REPORT ON IRRIGATION IN THE MIDLANDS OF TASMANIA.

INTRODUCTION.

During the year 1920, the writer spent six months in the Midlands carrying out a geological survey of the district with the object of determining the possibilities of the existence of under-ground water supplies.

The district examined extended from Rhyndaston on the south to near Campbelltown on the north, and from Interlaken on the west to the Mt. Pleasant Closer Settlement on the east.

The recently published report by Mr. H. Ekland on irrigation deals particularly with this district, and on perusal of this report the writer realised that he could supply a large amount of information both supplementary and additional to the above report.

The information is rather of a general, than a detailed nature, but should greatly facilitate any surveys and investigations carried out in the future in connection with the irrigation scheme.

TOPOGRAPHY.

The possibilities of irrigation together with the attendant problems of water conservation and distribution depend largely upon the topography of a district.

In the Midlands the topography is varied, some parts being of high relief and others of low relief. The western portion of the district includes the eastern portion of the Central Plateau of Tasmania, the surface of which is at an altitude of about 2,800 feet above sea-level. Lakes Sorrell and Crescent are situated on this plateau within a short distance of its eastern boundary. The eastern edge of the Central Plateau forms the conspicuous mountains known as the Western Tiers. To the north these Tiers present a very steep scarp which in places is 2000 feet and more in height. To the south, this scarp is not so prominent, and a spur runs off to the east between Oatlands and Woodbury.

To the east, this Eastern Spur connects up with similarly elevated country which extends to the north and forms the Eastern Tiers which form the Eastern boundary of the district. To the north of the Eastern Spur and between the Western and Eastern Tiers, the Tunbridge Plains occur. These plains have an altitude of about 600 feet above the sea with a gentle fall to the north in which direction they extend for a considerable distance as far as Western Junction.

The district is drained almost entirely by the Macquarie River and its tributaries, the main streams besides the parent one being the Blackman's River and the York Rivulet.

It is in the Tunbridge Plains and their northerly extension that the possibilities of irrigation are under consideration, while it is at Lakes Sorrell and Crescent and in the upper parts of Blackman's River that the questions of water supplies and their conservation are being considered.

RAINFALL.

The following table (No.1) gives details of the rainfall at recording stations in the part of the Midlands in connection with which irrigation is being considered.

Table No. 1.

Station	Yearly Rainfall Min. Points	Yearly Rainfall Average Points	Yearly Rainfall Max. Points	Monthly Rainfall Min. Points	Monthly Rainfall Average Points	Monthly Rainfall Max. Points
Ross (Roseneath) 16 - 1920	1491	2105	2889	15	175	553
Ross (Beaufront) 88 - 1920	1013	1797	2896	0	150	668
Campbelltown belltown 85 - 1920	1136	2034	3418	0	170	815
Woodbury bury 1909 09 - 1920	1083	1787	2988	8	149	692

Table No. 2 shows by means of the average monthly data the distribution of the rainfall throughout the year at the above stations.

Table No. 2.

Station	Jan.	Feb.	March.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Woodbury bury	142	85	142	190	154	186	109	135	147	169	132	197
Roseneath neath)	135	148	76	170	212	272	154	164	176	205	161	230
Beaufront front)	171	103	130	153	159	179	120	141	150	178	134	178
Campbelltown elltown	190	115	140	176	163	193	147	162	188	215	152	191

Table No. 3 gives the rainfall data for stations within in the area in which water conservation is suggested in connection with the irrigation proposals.

Table No. 3.

Station	Minimum Points	Average Points	Maximum Points
Dog's s Head 89-1911 16-1920	1816	3594	5292
Interlaken erlaken 00-1907 10-1919	1427	2830	4579
Bow Hill	1744	2481	4235

GEOLOGY.

The geology of a district has an important bearing on the question of irrigation from numerous points of view such as soil, soil drainage, sites for water conservation, quality of the water etc.

The oldest rocks occurring within the district are the white silicious mudstones of the Permo-Carboniferous System which are either horizontally bedded or dipping at very low angles. Succeeding these with a disconformable relation are those of the Trias-Jura System which is divisible into at least two series. The lower or Rose series consists of 50 feet of conglomerates and grits passing upwards into 700 feet of sandstones with interbedded mudstones.

The middle of Felspathic Sandstone Series consists of 500 feet of felspathic sandstones with interbedded mudstones and coal seams. These strata are also horizontally bedded or dipping at low angles.

Diabase of Upper Mesozoic age, occurs in the form of small flows, dykes etc. overlying or intruding the above rocks.

River alluvium has been, and is, forming along the courses of the present streams.

The diabase and the rocks of the Trias-Jura System are by far the most numerous types and together occupy the greater part of the surface.

IS IRRIGATION NECESSARY?

From the data given in Table No. 1, it is seen that the average yearly rainfall within the Tunbridge Plains varies from 18 to 20 or 21 inches. With yearly rainfalls of these dimensions, agriculture can often be carried on successfully by dry-farming methods, but it is always subject to uncertainty and difficulties, and irrigation is always an advantage, if not an absolute necessity.

Of far greater importance than the average annual rainfall, is that during the growing period. In this part of the Midlands, the sowing period extends from March to June, but as early a sowing as possible is effected. The main growing period is from July or August until November or December. Considering the total rainfall for the six months from July to December for the stations in Table No. 2, the following results are obtained:-

Woodbury	889 points.
Ross (Roseneath)	1090 points.
Ross (Beaufront)	901 points.
Campbelltown.	1005 points.

Mr. Ekland calculates that a rainfall of at least 12 to 15 inches is required during the growing season, and the above figures show to what extent the actual rainfall falls short of the required amount. It would appear certain therefore that additional water supplies by means of irrigation are an absolute necessity during average seasons.

THE SOILS.

The soil in any district varies with the underlying rocks from which it is derived. Diabase yields a dark brown to red, rather heavy soil which is of very fair quality. Unfortunately the diabase disintegrates and decomposes with the formation of soil at a very slow rate, and generally the rate of denudation and removal of the soil keep pace with that of soil formation and only very thin layers of soil, if any, are found on diabase.

This is particularly the case on hills and steep slopes, but on more level country the soil has a better chance of accumulating. Several areas of this soil occur between Woodbury and Tunbridge.

The Ross sandstones readily yield a sandy soil of fair quality and depth and which should have a good natural drainage.

The felspathic sandstones yield a light soil of good quality (the successful closer settlement of Mt. Pleasant has this type) and fair depth with good drainage. Such rocks occur only around Lowes Park and Glenmorey and this type of soil is, therefore restricted to these localities.

The Permo-Carboniferous mudstones yield a light soil of poor quality and of little use for agricultural purposes. Only small areas of this soil occur in the Midlands.

Basalt should form a heavy soil with a quality superior to most other soils in the district. However it does not weather, probably due to the low rainfall, at a rate sufficiently in excess of that by which the soil is removed by denudation. As a result, the basalt land in the Midlands is generally rocky and with only a thin layer of soil. Small areas of soil do, however, occur at various times between Ross, Campbelltown and Conara. The land is somewhat badly drained in places due to the underlying somewhat imperious basalt.

The recent alluvium readily forms a soil of great depth. It should be of fair quality, but does not appear to be used to any large extent for agricultural purposes. The reasons for this are not apparent although the danger of flooding from adjacent streams and the necessity for efficient drainage at all times are probably contributing factors.

To the north of Ross large areas of Tertiary rocks occur, but the soil from these is generally very poor and little used for agriculture. Where a mixture with soil from adjacent basalt soil exists, however, the mixed soil is of good quality and a great deal of the soil between Ross and Conara is of this nature.

IS SUFFICIENT SUITABLE SOIL AVAILABLE?

This is one of the most important questions to be considered in connection with an irrigation scheme in the Midlands and the one that should be the first to be investigated.

Around Woodbury and Tunbridge fair-sized areas of alluvial and diabase soils occur. These extend as far to the east as the York Rivulet and patches are found as far as Mill Bank on the west.

On Lowes Park and Glenmorey small areas of felspathic sandstone soil exist, but on portion of these the topography will be unsuitable for irrigation.

On the Salt Pan Plains considerable areas of Ross sandstone soil occur but it is generally of poor quality.

Between Tunbridge and Ross areas of alluvial soil, diabase soil and Ross sandstone soil exist. Along the course of the Macquarie River from near Mona Vale to the north of Ross large tracts of alluvial soil occur.

Around Ellenthorp to the west of Ross patches of Ross sandstone are found.

Along the courses of the main road and main line railway from Hobart to Launceston, basalt and mixed basalt and Tertiary soils exist. These extend as far north as Conara where the poor soil of Epping Forest comes in, but similar soils extend up the valley of the South Esk River to the east.

Other areas of suitable soil may occur along the course of the Macquarie River between Ross and Cressy.

The above indicates generally the location of the larger and more important areas of suitable soils. An investigation is necessary to determine the total amount of such suitable soil and also its distribution in order to ascertain whether the number and size of the more or less isolated areas warrant the expense of an irrigation scheme.

WATER SUPPLY.

If sufficient areas of suitable soils are available the next problem is that of providing water supplies for the irrigation scheme. The only two schemes to be considered in connection with the southern part of the Midlands are those of the Upper Macquarie River and of Lakes Sorrell and Crescent and the Upper Blackman's Rivulet. The writer is not acquainted with the former areas, and will therefore deal only with the latter scheme.

CATCHMENT AREA.

Lakes Sorrell and Crescent have areas of 18.95 and 6.43 square miles respectively or a total area of 25.38 square miles. The outlet is through the River Clyde which flows to the south-west past Bothwell and joins the River Derwent near Hamilton. The catchment area of the lakes is unfortunately comparatively small. They are situated very close to the eastern edge of the Central Plateau and the only intake is the Mountain Creek at the northern end of Lake Sorrell.

On the eastern and portions of the southern and northern sides, the catchment area consists of a narrow strip of country varying in width from one-half to two miles, the average being probably between three-quarters and one mile. A similar narrow catchment area of Mountain Creek is a matter for investigation, but it cannot be large as the stream must rise on Mount Franklin and other similarly elevated mountains to the north-west and therefore be of very short length.

The total catchment area of the Lakes, including the lakes themselves, is in excess of 50 square miles but probably does not exceed 60 to 70 square miles.

Mr. K. L. Rabbek in 1902 estimated the catchment area of Lake Sorell including the lake to be 55.7 square miles. Adding to this the area of Lake Crescent 6 square miles and its further catchment area of at least 4 square miles, the total catchment area of the two lakes will be approximately 66 square miles.

RAINFALL.

The average annual rainfall in the vicinity of the lakes is shown by Table No. 3 to be 28 inches at Interlaken and 36 inches at Dog's Head while on the mountains to the north, it is probably greater than these figures.

QUANTITY OF WATER AVAILABLE.

Over the 25 square miles covered by the lakes themselves there would be received say 32 inches of rain per year. From the remaining 40 square miles of catchment area, assuming the total run-off as 33% for the rocky diabase country the amount of water entering the lakes would be equivalent to 17 inches over their surface. The total annual intake would therefore be 49 inches over the area of the lakes, less the loss by evaporation from the surface of the lakes. For a rainfall of 35 inches the evaporation at the lakes was estimated by Mr. Rabbek to be 22½ inches. The total amount of water available annually would therefore be equivalent to 26½ inches over the area of the lakes.

As 100,000 cubic yards per day (equivalent, to a total depth of 16 inches per year over the area of the lakes) has to be supplied to the River Clyde, this has to be deducted from the above in order to ascertain the amount available for other purposes.

It would therefore appear that a depth of 10½ inches over the 25 square miles of the lakes, or 14,000 acre-feet of water is the maximum amount available from the lakes during years of average rainfall.

CONSERVATION FACILITIES AT THE LAKES.

The western shores of the lakes are very flat and at altitudes very little above that of the water level in the lakes. Comparatively long retaining walls would therefore be necessary and a large area of land would be flooded. No great height of wall would however be necessary owing to the large area which the water would be distributed.

Alternative proposals are conservation schemes along the Blackman's Rivulet, the water from the lake being discharged into this stream.

METHODS OF DELIVERING THE WATER TO THE MIDLANDS.

There are two possible schemes for conducting the water from the lakes to the Midlands.

1. From the north-eastern corner of the Lake Sorell a tunnel of approximately 40 chains in length would deliver the water onto the slopes of the Western Tiers and into the head of Flood's Creek, a tributary of the Mill Brook which is itself a tributary of the Blackman's Rivulet. The tunnel would be through the very tough diabase rock for the whole of its length. No suitable sites for conserving large quantities of water are available along Flood's Creek, although suitable intakes for channels occur. The steep slopes of the Tiers would permit the water being used for hydro-electric power schemes.

2. From the south end of Lake Crescent, tunnels of 60 - 80 chains in length would conduct the water into Fern Creek or one of the other numerous headwater streams of the Blackman's Rivulet. If the water be taken to Fern Creek, the tunnel, would be in the comparatively soft Ross sandstones for the whole of its length, but if the tunnel be driven further west, it would be in diabase for a large part of its length.

Facilities for conservation of large amounts of water occur along the Blackman's Rivulet and will be discussed below. The conditions are not so ideal for hydro-electric powers schemes as at Flood's Creek but moderate heads could be obtained.

CONSERVATION FACILITIES ALONG THE BLACKMAN'S RIVULET.

From the south-western end of Mike Howe's Marsh the Blackman's Rivulet has a very flat grade for a length of four miles (the total fall being less than 200 feet) until opposite the hill known as Flat top. This is due to the river flowing over soft Trias-Jura (probably of the Ross series) sandstones, for, the whole of this length. On the downstream side of these sandstones, the stream flows through a deep gorge in a large body of diabase for a distance of 3 miles. The hard resistant diabase has greatly retarded the work of the stream whose development has not advanced beyond the cutting of the deep gorge. In the softer sandstones upstream however, the development of the stream has reached a much more mature stage in which it has a low grade and a more open valley especially on the south-eastern side.

These conditions are favourable for water conservation schemes. A retaining wall of short length and moderate height situated at or near the entrance to the gorge would cause the water to fill the valley for considerable distance upstream. Dam sites could be readily obtained to impound the surplus water (14,000 acre-feet) calculated above together with that from Blackman's Rivulet to be considered below.

The most suitable and economical site in the above locality would require to be determined by a detailed survey.

The eastern side of the proposed dam site is occupied by Trias Jura sandstones. These are somewhat porous, and a small amount of water might be lost by passage through them, but it is not anticipated that it would reach such dimensions as to effect the proposal. Any such water would find its way into the Stringybark Creek and could be returned to the Blackman's Rivulet at the northern end of the Gorge by a race two miles in length at a point suitable for distribution to the Midlands.

The very steep and rocky sides of the gorge below the proposed dam site presents difficulties, not necessarily insurmountable, in the construction of channels. If hydro-electric power schemes are not combined with the irrigation, the conserved water could be allowed to flow down the river and taken off by channels further downstream where their construction would not be so difficult.

WATER SUPPLY FROM THE UPPER BLACKMAN'S RIVULET.

With a dam situated near the entrance to the gorge, an addition to the water supply from the lakes would be obtained from the catchment area of the Upper Blackman's Rivulet. The total catchment area of this stream down to the entrance to the gorge is 27 square miles. The average yearly rainfall at the neighbouring station of Bow Hill is 2481 points, while that at Interlaken is 2838 points. The catchment area is composed of diabase and Trias Jura sandstones and the total run off may be taken as 25 per cent.

Using the above figures of 27 square miles, 24 inches rainfall and 25 per cent off, the amount of water available per annum would be 8,640 acre-feet.

QUALITY OF THE WATER.

In general, surface water is suitable in quality for irrigation purposes. While it is not anticipated that the supplies discussed above will be of unsuitable quality, the matter is one that should not be passed over without investigation.

It is found that the waters of the Midlands particularly when they occur underground, derive certain mineral substances from the rocks over and through which they pass. From the decomposed diabase salts of calcium and magnesium in the form of bicarbonates are obtained, while from the Trias-Jura sandstones common salt (chloride of sodium) and epsom salts (sulphate of magnesium) are obtained. When the content of such substances, as common salt reaches certain dimensions care is necessary in the use of such waters.

The water from the above sources would be of quite suitable quality during periods of heavy rain, but during the dry portion of the summer, there is a tendency for the stream waters to become somewhat concentrated in the above substances.

The only satisfactory method of testing the quality would be to take a series of samples every week, fortnight, or month from a few points on Lakes Sorrell and Crescent and the Blackman's Rivulet, throughout a period of one or more years. These samples could then be analysed in the Mines Department Laboratory and the quality of the water over a year be determined from the point of view of irrigation.

POSSIBLE COMBINATIONS OF IRRIGATION AND HYDRO-ELECTRIC SCHEMES.

1. If the water be taken from the north-east corner of Lake Sorrell into Floods Creek, very favourable conditions for a power scheme would exist. From the outlet of the proposed tunnel a fall of 900 feet could be obtained in a distance of 45 to 50 chains, 1,100 feet in 110 chains, 1,300 feet in 160 chains, or even greater falls in larger distances, without affecting satisfactory distribution of the water to the Midlands.

2. If the water from Lake Crescent be conducted into the Blackman's Rivulet the conditions are not quite so favourable.

From the tunnel, a fall of 500 feet in 100 chains or 700 feet in 160 chains could be obtained.

In addition further use might be made of the water in the proposed dam. A channel with a length of 200 chains would give a head of 600 feet. Slightly larger heads could possible be obtained and without affecting the distribution of the water for irrigation purposes.

The total amount of power to be developed by either of the above schemes would not be large in comparison with other power schemes within the State, but should the irrigation scheme be proceded with, the development of the above scheme or schemes in conjunction with it, are worthy of consideration.

CONCLUSIONS AND RECOMMENDATIONS.

In the Tunbridge Plains and their northerly extension through the Midlands soils generally suitable for irrigation purposes as regards quality, drainage and topography occur.

The rainfall in this district is 18 to 21 inches per annum, and the amount during the growing period is much below the maximum required by crops during the period. Additional supplies of water would therefore be of great advantage, if not an absolute necessity in order that the land be utilised to its fullest capacity.

Probable water supplies are obtainable from Lakes Sorrell and Crescent and the upper parts of the Blackman's Rivulet. Approximate calculations have been made to determine the amounts of water available from these sources and indicate that approximately 14,000 acre-feet are available in Lakes Sorrell and Crescent and 8,640 acre-feet in Blackman's Rivulet during years of average rainfall.

Facilities exist for conserving these amounts of water along the course of Blackman's Rivulet while storage is also possible in the lakes themselves.

Assuming that the duty of the water will be one foot, though this figure requires careful investigation, the maximum area of land that could be irrigated would be 22,640 acres.

Conditions are favourable for the development of small hydro-electric power schemes in conjunction with the provision of the water supplies for irrigation.

Before a scheme is formulated however there are many preliminary and essential investigations, surveys etc. to be carried out, including among others the following:-

1. Soil and irrigation survey of the Midlands.

2. Survey and investigation of the whole question of obtaining and conserving water supplies in Lakes Sorrell and Crescent and the upper Blackman's Rivulet.

3. Investigation of the quality of the water supplies.

When these and other problems have been satisfactorily investigated, and estimates of the schemes prepared, the further and vital question as to whether the irrigation will be a payable proposition has to be considered.

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