pipes were laid on a solid bed upon the ground, in such a manner as to give nearly an equal width of joint all around, except where we had to make a small turn, which was effected by an inequality of joint. The pipes were connected by lead joints, in the following manner: A ring of dry hemp about an inch in length, was driven in to prevent the melted lead from getting around the spigot end into the pipe; after this, well wrought clay was put all round between the outer end of the faucet and the spigot pipe, and formed into a cap at top, into which the lead was poured; when the lead had cooled, the clay was removed, and the lead caulked by a hammer and chisel, which completed the joint; each joint required about 15 lbs. of lead.

The pipes were delivered by Mr. Samuel Richards, of Philadelphia, in Richmond, at the following prices:

7 inch pipes 3-4 inch thick,	$1 25 per foot.
7 do 1-2 × 1-16 do	1 20 do do
7 do 1-2 do	1 15 do do

The side walls of the Reservoir are of brick, 5 feet high, and 3 feet thick at bottom, and 2 feet at top. The height from the top of the reservoir to the side wall is 4 feet. The remainder of the height of the sides to the top of the surrounding ground, has been sloped and paved with pebbles. The sides behind the wall, and under the pavement have been puddled with clay to prevent leaking. The Reservoir is 93 feet long, 52 feet wide, and four feet high; between the brick walls, and as far as the pavement extends, it has a mean length of 110 feet, a mean breadth of 70 feet, and a depth of 6 feet, and contains about 400,000 gallons.

In order to supply the town with clear water, we have divided the reservoir, by a partition wall of 3 1-2 feet thick and 10 1-2 feet high from the bottom of the reservoir in two parts, A. and B. of 46 1-2 feet by 52 feet each. A. receives the water from the pump, and after it has here sufficiently settled, it is discharged into B. by 2 pipes of 7 inches bore, fixed in the partition wall. The bottom of the reser-

voir has been puddled with clay 2 feet in thickness, and paved with brick.

The mouth of the main pipe through which the town is supplied from B. is in the form of a bell muzzle, and is provided with a gate, and to prevent floating matter from entering the pipe, it has been enclosed by a wooden frame, surrounded with lathes closely put together.

The ground owned by the Corporation will allow the enlargement of the present reservoir to double its size—a large reservoir is advisable in all cases where the water is raised by artificial means, in order to prevent serious consequences—high water, an accident to the pump, or other parts of the machinery, may stop the supply into the reservoir for several days.

The main pipe which conveys the water from the reservoir down town, is 8 inches bore, and the stop cocks attached to it, have waterways, fully equal to the section of the pipes—with regard to the size of the MAIN-PIPE, which has been considered by some too large, it is necessary to observe, that in all cases it is desirable to have it large enough, and that the only objection to the increase of size is the increase of the first expense of the pipes—in every other point of view, the larger the main is, the better. The branch pipes are all better supplied, and the capability of the work every way increased to meet any unforeseen increase of the town, or any other demand for water. Each joint of these pipes required at an average 12 pounds of lead.

The BRANCH PIPES, through main street, water street and 4th and 7th alleys, are 3 inches bore, and that through 3d street, 4 inches bore—a joint of the 4th inch pipes required 7 1-2 pounds of lead, and a joint of the 3 inch pipes 5 pounds. The branch pipes form at the junction with the main pipe, an easy curve, and at the same time are made larger and tapering.

STOP-COCKS have been placed at the intersection of the streets, to shut off sections of pipes for repairs, and they are placed in line with the houses. The stop cocks are surrounded by a wooden box, upon which is laid a cast iron frame, with cover.

FIRE PLUGS have been located at different places through the town, from which water can be drawn in case of fire.

For the supply of private families lead pipes are used.

The following are the prices of the pipes, stock-cocks, fire plugs, &c. delivered in Richmond :

Pipes 8 inches clear in the diameter,				9	feet long,	$1 20	per foot.
do	4	do	do	9	do	0 52	do
do	3	do	do	9	do	0 37	do

Branches, fire plugs, &c. at fifty-eight dollars per ton.

Frames and covers at fifty-five dollars per ton.

8 inch stop-cocks, with brass faces, the cast iron excepted,				$56
4	do	do	do	30
3	do	do	do	28
A fire-plug, including eye-bolts, cast iron excepted,				16

I cannot close this Report without referring you to my report of

January, 1827, in which the different works are named, and from which it will appear that the execution of the works has not exceeded the sum of my original estimate.

I am, Sir,

Your most obedient servant,

ALBERT STEIN,

Civil Engineer.

Lynchburg, Feb. 15th, 1830.

The Committee will here subjoin a summary of the cost of the whole work :

Paid for purchase of water power, lands and privileges,	$5,200
Disbursed for the erection and cost of the various parts of the work, including pipes, building pump house, pump, &c. &c.	38,616 08
	$43,816 08

The water is now distributed through two of the principal streets and intermediate alleys, and introduced into the yards of most of our citizens. For every purpose of refreshment and culinary use, it has the decided preference to the water heretofore used, and is obtained at a less cost of time and labor. The convenience of a well constructed Hydrant is fully equivalent in family arrangement to the cost and support of one servant ; but it is impossible fully to estimate the value of this water—the great security in case of fires---the ornament of our town in the erection of fountains, should the taste of our citizens please to direct them ; the benefit to manufactures in the establishment of a water power, even in the town, may be named among the advantages of this work. Already is there in progress an estensive manufactory to be propelled by the water power created in the erection of this work ; but above all these, we are to estimate its effect upon the cleanliness and health of our growing town, which would of itself justify a much greater expense.

Your Committee would recommend the extension of these benefits, by supplying those streets and alleys not included in the original plan and estimates, and most respectfully would they urge the speedy improvement of the lots on which the pump house building and reservoir is situated, in a style that will combine elegance with utility.

The Committee cannot close this Report without bearing their testimony to the professional merit and personal worth of their Engineer, Mr. Albert Stein. To the scientific skill of that gentleman, we are indebted for the plan, and to his untiring industry and attention for the successful completion of this important work ; and the Committee must be permitted to express their hope, that the conclusive evidence he has here given of his prominent qualifications in his profession, will insure him employment in other works equally important and useful ; and their sincere belief, that wherever he may be employed, his talents, integrity and excellent economy will insure equal success.

The Committee will here express their obligation to Mr. Frederick Graff, the distinguished superintendant of the Philadelphia Water works, for his kind and gratuitous attention in supervising the execution of the Machinery and Pipes, and for other valuable services rendered the Corporation. All of which is respectfully submitted,

By order of the Committee,

JOHN VICTOR, *Chairman.*

March 24th, 1830.