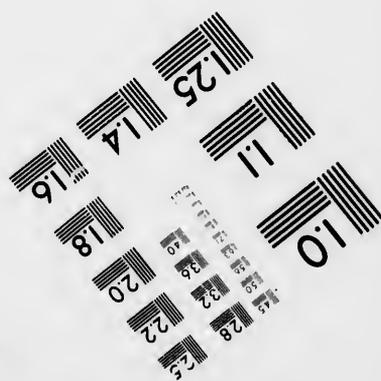
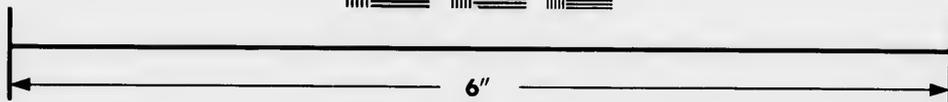
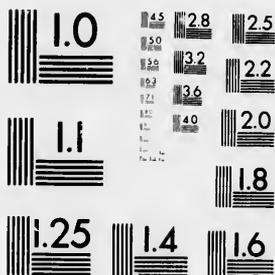


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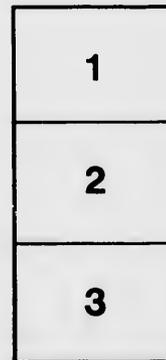
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A REPLY

TO

COOKE & PLUNKETT'S PAMPHLET,

BY

MR. McALPINE, C. E.

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WATER WORKS IMPROVEMENTS.

MR. McALPINE'S REPLY TO MESSRS. COOKE & PLUNKETT'S PAMPHLET.

The following letter has been received by the Water Committee in reply to Cooke & Plunkett's pamphlet :—

ALBANY, FEB. 9th, 1870.

To J. W. McGauvran, Esq., Chairman of the Water Committee.

Sir,—On the 29th of January, I addressed you a letter, in part reply to a Resolution of your Committee passed on the 17th ult., and to a pamphlet which had also been forwarded to me, entitled "Observations upon the report of Mr. McAlpine, etc," and then stated that I would avail myself of the permission given by that resolution to reply to the material points contained in the pamphlet.

The resolution was in these words:

"Resolved,—That a copy of Messrs. Cooke & Plunkett's pamphlet on your report of the Water Works of this city, be transmitted to you, in order to enable you to answer statements therein made, if you think proper to do so."

In my previous letter, I stated that I would reply to any particular points that you or any of the members of the Committee desired, as I was at loss to understand how far you wished me to extend my examination of the pamphlet.

I also stated that the pamphlet seemed to be a voluntary act, and was not prepared in answer to any formal request of the Committee, or, as I inferred, from that of any of the members thereof, and it bears upon its face none of the evidences of a public document.

The chief significance which it has with me is the reference of it to me by a vote of the Committee, and in the absence of any further expression of your wishes I am compelled to regard it as emanating from the disappointed authors of a crude and ill-digested scheme which I was forced to report against.

My respect for your honourable body requires that I shall give it more attention than would otherwise be expected or required from me.

If this scheme had been presented to a Board of respectable hydraulic engineers without any quasi endorsement, such as your original resolution gave to it, and it had to

be considered in comparison with the other plans which had been suggested, it would have been summarily disposed of.

At your special request, I devoted considerable space in my report to show why this plan was inferior to any of the others, and I then avoided any expression of my opinions in regard to its feasibility.

In a general way, the pamphlet asserts that my report is one of generalities, avoiding figures, and, especially, estimates of the cost of the several plans; that my calculations are erroneous and in conflict with each other, and with those made by other engineers; and that my opinions in regard to the practical questions involved—in regard to frazil, wheels and steam engines, are valueless, and that I am biased against their scheme.

I pass by the use of unprofessional language, as merely indicating the taste of the writer, and not material to the subject, so far as the Committee is concerned. In answer to these general allegations and the minor ones in the pamphlet, it may be said that they are actually contradicted by the authors, or by the published opinion of Messrs. Shanly, Keefer, and Francis, or are self-evident even to unprofessional persons.

After reading the pamphlet and reviewing the whole subject, I now deliberately state that I entertain the same opinions; upon the several subjects alluded to, precisely as I have heretofore expressed them in my report of Oct. 21st, 1869.

On page 16 of the pamphlet, the authors condemn their own scheme so effectually, that, if their opinions have any value; they have attempted to foist upon the city a plan involving *three times the outlay* that would be required "for the next twenty years." They say, "If the quality of the water at present furnished is satisfactory to the Council and citizens, then we say that the required quantity can be supplied for the next twenty years, for less than one-third the cost of any system of water power whatever."

But the above opinion is in direct antagonism with that of all the engineers who have examined the subject, such as Messrs Keefer, Shanly, Francis and Lesage.

All of these gentlemen, as well as myself, have had, at least, equal advantages in obtaining all of the information in regard to

the relative cost of water and steam power, as used at the Montreal Water Works, and the most of them have been engaged in the construction of other Water Works, which, in some cases, demanded the use of water, and in others steam power; and are, therefore, far more familiar with the application of each, in its appropriate place, than the

authors of the pamphlet who have no experience in either.

While perusing the pamphlet, I made endorsements thereon, which I intend to submit in reply to the minor allegations there-in made.

Respectfully submitted,
(Signed,) WM. J. McALPINE.

EXTRACTS FROM, AND ENDORSEMENTS MADE ON THE PAMPHLET OF MESSRS. COOKE & PLUNKETT.

Page 3—"The chief feature of Mr. McAlpine's report, and that which will strike any one as remarkable in an engineering document, is the masterly way he confines his observations, with a few exceptions, to general statements, and avoids committing himself to particulars, and, above all, to figures. To such an extent does he carry his caution in this respect, that although he strongly advocates an open canal somewhat like that proposed by Mr. Lesage, yet he completely abstains from giving any opinion respecting two of its most important features."

"Even on the very important question of cost, Mr. McAlpine gives no estimate whatever. It thus appears that the gist of the report merely consists of a general recommendation to build an open canal, of which the form of prism, details of the protections and form of the entrance and cost of construction are still undetermined and unknown."

It is not customary for consulting engineers to make up the details of plans and estimates unless specially requested. This course was followed by Messrs. Shanly and Francis, and, I believe, by Mr. Keefer.

The committee evidently did not expect from me such details or estimates, for they requested me to report within a few weeks, knowing that the preparation of such details would have occupied the time of a staff for several months.

My report was in the hands of the Committee several months, without any intimation that they desired from me any more than it furnished.

The writers of the pamphlet have, therefore, arrogated to themselves the right to censure not alone me, but also the Committee.

The following extracts from my report will show that even on this point they are somewhat mistaken:—

"From the foregoing discussion, it would follow that the plan of an enlarged canal

on a new route is the proper one to adopt. Its dimensions and particulars of construction will be the next subject for examination."

"The plan of Mr. Shanly or Mr. Lesage, and particularly the latter, is the one recommended, and the location (with a slight modification at the entrance,) and the dimensions proposed by Mr. Lesage are proper."

"In conducting this examination, I have had occasion to make estimates of the cost of the various plans, and calculations in regard thereto, which were sufficiently accurate for the purpose required, and for the comparisons made in the argument; but, as the data furnished me were not complete, it would not be advisable to insert these estimates in this communication."

"I have, to a considerable extent, relied upon the estimates made by Messrs. Keefer, Shanly and Lesage, modifying them where my opinions, in regard to the plans or cost of the work, differed from those gentlemen."

"In regard to the prism of the new canal, I have followed the opinions of Messrs. Lesage and Sipple, in making the estimates of its cost and capacity. The experience of these gentlemen, on the effect of the rigorous climate upon canals, so similar to the one proposed, entitle their opinions to great weight. Before new works are commenced, it may be advisable to have the question of the form of the prism again carefully examined."

"Before I could advise in regard to the details of the protections and form of the entrance to the new canal, it would be necessary to obtain more information than I now have of the action of the ice and frazil, which pass down the river at that place."

"Whenever you shall have determined upon the general plans of the new works, I will be happy to furnish your engineer with some further suggestions in regard to the

details and execution of the work which have occurred to me during the present examination."

Page 8 of the pamphlet.—"In plans of conduit furnished Mr. McAlpine by us, the form and size of the entrance were purposely omitted, as we intended leaving those open questions until sufficient data respecting frazil had been obtained, during the next few winters, to enable us to design an entrance that would effectually exclude it."

It will thus be seen that while my report was based upon dimensions, form and estimates, already before the Committee upon the plan which I recommended, that the form and size of entrance of the covered conduit plan was "purposely omitted" by its authors, and hence that they themselves could not have presented even an approximate estimate of the cost of their scheme.

On Page 10 they say—"He, Mr. McAlpine, now presumes to speak of our not having fully digested our project. As he was furnished with the fullest particulars of the conduit, it was a simple matter for him to point out any inaccuracies in our statements, had they existed. We now beg your Committee to notice that he has failed to do so."

In one place, the author says that he has furnished me with the "fullest particulars," and in another that it would require several years of more experience on his part, before he could design a proper plan of entrance for his conduit.

In submitting to me what they termed their plans, the parties distinctly stated (what was apparent,) that they were only intended to exhibit the general design of their scheme, and were very eager for me to point out any alterations that I thought necessary. I did suggest several necessary alterations, and they then expressed themselves very grateful to me therefor.

I would have pointed out to them many other necessary alterations to render the plan practicable if I had supposed that there was any possibility of the adoption of their scheme.

While I felt it my duty to report against their scheme in the following words:—"It is, therefore, evident that the plans of Messrs. Cooke and Plunkett, not only have no advantages over that of the enlarged canal, but are decidedly inferior to it. There are also so many practical difficulties and objections to this plan, that I am constrained to recommend that it should not be adopted." Yet I desired, as far as possible, to avoid the expression of any opinions which would injure the authors professionally.

Page 4—"Mr. McAlpine's reserve on the question of cost will be appreciated when the following facts respecting a former estimate of his are called to mind. In 1853 Mr. McAlpine stated in his report on Montreal Water Works, that they could be constructed for \$600,000. In 1857 Mr. Keefer,

the engineer reported to Council that the works actually cost \$1,144,945."

I stated in my previous letter that I had never visited the site of the Montreal Water Works prior to 1854, and that I submitted my report, as consulting engineer in 1853, entirely upon the plans and informations which Mr. Keefer sent me at Albany. Among other things, I endorsed his estimate of \$600,000 for certain works specified by him, which particular works, I have been informed, have cost about that sum. I have also been informed that Mr. Keefer had explained the reason why the works actually constructed have cost nearly twice as much as those originally designed by him.

Mr. Keefer is fully competent to defend himself, and I have only to add that it is not true, as alleged in the pamphlet, that the works which he estimated at \$600,000 and which I endorsed, have cost nearly twice that sum.

Page 4—"Now in regard to the formula (Eytelweins'), we beg to say it is not applicable to our covered conduit, and even for open channels it is intended to give the approximate superficial velocity, not the mean velocity from which the discharge should be calculated. What induced Mr. McAlpine to parade it in his report, instead of using some one of the simple practicable tables such as Neville, Beardmore, &c., we cannot imagine."

It is well known to the profession that Eytelweins' formula is the basis of a number which have been given by subsequent hydraulicians. In Beardmore's tables, page 13, this Eytelweins' formula is stated to be "the rule on which this table is constructed." It was stated in my report that it "was not strictly correct," but sufficiently so for the purposes for which it was used, viz:—that of comparison merely.

Applied to the covered conduit it gives a discharge of about four per cent. more than the results given on page 28 of the pamphlet, which is stated to be "according to the best authorities."

In fact, however, one of these parties asserted to me that this formula, or rather its equivalent, was strictly applicable to the conduit.

This approximate formula was sufficiently accurate for all the purposes for which I used it, and I stated it merely to prevent any person from supposing that it could be used when greater accuracy was desired.

As the "simple practical tables of Neville and Beardmore" are referred to, it is proper to remark that such tables are made up from well known formula, and are only used by young beginners, or for rough calculations. In all cases when great accuracy is required, these formulae have to be modified to suit the circumstances of each case. To make these modifications correctly requires study, experience and judgment.

Page 5. "We will now proceed to show

that the table (in McAlpine's Report) is *entirely unreliable and erroneous.*" "We propose to confine ourselves to a few simple illustrations of its *inaccuracies.*"

"It will thus be seen that Mr. McAlpine makes a horse-power equal in the first case to 38 c. ft. of water per minute; in the second, 48; in the third, 33; and in the fourth 40. As the fall of the water as applied to Breast Wheels, proposed to be used by Mr. McAlpine, will be the same in all cases, it is of course an utter absurdity to say that a horse-power requires 20 to 25 per cent. more water in one case than it does in another; yet that is practically what Mr. McAlpine's calculations tell us."

Among honorable men, the suppression of the truth is regarded nearly in the same light as the utterance of a falsehood, and as one-fourth of the "observations" are devoted to these alleged "errors, deficiencies and absurdities," an examination of their truthfulness will serve to show the general character of the whole pamphlet.

In ordinary conversation with a moderately intelligent person, not even an engineer, it would not be necessary to state that the power of any water fall depends, not only upon the quantity of the water, but upon its falls. Yet the whole criticism of the above quotation from the pamphlet depends upon the "absurd" omission of the fall of the water, in each case stated in the table.

The table states four distinct conditions of the water at the wheel-house, viz:—its elevation (and consequently the height of its fall) when the river is 36 and again 38 feet above the datum line, and then again when it is at these two elevations, but obstructed by ice three feet thick.

These elevations and obstructions give different falls to the water of 14, 16, 11 and 13 feet, and these falls multiplied respectively into the quantities of water flowing at those times produce the different theoretic horse-power stated in the table.

It is therefore a mere arithmetical question to determine whether the table is correct or "erroneous." Thus with the water at

36 ft discharging	111,375 c.ft. with 14 ft fall	=	2,933 H.P.
38 ft	160,772 " " 16 "	=	4,569 "
36 ft & 3 ft of ice	84,672 " " 11 "	=	1,764 "
38 ft	122,760 " " 13 "	=	3,023 "

These amounts (with two trifling discrepancies of a tenth of one per cent., chargeable to the copyist or printer,) correspond exactly with those stated in the table.

The pamphlet occupies the remainder of page 6, in repeating this blunder of computing the horse power, under these varying conditions of head, by again using only one of the elements necessary to determine the power, and then adds on page 7:—

"The foregoing example shows the *inconsistency and consequent worthlessness of the table as judged by itself.*"

Page 7—"We will now compare the calculations given in table with those found

in another portion of the report." And then follows a statement of Mr. Sipple, that the Lachine Canal in the worst times had an area of 500 square feet, and a velocity of 50 feet per minute, giving with 14 feet fall, 663 horse-power," and then is added—

"That is, the proposed enlarged aqueduct will have 2½ times as much power as the Lachine Canal, under the same fall."

"As the enlarged aqueduct will be, at most, only 10 to 20 per cent more capacious than the Lachine Canal, it is evidently absurd to calculate upon getting 225 per cent more power from it, under the same fall, as stated in table."

The question at issue in this case is again simply an arithmetical one. 500 square feet area of water, moving at the rate of 50 feet per minute and falling 14 feet, will produce 663 theoretic horse-power; and 672 square feet moving 225 feet per second and falling 11 feet, will produce 1,764 theoretic horse-power.

Mr. Sipple stated that his canal had 500 square feet of water way, under the ice, "in the worst times," which were, when the ice may have been upwards of four feet thick. The table is calculated upon a different size and formed canal with an ice covering assumed at three feet thick.

The Lachine Canal had two inches, and the enlarged canal was calculated with ten inches fall per mile.

The deception practised in the pamphlet is thus rendered apparent.

Page 7—"We will now test Mr. McAlpine's calculations with some of those made by others." And then follows an assertion that Mr. Shanly has stated "the discharge from a canal almost identical in size, &c., with the one recommended by Mr. McAlpine, at 450 millions of gallons in 24 hours," while the latter estimates "the discharge at 760 millions or 70 per cent. greater," and it also states that Mr. Lesage calculates the discharge of the canal proposed by him in January, 1869, at 895 millions or 38 per cent. different from Mr. McAlpine."

I do not have the supplemental report of Mr. Shanly to refer to, but I find on page 14 of his first report, that he estimates on the general proportions (of a canal,) on a scale to insure the passage of at least 600 millions of gallons in 24 hours, under the most obstructive condition of frost and ice, and I am therefore warranted in distrusting the accuracy of the extract from his supplemental report, or of its applicability to the comparison which has been made in the pamphlet.

The report of Mr. Lesage does not state at what level of water in the river the discharge of 895 millions of gallons is calculated, but he does state that his canal was to have a fall of only two-tenths of a foot per mile, while my calculations were based upon a fall of three inches per mile.

The pamphlet is characterised throughout by such deceptive statements.

If Messrs. Shanly and Lesage, or any other respectable engineers, are furnished with the data given in my table, it is impossible that any one of them would report calculations, materially different from those in my report, and yet this pamphlet asserts:—

Page 8—"The above considerations we think fully warrant us in saying, that the so called table is altogether unreliable and erroneous and consequently that the deductions and conclusions based on it are worthless and deserving of attention."

As the above examination has shown the table in my report to be reliable and correct, the converse of the above quoted statement must be true; viz: "that the deductions and conclusions based on it" are worthy and deserving of attention.

Two pages of the pamphlet are devoted to a review of my statements in regard to frazil.

In my intercourse with the committee, I stated that I had had almost no experience on this subject, and in my report, I used the theories and arguments of Mr. Keefer, the Detroit Water Commissioners and some gentlemen of Montreal, whose names I did not give.

The authors of the pamphlet claim to be better informed than these gentlemen, but as they state on page 8 (already quoted) that they intended to experiment "during the next few winters to enable them to design an entrance (to their conduit) that would effectually exclude it," it is evident that they themselves think that subject also is beyond their present comprehension.

Page 11—"Had Mr. McAlpine shewn that the difficulties to be encountered in (the) proposed conduit, could not be met at the estimated cost, his statement would merit attention. * * * We beg to say what we fully appreciate all the practicable difficulties to be anticipated in the construction of the work proposed by us and have amply allowed for them in our estimate * * * We venture to say the Council will have no difficulty in getting responsible parties to undertake and complete the work, even below our estimate."

A letter from Mr. Shanly is attached to this pamphlet. This distinguished engineer, and now extensive contractor, remarks in regard to the details of their plans and their estimate as follows: "of the correctness of your estimates of quantities and their classification, I have no mean of judging. In respect of cost, your prices appear to me to be all somewhat slender, and on the items of culverts, entrance and lands are in my judgment quite too low." And then he adds that for their item for contingencies twice the sum "would be none too much."

In my report I stated as follows:

"These several projects have been so thoroughly discussed in the reports of Messrs. Keefer and Shanly, that I shall often be compelled to use their arguments in the

expression of my own opinions, and can therefore be more concise."

The above portion of the letter from Mr. Shanly, written on nearly the same day as my report, expresses my opinion so nearly, that I would have been glad to have incorporated it in my report, as I have done in respect to many of his other opinions, in regard to the Water Works.

Mr. Shanly and myself would probably agree that the authors of the pamphlet had not "fully appreciated all of the practical difficulties," nor that they had "amply allowed for them in their estimate," nor that any "responsible parties would undertake and complete the work" at even much higher figures than their estimate.

Page 13—"A practical test of the relative merits of the Breast Wheels and those of the Turbine class is that no miller or machinist in the country ever uses the former in preference to the latter; moreover, the experience of your own works shews the superiority of the Turbine. We think the above facts prove, that in recommending Breast Wheels, Mr. McAlpine has given an unsound opinion."

Mr. Shanly, whom the complainants so unfortunately attempt to bring in as a witness against some of the opinions expressed in my report, testifies on this subject as follows: "Nothing can be better than the plan, construction and arrangement of the wheels and pumping generally. The Turbine has proved a most efficient auxiliary at all seasons, * * * but for steady, regular action, for simplicity of construction, and for perfect adaptation to the winter conditions of our climate, the Breast Wheel is the best motor for your pumps. Compared to it the Turbine is a complex and delicate piece of mechanism, liable to cause trouble and detention at any moment, if deranged by the accidental admission of some stray piece of float wood, or other obstructive substance. Give the Breast Wheel plenty of water, and it will always do its work well."

Mr. Keefer has expressed his opinions in favor of Breast Wheels over those of the Turbine class quite as strongly as Mr. Shanly. The master mechanic and Mr. Lesage informed me that they also preferred them.

The authors of the pamphlet differ in opinion with all of these gentlemen, and their remark of an "unsound opinion," if worth any attention would apply with still more force to others than to me; and their opinions in preference of the Turbines are entitled to just so much weight as their knowledge, experience and judgment compares with that of the gentlemen who have expressed the opposite opinion.

For ordinary purposes the Turbine is generally preferable to Breast Wheels, but after further consideration of the subject, I am constrained to repeat from my report that "The experience obtained by your works, enables you to determine the relative merits

of Breast Wheels and Turbines. For your works, and especially after they have been enlarged as proposed, I am of the opinion that Breast Wheels will be the most suitable."

Page 13—"The question of the purity of the water to be supplied, has not received from Mr. McAlpine the particular attention, such an important matter ought to command. On this point he merely says page 10, and then *four lines* are quoted from my report, and there is added: "We consider the statement that defilement may be prevented by strict supervision, *unworthy the reputation of a practical engineer.*"

Accuracy of statement is not a characteristic of this pamphlet. In addition to the four lines quoted, more than a page (21) of my report was devoted to this subject.

The authors of the pamphlet consume more than two pages, with the discussion of the question of preventing "defilement" on five miles, when there is more than a thousand miles above the Water Works, along which are cities, villages, houses and manufactories, discharging their filth and sewage into the stream.

The "defilement" is alluded to in the pamphlet as follows, page 14: "This fact was abundantly proved to His Worship the Mayor, many of the Water Committee and Mr. McAlpine himself on the occasion of the latter's visit to this city, when the most disgusting causes of defilement were to be seen on all sides of the entrance bridge."

The writer of the pamphlet omitted to add, that the same gentlemen witnessed on the same day, much worse cases of the same kind of defilement all along the river shore for a mile above the Water Works; and that the Superintendent assured the Committee that he would take measures to prevent any similar defilement in future, at and above the canal entrance; but all of the gentlemen present agreed in the opinion that there was no legal authority to prevent defilement along the river shore above the entrance to the Water Works.

In almost every American and in many of the European cities the supply of water is obtained from running streams into which must necessarily drain the filth from whatever population occupies its borders. In most cases, as at Montreal, the length of the conduit or canal is small compared with that of the open and unprotected channel above. Even the New York Croton Aqueduct is but half as long as the open channel above, from which the whole of the water is obtained, and at Philadelphia they have used water directly from the Schuylkill, for half a century, with a drainage of two hundred miles of densely populated country, and numerous manufactories.

The line of argument on this question adopted in the pamphlet is rarely resorted to, except by some demagogue in pandering to some local and vulgar prejudice, and is unworthy of any one who hopes for the reputation of a practical and sensible man.

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