I. INSPECTION OF MALOPO RIVER

Minute from Hydrographic Surveyor Mr. Karlson
to Chief Engineer Irrigation

dated 22 January 1908

Irrigation and Water Supply Department

II. REPORT OF INSPECTION OF ZEERUST SPRINGS

for Hydrographic Surveyor (Mr. Karlson)
to Director of Irrigation Pretoria

dated 5 November 1906

I. INSPECTION OF MOLOPO RIVER

In compliance with verbal instructions received, an inspection was made (16th - 17th January) of the Molopo River from the "Eye" to the Western Border of this Colony.

2. The Malopo River

The river rises on the farm "Molopos Oog 266" at an approximate height, above sea-level, of 4680 feet (Datum rail-level at Pretoria 4471 feet). The "Eyes" are situated 10 miles south of Ottoshoop, and 4,8 miles south-west of the "eyes" of the Malmani River, and are separated from the latter by a ridge which rises to a level of 35 feet above the springs.

3. Discharge

The discharge of the Molopo Springs is at present 4,40 cubic feet per second or 2,370,000 gallons in 24 hours. (The discharge of the Malmani Springs is at present 4,90 cubic feet per second and in March 1907 was 5,80 cubic feet per second).

4. Malmani Springs

These issue at approximately the same level as those of the Malopo, though it is possible that the latter are from 5 to 10 feet lower.

5. Dolomite Catchment Area

The total catchment area on dolomite for the two rivers is, approximately 240 square miles, of which topographically, the greater portion belongs to the Malmani.

6. Weirs

A masonry weir which has raised the water-level 4 feet was built ten years ago. It is situated 3/4 mile below the Molopo "Eyes", but the fall of the river is such that the principal "eyes" were in no case submerged to a depth of more than a foot and the water can be seen to be still bubbling up. There is a small pick-up weir 12 miles lower down (vide para. 9 (e)).

7. Malopo Catchment

The greater part of the catchment lies to the west, between the "eyes" and the border, towards which it rises considerably.

8. Underground water-level

This on the Western sideis considerably higher than the river itself, a spring even issues above the water-level in the dam at the masonry weir below the "eye" and on the farm "Doornplaats" No. 109, seven miles lower down, the underground water-level, at a mile from the river, stands twenty feet above the river bed.

At this latter point the water can be seen in a hole (called Wondergat). The hole is about 200 ft x 300 ft, the water in it being over 150 feet deep so it contains at least 10,000,000 cubic feet. After last year's heavy rain the water in the "gat" rose two feet but has now returned to its original level.

As the fissures in the dolomite can only be considered to represent 3 or 4 percent of the rock the infiltration cannot exceed 3 or 4 percent of a rainfall of 24 inches but as the "gat" is close to the river it is probably even less.

9. Observations

a) As the lower Molopo is quite dry and there are no other springs in the district, and as the black reef divides the dolomite from the Ventersdorp system at Mafeking, it seems probably that the whole dolomite area is feeding the Notwane River through the Linokana (location) Springs.

b) The Malmani disappears at Ottoshoop and at Rietpoort and in the same manner the Molopo disappears close below the masonry weir on the "oog". Even if the Molopo Springs yielded ten times as much water as they do it would all be lost in the vlei which extends for 16 miles between the "oog" and the Border.

c) At Rietvlei 12 miles below the "Eye" the water reappears and is there intercepted by a small pick-up weir; the flow is small and the left bank furrow carries only 0,40 cusecs. The water is all used up and the river is quite dry again before the border is reached.

10. Alleged Diversion of the Springs of the Molopo

From enquiries made it seems that the pick-up weir mentioned above has given rise to the statement that the Molopo has been dammed up to the advantage of the Malmani; but the dam in question is over ten miles from the point at which the Malmani disappers at Ottoshoop and is besides at a much lower level.

The weir at Molopo's oog, though open to objection, can have little influence on the flow. I was told by the farmers that the stream is as strong now as before the weir was built.

The Malmani Oog, 5 miles distant, lies if anything at a slightly higher level and a rise of one or two feet of the Molopo Springs could not possibly divert the flow to the Malmani especially when (as stated above) in the Western and greatest part of the Molopo Catchment the underground water -level is higher than the river.

11. Possible Improvement of the Flow

This can only be obtained by a complete canalisation of the river from its source to the border, and by tightening all holes where the water at present disappears.

Subsequent note by H.S.

In returning from Mafeking to Lichtenburg it was noted that a furrow with a large permanent supply of water coming evidently from Weltevreden or Grootfontein crossed the Cape border at Rooigrond. It is possible that this water formerly went down to Burhman's drift and has been diverted over the border during recent years, and that in the season why the Molopo is now dry at this place.

HYDROGRAPHIC SURVEYOR

II. INSPECTION OF ZEERUST SPRINGS

The undersigned has the honour to report that during his recent visit to Zeerust (23rd to 26th October) he made a careful investigation of the water supply of that Town with regard to the points touched upon in the Town Clerk's letter No. 211, addressed to the Assistant Colonial Secretary.

2. The Hydroraphic Surveyor informed the Municipality of the object of his visit and received some useful information from them.

3. The Town of Zeerust, which has a population of 1,000 white and 1,000 Native inhabitants, (all of whom cultivate large gardens) obtains its principal water supply from Karree Spruit, the intake of the water furrow on Kameeldoorn being at such a level that water can irrigate the town as high up as the Cemetery. The flow in this furrow was, at the visit of the Hydrographic Surveyor, 110,00 gallons per 24 hours.

This included the whole flow from the Klaarstrom branch of the Karree Spruit.

Another furrow enters the town at a much lower level of the principal street. This furrow takes the overflow from the farm Vegenoogd. This furrow is sometimes nearly dry when the farmers on Vergenoogd use up all the water on the farm.

At the visit of the Hydrographic Surveyor, the flow was unusually large and about 210,000 gallons per 24 hours were running in the furrow. Besides which the river itself carries a small flow; leakage from this furrow, amounting to 16,000 gallons.

Consequently, in all, 336,000 gallons per 24 hours entered the town. Although this water is by no means clean, a certain portion of it is used for drinking water.

A number of shallow wells exist evidently more or less contaminated, from which the household water is taken. The Government has put down 3 boreholes which are not, it is believed, being used. There are also three other deep boreholes, one in the S.A.C., Camp, one at the Magistrate's Court and one in the garden of a town resident, Mr. Dietich, which all give a relatively large water supply. Below the town of Zeerust the Klein Marico River is entirely dry. At present the water supply to the town is entirely inadequate even for irrigation purposes.

The river water, even at the springs on Kameeldoorn if used for drinking, would have to filtered and pumped. The Klein Marico River was formerly supplied from 6 springs as follows :

a) Rietvlei (5) near the road from Krugersdorp to Zeerust.
b) Buffelshoek (190).
c) Stinkhoutboom (269) In the ridge west of the road to Ottoshoop.
d) Vergenoegd (3)
e) Karee Spruit on Tweefontein (64) In the same ridge west of zeerust.

(It could not be decided if the original spring is on Tweefontein or on Klaarstrom).

f) A small portion of the water from Malmani, running down through a gorge on Paardevlei to the Klein Marico Valley.

5. The Rietvlei Springs were supplied from a portion of the dolomite formation near the farm Groot Afdeeling where also there as formerly another large spring, tributary to the Great Marico.

The Rietvlei springs no longer exist. Trenches have been cut in the river banks where small streams are oozing out, but no water now comes down as far as Kaffirkraal.

6. The spring on Buffelshoek was even as lately as six months ago a relatively large stream. It supplied Buffelshookand Jacobsdal, (situate on Vergenoogd No. 46) this stream has now dwindled down to nothing, in consequence of which the people on Jacobsdal have been obliged to leave.

Stinghoutboom was never a large stream and the water was used up on the farm.

7. Vergenoogd Springs were, and are still, the largest springs of the valley. The discharge in now 1,020,000 gallons per 24 hours. It seems that the real spring is on Uitvlugt or in any case on the limit of Vergenoogd, Uitvlugt and Wolvekoppies. The discharge was undoubtedly formerly much greater, probably at least double the present flow. The water from this spring is divided into two furrows, supplying Vergenoogd, Uitvlugt and Weltevreden. The Government has become the owner of one seventh of the undivided portion of Vergenoogd which includes Mr. Erasmus's house.

The natural water course from Vergenoogd joins the Karree Spruit a mile above Zeerust but at the present time only 226,000 gallons or one fifth of the whole flow is let down to the lower farm, and this quantity is seven unusually large. It would seem that Zeerust Town is entitled permanently to a larger portion of the flow and that an application to the Supreme Court for repartibation of the water is justifiable.

8. The Karree Spruit spring on Tweefontein Klaarstroom eye now carries a discharge of 80 000 gallons. This spring was formerly much larger. It has lately been opened up.

The water from this spring is flowing down to Klaarstrom. There it is evidently quite illegally all intercepted in a dam and the water used for the irrigation of Klaarstrom. Below the dam for three miles, the river is dry. The water appears again in pools in Kameeldoorn, but the water in these pools is not perfectly clear, so it is probable that it is not anything else than the leakage under ground from the Klaarstrom dam.

9. The Malmani Spring which rises eight miles above Ottoshoop, and which there carries not less than 4,200,000 gallons - (Measured 6 months ago by the Registrar of Mining Rights, the discharge was found to be 5,000,000 gallons) - reached formerly as far as Paardevlei, 9 miles below Ottoshoop. The last furrow in the Malmani Valley is now at Kaffirkraal, but there the surface flow ends. The Malmani Valley has, however, on Paardevlei, a connection through a gorge, with the Klein Marico Valley. The river was seen flowing through this gorge after a storm, two years ago. The existence of this connecting gorge is extremely significant, as the Malmani River is thus geographically a tributary of

the Klein Marico and the Malmani water belongs evidently by preference to the Klein Marico Valley.

10. The other springs issuing from the dolomite basin north of Lichtenburg are :

a) The Great Marico Springs, which are entirely independent of the Malmani catchment.

b) The Molopo which carried a small amount of water to Mafeking and inthe catchment of which several small independent springs appear and disappear.

c) The Tweefontein Spring, which is the real eye of the Notwani River and which supplies the Matjesvalley, now leased by the Government.

d) Linokana Springs, which are supplying the Moilor Location.

e) The Gopani Spring, small spring also inthe Moilos Location, both these latter springs lead to the Notwani River.

11. The springs which are of real interest in the present case are the Tweefontein and Linokana. Tweefontein is a small spring with a discharge of 110,000 gallons per 24 hours. It supplies the farm Matjesvalley, (leased by the Government) which would be of no value if this spring disappeared.

The Linokana Springs have at present daily a discharge of 2,140,000 gallons. All the water is wastedin hundreds of trickling streams amongst the Kaffir huts, absolutely without any attempt at artificial distribution. A portion of the water is said to be used for the irrigation of some winter crops below the Poort, but in general the natives mostly cultivate summer crops on dry land. No water from the spring is flowing into the Protectorate. Although the native population of the Stad is 9,000, the Hydrographic Surveyor considers that a reduction of the discharge of the springs to one half of the present flow would be no hardship if a wiser distribution of the precious water was made.

12. The native occupy this location as freehold ground. Any harm done to them therefore can be taken up in a Court of Law, so it is extremely important not to undertake any work which could lead to an action in the Supreme Court.

13. The dolomite area supplying the above springs is :

i)	Area above Malmani Oog.	209 square miles
ii)	Remainder of catchment area of the Malmani and Klein Marico on dolomite above the hillside springs of the Klein Marico	148 " "
iii)	Dolomite area West of the Malmani Catchment, not supplying the Molopo or Ramathlabama Spruit.	51 " "
iv)	Dolomite area of the Notwani Catchment above Linokana.	102 " "
	Total of ii), iii), and iv).	301 " "
	Total of i), ii), iii), and iv).	510 " "

14. The 209 square miles of the Malmani produce at Malmani Oog 5,000,000 galls per 24 hours, of which a quantity of at least 4,300,000 gallons goes in-to the Vlei at Ottoshoop where the river disappears and presumably feeds the other springs below.

The discharge of all these springs is :

Buffelshoek say	100,000 gallons
Stinkhoutboom say	100,000 "
Vergenoegd	1,020,000 "
Karree Spruit (Klaarstroom oog)	80,000 "
Tweefontein	110,000 "
Linokana	2,140,000 "
Rietpoort nie gemeet nie	
Paardenvallei oog droog	
Total	3,550,00 Gallons

Consequently the original area of 209 square miles above Malmani oog produce a much greater quantity of water than the whole area of 510 square miles (Which presumably constitutes the catchment of all the above named springs) can provide.

15. This anomaly can be explained if it is supposed that the springs now are living on the reserve and as the water plane in this district is rapidly falling, it is probable that this is partly the case. But it is also certain that the considerable water supply of the Malmani, is to a great extent, lost by evaporation in the Vlei at Ottoshoop or on Rietpoort, where the Malmani for an instant again appears.

16. So as to be able to come to a conclusion on this subject, a study of he nature or cause of the springs and of their relative level was undertaken.

The cause of the springs is not the same as for the Great Marico where, in general, the springs appear at the limit of shale formation.

The Malmani Oog, (itself undoubtedly as continuation of the Malmani Wonderfontein which appears and rapidly disapperas again at a distance of 8 miles from Malmani Oog) rises as a strong spring in the same way as the Mooi River Wonderfontein, in the middle of the dolomite. One of the numerous metalliferous reefs of the Malmani is undoubtedly the cause of the appearance both of Malmani Wonderfontein and Malmani Oog, as well as of the re-appearance of the Malmani on the farm Rietpoort.

The hillside springs of the Klein Marico are also issuing considerably above the limit of the dolomite and shales. The Karree Spruit issues in this way 240 feet above the Klaarstroom dam where the dolomite ends and the Vergenoogd springs 150 feet above this limit. The case is the same with the two other hillside springs as well as with the Tweefontein. Linokana Springs issue, on the contrary, at the edge of the shale, although a small patch of dolomite appears below the springs.

The hillside springs must therefore flow over a reef and samples of the same reef were found at both the Karree Spruit and Vergenoogd fountains, distant 3.1/2 miles apart.

It can therefore be presumed that this reef shuts out the water from the Klein Marico Valley, and that the greatest flow of the water is underground through the high hills north of Moilos Location, to the Linokana Springs.

17. This was made still more clear by the aneroid levels taken at the springs. For Zeerust being at 3,960 feet above sea level, the following levels were found :

Malmani River at Ottoshoop	4,515 feet
Malmani River at Rietpoort	4,472 feet
Malmani River at Paardevlei above gorge	4,382 feet
Vergenoegd Spring	4,351 feet
Karree Spruit Spring	4,382 feet
Tweefontein (approximately)	4,380 feet
Linokana springs	4,292 feet

Although these levels were taken in comparison with a fixed aneroid in Zeerust they can of course only be considered as approximate. They show however that there exists a perfectly gradual fall of the Waterplane from Malmani to Linokana except for the Tweefontein springs which are at the same level as Paardevlei which is now dry.

The small an constantly decreasing discharge of these two springs is therefore explained. It is also evident that if the cycle of dry years continues the water plane will fall more and more and the small quantity of water remaining will find its way to Linokana. Linokana is in this way exactly in the same position as Pretoria which is supplied with water which originally belonged to the Hennops River and which there in former times was flowing out in natural springs, and Zeerust is in exactly the same position as Rietvlei of the Hennops River with the difference that it is much easier to get the water back, and it seems necessary that steps should be taken on this subject although a previous cycle of dry years after 1860 made the situation even worse than at present.

18. The original cause of the shortness of water is of course the disgraceful way in which the water, so precious in this district, is wasted in the Malmani River without any attempt ever having been made for remedying this state of affairs.

From Malmani Oog to Ottoshoop the Malmani flows in a series of large vleis, where evaporation is considerable.

On Kaalplaats an artificial dam of 60 feet in length is unnecessarily spreading the water further. Below Ottoshoop the Vlei extends another mile standing full of water to a considerable width. The water then disappears to appear again in another Vlei to miles long on Rietpoort where a small quantity of water is used for irrigation and a small quantity is led down by furrows to Kaffir kraal and Paardevlei.

19. It is of course quite easy to dig or dredge a defined channel for the river through the Vlei from Malmani Oog to Ottoshoop; and in dredging such channels the places where the water is lost in the Vlei would probably be found and could be closed up. This channel should be continued to Rietpoort where the Vlei can be drained in the same way, and the caves there found.

Between Rietpoort and Kaffir kraal, the channel through the present dry river bed should be continued for leading the Malmani water. But at Paardevlei this water should be led in a furrow on the right bank at a certain height above the river bed. In the gorge through the hills the water will again be let down in the river bed and come out in the Malmani at Botha's House at Weltevreden. The Malmani River, joins the Klein Marico on Kruis river and both join the Karree Spruit below Zeerust. If Zeerust is to use the water, an artificial channel must therefore be made from Paardevlei below the gorge to Zeerust.

On Paardevlei above the gorge, the river bed should also be canalised, although the permanent flow is brought down through a furrow on the hillside. This canalisation is for the purpose of leading the storm water from the whole valley, which extends nearly to Lichtenburg, down through the new channel from Malmani Oog to Paardevlei. This storm water is now evaporating in the Vleis.

At the gorge on Paardevlei a weir of 10' or possibly more could be erected without inundating any valuable land on Kaffirkraal. The storm water would rapidly infiltrate in a few wells and would feed the existing springs of Vergenoegd, Tweefontein and Linokana. When the water from Malmani is not used in the lower valley this water can also be turned down into three absorption wells, and it is most probable that in this way it would be quite as much water in these springs as at present, although the great Malmani stream has been diverted.

20. The question is, how is this water to be utilised in Zeerust without being intercepted by all the farms above the town. It is seen that on Vergenoegd and Witvlught over 1,000,000 gallons are used up and it is complained that this is not sufficient for their needs. Without a regular distribution of the water in pro rata shares fixed by law, very little water would reach Zeerust. But it is certain that this canalisation is technically possible and as the distance from Malmani oog to Paardevlei is only 18 miles (of which the greatest portion could be dredged) the expense would be very moderate.

21. For the purpose of safeguarding more perfectly the interests of Zeerust Town, though sacrificing possibly to some extent the general interests of the Klein Marico Valley, the above programme could be followed as far as cncerns the canalisation of the Malmani River. But only a slight attempt should be made to stop the leakage underground in the Vlei below Ottoshoop. The tightening of the river at this place would be for the purpose of avoiding an unduly great increase of the Buffelshook springs.

The next dry farm Wonderhook could be bought so that the water is not used on this farm. On Rietpoort, where the water again appears, the vlei should be canalised, the natural opening in the dolomite where the water again disappears, should be located and opened up. The ordinary flow should be let down in these holes. This would avoid a complete irrigation of Kaffirkraal and Paardevlei for which the whole stream would not be sufficient. The storm water should however be let down in the canalised river bed over these two farms and the weir in the gorge on Paardevlei constructed so that all the stormwater could be brought underground at this place in the artificial wells to be sunk above the gorge.

The water would, in the case, be conserved in the Malmani Valley, without any unduly great consumption for irrigation.

To avoid a too great flow down to the present Linokana Springs, it would be sufficient to lower the outlet of the Karee Spruit 40 feet, that is to 10 feet below the outlet of the Vergenoegd Springs.

The outlet of the Karre Spruit would still be 50 feet above the Linokana Springs which are at a distance of 9 miles. A trench of a length of 2,400 feet, or a tunnel of 1,200 feet and a trench of 1,200 feet, would enable the spring to flow out by gravitation at this lower level.

The Linokana spring would by this method hardly be affected. The Vergenoegd Spring may slightly suffer, but the Tweefontein Spring, flowing to Matjesvalley would probably disappear. The damage would however not be very great. It may be possible to lower also this spring slightly without too great oost.

The Vergenoegd Spring could not be lowered because the fall on the first mile is very slight.

22. The opening up or lowering of the Karree Spruit spring on Tweefontein would be of considerable advantage to the town of Zeerust. The new outlet of the spring would still be 480 feet above the main street of Zeerust.

It is to be hoped that before long a public health act will forbid the distribution of water in towns by means of open furrows. Even then it would not entail any prohibitive expenditure to lead 1,000,000 gallons from the spring by a gravitation pipe of steel concrete for a distance of seven miles to a reservoir commanding the highest points of the town, from which the water could be distributed.

23. This would require a right to lead the water over the farm Klaarstroom but, although a judgement of Kotze adds the increased discharge of a spring to all riparian owners, it seems reasonable that the owner of Klaarstroom would have to be satisfied with, for example, two thirds of the present original discharge of the Karree Spruit, and the expropriation of this farm - impossible for a small town - would not be required.

24. As the law now stands, surrounding landowners could not claim damages if the springs now existing on their ground suffered. Even the natives in Linokana could not claim damages even if the whole spring disappeared before they have proved in Court that their water is flowing in a defined channel from Malmani.

With the Amendments proposed by the Irrigation Commission, this proof would not be required. As the level of this spring (Linokana) is so low, it is however not probable that any difficulty will arise from this side.

25. The rateable value of Zeerust being small it may be possible that a loan which should enable the town to undertake a work of this nature would not be authorised. A very great portion of dolomite exists in the Klein Marico Valley inside the abovementioned reef, without producing any spring small or large. It is therefore possible that a portion of the rain water from this catchment is running on the diabase under the shales. In such

case repeated boring would enable the Municipality to establish a water supply by pumping from a great number of wells. The Hydrographic Surveyor doubte very much if this solution would, in the end, be cheaper than a proper water supply by gravitation.

The Hydrographic Surveyor has, however, brought for analysing, a gallon of water from one of the deep wells and if this water contains the usual quantity of magnesia found in dolomite water, it may be presumed that the supply will be permanent.

26. As it is certain that some steps must be taken on the matter of the leading of the Malmani water to Zeerust, it is important that preliminary steps should be taken at once. These steps are :

1. The exact levelling of all the abovementioned springs.
2. A survey of the Malmani.
3. Construction of gauging weirs at Malmani oog, Linokana, Vergenoegd and Karee Spruit.

A sum of £360 would be sufficient for the construction of these weirs and although the revenue of the town of Zeerust is not very great, the Hydrographic Surveyor considers that this matter is of such importance that there should be no hesitation in voting this sum for the purpose. These weirs ought to be built at once.

27. The Hydrographic Surveyor is greatly indebted to Captain Fowler, Commandant S.A.C., Zeerust District, for information given with regard to the topography etc., of this district.

28. It is not considered that an investigation by the Geological Survey Department is necessary, at any rate at present. Before however any infiltration in the Paardevlei is attempted, the reef, which undoubtedly crosses all the hillside springs, must be traced so that all infiltration may be carried out inside it.

HYDROGRAPHIC SURVEYOR

Accompaniment

Sketch

Forward to the Director of Irrigation in compliance with instructions contained in D.I. Letter No. 5889/102, dated 10th October, 1906.