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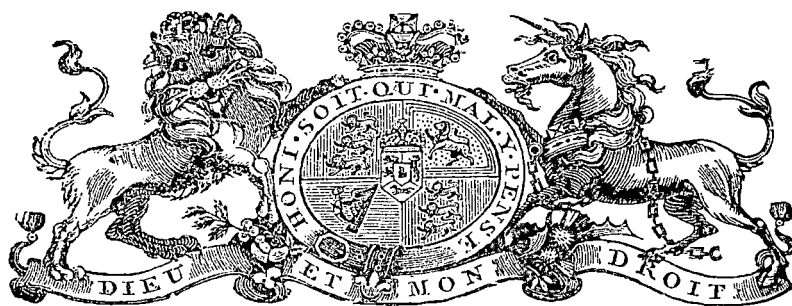
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SEWERAGE AND DRAINAGE OF THE  
CITY OF HOBART:

NOTES ON THE REPORT OF MR. NAPIER BELL BY A. MAULT, CONSULTING  
ENGINEER TO THE METROPOLITAN DRAINAGE BOARD.

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Presented to both Houses of Parliament by His Excellency's Command.



NOTES ON THE REPORT

OF

MR. NAPIER BELL

ON THE

SEWERAGE AND DRAINAGE

OF THE

CITY OF HOBART.

BY

A. MAULT,

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## MR. C. NAPIER BELL'S REPORT.

*To the Hon. the Chairman and the Members of the Metropolitan Drainage Board.*

GENTLEMEN,

1. I have the honour to report to you that, in conformity with your instructions, I have unreservedly placed my services at the disposal of Mr. C. Napier Bell while employed in preparing his report upon the scheme which I submitted to you in 1892 for the sewerage of the Metropolitan area. During the month he was employed on this work I accompanied him all over the City and Suburbs, assisted him in his observations, checked his quantities and prices for him by taking them out independently, and supervised the reproduction of his plans.

2. In anticipation of the requirements of any Engineer you might appoint to report upon my scheme, and to facilitate his work, I had, during the preceding nine months,

- (a) Prepared a contoured map of the City from the materials at my command, showing the lines of each 10 feet of rise from mean sea level.
- (b) Carefully re-examined every part of the area, and prepared a geological map of the City and Suburbs showing the nature of the formations of the subsoil.
- (c) Prepared a plan showing the graduations of the sizes of the collecting sewers in the area.
- (d) Made copies of all the general sanitary notes upon which my scheme was based.
- (e) Made copies of the detailed calculations of cost of all works, machinery, etc., connected with the collecting sewers, the irrigation scheme, the precipitation scheme, and the scheme for discharge without treatment, with copies of the rough working drawings they were based upon, such as Macquarie Point outfall, the sewage precipitation reservoirs, manholes, flushing sluices, ventilating shafts, rivulet crossings, and cross sections of the seven different sized sewers in trenches showing my averages of quantities of greenstone, sandstone, and earth to be excavated; and
- (f) Prepared the fresh estimates of quantities and outlay necessitated by the self-exclusion of the Queenborough, Lower Sandy Bay, and Glenorchy districts, and again others that would be necessary should New Town be also excluded. (These fresh estimates showed that such exclusions would reduce the total estimated cost from £60,585 for discharge without treatment for the original area to £44,936 for the reduced area. This latter sum, with about 10 per cent. addition, is that referred to by Mr. Napier Bell as £50,000.)

All these plans and notes I placed at the reporting Engineer's service.

3. I have read Mr. Napier Bell's report, and gladly put upon record how pleased I am to find that upon all the principles upon which my scheme is based we are completely in accord, both as regards the system of collection, the exclusion of storm water, and the perfect safety of discharge without treatment in the circumstances in which Hobart is placed. We are also in agreement in regard to nearly every detail of the manner in which the scheme can be carried out. It is only on the financial question as to the desirability of spending over £42,000 for the purpose of having an outfall at One Tree Point—that is of practically about doubling the initial outlay, and nearly doubling the yearly burden of rates—that there is any serious disagreement between us. I refer to this further on, and also to the minor matter of having but one discharging place. In the following notes I also correct some misapprehensions and make general reference to the question of cost of works.

4. With reference to the second paragraph on page 6, I would remark that in many places it is necessary to complete the detailed plan, not only for the purpose of setting out the back drainage of houses, but also for that of precisely locating the main sewers. A complete set of levels has not yet been taken. Bench marks have been fixed and levelled and some of the courses of the rivulets, but

nothing further has yet been done by the Board. The contour plan referred to by Mr. Napier Bell was prepared partly from the information thus obtained, partly from levels marked on Mr. James's old skeleton plan, corrected for difference of datum, and partly from aneroid observations. It is a compilation that does not profess to be other than approximately correct.

**Cost of works.**

5. With regard to the last sentence of the same paragraph, I understood from Mr. Napier Bell when conversing with me on the subject that the details he refers to were in connection with the inverts of the sewers and the jointing of the pipes, and that he added the ten per cent. mentioned really because he wished to be completely on the safe side in his estimate. I replied that I was confident that I was already largely on the safe side, especially if he would consider what he says in the second paragraph on the seventh page of his Report taken in connection with what I have said in the last sentence of paragraph 33 of my Report of 1892. Mr. Napier Bell says that some of my sewers appear to be too large. In the 1892 Report I explained that much excess of carrying capacity of the sewers arose from my having taken no intermediate sizes between the stock sizes made at Launceston, so that when a larger pipe than a 6-inch one was needed I calculated upon using one of 9-inch, and so on with other sizes. This is the safe method to follow in framing estimates; but in carrying out the work, when the gradients are correctly known, it will be found that quite one-half of the 9-inch pipes can be replaced with 8-inch and 7-inch, and quite one-half of the 12-inch with 10-inch, and so on with other sizes. This alteration will save more than £2,000 on the cost of the works. In fact, Mr. Napier Bell agreed with the sufficiency of my estimates, and told me that I might say so.

**Dead ends.**

6. With respect to the fourth paragraph on page 7 of the Report, the statement is made under a misconception. There are no "dead ends" in my scheme, as each sewer has a man-hole for flushing purposes at its upper end, as mentioned in paragraph 37 of my 1892 Report. The system of running a sewer where it is not required but for the purpose of connecting it with a manhole on another system of sewers is not only costly, but is found to be very objectionable, not only as regards the difficulty of flushing caused by the often great difference of level between the two sets of sewers thus connected, but also, and chiefly, for the reason that it greatly complicates the system of sewer ventilation, often to the extent of vitally affecting its successful action. A proper system of sewers should not be reticulated like water or gas mains, but should be simply branched.

**Outfalls.**

7. With reference to the seventh paragraph on page 10 of Mr. Napier Bell's Report, I do not agree in considering it important to have only one outlet for the sewage. It would be important if any nuisance would be created by the discharge of sewage, as it is undesirable to multiply the number of places to be affected by a nuisance. But as no nuisance would, as Mr. Bell conclusively shows, be created by the discharge, I am sure it is not worth while carrying sewage farther than necessary whenever a good discharging place presents itself, and Battery Point, in the neighbourhood of the old slip and smelting works, is an unexceptionally good place, almost, if not quite, equal to Macquarie Point. The only advantage of the latter point over Battery Point is that it is more in the outer sweep of the tides. But to compensate for that there is much deeper water opposite the old slip, where the Admiralty chart shows the 3-fathom line to come in to the head of Risby's wharf, and the 5-fathom line to come to 18 yards from it, whereas at Macquarie Point the 3-fathom line is 35 yards out, and the 5-fathom line 78 yards out. These facts, taken in connection with the relative quantities of sewage to be discharged at each point—being at Battery Point not one-fifth of that discharged at Macquarie Point—go to show that the sewage outfall at the former will be as suitable as at the latter.

**Pumping sewage.**

8. With reference to the eighth paragraph on the same page (10) of Mr. Napier Bell's Report, I quite agree in the desirability of doing away with pumping, and this can now be more effectively done by retaining the Battery Point outfall. As Queenborough is now out of the Metropolitan Area, there is no longer any need to provide for its circumstances. Those circumstances necessitated the keeping down to as low a level as possible the outfall of the Wellington Rivulet sewer, so as to receive the sewage from the Queenborough districts in that neighbourhood, which are low-lying as compared to those on the Hobart side. But I can now keep the Wellington Rivulet sewer from the point where it crosses the Montpelier-road at a higher level, so as to deliver its sewage at the Battery Point outfall without pumping. And this sewer would have an average gradient of more than 1 in 150—a very good gradient, indeed—and would run generally on the lines marked on my plan for the sewage main round Battery Point. By this diversion all need of pumping will be obviated, and a considerable capital outlay and yearly charge saved. And furthermore, there will be no occasion for using a pressure pipe. Such a pipe should only be used when there is absolute necessity, as in cities where good gradients are hardly obtainable, for, though they act well enough when kept continually flushed and free from accidents, when accidents do occur they occasion great annoyance. But the most important benefit secured by my proposal is that no portion of the city need be excluded from the system, and compelled to discharge its sewage into the Hobart Rivulet, or at the city wharves. I do not think that Mr. Napier Bell realised that the district that he proposes should "be left to drain into the harbour" comprises the most thickly inhabited part of the city, and the part in which, in relation to population, preventible diseases are most prevalent. This district includes Lower Campbell-street, Lower Collins-street, Lower Macquarie-street, Hunter-street, Morrison-street, Brook-street, and Lower Salamanca-place, and contained at the last census a population sleeping there considerably over 1,000, and by day probably 2,000. As I have said, all this district can be drained without pumping under my scheme, as well as the city portion of the Wellington Rivulet basin.

**Areas needing pumping.**

9. On the plan referred to in the first paragraph of page 11 of his report, Mr. Napier Bell shows, among the areas requiring to be pumped under my scheme, all that draining into the sewer that crosses the Hobart Rivulet at the lower end of Hunter-street. This arises from another misconception.

In my scheme of 1892 all this district is drained without pumping. But I mentioned to him that I had always intended to see, when the area was all levelled, which would be the more economical course to pursue at this point, the course shown in my scheme, or one having a Shone's ejector, and saving considerably in the size of the sewers described in my report. I subsequently gave him an estimate of the cost of this course, taken in connection with the Wellington Rivulet pumping, and he has evidently understood that I intended adopting it. I certainly had not done so; and now, as in accordance with Mr. Napier Bell's own valuable suggestions, I have shown how the Wellington Rivulet can be drained without pumping, there is no occasion to further consider the question of pumping at Hunter-street.

10. With respect to the proposed outfall at One Tree Point, Mr. Napier Bell (fourth paragraph, Outfall at One Tree page 11) has truly pointed out that the great objection to it is its costliness. The costliness will be a permanent charge, as much pumping is required. The area in the city and Queenborough that would, according to my scheme of 1892, require pumping for the discharge of its sewage, contained a population of 2,100. The city area, the sewage of which would need pumping in the One Tree Point scheme, has (excluding Queenborough) a population of 2,800. I estimated the cost of my plant at £5,000, and Mr. Napier Bell estimates his at £3,828, the lift being about the same. I gave the yearly cost of pumping at £600 for the smaller population, and he gives it at £365 for the larger. The reason for the difference being that I provide for duplicate engines and continuous pumping, so as to avoid all pollution of the rivulets and wharves, while Mr. Napier Bell thinks it necessary to pump only the day sewage, and leave the night sewage to flow off as at present.

11. This touches the whole question of comparisons of cost. They are quite useless in such cases as present no accordant data as to objects to be secured. In the above case the question for you to decide is, which system will you adopt—continuous pumping, or day pumping only? If the former, you should calculate upon a capital outlay of £5,000, with a yearly expenditure of £600 for the service; and if the latter upon an outlay of £3,828, and yearly expense, £365. And these calculations should be applied to all the schemes compared, and the comparison would then be fair. Again, in treating for comparison of the estimated cost of my collecting and discharging works Mr. Napier Bell has added ten per cent. to my prices, while in the new work he has proposed, which has been priced out at exactly the same rates, as far as applicable, as my original estimate, the ten per cent has not been added. Here the question you have to decide is whether you will or will not add it, but both estimates must be treated in similar manner. Yet, again, I made certain provisions for sewer flushing and for general administration, and purposely made them largely sufficient. In the former of these matters my scheme would certainly require much less provision than Mr. Napier Bell's, and for the latter would as certainly not require more. Yet in both cases much less is provided for the One Tree Point outfall scheme. You have to decide which provision is sufficient and apply it equally to all schemes.

12. If these bases of comparison be accepted, and they are the only fair ones, the total cost and yearly charge upon each scheme can be equitably considered. With respect to the total cost of each scheme the estimate for the collecting and discharging sewers must be taken with or without the suggested additional ten per cent., and the cost of the necessary pumping plant, either for continual or for only diurnal pumping. And with respect to the yearly cost of each scheme, the charge for interest and sinking fund and for maintenance must be calculated upon the total cost, either with or without the added ten per cent., the cost pumping either continually or only diurnally, and the allowance for general administration, sewer cleansing and flushing on the scale of either one or other of the provisions made. If this be done, first by taking the estimates with the added ten per cent. on the sewers, with provision made for continual pumping, and with the higher provision made for administration, flushing, etc., we shall get the highest estimates in each case, and the following will be a fair comparison:—

I. Discharge without treatment, but with pumping at Macquarie and Battery Points, being the original scheme with Queenborough and New Town excluded:—Total cost, £56,149. Yearly charge, £5,418. Estimates with 10 per cent. added, and continual pumping, etc.

II. Discharge at Macquarie Point only, with intercepting sewer from Queenborough without any pumping, Queenborough and New Town excluded:—Total cost, £59,140. Yearly charge, £4,998.

[If it be decided, as it should be, that the sewage from Lower Macquarie-street and Hunter-street, etc., should not be allowed to flow into the Rivulet, etc., pumping would be necessary, and the above estimate would stand:—Total cost, £65,289. Yearly charge, £5,958.]

III. Outlet at One Tree Point—Queenborough and New Town excluded: Total cost, £94,848. Yearly charge, £7,740.

IV. Discharge at Macquarie and Battery Points without pumping, as described hereinbefore in these notes—Queenborough and New Town excluded: Total cost, £50,800. Yearly charge, £4,498.

If we now take the estimates without the added 10 per cent., with provision made for only diurnal pumping, and with the lower provision made for administration, flushing, etc., we shall get the lowest estimates in each case, and the following will be an equally fair comparison:—

I. Discharge at Macquarie and Battery Points with pumping: Total cost, £51,085. Yearly charge, £4,490. Estimates without added 10 per cent., day pumping only, etc.

II. Discharge at Macquarie Point only without pumping: Total cost, £53,169. Yearly charge, £4,250.

[If the necessary pumping be done as before described the above will be: Total cost, £56,000. Yearly charge, £4,900.]

III. Discharge at One Tree Point : Total cost, £83,603. Yearly charge, £6,441.

IV. Discharge at Macquarie and Battery Points, without pumping : Total cost, £45,663. Yearly charge, £3,800.

One Tree Point sewer. 13. In my preliminary examination in 1892 of the whole area I had considered the desirability of a down river discharge, and dismissed the idea as impracticable on account of expense, and unnecessary from a sanitary point of view ; and I am still of the same opinion. The only thing that could justify the incurring of such additional expense would be the avoidance of creating a nuisance. But Mr. Napier Bell has most unreservedly declared that no nuisance can be created by the outfalls I have proposed, and his declaration to that effect should suffice to remove any alleged popular feeling. After such a formal declaration by such an engineer it would surely be the height of absurdity to nearly double your expenditure and your rates to remove what he shows to be a baseless prejudice. An incidental disadvantage connected with this outfall would be that more than £25,000 of the additional cost of it would have to be spent before the City was reached or a single house in it drained ; and during the expenditure of this sum double rating would have to be endured—that is both a drainage rate and the sanitary rate would have to be levied. But with the Macquarie Point and Battery outfalls house drainage could be begun before £2,000 had been spent, and no increase of rating would be needed, And furthermore, the whole of the house drainage of the City could be done for about one-half the additional cost of this long outfall.

It must not be forgotten that the above estimates do not include the cost of draining Queenborough. If it be included in the One Tree Point scheme the above-mentioned estimates for this scheme would be £109,000 total cost, and £9,050 yearly charge on the higher scale ; and £96,000 and £7,600 on the lower scale.

On these grounds I am very sorry that this One Tree Point outfall scheme has been revived, Those who have all along opposed underground drainage are sure to take advantage of its being now brought forward by a man of Mr. Napier Bell's eminence, making it an excuse for further and indefinite delays such as proposing to wait till we can afford the further outlay.

It must be understood that I am opposed to the adoption of this scheme solely on financial grounds. From an engineering point of view it is perfectly feasible, or Mr. Napier Bell would not have proposed it. It is the same in principle as all the rest of the work. And I am very glad that an engineer of Mr. Napier Bell's large colonial experience is in perfect accord with me on all the principles upon which a system of sewerage should be carried out.

In conclusion, I strongly urge again the importance of proceeding with the further surveys and levelling necessary for this or any other scheme of drainage you may adopt. The time required for making of the surveys and detailed plans of the area would be ample for the discussion of the question of outfall, the obtaining of the necessary powers and the making of all financial arrangements.

I have the honour to be, gentlemen,

Your faithful servant,

A MAULT,

Consulting Engineer to the Board.

Hobart, 13th December, 1895.