AN ADDRESS

TO

THE MAYOR, THE ALDERMEN, AND INHABITANTS OF NEW YORK,

SUPPLEMENTAL TO COL. CLINTON'S REPORT,

ON

WATER,

Demonstrating, from the facts ascertained by the Surveys, as well as others, the advantages of

A ROCK-WATER COMPANY,

WITH

BANKING PRIVILEGES.

APPROPRIATING THE SURPLUS TO PUBLIC BATHS, AND CLEANSING STREETS.

ALSO, A

PROPOSITION TO THE MANHATTAN COMPANY,

To fill their Aqueduct with Rock-Water.

BY

JOHN L. SULLIVAN,

Civil Engineer, and Co-Patentee with LEVI DISBROW.

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ORDER OF TOPICS.

To Col. CLINTON,

SIR,

So much your senior in life, as well as your predecessor in the appointment you have the honor to hold, I should feel sincere regret if the remarks in the following address on your valuable REPORT ON WATER *should appear to any to be a professional difference on precisely the* same *premises: This is not the case.*

Having at my leisure attended to the details of Mr. Disbrow's art, and applied to its improvement the principles essential to its greatest useful effect, I have been aware of much, that time did not permit you, among so great a variety of topics, to inquire into minutely.

And while I acknowledge myself indebted for the strength of my argument to your elucidation of the difficulties of the BRONX *surveys and plans, perhaps, in regard to the* CROTON, *my practice in river works, early in life, in connexion with some of our northern canals, may be my apology for the frank objections I have made to your plan, as proposed for the latter.*

I am, with high respect,

Your humble servant,

JOHN L. SULLIVAN.

New-York, March 25th, 1833.

POSTSCRIPT.

Subsequently to the printing of the following Address, the Common Council was petitioned, and this Letter was consequently written to the Board of Commissioners, further to explain the reasons for a Rock-Water Company, being of public interest, and a part of the subject.

To the Board of Commissioners appointed under the Law passed February 26th, 1833, in relation to supplying the City of New-York with pure and wholesome water.

Gentlemen,

A few days ago I transmitted a copy of our Address to the Inhabitants of this city, supplementary to Col. Clinton's Report, with a view to describe the *true value* of the deep veins of *pure water* discovered by boring the primitive rock under this city.

Conceiving that the instruments hitherto employed in searching for and raising this water, adapted to the peculiar hardness of the rock, and the requisite penetration into the deep alluvial sand here covering it, and to bring up the water, would be very useful in proportion to the generality of the operation, we petitioned the Common Council, last autumn, *for leave*, as Patentees thereof, to lay down pipes to distribute this water; a preliminary step to forming a Company for the purpose; and lately renewed it, not supposing the Board of Commissioners would be called to take cognizance of this mode of operation; but I am happy to learn from His Honor the Mayor, in his letter of the 16th inst., that he thinks this method also within your commission. He says,

"I have been led to understand, that the leading argument in favor of the late application to the State Government for legislation, and for the appointment of the Board of Commissioners, grew out of the contrariety of opinion and the discrepancy in the numerous reports, now existing in relation to the practicability and the best mode of supplying the city with water; it was believed that a new and disinterested board of men, separated from, and unbiassed by the counter opinions that exist in the Common Council on this subject, would be able to produce beneficial results. In this view I have officially approved the ordinance calling on the Legislature. The terms of the law passed by that body are not now before me; my impressions are, however, that it will be the duty of such commissioners to inquire into all possible modes of watering the city, as well the sources of rock water as those of the Croton, Bronx, and others, and to report that which they deem most eligible. As the sole object of the measure, so far as I have understood it, was to close a controversy, which appeared to be the principal impediment to the great object of supplying the city with wholesome water, it appears to me, that until the anticipated report of such commissioners shall be made, any action or expression on the part of the city government, or its members, would be ill-timed and improper."

This impression of the Mayor and Common Council, of what is due in courtesy to your Honorable Board, is most cheerfully admitted, and I am happy that this whole important subject is committed to your hands. But, on the ground that induced them to ask your appointment, there is a distinction evidently to be made between the streams that have been the subject of surveys, and the *deep rock veins* that have been the subjects of practical experience. They have been presented no otherwise than on our petition, last autumn, which the expected re-

port probably prevented any action upon. The facts in this branch of the inquiry being as mature now, as they will be after a year, it seems desirable they should be acted on now.

The question then which I ask leave to submit to the Board is, whether, this being the case, an *immediate* report on the usefulness of this branch of supply to some extent, might not be made, at this early period, beneficially to the city? Whether there is not something in the *exigency of the times*, and in the *uncertainties* as to *both streams*, that prompts to the conclusion that the city should, at once, avail of this opportune gift of Providence, and make the best use of it, as a precautionary measure against the recurrence of the epidemic, which visited this city last summer; to which end it is applicable in a few months.

If it be asked what proof there is that the perforation of the earth and rock affords large quantities of pure water *here?* the answer, though much in detail in the said "Address," may be in part repeated. The *great well* of the Fire Department gives about 10,000 gallons per day, from rock excavation, and cost 9,000 dollars, but the boring on Bleecker-street and Broadway, which cost 10,000 dollars, gives 129,000 gallons a day; the deepest of the borings at Greenwich, cost one thousand, and gives 26,000 gallons a day.

That at Mr. Underwood's affords the greatest part of the spring water distributed in carts. There have been made for the Corporation, and for various persons, *earth* borings 70 to 130 feet deep, down to the rock, affording good water: perhaps the only pure water in the first ward, is that of an *ancient well*, in Lumber-street, the bottom of which is the surface of the rock, from the fissures of which the water pours up.

It will be recollected by the Board, that the prevailing reason in favor of bringing in the distant streams, was the supposed necessity of *much* water to wash the streets, but the *quantity required* depends on the manner in which the pavement is laid. The present method is unfavorable both to cleanliness and economy. In Paris, the gutter being in the middle, the rains are more effectual.

But as to health, the importance of pure water in *drink*, in *food*, and *cookery*, is admitted by medical men, to be of far more consequence to the general health than street cleanliness, however important this may be: and certainly it is of great consequence to the comfort of the people.

When, too, it is recollected that the purpose of introducing water from the streams, *originated* in the deficiency of good well water in the city, is there any thing unreasonable in the reflection that since *that motive* has been superseded by the discovery of the deep-seated rock springs here on the spot, it should, at least, modify the plans and the extent of those works to a degree of expense commensurate with the actual present deficiency.

And there is another reason why this providential supply should not be undervalued; it is not only pure and soft, but unaffected by change of seasons; and might be pretty largely supplied this very year; perhaps in quantity enough to prevent a sickly summer, in its consequences very expensive as well as distressing to the community.

The first part of the process down to the surface of the rock might be quickly effected. Those who live around one of these borings would not part with it for a sum much greater than its cost.

Were not the subject so familiar to you, testimony might be had of the city authorities relative to a boring of this kind at the City Hall; also at Washington market; at the corner of Thompson and Grand, also Wooster and Grand. At the Dry Dock; at Samuel Ficket's, in 13th ward; at Mr. Dodge's, in Columbia-street; at Cram's distillery, Wooster-street, near Canal; at Richards', at Underwood's, in Greenwich; the Manhattan Company's is familiar to you; also Mr. Shaw's at the Botanic garden; and there is one in College-place. Fine water has been thus obtained in considerable quantity. On the Jersey side of the Hudson others may be named. And in the cities of Baltimore, Philadelphia, Princeton, Albany, and Boston; and I have not heard of any one not made with the instruments invented by Mr. Disbrow. By applying to his *art* certain principles of mechanics and hydrostatics, I have made

it ten times as valuable as it was before. It is now an established art, in a manner indispensable in this alluvial country with primitive rock base.

While the surveys have, since 1798, only revealed the difficulties and cost, the population of the city has more than doubled, and made the want of good water a very serious inconvenience.

Those surveys, instead of suggesting a work for future ages, have rather prescribed, by their expense, reference to present numbers, and in such mode of construction as to permit redoubling the ducts without detriment to the plan.

If we have now 225 thousand inhabitants, and the property, real and personal, is 150 millions, and 10 millions accumulate annually, surely we may well hope that one million may be employed in opening these pure springs of the rock beneath, and distributing the water, even if two or three other millions are required to turn hither the current of the Bronx, for the use of the public institutions of charity, the markets, the shipping, the wharves, the fountains, and the streets. The actual possession of pure water here, thus availed of, will enhance the value of this great property more in one year than the whole cost. This is wanting to give New-York the advantage that Philadelphia possesses. And with a fine command of water, other improvements follow.

It is generally supposed that a company can conduct a work more economically than a city government. When accomplished, there can be no prudential objection to its owning much of the stock; and having the privilege of extending it. But when it is recollected that it commonly requires some privileges to induce men of capital to undertake a work generally of some hazard, it may be doubtful whether the city would borrow, to effectuate what men of calculation would not undertake. It may be a formidable objection to extensive aqueducts, as a *sole reliance*, that they are liable to break.

And I may urge, that if the public health and accommodation has always been the great end and aim of every projected aqueduct, it is so of this also, and the delay has created an exigency now become pressing and great. It seems to me, however humble the instrument of a blessing, it should rather be appreciated by its effects. Like the machine for card making, and the cotton gin, though not equally, the ingenuity manifested in these instruments must long place Mr. Disbrow's name among the mechanic benefactors of his country.

If a high degree of probability always attends this process, if the facts are before the Board, if the volume of testimony might be satisfactorily investigated, if there can be no doubt that there is *now* on the island, much good water, if actually availed of to some extent, may it not be best to avail of it immediately, as far as it will go? Possibly such a summer as the last might be prevented from recurring. We might do much to stay so great a calamity, the coming summer, by the first step in the process, placing the tubes down to the rock.

And I ask leave, under this impression, to urge the remark on the attention of the Board, that this is not a question of comparison between the rock-water and the streams, as it is between *them*, as to which of them shall be preferred for the supply of the deficiency; but whether or not these *discovered* springs shall be availed of. If they are refused, will it not be to reject a beneficent gift of Nature?

In answer to Colonel Clinton's report, I have shown how doubtful and uncertain the streams must be at the season when most wanted. Investigation will only enhance the value of the rock springs. We might make private contracts for the supply of squares and blocks, and afford it too as low then as the Boston water tax, 12 dollars a-year, for aqueduct water, fit only for washing. But, is it the opulent alone, who are to be supplied with pure soft water? Would it not be better for all that it should be general, and as low as the water tax of Philadelphia.

Although, gentlemen, the final report of your Board must be made on, or before the first of November, the Act does not appear to forbid a *partial report previously*, should you see cause to make one. If the facts will, in your opinion and belief, justify the recommendation to the Common Council

forthwith to consent, that as much good water be raised and distributed as can be, regardless of the surveys *mean time going on*, without the precipitation and hurry, that might attend them, if to be the sole reliance, there can be no doubt of its acceptance, and that the Legislature would thereupon grant a charter, which may provide for the best interest of the city and community.

And there is this further reason for it, that the limitation of the commission to one year may defeat its purpose. The summer may prove wet, and permit of no data for calculations of quantity, when a dry season shall occur. In this case the Board must be renewed, if the city desires it, and thus from year to year, there would still be that uncertainty hanging over the result, that must prevent the work from being undertaken.

But let the streams be considered *tributary of the residue* required, and the investigation becomes less complex, the delay is less injurious, and the public economy may be more truly consulted.

In this view of the whole subject, the facts stated in the said Address, become arguments.

1st, I there show, that the reservoirs expected to be formed on the head ponds of the Byram, are not within our legislation, though within the state. They flow through Connecticut. And even the Legislature of that state may not devote them to the public good out of that Commonwealth.

2d. That the Bronx, by its repeated measurements, does not appear to be *alone* sufficient, allowing for transit waste.

3d. That the Croton, if practicable to be brought in, is at double the distance of the point of the Bronx where the water might be taken out.

My suggestion, therefore, is, that this stream should be investigated specially with a view to make up the deficiency for public uses in the summer season; and be brought in, by the most direct and convenient route; or supplying the shipping, wharves, and eastern part of the city, it may receive considerable revenue from these quarters:—and it will be less expensive to elevate as much as the high streets require, than the whole at the Harlæm.

But here the difficulty of crossing Harlæm river again presents. The question put by the Committee to Col. Clinton, how this river might be crossed? was answered by the description of an aqueduct bridge, 138 feet high, 1000 feet long, and the embankments for access to it of no small elevation and extent, for we learn from his report, that the line from Harlæm river at Macomb's dam, was run nearly two miles north before the ground had ascended 120 feet.

But there is a less costly method of crossing a navigable river. It may be done by a work wholly constructed above water *before it is immersed*, to allow vessels to pass the draw of the bridge over it, and yet be capable of repairs, or clearing out above water, without interrupting the current through it.

To keep open the navigation of Harlæm river may be thought of some consequence, to avoid claims for damages.

I expect that in this manner as much water might be introduced, with sufficient economy, as the public gratuitous uses may require, that is, the public institutions, the shipping, the squares, streets, and fountains. *With the combination* of these two methods, this city might be watered far *more* satisfactorily and elegantly than the city of Philadelphia now is.

The water tax may be as low here as there, and the city might hereafter invest any sum in these water works to extend them, with better results in public economy, than in executing any great uncertain work of this kind *alone*, because the number of springs opened permits this to be a safe and sure investment and source, while that of the Croton would be neither the one nor the other. When one extensive aqueduct is relied on, there is a liability to interruption; which a supply of water to a great city, should not be subject to.

Thus, it is respectfully urged, that, without impeding or preventing any ulterior plans, which the Commissioners may recommend, there seems to be in this, a distinct, immediate, and sure advantage, to some considerable extent at least.

If then, these mechanic means must be exerted by some one, they may be most efficient in the hands of the in-

ventors. If a large sum is necessary, it can only be embodied by an association, or by a public debt. The latter might not indeed be *equitable* towards those who *have paid assessments for borings*, made by Mr. Disbrow, by request of the corporation, unless exempt from their share of interest.

This is not a question of a little more or less expense. The whole State has an interest in the healthfulness of its great commercial metropolis. The Legislature, we have no doubt, would approve your approbation of this prompt and sure method.

It is well known to you, gentlemen, that the streams of our country are diminishing, and at mid-summer, are greatly exhausted; and comparatively it will not be safe to trust *alone* to reservoirs on them. May it not be safer to trust rather to those which Nature has formed beyond reach of the influence of the seasons?

The lateness in the session is not an insurmountable objection. The increase of information—the urgency of the occasion—the safety of the operation—the practical experience on the spot,—all contribute to form a claim on attention, which the Legislature will not, I think, reject.

But we submit it, thus explained, to your better discernment and unbiassed judgment, requesting as early a decision on this *request*, as may be convenient.

Remaining, with high consideration and respect, Your humble serv't.,

JNO. L. SULLIVAN.

Also for his Associates.

P. S. In Mr. Weston's Report, he compares the Collect with the Bronx; the former, at that time, existing and dividing opinion; and he gave his decided preference to the former, as to time and expense of execution, notwithstanding the use of steam power to raise the water; the only doubt was as to *quantity*. And what would, therefore, now be his opinion on seeing the quantities produced by the rock excavations and borings?

And having, since the above communication was written, seen and measured the Bronx, to know its volume ordinarily at this season, (March 26,) and viewed the Harlæm Rail-road graduation, I avail of this opportunity of saying that, however ornamental a command of water might be made, and however, the Bronx might elegantly water the beautiful plains of Harlæm, (the seat of future villas,) this level graduation will *not accord* with the slope required by an aqueduct. But while naming this public work, I must, in truth, say, (to allay apprehension,) that there is a mode of forming rail-roads in all cities, that also improves the street for all other travel, not exclusive, though appropriate. A method that would combine also, economy of paving with freedom from mud and dust, so that all should travel as freely as they now do, yet not be exclusive of rail-way wagons—for why should *any* form of carriage that does no injury be *excluded?*

To His Honor the Mayor, the Common Council, and other Citizens of New-York.

This communication is respectfully made and submitted, in answer to so much of *Colonel Clinton's Report* as relates to boring for pure water.

And since it will appear from *the facts* abstracted from that publication itself, that there is no other source than the rock beneath it, from which this city can be at present economically and amply supplied; a company is suggested to be immediately formed and incorporated, and with bank privileges for a part of the capital, if agreeable to the Legislature, as nearly like those of the Manhattan Company as may be consistent with the bank law; there being room and occasion for *two water companies*, (besides what the city can do for public purposes;) proposing to supply their aqueduct also with rock water as far as it is extended, if the terms are found acceptable; the supply of the rest of the town being the object of the new company as subsequently described.

In addressing the community at large on a subject that has lately received the special attention of a joint committee of the constituted authorities, whose accepted report has been published, containing erroneous views of a branch of the inquiry in which we are not only interested specially, but in which the public is deeply interested, so far as to know the true and full value of the rock sources here recently discovered, it is my excuse that this elucidation of that subject has been thus *made necessary in this form.*

Pure water is indeed so essential that no apology will be deemed requisite for any contribution to the general information before the community, called on as this is by deep motives, to form an opinion on its means of supply.

But when *an opinion* is expressed by a professional man, so high in station and reputation as Col. Clinton, it becomes almost necessary to show, *if incorrect* in one point, that he could not have had at the time a full view of the facts; that the geological formation of this island had not been sufficiently examined by him, nor the results of practical experience in this art fully investigated. And it may even be expected of the candor of a professional man, if himself convinced, to admit that he had not the whole case before him.

The matter was not indeed submitted to him *by the committee;* for, they had not this subject officially before them; and no opportunity has occurred of laying the facts within their official cognizance. It was therefore taken up by the engineer in part, incidentally, and coupled, *because rock*, with the great reservoir well; and their data, *essentially distinct*, sometimes blended, sometimes contrasted, so as by no means to lead to any correct result, being as distinct in mode as object. Thus an unfavorable impression has gone forth to the

world under the auspices of your honorable councils, essentially injurious to the interest of *the city*, in respect to its supply of pure water, if we are right.

For if it should appear demonstratively, that, after all, the rock is the best source, and the invention of mechanical means of reaching and opening it, and of raising this fine soft water, cheap for distribution, practicable, may it not be unwise to LEAVE this BEHIND to go in search of streams which your own engineer discourages positively as to the *Bronx*, and reveals the insuperable difficulties of, as to the *Croton?*

If the opinions of Col. Clinton against the Bronx, as a source of supply, are well founded, and if his recommendation of the Croton is susceptible of serious objections, it seems natural, rather to expect, that the city will the more appreciate and consider the proof of the value of the rock sources at hand. And the more so as a concurrence of circumstances has, of late years brought stronger convictions than ever, of the value, in comfort and healthfulness, of pure water. Indeed, it is not easy to see how *philanthropic dissuasions* from *intemperance* can be so effectually *seconded* as in placing pure water at command of all. On this subject, I cannot forbear substituting the language of a respected friend, (S. V. S. W.,) as well known in the walks of christian benevolence as of commerce: "By thus supplying the inhabitants with fine pure rock water, it will remove the *popular pretext* for using alcohol to correct the impurities of the water now in general use, and be the most effectual means of promoting the great and noble cause of temperance in this city." And these plain terms are not too strong: the idea is meant also to be conveyed, that is expressed in the language of an eminent physician, when on a visit last summer to Montreal. "Cholera has stood up here, as it has every where, the advocate of temperance." Nor will this seem too forcible when we recall to recollection that Philadelphia, which has good water, lost but 740, while New-York lost 3515, by that fatal epidemic in a short time. And it is not for me to compute the pecuniary cost of a disturbance of trade for two months in this great city. We know that this calamity may now have *past over* this city *once for all*, and may never recur, nor is it necessary to suppose it may, to accumulate motives to that force of public opinion on which all great movements depend; but there are many motives besides the promotion of temperance that all feel, especially since the monitions of the committee of the Lyceum reminded *parents* that, however some may habituate themselves to the *taste* of bad water, and become reconciled to dyspepsia, its *quality remains* the same, and to the young and the delicate, injurious or dangerous; and it was perhaps intended by medical men on that committee, to touch a chord that would vibrate home to scenes of deeper interest than personal welfare.

New-York, highly favored in its insular situation, as regards a pure atmosphere, can hardly realize her natural advantage in the

summer season for the want of a command of water. Philadelphia, by no means so fortunate, is enabled to defend itself against the causes of impure air by works, deriving it from a source beyond the reach of contamination.

But when it is recollected that the Schuylkill is becoming more and more the seat of villages, it cannot be pretended that river water will remain always as wholesome as that derived from the primitive rock in the northern liberties of that city.

The command of an unlimited supply from the rock, places New-York before Philadelphia in respect to this article; as we believe will be *evident* from the facts to be stated. The subject is therefore one of great public interest, though this *mode* is as yet a private concern; nor is it one that can be carried into effect without an act of incorporation which will enable those to take the water who please to do it, and that those who yet have good wells, be *exempt* from a *water tax*. This is indeed the case with several quarters where Mr. Disbrow has made borings for the corporation. But it is thought best now, for the public accommodation, to put the privilege of our patents, for this branch of usefulness, into the hands of a company, who may have a motive to give the utmost extension to the supply permanently. It is on this principle that London is supplied by five or six corporate associations. And it is thought to be more conducive to economy in practice, when personal attention is given to a concern in which we are interested.

The subject is therefore presented to the public as one of business; and though peculiar in its origin, nature, and purpose, it is simple and sure in its details; and it is supposed to be, for the reasons alluded to, peculiarly acceptable to this community. We should feel that the city was denied some portion of the information due to it, if this communication were forborne.

The natural divisions of this subject are the following—

1st. The true results of the actual surveys of the Bronx.

2d. The comparative aspect of the plan of supply from the Croton.

3d. The calculations, from experience, on deriving an ample supply from the rock beneath the city.

4th. Why the rock borings may be expected always to afford it.

5th. How the proposed company is to be organized to carry this improvement into effect profitably.

6th. How this may be done without detriment to the Manhattan Company, whose legal rights therefore it is necessary to advert to, and whose interest may at the same time be subserved, in the manner to be suggested.

7th. An examination of the objections sometimes expressed against a gradual increase of banking capital in this city; suggesting a mode of account by which bank credit may be more useful to young mechanics.

The surveys, originated in the favorable representations of Mr.

Browne, of Westchester, whose description of the practicability of leading the waters of the Bronx out of their natural course, towards the city, produced a more systematic survey, at the corporation's expense, by Mr. Weston, a distinguished civil engineer, from England, then occupied on some of our earliest canals. His report, in March, 1799, appears to have led to the incorporation of the Manhattan Company, in April, 1799.

Mr. Weston described, in his report, a route passing around the north end of the island, and along the west shore, for a canal to serve as an aqueduct, to be made impervious by some artificial means; and no calculation appears to have been given of the quantity of water that would waste, nor of that it would deliver. The investigations were probably followed up after the Manhattan Company was formed, but the cost must have forbidden the execution of the work so long as the city remained of moderate size, and content with the best water then at command.

The time within which the waters were to have been introduced rolled away in the enjoyment of the other branch of their privilege, which was confirmed by an act of Assembly, passed in 1808, whereupon the state subscribed for a thousand shares, or 50,000 dollars, still held in this incorporation.

This institution then changed its character, in some measure, that becoming primary which was at first secondary—if the comparison be made relatively to the amount of capital respectively in each branch. It is obvious, both on that occasion and since, that whoever buys into the stock, has regard to its bank privilege mainly. But the aqueduct is, in my opinion, capable of being made equally good property, in proportion to its cost.

On a recent occasion, the Supreme Court has said, " The predominant intention of the Legislature in incorporating the Manhattan Company, was undoubtedly to procure, for the city of New-York, a supply of pure and wholesome water." The 5th section of their law expressly contemplates the introduction of streams and rivers, and clothed the company with all requisite authority; perhaps vesting in them a *pre-emptive right*. But it does not appear to have been *otherwise an exclusive privilege*, as other companies for the same purpose appear to have been afterwards chartered, and under these, more mature surveys were made.

THE BRONX surveys are thus summarily described.

Mr. *White's first plan*, in 1824, takes the waters of the Bronx one mile below Williams' bridge, cuts 42 rods into Morrisiana creek, and tunnels into Mill creek 72 rods, then follows its valley on steep lying ground to a reservoir, supposed at Macomb's dam five and a half miles, and five and a half feet above the Park. He proposes it to be raised by machinery 44½ feet, to be 50 feet above the Park, to a reservoir; bringing it thence to the city in main pipes; and estimates the expense at $953,000.

His second plan was to take the water into Morrisiana creek, and

allow it to flow therein, and be received into a canal, whence it would have to be raised 70 feet; the estimate $920,811.

His third plan was to take the water by means of a dam, at a point 56 feet above the Park, at the City Hall, allowing one foot fall in a mile, 21¼ miles distant, and making a bend up Valentine's brook, and hence following the rocky bluff shore described by Mr. Dewey, come out, as before, at a higher level, and brought on in a *brick tunnel* five feet in diameter; the estimate being $1,949,542.

His fourth plan was a canal on the same line.

His fifth plan was the result of a survey for the then New-York Water Company. It commenced two miles higher up, 132 feet above tide; again recommending a stone or *brick tunnel* (forming a closed canal) as far as Harlæm river, and from thence through iron pipes. The tunnel was to pass along the shore of the Bronx for eight miles, turn into Morrisiana creek valley, along the hills two and a half miles, then one branch to Macomb's dam, the other to Cole's bridge. The length of the tunnel was to be 13½ miles, with a fall of one and a half feet in a mile; a reservoir on the Westchester side, whence Harlæm river was to be passed by a permanent stone bridge, 112 feet above tide. The estimate was $1,321,000, exclusive of lands, water rights, and damages.

It is not my purpose to make objections to this plan of tunnel; yet there are difficulties, the effect of our climate, that cannot be neglected, but which its author no doubt provided for.

But Col. Clinton says, page 238—

"A closed tunnel, as proposed by Mr. White, is very objectionable, on account of the expense of execution, and the danger of leakage or breakage. If an accident of this nature should happen in winter, it would be impossible to repair it, as cement will not set in frosty weather. The work would also be weak in the different angles made in the route, and the velocity of the water would be very much retarded by friction and collisions with the different crooks in the line. It must also be recollected that the strength of the arch is its downward pressure; and the head of water is applied under it, thereby tending to throw it out upward; and nothing but the adhesion of the cement, and the filling above the arch, will prevent it from bursting."

"Pipes are also to be objected to, on account of the great expense of procuring and laying them, as it would require pipes of thirty inches diameter; and the friction of the water in its passage through them, would not only render a greater head necessary to overcome, but it would diminish the quantity delivered on the island. If pipes or a tunnel was adopted, to provide against accidents it would require a double line for each."

In looking back on the several plans he has been examining, he further remarks—

"If we turn our eye to the plan recommended by Mr. White, in 1826, to secure a supply of water from the Bronx, we find it necessary to construct a canal or tunnel, through a very difficult and expensive country, to Underhill's bridge—the distance is thirteen and a half miles. At that

point it would be necessary to construct a dam and sluice gates, &c. At the Rye pond, 34 miles from the city, we also find another dam, sluices, &c. And following the line to Byram pond, a canal or close tunnel would have to be constructed seven miles in length, and a branch to the Wampus pond, three miles more, and at the outlet of each of these ponds, dams and sluices would also have to be provided. Those ponds are 41 miles from the City Hall, as measured on the route of the work. We have, therefore, twenty-three and a half miles of canal, four dams, and four sets of sluices, besides overflowing and destroying much land, and paying great damages for diverting and using the water. The expense of all these works, and unavoidable damages to property, must be very great; and the cost of their maintenance and superintendence equally so. A question more serious presents itself, in relation to diverting the waters of the Byram and Wampus ponds into Rye-pond reservoir. These ponds lay at the head of the stream which flows through the state of Connecticut; and it is questionable, at least, if we could change those waters from their channels without first obtaining the sanction of that state."

It is not believed to be at all doubtful in legislation, that the law of no state can transcend its limits, and however favorably disposed Connecticut might be to accommodate New-York, or empowered by its constitution to take private property for public uses in the state, paying the value, yet how, it may be asked, can it be taken for the public good of a city, beyond her jurisdiction? The head waters of the Byram are therefore beyond the control of either Legislature: and all the speculations on the value of reservoirs formed thereon, were it worth while, are nugatory. There is no other stream then, in that direction, but the Bronx—the estimate must be limited to its waters alone.

We come then to the simple inquiry, what is to be considered the true value of the Bronx?

In stating the answer, as far as ascertained facts permit, I shall assuredly do it unexceptionably, because taken from the report itself. According to Mr. Weston, a mill's water comes from Rye pond, in 24 hours, the main branch then affording scarcely any. This I compute to be . . . . . 1,691,746 gallons.

I am informed that the measurement, by Gen. Swift, Sept. 5th, 1819, was nine inches deep, 5½ feet wide, velocity 37 feet in 25 seconds, (which comes to more than Col. Clinton states it, by nearly a million of gallons; but he may not have had the same data,)

		3,767,000 galls.
The gauge, by Mr. White, in . . .	1822,	1,000,000
by Mr. Dewey, in . . .	1832,	4,173,000
by Mr. White, in . . .	1824,	3,000,000
" in . . .	1826,	4,302,760
The average of which, is		2,989,000

The reservoir proposed on *Rye pond* (the head of the Bronx) being the only one practicable, to estimate it justly, more considerations are involved than the mere raising a dam, or the consequent expanse and depth. It is always *very uncertain*, what the value of a reservoir will be *practically*. Evaporation is a constant but variable cause of diminution.

The remarks of General Bernard, and Col. Totten, when consulted on the survey for Morris canal, were so explicit of their doubts, that I quote them here as proper to the occasion.

"The evaporation from any given surface of water, varies with the temperature, with the force of the winds agitating the surface, and with the elevation above the level of the sea. In warm climates, water has a greater tendency to assume a state of vapour than in cold regions; the air in contact being more rarefied, and opposing less resistance to the disengagement of the vapour. At a high elevation above the level of the sea, the atmosphere is less dense, and presses less heavily upon the surface of the water, every thing else being equal, resists less the escape of vaporized particles; and when the *atmosphere is agitated by the winds*, the vapour is carried off *with great rapidity by the continual succession of portions of dry air*."

Evaporation taken in the ratio indicated by a rain gauge, leads to disappointment in practice. The wind, in passing over a lake or reservoir, in fact, increases the surface as much more as that of the waves is greater than when smooth; at the same time, their resistance and agitation promote the escape of particles into the air.

This loss is by the gauge greater here than in Europe.

In computing water for the supply of canals, engineers allow the whole of it, without deducting for the rain that falls on the surface thereof.

Those gentlemen say the instruments in use for measuring it must always give results below the truth, from not being exposed to winds and currents of air; and we therefore adopt the whole sum of 51 inches as expressing the maximum loss of water by evaporation.

Thus, so uncertain is it, that Sutcliffe, in his work on canals, states, that, even in England, the reservoir of Rochdale canal, when all was shut tight, lost sometimes, even in that humid climate, *one inch a day*.

When reservoirs are formed on ponds, it is impossible to know (especially in a mountainous and rocky country) that *the pressure of deep water* will not force itself *secret escapes*. The obvious outlet may not be the only one; and yet, to be guarded from great loss by evaporation, they should be deep rather than large. In Europe they are from 50 to 120 feet deep. That of St. Feréol, for the canal of Louis XIV., is of the latter depth, when full.

The rain too is greater here. The sum of all that falls in a year is found to be 36 inches at Salem, 32 at Philadelphia, and 45 at New-York.

The measured surface of Rye pond is stated in the report, page 230, to be 245 acres, when raised six feet; and, in another place, that the outlet may be reduced about a yard. The latter is, however, uncertain. If then it be raised 72 inches, once for all, must it not be reduced by evaporation, at least 51 inches, leaving 21 as the appreciable value of it? And this would give, over that surface, 140,978,105 gallons; and if wanted 4½ months, or 140 days, is 1,000,000 a day only.

But it has to flow 12½ miles from the outlet to Underhill's bridge, where the aqueduct is supposed to commence.

If such is the proper calculation for canals and reservoirs, how much more ought to be allowed for loss when the water is in summer turned into a shallow, precipitous, rapid water-course, among its stones and sands, to reach the commencement and the protection of the tunnel, or the canal leading to the city! when *even* one of the best made feeders, that of the canal de Briare, loses, in the summer season, *three fourths* of all it receives at its head, in running on a paved bottom eleven miles. Paris is 8° lat. north of New-York.

Little then can be expected of the Bronx besides its natural flow at the point where it is to be taken out, and of this we have had but imperfect information at the proper season of the year, and yet after being brought across the Harlæm, it is to be elevated to the summit of the island, 70 feet. Perhaps, should the city raise and bring in enough for *public purposes*, at public expense, the work will not be too costly for so valuable an end, availing of the rail-road graduation; but in that case the navigation must not be impeded. This difficulty has been neglected in all the plans.

Should it ever be a question, how the water of the Bronx shall cross this river, yet permit vessels to pass the draw of the bridge that brings it over, the method I invented to cross the Hackensack and the Hudson, when the corporation of Paterson offered a part of the Passaic waters, from an elevation of 112 feet, (alluded to in Col. Clinton's report,) will be found the only practicable method.

My intention was to lay the pipes on a submarine stone causey, rather above the city, and it required only a peculiar method of operation in a *diving-bell*, and the invented apparatus.

Whoever is acquainted with the works done in deep water in Europe, by means of this instrument, will readily conceive of the practicability of this: but it presupposed a tunnel through Bergen ridge, for the rail-road; and I am still of opinion it would, in that event, be preferable to the Bronx; but the Passaic water is too valuable as hydraulic power, at that elevation, to be again offered.

The quantity at command thus, *at a distance*, has been found to average about *three* millions of gallons; for, we have in Dr. Browne's memoir, no data of his estimate, and those of Mr. Dewey, in October and November, were not data for the hot months of summer; the next question is whether *Saw-mill river* may not be led into the Bronx.

This river, which discharges into the Hudson, six miles north of Harlæm river, is described as being much occupied by mills. When the Sharon canal was projected, its line led to the head of this stream after passing through *two tunnels*, each about one mile in length; and it was rather inconsistently conceived, that a work which could scarcely command water enough for itself, might, from such a distance, be made *an aqueduct to New-York*:—the waste, or requisite water for canals, being much underrated for our climate. The route from this river to the Bronx, was to begin near Union meeting-house; but we learn from the *report*, that not only the number of mills on this stream, but the scant supply it afforded them in summer, forbade any expectation of advantage from it, by a canal of *nine* miles.

Thus, again left to rely on the Bronx alone, the question occurred whether a succession of dams to detain water in the bed of this river, might not be made; but this expedient, your engineer has given good reasons for abandoning.

The survey, made by Mr. Dewey, describes the west shore of the Bronx as precipitous and rocky; prescribing to Mr. White, a long work *in masonry*, to commence high on the stream, as if begun near the depression in the ridge, too low to avoid the use of machinery with pumps to *raise* the water, according to one plan about 50 feet, by the other 70 feet.

How far the graduation for the Harlæm rail-road may *reduce* the ground, or favor the bringing on of the water, were it to be brought in, we do not know; but there can be no reason to suppose it will be less than the difference between the highest of that graduation, and the position before intended. This improvement would then, if availed of, favor the work to some extent; and if a stream on each side were running towards the city, filling basins, and playing in fountains, and covering the vacant space of the route with verdure under the trees that may ornament this pleasant avenue of future trade, it would surely be a fortunate and happy circumstance, that thus water enough might be brought in, at the expense of the city, for the purpose of having clean streets;—and were it to afford no more than Dr. Browne calculated the whole hydraulic power of the Bronx would be capable of heaving up to a *reservoir*, viz. 362,880 gallons a day, it would surely be very acceptable—though the city of Philadelphia uses a million of gallons daily.

But it seems to be unavoidable to use machinery to raise the water, unless the bold plan of Mr. White be adopted, of starting as high on the river, as Underhill's bridge, 132 feet above tide, with a brick tunnel, and declining $1\frac{1}{2}$ feet a mile, arrive in $13\frac{1}{2}$ miles at a reservoir, on the Westchester side, thus reducing the elevation to 112 feet, the height of the bridge above tide, of which the expense is estimated at nearly *two millions*, to reach a reservoir on the high ground; itself, however, an uncertain work, on a sloping stratified base of rock.

While we cannot but applaud the bold design of this tunnel, as we presume all must who deem *it necessary*, the questions will force them-

selves upon the mind, *whether it be so?* And whether the objections made by Col. Clinton, have not much force in them? and whether, if so, and the tunnel is dubious, and the water is to be *raised by machinery*, it may not be *best to do it here on the spot, from the newly discovered sources in the rock?*

Indeed, there does not appear to have been, as was supposed, any suitable ground for a *reservoir* near Harlæm river. To ascertain this point, Judge Wright was last year authorized to run a line of survey from Macomb's dam to the Bronx: and Mr. Dewey rendered the service; but, no ground 120 feet high was found within 1¾ miles; "over a rugged line mostly of stratified *gneiss* rocks dipping to the west."

Col. Clinton says to you with confidence and decision:

"Since 1819, surveys have been made by the authority of the city, and by the New-York Water Company, and as many plans were presented, I consider it my duty to place them all before you, as I am anxious they should all come under the consideration of your committee, to secure the city from undertaking works which must eventually lead to disappointment, and to unnecessary expense in their execution."

He then turns to the CROTON as the preferable source of supply. This stream is described as affording, at its lowest condition, 20 millions of gallons in twenty-four hours.

If we inquire what size of stream would afford this quantity, it appears to me, that if it were flowing at one mile an hour, it would give 5280 cubic feet for every foot of its section; and a cubic foot being 7 gallons $\frac{4}{10}\frac{8}{5}$, would give 937,857, and 23 feet wide gives 20 millions. We should not, on viewing such a stream, think it adequate to this object at that distance. But the language of the report itself best describes the route and source:

"The elevation at Pine's bridge, by Mr. Cartwright's measurement, is 183 feet above tide. I would propose at this point *to sink the bottom of the works below the bed* of the stream, to avoid the risks of a dam, and more fully to command the whole volume of water, if necessary. Sluices with gates should be provided, and also other contrivances, to prevent any *impurities* from the stream passing into the works."

"From Pine's bridge, the route would follow the *elevated and broken* banks of the Croton, until it intersected the banks of the Hudson river. It would then continue on the rugged slope of the lands, in the vicinity of that stream, to Tarrytown, about eleven miles from the point of commencement. In this distance it would be necessary to cross the valley of Sleepy Hollow, and several considerable ravines and gulfs. The route would have to be conducted meanderingly around them; or may be crossed in a straight line by embankments, pipes, or aqueducts. From Tarrytown the ground may be considered favourable, although principally a steep side hill to the mouth of the Saw-mill river, a total distance of twenty miles. From the Saw-mill river the route could either follow the northern bank of the stream to Danger's mill, a distance of 1¼ miles, and continue on, or in the vicinity of the route surveyed to *Macomb's* dam by Mr. *White*, a distance of nine miles, the deep cutting 108 rods, and there

cross the Harlæm river; or it would cross near the mouth of Saw-mill river, and follow the bank of the Hudson to Harlæm river, and cross that stream a short distance above its mouth, and reach on the opposite side *very rocky, narrow, and elevated ground*, lying directly on the bank of the Hudson river. This ridge is broken, in a short distance, in its continuation south, by a *ravine*, or hollow, which crosses the road to Kingsbridge, near Crawford's tavern. The line would be forced to pass over it to reach the elevated lands in the vicinity of Fort Washington; and the first reservoir on the island would be constructed near Madam Jumel's. The other reservoirs ought to be placed on elevated ground in different parts of the island."

"I must say that these routes present great, but not insurmountable, impediments. In some places the works may be very expensive, and in others very cheap; and I have seen nothing in the character of the routes but what perseverance and skill can overcome. It will, however, be necessary that a minute and careful survey should be made, to determine fully the difficulties of construction. The expense of the work will also, in a great degree, depend on the plan of crossing the valleys, some of which are wide and deep," &c.

"The bottom of the work being sunk six feet below the bed of the river, it leaves 177 feet. And if the line from that point should descend uniformly one and a half feet in the mile, the Saw-mill river, at Danger's, would be crossed forty-two and a half feet above the stream. On the lower route, it would require, at the mouth of the Saw-mill river, a work 147 feet high. At Harlæm river, on either of the routes, an aqueduct 138 feet high, and 1000 feet long; and over the low ravine at Crawford's tavern, a work 115 feet in height."

"I have strong confidence in the practicability of delivering it at 138 feet above tide, and it would admit of the bottom of the reservoir being 120 feet, provided it was 18 feet in depth."

"If a medium level should have to be resorted to, on account of unforeseen difficulties in the execution of the work, the water would then have to be elevated by machinery on the island at Harlæm river. In such a contingency, you have the tide power of that stream—the waters of the Bronx, on Dr. Browne's plan—and steam engines. All these modes require careful investigation to determine which is the best. If, however, the water could be introduced on the island, so as to supply parts of the city, it might be raised by steam engines situated at the reservoir, to the more elevated sections."

"Various plans have been suggested to bring the water to this city.—On a full examination, I am clearly of the opinion, that it would be best to introduce it through an open canal; that mode being the most economical, the most secure, and permitting the greatest quantity of water to flow through it, in equal space of time, and the attainment of a greater head for our reservoirs."

"An open canal has been seriously objected to, on account of ice forming in winter on its surface. To avoid this, it must be made narrow, and *deep*, and *direct*; and the fall being 18 inches in the mile, will cause a rapid current on its surface. The sluices at the Croton must pass in a greater quantity than usual. Mechanical contrivances could also be resorted to, to break the ice, and keep it open. The floating ice, if any, could easily be removed for that purpose, by labourers."

"It is said that the water flowing in the canal, would become *adulterated*

by the washings of the surrounding lands; and also that bars and shallows would form in the work. This objection would be tenable if the works are badly built, or the plan of construction not well considered."

"In respect to the *permanency* of the plan, there can be no doubt; as on side hills the canal must be cut the full breadth of the water line in them; and on the embankments, stone walls, or thin iron plates, can be resorted to; as the former will have to be the whole extent of the works."

Page 240. "From the best opinion I can form, I am satisfied that the waters of the Croton river may be taken at Pine's bridge, and delivered on the island for a sum not exceeding $750,000 in an open canal, and with some stone linings, ditching, and walls; and including damages, and other contingencies, it may swell the cost to $850,000. The expense of distribution, and reservoirs, on the island, may amount to $1,650,000 more, which would make the whole cost of the work $2,500,000."

It may be perceived, from these descriptive quotations, that your engineer does not veil nor smooth the difficulties of the ground; and I feel persuaded, that in a cause that is a common one to us in regard to the end in view, he will excuse, and candidly weigh other objections.

To draw the water from the point chosen, at *six feet below* the level of the bottom of the river, will not be worth while, in my humble opinion, merely to save the risk of a dam. How, indeed, could the river be so approached unless by a very deep parallel canal; and an opening into it from below the *natural bed* of the stream, if not a rock, would be likely to fill up the aqueduct; but if there be rock bottom, a dam might be made without hazard any where. Perhaps higher up stream such a place may be found.

Without a considerable head of water kept up at the entrance, the aqueduct would not fill. If the head of water be small, and varying with the depth of the river, the quantity entering would vary, and sometimes be too little.

So important, on this account, would a dam probably be, that unless there was a safe place for one, this plan would not, in my judgment, be practicable. And as to numbers of dams and sluices, how can the reservoirs *here* be made without them?

It cannot be denied that it is possible, on the various branches of such a stream, to form reservoirs;—but, when we are informed that "the east branch, which discharged (at a certain date) above five millions of gallons in twenty-four hours, will, in a dry season, run through an opening of seven inches square," may we not, with reason, ask, whether the rest do not diminish in the same proportion? If so, very much the same uncertainty would attend these reservoirs, as those of the Bronx. The streams, and even the great rivers, of our country, become very low in the summer months. And, besides the heat of the sun and air, their beds, amidst rocks and sands, are very unsuitable conduits of water from reservoirs at their sources. Who can say what proportion of the water let out twenty miles above the aqueduct sluice, would reach it? See Report, paragraph III.

This aqueduct is proposed to be made *like a canal;* and it must be subject, of course, to all the incidental causes of waste. It was to avoid these, that Mr. White had recourse to a tunnel.

The difficulty of making a canal tight, is well expressed in the report made by Gen. Bernard and Col. Totten, (United States engineers,) when consulted on the then incipient project of the Morris county canal, in New-Jersey—

"*Filtration*, they say, through the banks and bottom of a canal, causes a loss of water, which is by no means easy to estimate; depending, as it does as to quantity, not only on the manner in which the masonry and earthen embankments are constructed, but on the nature of the soil, which can only be known by *actual excavation*. If the earth is of clay; if the embankments are well shaped, and well rammed, and of proper dimensions—if the masonry is executed with care, and on foundations well secured, then the loss of water will be the least possible."

The report does not, of course, at present, speak of *dimensions*, but proposes a slope of *one and a half feet in a mile*, in order to bring the waters of the Croton to the island of New-York *without the use of machinery to raise it.*

The *quantity of water*, and the cost of the work, will depend essentially on its dimensions. If as large as *Erie canal*, all the water running in the Croton in the dryest season of the year, would not supply its ordinary waste, according to the official gauging by Mr. Bates, at *Rochester*, for the information and guidance of the state of Ohio, on a similar occasion. He reported 100 cubic feet for a mile a minute, as requisite; and this, for thirty miles, is thirty-three and a half millions of gallons a day; but the Croton supplies only twenty millions of gallons in its bed at that season.

The practical results of *feeders*, come much nearer in experience to our purpose than canals do. Shall we take the effect of our own climate, or that of Europe, as our guide? There being no feeders in our country sufficiently long: we must take some that are so in France, in about the latitude of New-York; and even there, the temperature in summer is more moderate than here. Example is the best argument, because the *elements of this calculation* cannot be grasped by the engineer, they vary from time to time. The feeder at St. Privé, for the canal de Briaire, well constructed, surface width 12 feet, bottom width 9 feet, 3 feet deep, slope 5½ inches per mile, 11 miles long, delivered but *one fourth* the water it received. The mean velocity was 10 inches per second, or 3,000 feet per hour.

With such an aqueduct, the 20 millions of the Croton might be reduced to *five millions, at the distance of* 11 *miles; and this to* 1¼ *millions, at* 22 *miles; and this to* 312,000, *on reaching the reservoir nine miles from the city.*

To deliver the water from the *great reservoir of St. Feréol, into the canal of Louis XIV., distant* 12 *miles*, it has a slope of four feet seven inches a mile, as stated in Sganzin's lectures; and this descent is, in 30 *miles*, 137½ *feet.* Might not this loss of elevation *frustrate the purpose of attaining the elevated part of the island*, as proposed?

Practical minds will here naturally inquire, what slope is given by *millwrights* to their *raceways*. In Oliver Evans' book, edited lately by Dr. Jones, it is stated, (page 117,) that he allowed one inch fall to 100 feet, or four feet four inches $\frac{8}{100}$ a mile; and that this caused a current of $1\frac{1}{2}$ feet per second.

Now, suppose a perfectly *straight and smooth* raceway, flowing at this rate, and 5 feet broad, 4 feet deep, equal to the cross section of the *Croton at low water*, it would carry 20,839,840 gallons, *to the usual distance, or length of raceways; but how much of this would it deliver at the distance of* 30 *miles?* The tunnel was to have $1\frac{1}{2}$ feet slope.

If we were to take the rule of slope according to the experience of millwrights, then we again *lose so much elevation*, as to *defeat* the plan of gaining the summit of the island, and even of reaching Harlæm river, by the route surveyed by Mr. White, from Saw-mill river, to Macomb's dam. A serious dilemma hence occurs, that might have some influence, were it a mere question of money.

The fair conclusion is, that unless the work be in masonry, so as to defend and keep the water both from soakage, leakage, and evaporation, the canal must be of larger dimensions than here spoken of, and command a more ample supply of water at its entrance than the Croton contains in its summer state: and this brings us back to the subject of *reservoirs*.

There will be much less certainty of supplies from reservoirs in our climate, than in France. The clearing up of our forest, is changing our noble rivers to torrents in the spring, and rivulets in the summer.

Very few of our ponds can be enlarged without flooding *low grounds* extensively, and thus increasing loss by evaporation. The surrounding inhabitants would never consent to the unhealthiness produced by flooding and unflooding lands in their neighborhood. We recollect the controversy between the town of Northampton, and the Hadley Canal Company, and the case on the Housatonic, (Ruggles' mill-dam, in Milford.) There can be no compensation for such damages as affect *health*, and therefore all such raised dams increasing stagnant water are abated as nuisances. The report (paragraph 113) has given an unanswerable objection to converting *rivers* into a succession of reservoirs. "If it should unfortunately happen, that one of the dams should be swept off by ice, or by floods, the fragments and the water collected in the pond might sweep off the whole of the lower works. Accidents of a similar nature annually happen on most of all our mill streams."

These remarks, made in reference to the Bronx, equally apply to the Croton, and perhaps with the more force, as being a more extensive stream in its course, and where the reserved waters would have to run further in their hot and thirsty channels.

He describes the Croton (article 67, page 215,) thus: "its branches, and the main streams, flow over gravel and sand-beds, or

over broken masses of rock and compact sand-stone. The banks of the stream are also generally high and elevated."

We also learn, that numerous lakes and ponds lie *at the head* of most of the branches. It is on these the reservoirs are to be formed.

There can be no doubt that much water might, at considerable expense, be reserved; but no one can calculate what *proportion* would, in such channels, reach their object. *Wherever, in Europe, reservoirs are made to supply canals, suitable ducts are artificially formed to convey these waters to their destination.*

In conclusion, the obvious and principal difficulties in supplying this city from the Bronx or the Croton, consist in the distance, the deficiency of water, the intervening elevation of ground, its expensive character, consisting generally of rock, the waste of water that must attend its transmission in our climate, the moderate quantity to be relied on without recourse to *reservoirs*, and their dubious value at such distant positions, flowing a long way in shallow channels.

The report contemplates, notwithstanding these difficulties, the preliminary of a plan of supply commensurate with the probable numbers here, after the revolution of a few centuries, when New-York, like London, shall contain a million of inhabitants. But does not this liberality to posterity increase the difficulties of supplying from the Croton? If it were only, as at Philadelphia, a question of making room for a few more water-wheels under the same roof, giving architectural consistency to the edifice, it would do; but here it is a question of the *size of the aqueduct*, and of a heavy increase of expense. "Sufficient unto the day is the evil thereof." When there are more people there will be more industry and more wealth. I think, whatever the plan, it should be adapted to *present* century and the present *exigencies*.

It is understood that the Common Council, on receiving the report of their engineer thus decidedly against the long cherished hopes of supply from the Bronx, and in favor of turning towards the Croton, under such prospective difficulties, determined to apply to the Legislature for the appointment of a board of commissioners.—The advantage of this board may be, that those who compose it, will be vested with authority to cross lands and make surveys. But is it likely that they can discover any new source, or smooth away those obstacles which nothing but the power of much money can render less formidable? It is not at all likely that they can materially improve the *present aspect* of this subject, yet in that expectation it may be necessary for the city councils in courtesy, officially, to wait, *but will it be prudent in their fellow citizens to lose yet another and another summer?*

Let us then turn to a close examination of the alternative offered, and interrogate experience and philosophy. The facts are few, and within the reach of every mind. They are almost comprehended in a glance at the little maps prefixed.

Every body knows that the constituents of the oldest rocks were once fluid, and by the fiat of the Creator became crystallized and deposited in strata, until the time when the hills were uphove, forming their sloping sides of granite, gneiss, and other primeval stratified rocks: and such are the Alps, and such is every great range of mountains, whose intervening valleys, vast as some of them are, like that of the Mississippi, have, in the revolutions of time and the grand operations of nature, become covered with successive strata of the rocks of secondary formation—the diluvial aggregates which succeeded the flood, and the alluvion of more recent arrangement.

Among these great upheavings of the hills, those of Berkshire, in Massachusetts, extending also through Vermont, appear to be parallel to the Alleghanies, and though generally covered by the secondary, there is *a line in which the range of primitive rock is to be traced*, declining south from that elevation till it comes to constitute the island of New-York; and here, as if obedient to the claims of commerce, it stoops beneath the city and the Hudson, and continuing its course, is found to occur at the head of tide, and to await beneath our three central cities to yield its stores of crystal waters to them.

In this whole range it dips north westward, and is invariably found to be formed in strata. In its course it often gives out copious springs, and in one place, on the very top of a hill on the borders of Connecticut, in a line between New-York and Pittsfield, between two masses of this stratified rock, is a large clear pond, affording water enough, when bored into, for a mill.

Wherever this rock is excavated the sides of each stratum are found smooth, as if water-worn; and they are so; for running water is always found between them. Perhaps there can be *purer water* than that which falls from the clouds: probably the evaporation from the sea may bear, at times, particles of matter, which may have been partially dissolved; but when it has fallen on the mountains, and filtrated through the upper strata of earth and rock of the less dense kinds, into the deep cool caverns of the oldest rock, deeper than the mineral and calcareous formations, it must flow towards the parent ocean, in perfect purity, in these passages. Such is the process continually going on. But, according to the discoveries of geologists, this range of primitive, which thus comes down from the Alleghanies, and comes to us also from the Berkshire mountains, charged with this pure water, exists, though hidden, and is testimony independent of this subject. Whenever perforated deeper than sixty feet it has yielded a liberal flow; and, in many instances, even fine water is found on approaching its under-ground surface. There are a number of earth borings in this city, as well as those which penetrate rock; but the latter yield a larger quantity.

It will be perceived why importance is attached to the fact of the existence of this range of the primitive *gneiss*, (differing but a little from granite,) and to the fact of this island being a part of it.

Those who attach the same value to this fact that I do, may ask

what are the appearances of it, which manifest its range and dip. In traversing this island from south to north, it will be seen in massive ledges, above ground, extending from S. W. to N. E. nearly; and if an excavation is made among them they develope strata with inclination westward. This is seen on the rail-road grading. But it is most evident in the *city reservoir well*. I have the written testimony of the contractors, who made it. Mr. *John Tregaskis* states, that he had been employed by the City Corporation to make this well, and excavated it down through successive strata of gneiss, sloping west, so as to gain 10 feet in 16, its diameter; and that the water flows in from between the strata. Another statement, in writing, in my hands, is from Mr. *William Blewitt*, a miner from Cornwall, who was employed by the Corporation to excavate the horizontal shafts of it, mentioned in the report. He says, in this paper, that the well is sunk through *strata* of primitive rock, one and a half to three feet thick, all dipping *regularly to the west*, about 31°, distinctly separated by partings, more or less filled with fragments of the rock; some so little apart as scarcely to admit the blade of a knife, others so open as to admit "a man's fingers;" that the strata have smooth surfaces; that the spaces afforded water after getting down 50 or 60 feet; that those of the western shaft especially afforded it; and on both sides, when crossing or opening the north and south veins; and that the spaces were most open between the deepest strata. And Mr. Blewitt also states, that he had seen the excavation on the Harlæm rail-road, and they also dip west.

But it may be thought unnecessary to insist on proving what is so obvious. It would be so were it not denied in the report accepted, as matter of fact by the Councils, who must have known all the facts in relation to the great well, but did not attach that importance to the subject which it perhaps merits. The geology of this part of our country is the foundation of the theory of these artificial springs. In the REPORT, however, there is some contradiction, through haste.

At page 203, article 38, in describing the island, it is said: "It is commonly sand and gravel intermixed with pebbles and loose rock, resting on a *stratified* mass of gneiss."

Again, in another place, Col. Clinton says:—

"It has been asserted by some, that the rock on which this island rests is in uniform strata dipping almost perpendicularly; and by others, that it dips in all cases towards the west, and becomes gradually inclined, and assumes a horizontal position. Both of these theories are, in truth, but the common deductions of speculative geology, and apply only to the interior structure of our globe, when considered as a whole. They cannot, therefore, be properly applied to the internal arrangement of the rock in this island; as it is evident, from an examination, that the rock on the surface has no uniformity in the angle of their dips; and, in fact, the strata preserve no harmony in their arrangement, as some are more inclined than others, and, in different parts of the island some incline to the south, and others to the west and the east."

☞ I had always understood that geology was not speculative, but a mere science of facts, relating to the position and nature of the various substances of which the earth is composed, as well in its parts as a whole. And although it is not to be denied, as a matter of fact, that, as said in the above passage, there are "*rocks on the surface*," that have no uniformity in their dip, or position; for there are also rocks of *secondary formation* on this island; yet it is not conceded that the *strata of primitive rock preserve no harmony in their arrangement beneath the surface.* On the contrary, they are systematic. He speaks of rocks. We speak of a specific kind of rock. It is true a cursory observer of its masses on the surface, would scarcely discern them to be stratified.

So, also, from not discriminating between the primitive and secondary, Col. Clinton rather hastily assumes in respect to the great well, that the chances of its finding and affording water were precisely as much greater as the area of its section, 16 feet diameter, is greater than that of a boring of 7 inches.

The best answer to assertion, is an appeal to facts:—especially so when the reader is interested to know them. Those most in point are the borings on this island. There are several, but the utmost useful effect can be known, only by the use of steam power. The boring of Mr. Underwood seems inexhaustible by human labor. That belonging to Mr. Richards, at Greenwich, is but two and a half inches diameter, and 137 feet in the rock, cost $1,000, using about the power of *one* horse to raise 22,000 gallons a day; and capable of much more. And this quantity is *more than double* the product of the great well, which cost 9,000 dollars.

It is not my intention to say any thing against this very useful work, which is said to have saved the city much more than its cost. To state some facts concerning it, however, has been made necessary, and we think rather interesting to a community to whom information is always acceptable. It is necessary for us also to compare it with the *deep boring* on the estate at the corner of Broadway and Bleecker-street, since they are blended in the report.

The excavation being about 100 feet deep, 16 feet diameter, with two horizontal offsets of 75 feet—must have measured 23,000 cubic feet of rock. This is equal to a boring eleven miles deep, eight inches diameter. The cubic measure of 400 feet, eight inches diameter, is equal to 138 feet, or about $\frac{1}{170}$th as much—the comparative cost we will presently note. The product of the great well is 220 gallons a minute, or 13,700 gallons an hour, three hours, twice a week:—averaging 10,428 gallons a day; enough for 260 families.

The Bleecker-street boring, by actual measurement, gave 129,600 gallons a day—during a long period of *trial* last summer, and with an imperfect pump, using only a six-horse engine; and is, no doubt, capable of producing more:—enough for 3200 families.

But Col. Clinton compares the cubic contents of the *great well*, when it has stood long enough to fill, with the cubic contents of the

boring. The former 175,000 gallons, the other 1154 gallons; doubtless correct, but with one most *material difference* not regarded, that the large quantity is *quiescent*—the small one in *rapid motion*. The comparison ought rather to have been made between the great *well*, and the *reservoirs* of the rock.

He does, indeed, admit, as a fact,

That "perforations, if sufficiently deep, will produce water, and by tubing out the bad springs and veins, it may be of excellent quality, soft, cool, and palatable."

Is not this to admit the useful effect of borings? is not this always done by Mr. Disbrow? and are not these the qualities of this water? But there is an exception made, he says, further,

"But it does not follow, as a necessary consequence, that the *rush* of water into the well will be equal to the depth."

In discussing professional matters, it is necessary to perspicuity, sometimes, to be prolix, and to leave the reader in no doubt of what is intended; this aim will excuse, I hope, these minutiæ. They are premises to perhaps valuable conclusions. It is not pretended, nor ever has been, by these patentees, that the "rush of water," would be in proportion to the depth of the *well*, (or boring,) but in proportion to the depth of the column of water that *had stood* in the boring, before it was abstracted suddenly by the pump, which, if it pump from the bottom, would cause a *vacancy*, into which the veins of water opened, would unquestionably *discharge with a velocity equal to that due in calculation to the head;* and this explains how it happens that such large quantities are obtained from these small deep borings. It is from the inexhaustible nature of the source, and from the draft on it, by producing hydrostatic pressure, and a rapid movement towards the vacancy, and of course incessantly, that such great effects are produced.

Hence it is that Col. Clinton is by no means right, in supposing the quantity of water will be in proportion to the size of the *well*. For that of the city has opened no more veins than a boring would have opened, in the same place, to the same depth, including its horizontal excavations. If a perforation is made through *sloping strata*, every space must be passed as well as every stratum. And the abstraction must be according to the pump and power, whatever the diameter.

The next point in this elucidation is the comparative cost and economy. As informed from another source, the engine cost $2,600; the boiler, $700; the tank, $4,200: the building for the tank, $5,041; the foundation of tank, $4,415; the foundation of walls and fences, $1,377; pumps and pipes, $1,950; excavation of well, $9,000; and 11 lots, $12,250.

But this well and its appendages have a distinct and peculiar ob-

ject, exceedingly worthy of this expense; but to blend it with the expense of a boring gives no true result.

As on the one side it would not be conclusive, to assume that every great well, and its appendages, would like this cost $42,233; so also it would be to do little justice to the borings, to suppose every one would cost our proposed company, as much as that of Bleecker-street has cost the Manhattan Company. I presume the establishment of a boring, receiver, engine, lot of land, and building, would cost 10,000 dollars; and the quantity which this would raise, even allowing *the same expense*, per annum, ($3,165,) would yield *twelve times* more than the *city well* now yields.

These few and plain facts will suffice. It is of no use to follow the author of the report into future ages, through which his *calculations* extend. If there should ever be a time when the 49 wards of this great metropolis of the western continent, on paper, shall be all densely peopled, it is probable they will have wealth in proportion; and to such numbers it must be considered a fortunate circumstance, that the rock, beneath the 49 wards, will give them inexhaustible supplies of pure water, when, if they relied on the streams, they might be soon drank up!

But before quitting the point of practical utility, I may appeal to the recollection of the Common Council, to do the inventor of water borings the justice to admit, that, in various instances, his art has given excellent water in this city, where there was none before. That part of the 11th ward where the Dry Dock is situated, being originally a marsh, could not obtain good wells. One boring was made for that company, still in use, another was unfinished when the fire happened there: another was made for Mr. Ficket, and is among those the utility of which is realized greatly. The iron tube settled down 100 feet to the rock gives, in these places, as much water as a man can constantly pump. Another instance is at Mr. Dodge's, in Pitt-street; and we may appeal directly to members of the Common Council for the Corporation's own experience at City Hall, the Washington market, Grand-street, and others: and, we believe, the occupants of the new houses in the elegant street west of the College, will acknowledge that one boring affords excellent water enough for them all.

This example of the ease with which the opulent may be supplied, shows how much service may be rendered, in this partial mode of operation, should the Hon. the Councils of the city reject the prayer of our petition for leave to lay down pipes:—but what reasons for such refusal exist, it is not easy to conceive. If it be, as is commonly believed, an object of great solicitude to give the inhabitants in general a supply of pure and wholesome water, leave can be refused only on the ground of disbelief in quantity or quality. Let it then be allowed conditionally that there be quantity, for we shall, as a company, never lay down the pipes till this point is ascertained by the success of the boring, and let citizens judge for themselves of quality. To

refuse it thus, conditionally, would be but the expression of a prejudice impossible to continue, after the present statement of facts.

It is very uncertain, whether in conveying to a rock-water company all our right of operation by private contracts, we shall make so much as by them. But would this be that extensive service which every patentee should seek to render? Would this be to spread the blessing of pure water through this city distressed for want of it? Would this be to second, by mechanical force, that moral force which is operating such improvement in the habits and health of all the people, rich and poor? I deem it our bounden duty to use this art in our hands as a kind of trust, and yet we ought to derive from it a recompense worthy of our labors. At least, such is the plan and principle of this business, as will be presently more definitely explained. Our design of forming ward companies was relinquished, on the ground that they would be less economical and profitable on the whole, than one general company, in which capitalists in all parts of the town may hold the stock.

But, before we can ask the confidence of the community in the calculations, it is necessary to show the rational probability of profit, should a charter be obtained suitable to the occasion.

And first what is the ground of our *exclusive right* to this mode of operation?

The object of every invention must previously exist: the foundation of a useful discovery must precede it: the purpose to be effected must be first conceived: the means follow. But, page 204, it is said,

"That such perforations, as contemplated by Mr. Disbrow, will intersect veins and springs of water, which have their origin in higher land, is no novelty. It is true that this fact was accidentally discovered by a common drainer in England many years ago, who applied it to the drainage of lands."

The *intention* of this passage seems to be, to depreciate, in your estimation, the inventions of Mr. Disbrow. That boring for water is no absolute "novelty," will not be denied. He does not claim it to be so. This is not in his specification. Why then, by implication, accuse this useful mechanic of a pretension he has not made?

But if such perforations as those contemplated by Mr. Disbrow, have been successful in *some* places, why may they not be here? If some quantities of good water, *from high grounds*, have been obtained, why not more? Why assume that great quantities cannot? Might not the *uncommonly* fortunate *drainer*, alluded to, have possibly supplied a city? Is it philosophical to *limit* the effects of causes, the extent of which we know to be great, but not how great?

The inventions required on this occasion were novel and peculiar. Is was not a question of boring *in clay*, as in England; nor of draining the source dry—this Mr. Disbrow does not hope to do; but, of perforating the hardest primitive rock to great depths, with perfect accuracy; providing instruments adapted to the remedy of all accidents;

availing of steam power; and when the surface of the rock is deep buried in loose, foul sands, to bring up the crystal waters, defended and pure. This, surely, is no common draining; nor very common achievement in the mechanic arts. It is an improvement that must place this inventor among the most useful.

Things of this kind, however, must be always appreciated by their beneficial effects. Let us suppose that nothing had been known of these hidden waters, and that the angel of Death had, *last July*, revealed them to this distressed and scattered community, as among the means of healing and defence, and no means were known of reaching them, *would* you not have promised wealth to him who should open them, up to the glad acceptance of the people?

Perhaps, after a few more such desolating, dispersing summers shall have passed over us, they may be more appreciated as a providential resource, *better* than the far-fetched, and dear bought waters of the Croton:—it is ours to offer; it is yours to decide.

As some proof of the merit of these inventions, it may be asked, what man, or in what instance any other besides Mr. Disbrow, and those who have wrought under him, have ever succeeded in making these deep rock and sand perforations? He and his people have done all the successful work in this branch, since the year 1825; and experience has much improved his machinery since he began.—Witnesses might be called from the extreme borders, and the centre of the state; from the salt hills of Virginia, the deep alluvion of Boston, the well in the United States arsenal at Harper's ferry, and even the mineral springs of Saratoga and Albany, to bear testimony to the invariable success of this operation.

His earliest patent for certain machinery, bears date, the 24th March, 1825; *the second, the 1st November,* 1830, *for sundry additional implements, brought to desired perfection; and our joint patent, on the 28th August,* 1832, *relating to greatest product.*

In older countries, letters patent, for our own, or the purchased *inventions* of others, were well known to be an effectual encouragement of ingenuity in the improvement of the useful arts; and the difficulty while colonists of obtaining it, was among the thousand disadvantages that we were subjected to; and it was deemed of importance enough to be provided for in the constitution itself. It was made obligatory on congress to pass a law for the encouragement of the arts and sciences by patent. It must have been foreseen, that as a free people are ever the best generally educated, the mind unfettered by oppression and fear, would expand with all its native energy, and be much encouraged to act on useful objects, if to be recompensed assuredly by distinction and profit; but it was to have been expected that many would fail of success, while some would be justified by the event.

Indeed, we have, in America, been rather distinguished for success. Mechanic genius has caused wealth to spread over the whole southern

half of the union; and many would have claims to public acknowledgment, were not private interest consulted in national prosperity.

The laws for the protection of patentees in their temporary privileges were found ineffectual whenever their inventions proved very useful, and therefore profitable—trespassers interpreting the statute to mean that a verdict of *three*-fold damages was the price of the right. In 1819 Congress therefore gave more effectual encouragement by extending the jurisdiction of the circuit court to all cases arising under the laws concerning patents, with power to grant *injunctions* to stay infringements:—thus the intention of the constitution is fulfilled.

Having thus established the premises that the two streams heretofore relied on are not capable of supplying this city in the summer months, so certainly as the nature of the demand requires; and that hitherto there has been success in drawing large quantities from the rock; that its position and kind are favorable; that we have a special privilege or property in the only means adapted to this end—we come now to the practical conclusions:

It seems almost unnecessary to repeat to the intelligent reader, that we see no propriety in blending, in an estimate, two things so different as a *well*, and a boring, as is done in the report, page 207. It is not proposed to make *costly wells*, were it practicable, in the deep sands of the city. It is to avoid not only making such, but making any, that the iron tube with its *flat socket joint* has been devised. Let then the two things stand distinct, and perhaps the estimate for each boring will be nearly thus:—

Lot, ...	$2,000
Boring, pump, and engine, . .	5,000
Buildings and cistern, . . .	3,000
	$10,000

Which sum will probably suffice to raise 130,000 gallons in 24 hours if constantly in operation, which, at 40 gallons each, is sufficient for 3,000 families. Or, if this be deemed too high, take the mean of the two that are pumped with steam engines, half of 26,000 and 130,000 is 78,000 gallons in 24 hours, amounting in 213 days to 24,424,000 gallons a year. The average of eight gallons a person, is double what is *used* at Hudson.

The utmost annual expense will be, 2 men, . .	$730
Fuel, 187 tons of anthracite at $8, . .	1,496
Oil and repairs, 10 per cent., . . .	222
Deterioration of machinery, 10 per cent., .	222
	$2,670

40 gallons a day is 14,600 a year, hence the above quantity would supply 1,600 families, and if New-York should soon contain 250,000 inhabitants, it s 50,000 families, and at this liberal allowance the

whole would require 31 borings, and a capital of 310,000 dollars; which sum is, at least, an approximation, and, in this, as in all other branches of business that have not fixed and settled data, we must proceed on rational probability.

Presently still more favorable views of economy will be taken; but we must first advert to the expense of distribution. For the cost of distribution we have the experience of Philadelphia as a sure guide; and if the two cities were equally extensive we might here as there call the length of pipe 44 miles—3, 4, 6, 8, 10 inches diameter; the average cost of which is 158 cents a foot;—(though Mr. Wenman's average cost here, you will recollect, was 114 cents a foot.)—The above length with labor, &c. cost 335,470 dollars; together 615,470 dollars. But Col. Clinton by blending the city well, estimates 9 wards *at 5 millions* of dollars. We shall be excused then for considering the requisite capital to be $1,000,000. I believe the stockholders will be safe under this supposition. The expense of management cost in Philadelphia $8,294—which deducted from the gross receipts left $56,000 net revenue.

The Philadelphia water-works, from March 1799, up to December 1831, have cost—			$2,063,150 00
Previously to 1812, the city had been watered by steam pumps at the Schuylkill; the cost of which, and for twenty years expense of distribution included, had been $46,200 per annum, . .			924,827 10
Which deducted, leaves value of the present water-works, ...			$1,138,323 00
The analysis of which is—			
For purchase of ground, .		$116,834 00	
For water power, and rights bought out, ...		201,958 00	
For dam, and other water works, wheels, and pumps, . .		268,938 00	
For reservoir, No. 1, of 3,917,659 gallons, .	$29,136		
For reservoir, No. 2, of 3,296,434 gallons, .	10,203		
For reservoir, No. 3, of 2,707,295 gallons, .	24,522		
For reservoir, No. 4, of 10,000,000 gls. in part,	20,069		
		83,930	
For iron main, No. 1, 22 inch pipe, 2 miles,	72,947		
Do. do. No. 2, 20 do.	56,670		
		131,617	

Being 19,722 f. at 6,63 per f. 22 in.		
5,78 per f. 20 in.		
For distribution pipe in the city, (44 miles,) diameter from 3, 4, 6, 8, to 10 inches, 212,243 feet, average, $1,58 per foot, . . .	335,470	
		$1,138,323 00

The whole revenue in 1831, was 66,766 dollars, and progressively increasing.

That the reader may be the better able to judge whether more or less revenue would be likely to accrue from the reception of good water in New-York, that revenue is stated to have arisen from only 8,388 houses, about one third of the city; many not receiving it within doors,—but *fetching* it from the public hydrants.

Families pay various prices, ...	$5 to $25	
21 sugar houses, at	25	
1231 baths, besides the public bath-house, at .	3	
120 dyers, ...	10	
12 soap boilers, ...	25	
59 curriers, ...	35	
79 taverns, paying	30	
morocco factories, ...	35	
steam engines, ...	27	50
stables, ...	30	
baths, ...	40	
marble yards, ...	11	
hospitals, ...	50	
manufactories, ...	75	
bath-house, ...	400	
alms-house, ...	100	
deaf and dumb institution, . . .	60	

The rents come also from—

51 distilleries,
8 breweries,
101 hatteries,

Having thus taken the *least favorable* view, exhibiting an annual expense of $2,670; to which add the proportion of the interest of the capital employed in distribution; that is, $335,000, divided by 31 stations, giving $10,807, which at 7 per cent. is $756, adding the same proportion of the expense of attendance, (according to Philadelphia experience,) $8,700, divided also by 31 stations, is $280, making $3,706, the annual expense of supplying the average number of 1,600 families.

Another view of economy is, that an establishment, like that at Greenwich, which, with one horse power, pumps enough for 600 families, should, instead of one, employ two, and raise twice as much water. The expense of one horse power, is 10 pounds of coal an hour; and therefore a ton would last 22 days, and require 16

tons a year, which at $6, is $96, *plus.* interest of capital applied to the distribution and attendance, in the above proportion.

But there are inconveniences and uncertainties which attend this *blending of purposes*, making them mutually dependent, unless the aqueduct be the principal one. A city relying on its supply of water by *any artificial means* should render them independent of *accidents.* The liability to interruption is the great objection to a long *aqueduct* from one source in any form. If built like a canal, it is subject to the same liabilities. Rome did not rely on one alone, but unsparing of cost, the utmost solidity was given to their construction: and should we not keep in mind that our climate is not as mild as that of Italy? frost here besides being deeper relaxes, and resumes its hold repeatedly in the course of a winter. The chances of interruption *are lessened* in proportion as we increase the number of sources of supply:—then by uniting the pipes of all the borings and reservoirs of the company in the city, so that any one engine and *fount* may be *isolated* for repairs, yet all partake in all, continuity of supply is provided for.

Other views of economy may also be taken. Let us suppose the *surplus power* of each engine applied to some mechanic work; surely we should find numbers glad to attend the engine for this advantage. We should thus save the *item* of attendance; and, perhaps, some part of the fuel.

Again, sometimes a hotel, a brewery, or a sugar refinery, may employ a steam engine (as in the instance at Greenwich) that will raise a *surplus*, and our company may *reserve a right* to this quantity for distribution. This opportunity is not however likely to occur at *hotels*, unless at new ones: they will prefer to be our best customers. Those most frequented in New-York pay (it is stated) for *rock water* brought in casks about 400 dollars a year. One boring near the park might supply all the principal hotels, and all have pure baths.

Economy of capital may be also promoted by availing of every natural advantage. There are indications of favorable places for water; and there are so many instances in this city, where sinking the tube 100 feet *down to the rock*, has met with the outpouring of pure water from its fissures, (as in the Lumber-street well,) that in some such places it may *not* be advisable to bore into it at once, until the quantity yielded by the fissure met with is tried; because thus far it is the *preliminary operation* to the process of rock boring, and if the demand is no greater than to pay the interest of its cost, thus far, it may not be best to proceed, till the demand requires it, provided the water analyzes pure and is soft.

There is some experience in what we now speak of by the Corporation itself. At the corner of Grand and Thompson streets, Mr. Disbrow settled a tube for them, which yielded at first, when strongly pumped, good but somewhat *turbid* water; yet the effect of a *strong*

draft was to draw away the lighter particles of earth and leave the water clear. The lower strata are coarse pebbles.

In one instance, the experiment has been made, for one deep tube to answer for a range of first-rate houses, drawing the water by *suction pumps*. Mr. Disbrow's part was successful; but the pipes (made by some other person) may not have been perfect enough to exclude *air*. If any work be founded in natural philosophy, the execution must conform to its laws. This one boring gives abundance of fine water for the whole block,—and it is the more to be regretted that the mode of distribution had not been from a reservoir whence it would have flowed to each house spontaneously.

The objection made against earth borings is, that as the city becomes more and more dense, even the depth of 100 feet of sand between the drains and the bottom of the tube would be no adequate protection. This is contrary to experience; but if found to be true, the boring would have only to take the *second step* in the process, that of continuing into the rock and connecting the tube tight with the rock surface, (for which there is a proper implement,) and proceed to perforate the strata as usual:—the mere boring not being a very costly part of the work. It is however to be remarked, that the deeper the perforations, the more water has been produced, and the more also it is (on our theory) capable of affording:—once opened, it is perennial—a *living spring*.

How far the *Manhattan Company* pre-occupy the ground, is a question proper to be examined, but with delicacy. Corporations are creatures of the law, and if any doubt arise on the true meaning of an act, the Supreme Court has just said the *intention* of the Legislature, at the time, must be the only true guide. In document 69, page 342, they say

"Such construction ought to be put upon a statute as will best answer the intention which the makers had in view; and this intention is sometimes to be collected from the cause or necessity of making the statute, and sometimes from other circumstances," &c.

It may be remarked, that could any doubt have arisen of the intention of the Legislature, it would be dispelled by the provisions of the law which give power to take and conduct in the water of streams.

The 5th section of their act is in these words:

"*Be it further enacted*, That it shall be lawful for the said company to enter into and upon, and freely make use of any land which they shall deem necessary, for the purpose of *conducting* a plentiful supply of pure and wholesome water *to* the said city; and to erect any dam or other works across or upon any stream or streams of water, river or rivers, or any other place or places where they shall judge proper, for the purpose of raising such *stream* or *streams*, or turning the course thereof, or making use of such *streams*, *rivers*, or places for constructing or working any necessary engines; and to construct, dig, or cause to be opened, any canals or branches whatsoever, *for*

the conducting of such stream or streams, or any other quantity of water, from any source or sources that they may see fit; and to raise and construct such dikes, mounds, or reservoirs, as they may judge proper, for securing and conveying such supply of water as *aforesaid* to the said city; and to survey and lay out all such lands and *streams.*"

The court also say, "The predominant intention of the Legislature, in incorporating the Manhattan Company, was, undoubtedly, to procure for the city of New-York a supply of pure and wholesome water. The act is accordingly entitled, an act for supplying the city of New-York with pure and wholesome water; and eight out of the ten sections of which it is composed, contain provisions directed exclusively to the accommodation of that object. The object being, as the Legislature supposed, secured, they then proceed, in the 8th section, to give the company authority to dispose of what might remain of their capital, or be subsequently added to it, by the profits of their main business. They may employ such surplus capital as may belong, or accrue to them, in the purchase of public or other stock, or in any other moneyed transactions or operations, not inconsistent with the constitution and laws of this state, or of the United States. No argument against the banking powers of this company can, therefore, be drawn from the fact that the creation of a bank was not the main purpose of the act of incorporation."

It is plain that the act being passed on the exigency of the occasion, and immediately subsequent to the reports referred to, on the source of supply, admits of no doubt of the *intention* of the parties applying for a law, among whom, if I am correctly informed, *was the city* corporation itself.

The *intention of the act being thus manifest,* and the extended time allowed for bringing in the streams having expired in 1818, the Legislature, in March, 1821, and December, 1827, recognised the existence of the Manhattan Company *as a bank.*

But it does not appear that the court admitted the plea, that this recognition operated as a *waver* of the proviso, (page 339.) "The failure of the defendants, admitting them to have failed to perform the conditions of the proviso, did not *ipso facto* produce a dissolution of the corporation, or an absolute and instantaneous destruction of its corporate existence. The act declares, that in default of fulfilling the condition, the said corporation shall be dissolved, *that is, in the regular manner, upon the institution and prosecution of the established course of proceedings in such cases.*"

Although corporate companies are judged strictly and severely in law, and if transcending their powers are deemed to have forfeited their charters, because the managers are not personally responsible, and the public has no other check to the misuse thereof, yet there may be unexpected obstacles, hindrances, and delays, that may not have been other than the effects of caution, or the dictates of prudence

in those who are *ex officio* trustees. A corporation may be more justifiable for *not* doing what was intended and authorized, than for doing what was not intended.

Because authorized to bring on the streams it was not absolutely obligatory to do it; for it might have been found impracticable with their capital, without much sacrifice of property intrusted by investment in the institution *as a bank*. The Bronx lay beyond a navigable river that bounds this rocky and elevated island, and when measured, with due allowances for the waste of summer, was perceived to be of doubtful sufficiency;—perhaps there were even investigations made that have never been published; and it may have been understood, as well then as now, that the waters *beyond* were not at legal command. There was therefore a reasonable hesitation to begin a great work as difficult as uncertain; indeed the more recent surveys have proved the prudence of that delay;—and public sentiment has confirmed this impression.

To have raised the best water at command in one part of the city to deliver it into others *less favored*, has not been refused to be considered a service entitling this company to its *bank privilege*, because capital has been employed in a good, if not a great work. And the subsequent acts of the Legislature show that its inability without much sacrifice to overcome the obstacles that changed its main object, had not depressed the company in the confidence of the state.

But mean time, it is true the city has greatly increased, and needs and demands a liberal supply of pure and wholesome water from some source; and the community has naturally looked to the Manhattan Company for it, not discriminating between an exclusive privilege and a pre-emptive right.

The Common Council has, however, made this distinction *practically* as well as the company. The latter did not warn the former to desist from surveys that would be useless except to lighten their own path. The city has long considered herself as unimpeded in the preparatory steps for a great aqueduct except by the want of funds and the support of public opinion;—and has just asked the appointment of commissioners to make further surveys which could be of no avail unless the city felt unimpeded by the rights of the Manhattan Company. Wherefore we may conclude that by the force of circumstances the parties *reoccupy original ground*. The company cannot forbid the city without raising the question of its whole right;—nor, can the city object that the Manhattan is not a water company, because they might rejoin that the objection comes too late, and with an ill grace from those whose official representative at their board, had never been instructed to request any other works to be undertaken.

I therefore consider the company, in courtesy, if not in law, still in possession of their privilege, *though it be not an exclusive one*, to supply water to the city,—and it seems they practically entertain the same views.

The discovery of the hidden waters of the primitive rock by means of the boring instruments, has, it seems in a manner superseded the *original design* of drawing a supply from the streams. The intention of all such investments is revenue; and even beyond the usual interest of money; but, if the expenditure were so large that the bank dividends would be materially lessened, the stock would depreciate, and those who bought in, *as to a bank*, would be injured; and so I conceive on the other hand, if the present aqueduct were made very much more productive, the whole stock would rise in value.

They have made *one experimental boring*, which, according to trials and calculation, will afford 130,000 *gallons a day*, and this, at 40 gallons each, is enough for 3,000 families. And several hundred thousand dollars had been, it is said, previously expended on the water-works; and we do not know that they may not already yield a commensurate revenue, though probably not. However that may be, they, of course, possess no license to make more perforations of this kind, nor do we know that they will ever wish to do it. Still, judging of this matter as one of business or interest, it is probable that those who have made investments in the Manhattan Bank, cannot be indifferent to the condition of so large a part of their capital as that of the water-works; and if not as good as the rest of the investment, they may well wish it should be,—and if as good, they may not wish it better.

Therefore in proposing another company, may it not be due, in courtesy, to make a reservation in favor (as it seems to us) of the present company, since their confidence in the method has been expressed by making one boring, and with such remarkable success?

If then there is neither expediency nor necessity of bringing in those streams at present, (for it would surely be imprudent to do it with a view to *revenue*, with the present prospect of a better and cheaper supply by artificial means,) the company may think it best to avail of the present opportunity of making their aqueduct more valuable.

It is commonly understood that a very large amount has been invested in their aqueduct pipes and other water-works, and it may be presumed from so much as the company and the city have respectively done, none doubt if those pipes were filled with a full current of rock water, all who dwell on the streets where they are laid would be glad to receive it.

All who hold stock in the Manhattan Company have placed their money there for revenue. They must wish of course that the large sum invested in the water-works should not depreciate nor be lost; nor are they likely to wish to expend additionally, more than will make that part of the investment as good property as the rest. The local competition of another company possessing the means of giving a full supply of crystal waters, would probably have the effect of lessening the value of that investment. This I propose to avoid.

There is room and occasion for *two* companies. The Manhattan

cannot be expected to withdraw their capital from banking operations to make a more extensive aqueduct. Their capital is not sufficient for both purposes, unless the Legislature would now enlarge it on the *same liberal terms*, as when a more heavy undertaking was in prospect. Certainly then it may be supposed that a reservation and offer to make that investment as valuable as this of the second Company will be acceptable:—at all events when made, we shall have done as we would wish to have been done by, in a similar position.

The Manhattan pipes occupy certain streets in the centre of the town; but all the houses on them do not take the water, though it is likely *all would* if it were the rock water they brought.

Let this extent of the city then be their local division, and the rest, that of the Rock-water Company, and all at the same rates,—the latter having, however, the right to cross them to reach other quarters: for the people in those streets will not perhaps be content to be left out. It should be made certain that they will be supplied by the one or the other Company, as the value of rent depends very much on good water: and the one boring made by them may not be enough for their purpose. Such seems to be the occasion and opportunity of the following proposition.

The proposition is, that the aqueduct of the Manhattan Company be perfected, and fully supplied with rock water. *Let* the imperishable part, with the machinery and land, be appraised, and the amount, together with whatever further sum may be found necessary to raise and deliver the water to every house, past which the iron pipes are laid, be considered *the water-works capital.* Let this branch of the concern be put into our hands on the following terms, viz. The mechanic work to be done by Mr. Disbrow, at the customary prices, employing, (in preference,) for the castings, the same persons heretofore employed; and for my services, as engineer, half chief engineer's pay, as it will take about half time, meaning half as much as the chief engineer of the Harlæm rail-road receives, per annum, until the works shall be completed; and then, as compensation to us, as the patentees, the surplus revenue beyond seven per cent. per annum, for and during the term of the latest of our patents, viz. 14 years from 28th August, 1832.

The effect of this arrangement would be to save the amount invested; because, unless such an aqueduct be *fully* supplied with good water, it is as if it were *not at all* supplied; because, also, if it lay dormant thus long, the interest of the investment for this time is about equal thereto. If this arrangement takes place, at the expiration of that term, the Company will be in possession of a permanently productive property, that will give at least as much revenue as bank stock, and may be sold for, perhaps, quite as much as the water works have cost from the beginning; or, if not sold, the Company may have thus regained its whole investment safe and sound.

2dly. But there is another view of the interest of that Company, which might, and may be taken by some in regard to the prospective value of their perpetual privilege of supplying water to this city; for, a new aspect has been given to it since the discovery of the rock waters, and the invention of the mechanic means of reaching them. It is true they have not, at present, this privilege, but the patent rights would be instrumental when they shall have expired, to the continued power of using them in future.

In case the Manhattan Company should take this more enlarged and ulterior view of their privileges, it would require an increase of capital finally, two millions, half bank, half aqueduct. If this view should be deemed their best interest, the entire right of filling up this additional capital, might be compensation for the patent rights, with subsequently mentioned conditions. Nor could I consent, (nor ought the Legislature to grant it in my humble opinion,) unless on condition of the *immediate execution* of the work, and its steady progress so long as the custom shall give eight per cent. revenue. The further terms are, that during the patent term, half the surplus of net revenue above seven per cent. on the actual product of the capital, *in* and appropriate to the water-works; and the employment and pay of chief engineer, Mr. Disbrow having the mechanic department at customary prices, and employing the mechanics subordinate to the service, heretofore employed, (if not for good cause exceptionable,) the superintendency of the details, and collections as usual; or as provided for in a contract to be entered into in due form of law.

That Company, as a corporation, may possibly sustain some unpopularity, because the city has been disappointed of its expected supply of good and wholesome water, but the same sentiment cannot be felt towards individuals who compose it, since the surveys have shown that this Company has never had the financial power to bring in and distribute the waters of the Bronx.

But holding these instruments for myself and associate, who has committed to me the management of this concern by contract of partnership, I feel it incumbent to proceed as may be most in accordance with the public sentiment, and which I shall presently suggest measures to ascertain. For if the city is willing to leave the whole supply, perpetually in the hands of the Manhattan Company, with an enlarged capital, under the present uncertainties if no delay takes place, it may be best. This point can be known, only from the numbers who may offer to form the second Company.

The proposition for the Rock-water Company, is, that it supply all that part of the city not now occupied by the aqueduct of the Manhattan; assuming that an arrangement will be made with them, for the reservation of so much as they occupy, *otherwise the whole.*

The rates of *water rent* not to be more than those of Philadelphia,

provided they give net dividends of nine per cent., as by law is permitted at Hudson.

The capital to be ultimately two millions at first, with leave to increase it as herein provided. One half to be appropriated to the water-works, the other half to be bank capital. The purchase of the patent rights to be the amount of premium in market, when the Company shall be organized, under a charter, with banking privileges. This will probably be about half as much as when it shall have been one year in operation. But, as this estimation of the value will be wholly contingent, I reserve also half the net revenue above seven per cent., on the part of the capital, in and appropriate to the water-works, during the term of time, or continuance of our latest patent, from August 28th, 1832. And as we conceive the best success of the undertaking to be promoted by our personal services, I reserve the right also of serving this Company, so long as may be convenient, as their chief engineer, at usual pay, Mr. Levi Disbrow and associates having the mechanic department at customary prices.

But the time will come when the increase of the city and its population will have made it necessary to draw more water from the rock sources than the capital now proposed will be adequate to.

Therefore it is proposed that whenever more shall be wanted after the expenditure of one million of dollars in the water-works, *the city shall have the right of increasing the stock, and in order to induce moneyed men then to subscribe to the stock, the augmentation should always be accompanied with a like augmentation in amount as banking capital, and come under the same Company's charter, and be held or sold as Councils may determine.* Nor do we see why the city with this reservation in its favor would not have a supply commensurate to its size and numbers *for ever.*

And which ever of these propositions may finally prevail, at each station there will be a demand for more water *mornings* than the rest of the day; therefore, the engines may continue and the surplus be received over into lower reservoirs, and thence be discharged early every morning to wash the streets. And some part of the surplus may be reserved in suitable places for cold baths, being soft water, for the use of the laboring classes, at a very moderate price. But as we do not wish to make profit of this service to them, the price must be low; yet as it may give some excess beyond expense of care, it may go to some female institution of charity—I ask only the privilege of its disposition to some one or two of them. It may be a considerable fund.

The commission, under the recent law suggests the question, *What is* the actual position in which the law authorizing the Govern-

or to appoint commissioners to cause surveys and recommend a plan of supply places the city?

Suppose it should be satisfactorily shown that good water *might* be brought thence to supply a *million* of inhabitants, will any capitalists of the *present period*, while we have but 250,000 inhabitants, not half of whom will pay as customers, engage funds in that work? If not, will the Corporation be sustained by public opinion, in borrowing money to do it? It may be so. Meanwhile a public and private want is felt severely, and the question recurs, What have *capitalists the power to do to alleviate the distress and provide for the exigency*?

Shall the city wait for the new surveys, one, two, three years, feeling all the time the *improbability of accepting practically any plan recommended*, because of the cost, the liability to interruption, and the preferable quality of the rock-water?

If then it seems to be inevitable that this city must continue to suffer the same inconveniences, dangers, and losses, it has sustained, until it has pure water, it must appear to the citizens and the Legislature a *cheap alternative* to grant authority to do, in a usual way, what all are so interested in having done—and done soon; the general supply of this indispensable element of life and health.

The recent law to determine how the city shall be watered, was, I conceive, suggested by the doubts and difficulties, which Col. Clinton's examination of the facts had produced or revealed. It will, at least, strike the mind as probable, that had this supplement to the calculations reached the Councils before this temporary surrender of official authority, it would not have been made; for a *new aspect* is given to the whole subject, by the facts and principles, the practice and experience here shown. No Board of Commissioners, nor any engineer can deny these, any more than they can change the face of nature.

Besides, what is true of streams this year, may not hold good the next. Ours is the dryest climate known. And besides its extraordinary evaporation, it is liable to severe droughts. I have seen some large rivers in New-England at times so low, as not to permit an empty boat to pass. The Passaic has *seven* branches, each of which has as much water ordinarily as the Bronx, but sometimes people walk in the falls dry. The Schuylkill is known to become so shallow and warm that the fish sometimes perish.

The Croton shrinks to a rivulet, and its head ponds are twice as far from hence as those of the Bronx; and the Byram is not ours; and in practice I have shown *undeniably*, the great uncertainty of reservoirs, and of making the *bed* of dry streams the duct of their waters.

These facts and considerations no further investigations can change. The whole subject is now essentially before the public; and the dif-

ficulties of distant aqueducts are in all respects such, that it is not in the power of man to estimate on *any principles*, what a supply from either of these distant sources will cost. An estimate, after all, will be but an opinion; and from the nature of the things a vague one. *Weston* did not venture to make an estimate for the Bronx. Nor can an instance be shown in the history of the least difficult of the canals in our country, in which they have not cost much more than the estimates; and taken much more water of supply than was expected. The stratified formation of this island as *a base for reservoirs*, is a difficulty, that has never been taken into account: a fact that forbids any other mode of conveying water, than by iron mains. And I have shown, that at Philadelphia, those of two miles in length cost above $30,000 a mile each; and though for that distance, two bring in enough, how many more will it require to bring in the same quantity from six times the distance, even after it is elevated to a sufficient height, 70 or 100 feet, by steam power.

Can it be believed that Philadelphia would have made her water-works, even that short distance, if she had known that the rock beneath the city contained springs of better water, which they might raise at half the expense?

What then is the *effect* of the appointment of a Board of Commissioners? The delay of a year may, or may not, be material to the city—though one more such summer as the last may cost more than all the aqueduct.

The effect then of that law is to make it obligatory on his Excellency the Governor to appoint, and obligatory on the city to pay Commissioners, and all the engineers and assistants they may employ, and all is to be done anew in *one summer*, and this one may prove so *wet* as to permit *no available result*. Here then delay and expense is to no purpose. Shall the commission then be renewed. It may again and again be so, and still be inconclusive. The best *test* after all is, that men of sense and capital will embark funds in the undertaking. No man ought, or ever will, put his money into water-works, unless a sufficient number of the inhabitants stand ready to take the water, and he knows he shall be able to deliver it on terms, that will pay him a good revenue. And if individuals will not take this risk, ought the community to take it? Ought the present population to tax themselves with the interest of a public debt, for a work having no certainty? How can those who have been assessed to pay the cost of the borings, already made by Mr. Disbrow, for the Corporation, and are *pleased and satisfied*, be called on to pay a *water tax, or interest* for a public debt, to bring in water for their fellow citizens in general? I do not see the equity of it. They would say, do for them as you have for us.

Besides, the Manhattan Company has raised water enough from the rock, for *three thousand families*. And the *dwellings* which will enjoy the privilege of this fine supply must be preferred, and earnestly sought, and those which have the common well water, or that

of the river, will be after all, less valuable; and a general discontent will prevail until all have equally good water. But how are all to have equally good water, unless from the same source? The alternative then is to adopt the boring system, or *suppress the* Manhattan Company.

The Commission law, I fear, diminishes the value of the experience and investigation that has been had, postpones expectation, till the heart is sick of the subject of water, as the palate is of that of the city. It stops short the sources of the rock, which have been gaining by successful practice on public confidence; and strikes at the foundations of the Manhattan Company, if the Commission is hostile to that institution.

Is it intended that the Board shall inquire judicially into the powers of this Company, and the degree of impediment it may present to the introduction of pure and wholesome water? It looks like this. The Common Council in accepting the report of Col. Clinton, and publishing it, has adopted this language, (page 196,)—

"The Manhattan Company have, however, the ability from their charter, if not to defeat, at least to procrastinate the introduction of water by the city, for many years. A contention with that Company may therefore result in a vexatious suit, and defer the accomplishment of a measure so materially blended with the welfare of our fellow citizens for years, and be destructive to the prosperity of the city. But this subject is peculiarly the care of your committee, and your views, when once expressed, ought to guide the opinions of our joint City Council, and your determination in this matter ought to be well considered, and then followed up with energy, as it must rest with you to decide whether you will recommend coercive measures, or amicably adjust the difficulties and cordially co-operate with that institution to secure the accomplishment of the subject of our investigations."

Must not this public declaration of a hostile sentiment, in the City Councils, towards the Manhattan Company, be considered as the *index* to the spirit of the application to the Legislature. The report *passes over* the liberal efforts made by the Manhattan Company to fulfil its purpose by a costly experimental, and demonstrative boring for rock water, to blend its fortunate results with the heavy cost and small useful effects of the great well, as I have had occasion to show. The report has not allowed to that Company even the excuse of the difficulties that itself displays; but reflects this unfriendly feeling of the committee, by imputing blame for not yet doing that work, to bring the water from the Bronx, which the report rejects; or from the Croton, which, even the gentleman who suggests it, admits to be immature, in the surveys and plans, and by his estimate, far beyond the pecuniary ability of the Company were *all* its capital devoted to it.

An imputation is thus cast in the report and the law upon the character of this Company, as if it had injured or intended to injure this community. I confess my own prejudice in common with that

of many has, and will have, given place to the conviction from the facts now shown, that *there never has been a time* when they could have done better for the city than they have done *till now:* and now when they at length have reached that position on which they might render the greatest, that is the desired service, they are the *impeded party*, they are put on the defensive, and a blow is aimed at the very foundation of the *whole* institution; and through the Legislature, who are as well the guardians of the state's property in this institution as in any other.

This measure, it seems, not only calls upon the Manhattan Company to vindicate its course from the charge of being *hostile* to the *welfare* of their fellow citizens, and the *prosperity of the city*, but to refute it practically; perhaps adopt the privilege of doing it effectually for the next thirteen years, asking, as I have suggested, an increase of capital—but engaging forthwith to execute the work. For, whoever shall have the patience to read this address through, will have seen, that unless the Manhattan Company do this—or unless the citizens at large, interested in property, form a Company, the community *must continue destitute, and distressed, for good water, for an indefinite term of years*—and probably till they come to this conclusion at last. This persuasion has led me to offer as the purchase of the patent rights, the mere privilege of filling the new stock. New proprietors are admitted, but it adds nothing to the emolument of the present stockholders of the Manhattan Company,—other than as it enables them without withdrawing bank capital to effectuate their original purpose, and establish their then well earned rights.

And it would now be a proper offer to make to the city, that if the surplus water of the pumps did not prove enough for the streets, that then the Company would bring in the remainder from the Bronx, provided Councils would engage to pay 7 per cent. on the cost. And should that be accepted, I can assure the city that I have invented (as in my profession) a mode of crossing the Harlæm with an aqueduct, that will neither impede the navigation, nor be one fourth so expensive as the plans hitherto proposed—and no doubt the rail-road's levelled route, would be preferable to any other,—and the same bridge might take this road on to the valley of the Bronx, the future seat of numerous manufactures at successive sites—and it is not difficult for me to see that modifications of the rail-road will give them such adaptation to cities, that there may be no objections to their extension on an unexceptionable plan of accommodation.

Any one interested in the stock of the Manhattan Company, may well think its best interest might consist in taking *the ground*, or logical position, that from the beginning they had supplied the purest water that could be had,—that as the effects of a dense population had encroached on these sources, and they had deteriorated,—that still to accomplish their trust they had experimentally penetrated four hundred feet into the rock and brought up volumes of the pu-

rest water. The stockholders may deem it for their interest that the advantages of this experiment, and of the privilege under which it was made, should not be lost, nor the public, nor the Legislature be *disappointed.*

They may apply to the Legislature for more capital, because all who own the stock have bought in, *as into a bank*, as the state did. Then at the short period of the patent term, the Company would have established its perpetual right by its unceasing and competent usefulness; and whenever more money shall be wanting for water-works, the Legislature may authorize the inhabitants in future times to superadd it.

So also, if, as the report says, "It is admitted, by all, that an ample and pure supply of water, is one of the greatest blessings which can be conferred on a dense community, as it is one of the greatest conservators of public health and morals"—it seems to me that the Legislature must be willing to lose no time in granting, as a cheap purchase of such blessings, *permission to men of capital to employ their funds in raising and distributing this* indispensable element of health and aliment of life.

We have thus entered at large into the whole subject of water, because of very general interest: for, all who own real estate, and all who propose permanent pursuits here in business, must feel their individual concern in applying some remedy to the natural disadvantages of the ground on which New-York stands; it will be in vain that the providential discovery of the rock-water is made, or the inventions of implements to reach it devised, unless the undertaking to raise and distribute it, is generally and decidedly acceptable.

JOHN L. SULLIVAN,
Co-patentee with LEVI DISBROW,
who, having seen, concurs
in these proposals.

New-York, March 4th, 1833.

P. S. Attention is requested to the following statement of the bank argument.

Reasons for granting to Companies engaged in public works the usual privileges of lending an equal amount of distinct capital, on banking principles.

Having assumed in the aforegoing proposals that *those* who associate to render a service to the community by the execution of a public work of great utility, but of which the revenue must be deferred or delayed, are perhaps *the best entitled* to be allowed to lend another equal amount of capital on banking principles; and that it is good policy in the Legislature, thus to induce moneyed men to engage funds in such useful works; it remains to meet and obviate the *objections*, which the *seeming interest* of existing banks, as well as certain mistaken views of the effects of the American banking system, occasionally present. It surely must be, as we know from long experience it has been very beneficial to the commerce of our country, that there be *accessible capital* equal to its demands always at hand.

It is, however, natural and perhaps reasonable that those who are in possession of any branch of business, should wish to hold it free from disadvantageous competition; but as exclusion is not possible from any one that affords good profits in this country, it is for the interest of all that its enlargement should proceed on *some rule*, which might operate to bring with it in effect a commensurate increase of demand:—that something should be done as its condition, tending to increase trade in the same proportion at least, as the bank capital is proposed to be augmented. Existing institutions of this kind will perceive, that this rule once become *Legislative practice*, would operate both as a defence and a public benefit; and that every public improvement reacts upon themselves. This rule has been sometimes applied, and great works have been achieved here to this effect. Let it be always applied in future, and the effect will be to open the avenues of internal commerce, to the incalculable benefit of the metropolis and the state. The *bonus* thus paid to the public for this privilege of rendering it a service, is far greater than could be afforded in money.

The *annual accumulation of wealth* in our country, to the amount of many millions of dollars, must be invested in some form of property, and enter into some mode of productiveness. Resulting from commerce or other business it seeks to repose in safety as well as usefulness: but none will preferably invest in deferred stock without an equivalent:—none will put money into public works that take time to complete and bring revenue, without an equivalent inducement. Nor ought such undertakings *on a large scale* ever to be commenced, till the means of *finishing* them are in hand.

Many I know will often from motives of philanthropy and expansive benevolence, lay aside all ordinary calculations, and deal out their funds liberally in a good cause; but, if to such men I can offer a way of doing immense good without the necessity of such sacrifice of means, I shall save them their means for other good objects of benevolence, from which there can be no return in this world, though assuredly in a better. To supply this city with good water partakes of philanthropy as well as calculation.

The safety of property comes next in importance to its acquisition.—The laws of the state of New-York have made investments in banks safe

both to stockholders and the public. But it is perceived that the commissioners of the safety fund do not appear in their recent report to entertain this opinion. They appear to apprehend dangers from the American banking system, which it appears to me, from the nature of things *can never impend*. If I can show this, perhaps a cloud of distrust may be dispelled, that now surrounds the banking institutions of the United States, and help to produce that strong and unwavering confidence in them, which it is surely no disadvantage should be entertained even in Europe. I think it can be made to appear in a few words, that even the bank of England is not so safe as the banks of the United States.

The commissioners justly observe, "The currency is a subject of too pervading interest not to be regarded with intense anxiety by all, and of too delicate a nature to be exposed to the scrutiny of distrust."

I propose to show that they may be exposed to this scrutiny without producing distrust.

First. Their superiority to the bank of England may be shown by a mere reference to what that institution is founded on. Its origin was very different from those of our country. More than a century ago, when the ministry were embarrassed, an association of mercantile men, with much more intelligence in affairs, offered to loan the government a large sum on condition of making this public debt the basis of a bank, issuing bills, and paying it out, as the agents of the treasury, on a commission:—and, from time to time, this basis and this privilege have been extended, till, by the last statements I have seen, (1826,) its capital was equal to 106 millions of dollars—of which 84½ millions capital is in the national debt. Hence a revolution of government, or any considerable fall of stock, would be the overthrow of the bank. Its assets were, at that period, cash and bullion £1,273,000; notes discounted £2,907,000; bills in circulation £8,640,000; *advances* to government in anticipation of revenue £10,672,000. The specie being thus $\frac{1}{2\frac{1}{3}}$ the capital and about $\frac{1}{4}$ the circulation. In 1797 the distrust was so great that the bank was by law authorized to suspend specie payments. It is not intended to say that there is much danger now; but, considering the causes of revolutions, there can be no comparison between that country and this in point of safety. One is loaded with a public debt of 3500 millions of dollars, the other without any. One scarcely able to sustain its load of taxes, by all the arts of a refined and skilful industry, and immense commerce; the other lightly burdened, and more puzzled how to bestow its wealth, than how to acquire it.

The *safety* of banking institutions must mainly depend on being able to make choice of the objects of its investment, and its credits; and the more prosperous the people, and more stable the government, the more safe its operations; and if any one can be perfectly so, it must be that which has its foundations in civil liberty, regulated by a constitution which the interest of all supports, and a policy, whose basis being justice and reciprocity, is not so likely, as military glory, to lead to war. If the United States is thus the safest country for property, it may also be said that the middle and eastern states and cities are the safest part of it.

Before considering whether this city and state has its *comparative proportion of banking capital*, a moment bestowed on the plan of the American banks, though not *new* to any who are interested in them, may be acceptable to others. This view of the subject is necessary, in order to show that the dangers supposed, by the commissioners, do not exist.

A corporate bank in our country, is an association of capitalists, a limited definite partnership for the purpose of lending money, and the credit of the association: they are authorized to issue *accepted bills of exchange*, payable in specie at sight, or on demand, to the same and sometimes to double or treble the amount of their capital. Whenever a borrower applies, it is optional with him the moment he has obtained his loan and given his security, to take their bills, or to take specie. He will prefer to take the bills if they answer the same purpose; that is, if he can buy as much with them as with silver and gold. They then *represent* in his estimation, and among those with whom he deals, the same amount of money.—The precious metals are thus the *standard of value* in *this* country as in others—the same here as in Europe. There may at times be a slight variation of the level, but the ocean of this conventional representative of value, all over the commercial world, presently restores it.

Coin stamped by authority, denominated money, being the representative equivalent value in any form of property, is the *medium* between one kind and another; and bank bills represent it: its quantity is measured by transactions in it. Bank bills do not increase the money of a country, but only its active credit or transactions. Credit is confidence, and belief must have some basis. A merchant who sells goods for a note of hand, believes it will be paid; but, if the purchaser brings him *bank bills* instead, he *knows* they will be, and he does not think he incurs more risk in taking them, than if as many dollars in silver were offered him: he does not therefore make the purchaser pay a premium for the credit given, but sells *at the cash price*. The security originally given to the bank *has thus facilitated a succession of transactions;* and at length one of the borrowers pays in the bills. Their *basis* during their circulation has been twofold, that of the capital of the association, and that of the security taken when issued.

Meantime, in what form is the bank capital? It is in some form of productive investment, and in specie. Unless there were to be some advantage from *associating to lend*, men might invest their money in personal estate, or lend it out individually. But the business of lending requires time and vigilance, and much wealth would be *hoarded*, but for these convenient and safe institutions, in which the moneyed man places his wealth, and the lender and borrower meet on legal, safe, and fair terms; and with that promptitude and measure of accommodation precisely, which close calculations in business require.

Capital, thus combined, might lay too long idle, unless invested; but it must be not only in some productive stock, but in such as may be instantly converted to cash. After the capital is paid in, no more of it will be kept unproductive than the probable demands for specie will require. So much as this—so much as will respond to any extraordinary demand, must be there to respond with. This is the condition.

Such being the outline of our banks—of which the commissioners say we have in our country 373, with an aggregate capital of 159 millions of dollars; and that the *bank circulation*, or bills issued is 86 millions,—it is a striking fact that the capital is nearly double the loans—proving that American banks are the *repositories of wealth* and *the fountains of substantial credit for the facility of all transactions in trade.*

But the commissioners say: there is the great sum "of 53 millions due from the community to the banks in this state; besides an enormous

amount of capital loaned by other institutions, so that it is difficult to conceive to what use it can be profitably applied; yet there seems to be no want of borrowers, nor any difficulty in making safe investments at the legal rate of interest."

And does not this fact indicate prosperity? Does it not even prove that there must be a much *greater amount* of property in business? It cannot be all debt: it cannot be that all owe more than they hold.

But the commissioners apprehend these loans may fall suddenly back upon the banks. "When bank bills shall become practically as well as nominally redeemable in coin; when the necessities of the country will admit of no substitute, that the deplorable effects of the issues of bank paper will be developed."

Surely it need not be forgotten that whatever the amount out, it must have been borrowed on security given, that the same amount is to be paid in; and every bank is bound to take its own bills in payment.

What general calamity can be supposed to invalidate the whole of this security? Is it war? What severer ordeal can this country be called to pass through than that of the last war? Some of the New-York banks did in fact suspend specie payments, like the bank of England, but resumed them at the peace without loss of credit. Public opinion in both instances, knowing the occasion, justified it temporarily.

"Failure of crops?" When has this ever occurred in one part of our country so extensively as not to be remedied by abundance in some other quarter. Our agriculture is at once the most varied, rich, extensive, prosperous, and safe, of any country on the globe.

"A great demand for silver" in case of war in Europe? This demand and exportation, if it could happen, would only lead hither the streams of re-supply from South America:—moreover, it supposes no profitable exportation of cotton.

Besides, who is to gather up all the bills of all the banks, in order to come down on them suddenly with a crushing demand? We know of no such power. And were such a run possible upon any one, all the rest would sustain it; for, if sound, it would have the means of credit.

We do not therefore perceive any *danger* to the public in *bank circulation*. But it is said to produce *evils*, in that too *great plenty* of money encourages extravagance, and above all the evil of *high prices*. The improvident may for once possibly borrow to some extent; but when we recollect the scrutiny of character and purpose, which pervades society where there are many lenders seeking good customers, it is more likely that the sober, industrious, and prudent, will be preferred, and the careless and reckless passed by. There is then a moral as well as pecuniary power in banks.

High prices may, to some extent, be the effect of plenty of money; but, is this an *evil?* It can hardly be so to the planter—or the farmer—or the manufacturer, or the mechanic; they only prove demand. The exporter only can wish prices of produce low, and imported goods high. As all commodities are the results of skill and labor, their prices must be commensurate. The effect of scarcity of money must be to make them *too low* to recompense cost. The medium between these extremes is *sufficiency;* and this is what our *banking system* provides for.

Sufficiency is that supply of money which the purposes of business demand. We presume operations are made with a view to more profit than the interest. If debarred the means, profit could not be made. In-

genuity and skill may conceive of operations which industry might accomplish with capital, but faculty may remain idle for the want of credit.

A "*loan office*" can make simple interest, only by lending its *whole capital*,—a bank by lending its credit—substituting its own for that of those who borrow. These institutions are thus of great benefit to our country, in giving both facility and means to every safe branch of business, increasing general profits and recompensing labor. It cannot indeed, be true of them, that they draw away capital from manufactories; because those will rarely be undertaken, unless they are so far protected or profitable, as to give, *besides interest*, compensation for *care* and skill. But their *current transactions*, like those of other branches, of course, share in the accommodation which banks afford; and, it appears to me, that this *sufficiency of money* is like the vital fluid in health, neither deficient nor redundant, producing neither fever nor debility.

If then the banking system of New-York has no dangers, but under the present law are as safe as human institutions can be, and very beneficial to the community at large, it is a fair and proper *inquiry* on this occasion, Whether we have an undue proportion in this city?

In London, besides the bank of England, there are 70 or 80 others, and in all Great Britain, 732, most of which circulate their own bills. This *number* is double that of our country, and the capital employed probably much greater, as the commerce of that country is greater.

In New-York we have, by last year's statement, 67, whose capital is $27,033,460. Were the population of London any rule, her 1,358,541 *inhabitants* are really very much more accommodated than our 1,868,000 people.

The comparison, however, will be more to the purpose if made between this state and city and Massachusetts and Boston.

The state of New-York has 67 banks, capital 27,000,000; this city has 20 banks, capital $16,560,200, whole population 1,868,000; country population 1,665,428, has 47 banks, and capital $10,572,260. The statement of last year does not materially vary the argument.

Massachusetts with a population of 603,000, has 83 banks, capital $24,520,000, of which Boston has 21 banks, population 62,000, capital $15,000,000; country banks 62, population 541,000, capital $9,370,000. Thus Massachusetts has more bank capital than the state of New-York, in the ratio of 29 to $10\frac{1}{2}$; and Boston to this city, as 3 to 1.

It is not obvious why there should be so much more there than here, for in point of commerce this port is much before that.

In 1831, Boston imported	$10,452,000	and exported	$7,213,000 value.
New-York	$35,624,000	ditto	$19,698,000 "
Philadelphia	$8,702,000	ditto	$4,292,000 "
South Carolina	$1,054,000	ditto	$7,627,000 "

According to amount of commerce, New-York should have 45 millions instead of $16\frac{1}{2}$ millions—and according to the ratio of population, compared with Boston, as 62 to 220, so is 15 to 52 millions.

It is not intended to say that this is required, but that considered as REPOSITORIES of the *accumulating wealth of the community*, there is evidently no evil in banks, unless it could be shown to occur practically. But on the contrary, the prosperity of Boston is evidence to the contrary.

The amount of circulation does not depend on the amount in readiness in those repositories, but on the actual demands of business.

Whether banks should be authorized to lend more than the amount of capital and deposits, I frankly doubt, and as in fact, they rarely do, I should think there would be in future no objection to this limitation, and it at once puts an end to the objection of a dangerous excess of circulating medium.

Indeed there is yet wanting in the city of New-York one bank, which may, for the accommodation of the younger mechanics, operate like the banking houses of London, by opening a constant credit, for which security may have been given.

A running interest account would be more equitable than discounts; though not to the exclusion of these when asked.

If then, in conclusion, the Legislature can induce men of property to execute great and useful works, by merely giving them permission to use corporate credit as they have a right to do individual, it would seem to be good policy; especially since it is shown in the commissioners' report, that there are wanting, in this state, safe and productive objects of investment even for the funds of the state, and that unless accumulating wealth can be employed at home it will go elsewhere.

Notice of an Invention called a Steam Camel.

It will be recollected that the name of *camel* is given to the hollow floats, used to buoy up ships of war to cross barred harbors, especially at Amsterdam.

Wherever the current of a river meets the tide, a shoal is of course formed by the deposition of sediment, and may at length obstruct navigation. All that *art* can do then, is to contract the passage, and by a more rapid current compel the shoal to form further down stream. The effect of dredging is but partial and temporary. Vessels might be fitted out for foreign voyages, from Albany, and the largest class of coasters come to this port, but for this obstruction.

The *Overslough* is becoming a more sensible impediment to vessels since the increase of the population and trade at this city. Being the seat of government, and the meeting of the lakes and the ocean, it might become very commercial.

In case no permanent work should be devised to remedy the inconvenience of this shoal, it has occurred to me, that a *steam camel* is capable of being made, at once to raise and bear vessels of any size over it.

Having acquired the right to the recent improvement made in steamboats, by Mr. Blanchard, for the North River Companies, I have invented, by the combination of two of them, with machinery, the instrument to which I have given the name of the *steam camel*.

The *peculiarity* of his boat was essential to its construction. It required that their hulls should be exceedingly light yet very *stiff*, because vessels sit in the water according to the weight on board, and the displacement that equals it. The greatest weight will be in the broadest part of the vessel, but when she is lifted out that burden is transferred to the buoyant vessels (or camel,) and will come on them somewhat unequally. And if so, their vertical strength must be such, that one end may be depressed without injury to the other: she must be incapable of changing her vertical shape.

The requisite lightness and stiffness of this vessel is owing to her frame being composed of *arches*. These arches are vertical and opposite, and their ends are connected strongly: they are then braced apart by cross studs, and then tied together by screw bolts close to each stud. Thus combining the strength of the column with the longitudinal strength of the fibre of the wood of the curves.

Two such frames placed parallel and vertical, and resting the inverted arch on the floor timbers, the hull receives any desired model. The ends project far enough to bear up the impelling wheel, which is thus placed at the stern, and others may, for great speed, be placed also at the sides. The cylinders lay horizontal, in connexion with the frames, and thus the most vigorous action of the engine can be well sustained. This kind of steamboat draws about *one foot*, all on board. So far as we have experience, her performance is extraordinary. One runs up the Connecticut, over Enfield falls, between Hartford and Springfield; another runs up the Kennebec, from Gardiner, over the rapids, to Waterville. Another has ascended the Alleghany as far as Hamilton, the key to a direct trade with the valley of the Mississippi, from New-York, without the intervention of aid by the laws of other states; probably of future consequence.

Two of these light and stiff steamboats being properly *connected*, yet a part sufficiently to come on both sides the vessel to be assisted, she is lifted as much out of water as is requisite, by means of their steam power, and the application of the machinery, combined with them, to form the *camel;* and then applying the power to the wheels, she is carried quickly over the shoal. Thus any vessel might load at Albany, and be carried below the shoals, or be brought up, loaded; and sea vessels brought up more easily than to New-Orleans.

The Dutch camel is filled with water, and brought under the sides of the ship, when on being *pumped out*, they buoy her up; but this is a slow process. The impatient trade of the Hudson requires the most active aid. In five minutes the vessel should be raised, and in ten more set down. The specification of this improvement is too long for insertion in this place. This notice serves merely to show that the nature of the shoal is such, as not to permit of a radical remedy, but may be thus practically surmounted.

JOHN L. SULLIVAN.

EXPLANATION OF THE PLATES.

No. I. Shows the relative situation of the Bronx and the Croton. Scale 10 miles to the inch.

No. II. Exhibits three geological transverse sections of the Island of New-York. The upper and most northern of the borings, on the island, viz. at the Botanic Garden,—the middle one at the City Tank, from Greenwich to the Dry Dock. The abrupt termination of the strata towards the east, has been ascertained by a number of borings east of the Bowery.

The slope of the rock in the great well, ten feet to every sixteen, gives the general slope or dip of the strata; confirmed by the depth of the upper stratum at Greenwich.

The lower section gives the height of the rock, under those parts of the city, where the City Hall, and Trinity Church, and the College are situate. The rock comes nearest to the surface, at the bottom of the old public well, in Lumber-street. It appears to slope thence every way, being at the new street, back of the College, 70 feet, back of City Hall 90 feet, and at Holt's hotel 130 feet.

The reason why the borings in the alluvial sand, 70 to 100 feet deep, in the tenth, eleventh, and thirteenth wards, down to the surface of the rock, afford fine water, is, that the discharge, at the termination of the strata, flows down the eastern side the underground ridge, and is intercepted by the borings. It may not be necessary for the Rock-water Company to go deeper on that side in those wards, in the natural *ground*, than 100 feet. But much of the middle and southern wards are *made land*, and less deep, and good water may not be permanently had in them, and the western wards, without going into the rock, by borings, and bringing it up in a manner that perfectly excludes that of all receptacles.

No. III. *The third Map* exhibits the strata of rock formation, as ascertained by professed geologists. It shows the primitive strata, coming down from the Alleghanies, and becoming horizontal under the secondary rocks, west of Hudson river; then passing under the river, and rising to form the Berkshire mountains.

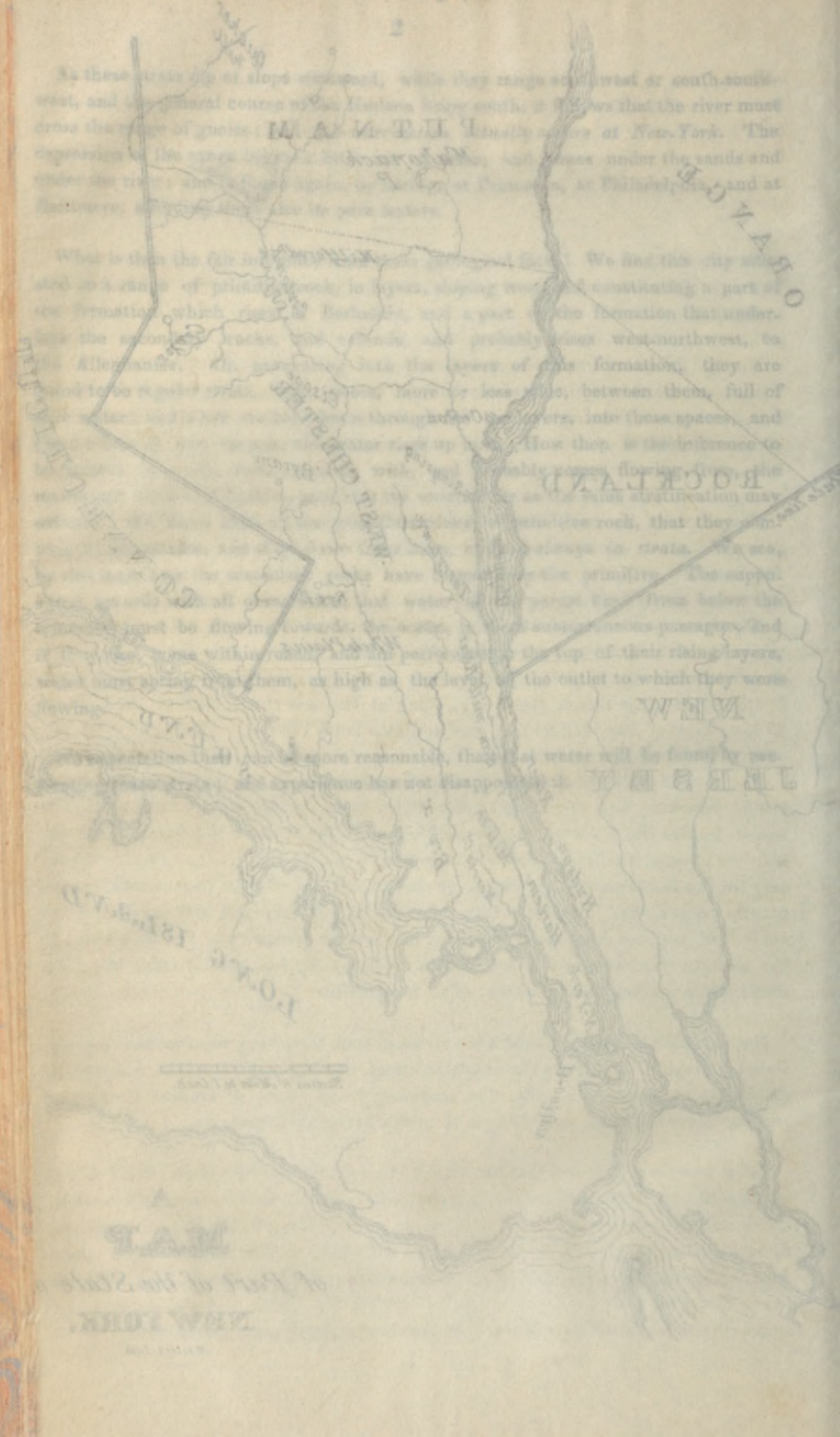
Let it now be recollected that the hills which contain and hide these *strata of primitive rock*, rise from south to north, from New-York city to the county of Berkshire; and it will be understood how, *at the middle waving lines* of the Map, showing gradations of the rise of the ground, the strata will appear at the surface, as the *gneiss* does at Quaker hill, on the borders of Connecticut; again, at the dividing ridge, between that river and the Bronx; again, between the Bronx and the Harlæm; and again, in the Island of New-York. At the former giving out copious springs.

As these strata dip or slope westward, while they range southwest or south-southwest, and the general course of the Hudson being south, it follows that the river must cross the range of gneiss; and this *intersection actually occurs at New-York.* The depression of the range begins a little out of town, and passes under the sands and under the river; and is found again, by boring, at Princeton, at Philadelphia, and at Baltimore, affording there also its pure waters.

What is then the fair inference from these geological facts? We find this city situated on a range of primitive rock, in layers, sloping west, and constituting a part of the formation which rises in Berkshire, and a part of the formation that underlays the secondary rocks, and extends, and probably rises west-northwest, to the Alleghanies. On excavating into the layers of this formation, they are found to be regular strata, with spaces, more or less wide, between them, full of pure water; and when we bore down through the top layers, into these spaces, and plant a tube of iron therein, this water rises up in it. How then is the inference to be resisted, that this water connects with, and probably comes flowing from, the mountains, both in Berkshire, and from the west, as far as the same stratification may extend? We know from all the great formations of primitive rock, that they compose the mountains, and slope down from them, and are *always in strata.* We see, by this map, how the secondary rocks have formed over the primitive. The supposition accords with all observation, that water of the purest kind (from below the minerals) must be flowing towards the ocean, in these subterraneous passages; and if they rise, come within reach, and are perforated on the top of their rising layers, water must spring from them, as high as the level of the outlet to which they were flowing.

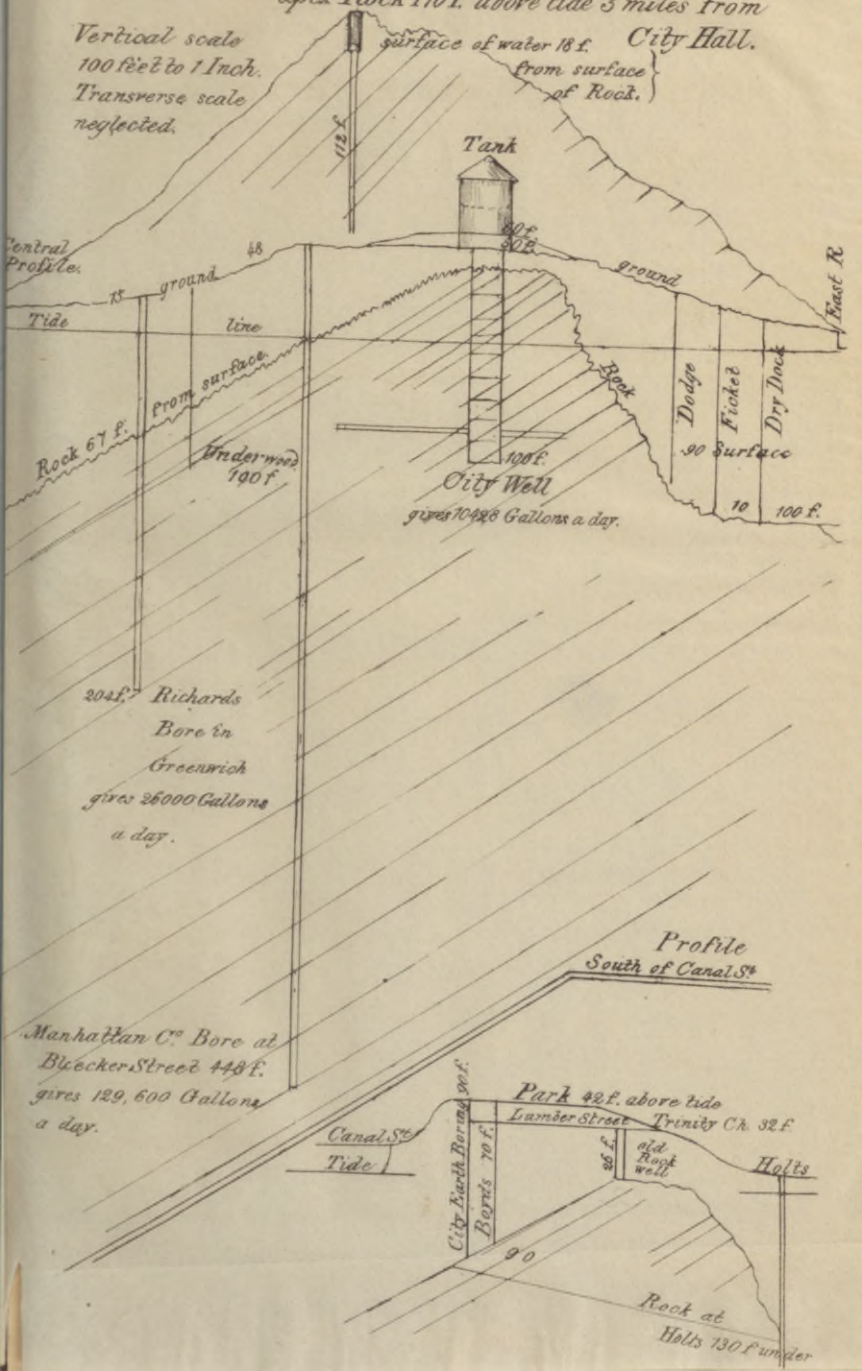
No expectation then can be more reasonable, than that water will be found by perforating these strata; and experience has not disappointed it.

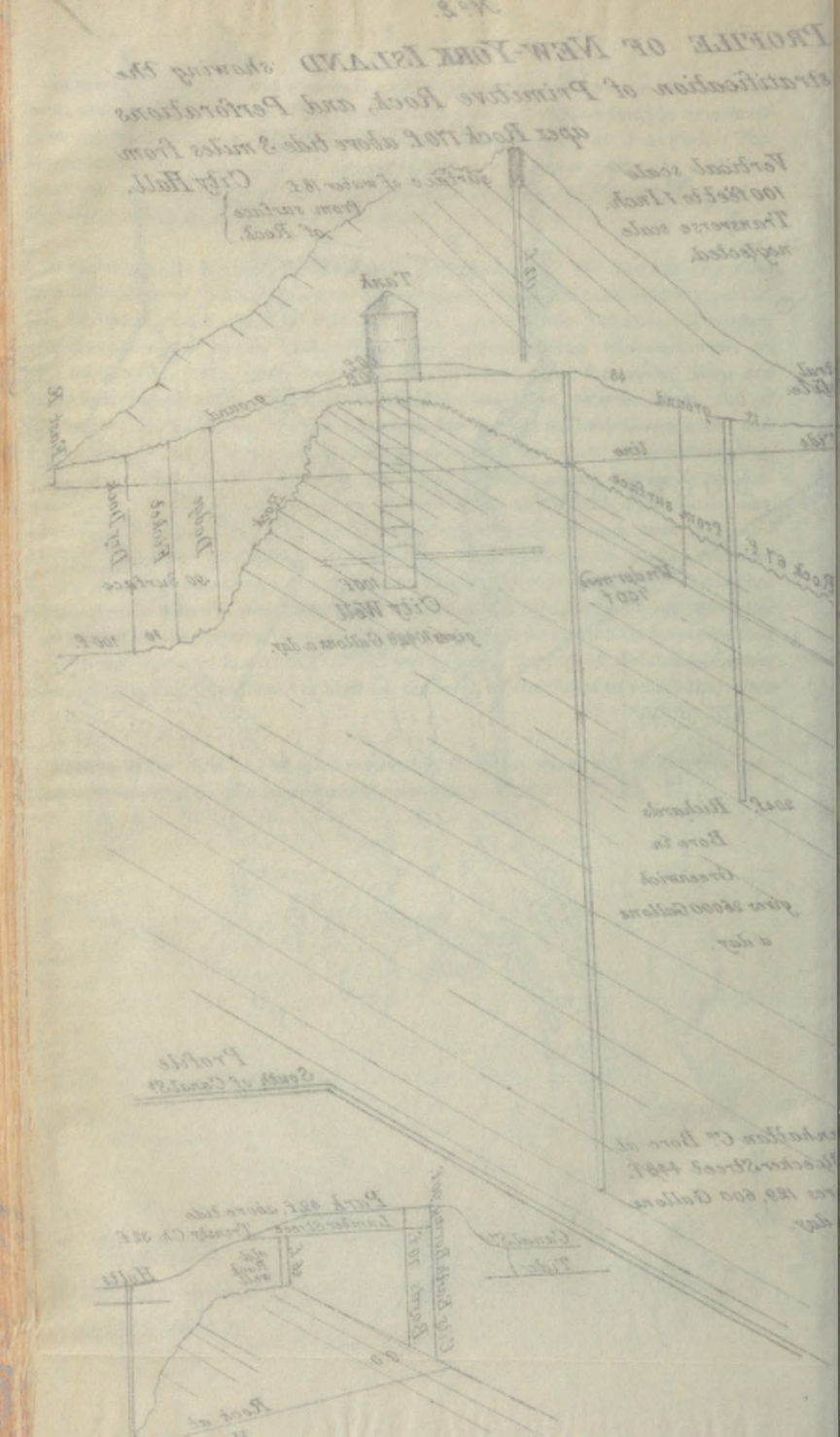

No 1
PUTNAM
Mahopack P
ORANGE
ROCKLAND
State line
NEW JERSEY
WEST CHESTER
CONNECTICUT
Millford P.
Croton R.
Croton
Singsing
Tarrytown
Ciscoe
Byram
Rye P.
White Plains
Hudson River
Saw mill River
Mills
Harlem
Morris Cr
Bronx
N. York
Brooklyn
SOUND
LONG ISLAND
Scales 10 Miles to 1 Inch.
A
MAP
of Part of the State o
NEW YORK.



PROFILE OF NEW-YORK ISLAND showing the stratification of Primitive Rock, and Perforations

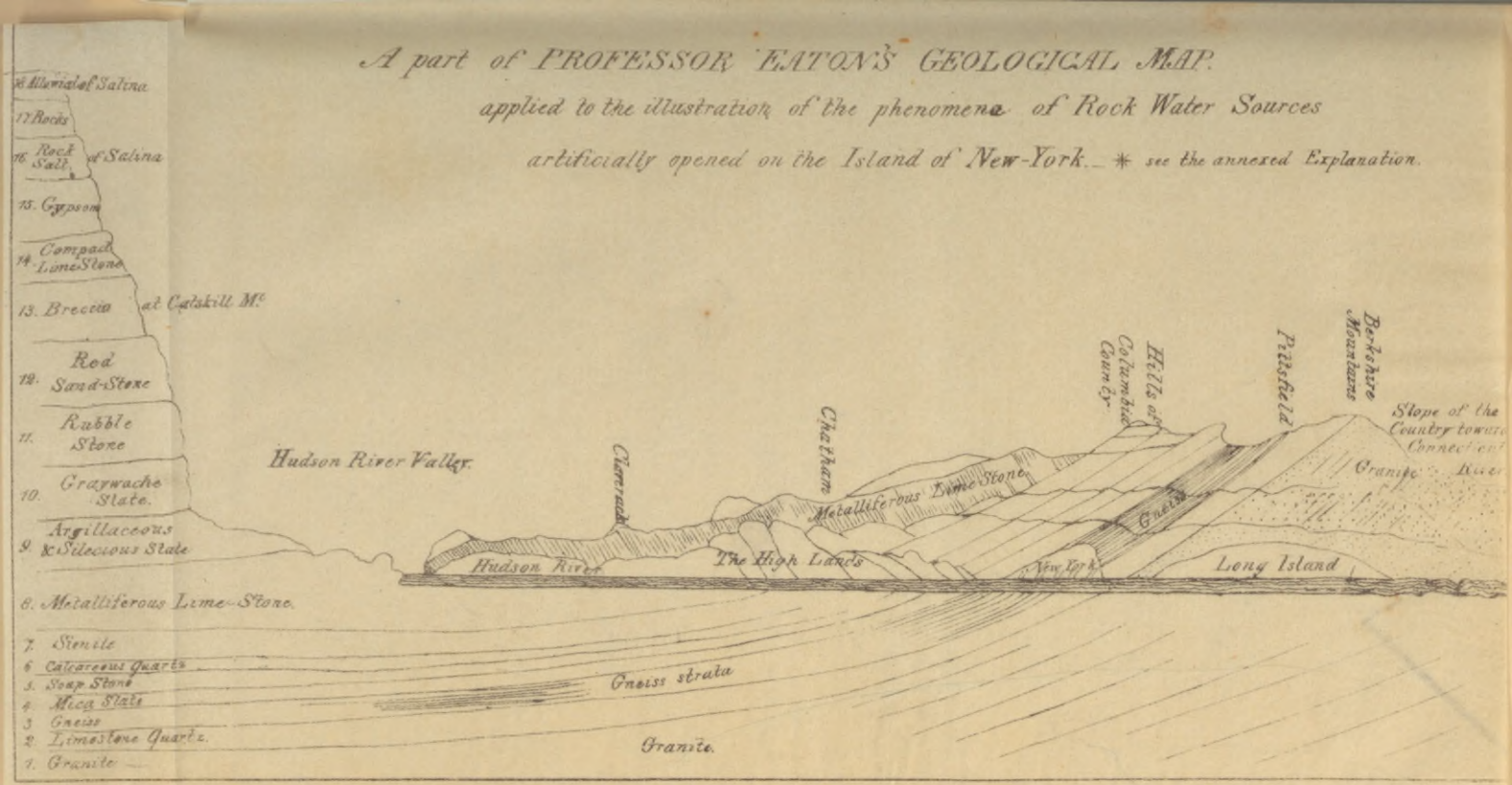
apex Rock 170 f. above tide 3 miles from City Hall.





A part of PROFESSOR EATON'S GEOLOGICAL MAP

applied to the illustration of the phenomena of Rock Water Sources artificially opened on the Island of New-York. — * see the annexed Explanation.



Prof. of Professor's Geological Map
explained by the illustrations of the Prof. Wm. Rogers Johnson
exhibited by person on the Island of New York * on the general description