ABSTRACT OF PROCEEDINGS, AUGUST, 1903.

INTERESTING PAPERS.

At the monthly meeting of the Royal Society of Tasmania on Tuesday evening, August 11, His Excellency the Governor (Sir Arthur Havelock) presided.

CONTRIBUTIONS TO THE PHYSIOGRAPHY OF TASMANIA.

No. 2.

RAINFALL AND WATER SUPPLY OF THE GREAT LAKE.

(By Mr. H. C. Kingsmill and Colonel Legge, R.A.).

In March last, a trip for scientific purposes was made by us to the Great Lake, and, as part of the work, we undertook the investigation of the supply of water flowing into the lake at the north, and mountainous, end. As is well known, the character of the country at the north is totally different from that at the south: the bare plains and barren hills of the latter giving way to the bold ranges of rocky mountains and glades and valleys of damp, boggy soil, which constitute the reverse slopes of the Great Western Mountains.

We were induced to pay attention to this subject owing to the wide-spread idea that the Great Lake has no "feeders," and that the outflow through the Shannon at the south end is compensated for by the influence of springs at the bottom of the lake. We would here remark that, from the results of our numerous soundings all over the lake, no bottom is more unlikely to contain springs.

As the result of a previous visit by one of the writers to the lake, a meteorological station was established at the north end, under the care of Police Trooper Archer. Observations commenced at the Little Lake in June, 1902. In that we now have a year's record, revealing one of the most interesting cases of great variation in rainfall between two contiguous stations that can probably be found in Tasmania.

As "the crow flies," the distance between the south end of the lake—Swan Bay—and the Little Lake at the north end is about 15 miles. At the former the rainfall was 18.0 inches during the 12 months ending May 31, and has averaged 33.87 inches during the past years; while our record at the station on Little Lake for the same period—June 1, 1902, to May 31, 1903—reaches a total of 63.62 inches.

This remarkable difference in the fall at the two places is caused by the proximity at the north end of the lake to the high mountains of the Western Ranges, which catch all the rain coming from the west and north-west, and precipitate it on the watershed between Dry's Bluff, with its contiguous mountains and the lake shores. Although this watershed is one of inconsiderable depth, measuring from north to south, it is traversed by several not unimportant streams, which lead to the lake in a belt of only about four miles in width.

After a heavy night's rain, with a fall of two inches, which is of frequent occurrence, these streams come down in high flood, which, from observations we made, lasts two or three days, and pours an immense body of water into the lake. This es especially the case as regards the principal "feeder"—omitted for some unexplained reason from the maps—and which we are desirous of naming the "Shannon Rivulet," as it may be considered as much a part of the Shannon as the upper portions of the Shannon River in Ireland, before it flows through the splendid lakes which are renowned for their salmon fishing. The rivulet in question rises in a locality called by shepherds, "Half Moon Marsh Creek," little above the Pine Lake on the crest of the Great Western Mountains, and flows through the Half-Moon Marshes, and into the Little Lake, which empties by what is known as the "channel" into the Great Lake.

As illustrating the effect of one of the heavy downpours which are frequent at the north end, while there is scarcely any rain at the south, we may mention that on the night of March 2, we were camped at the Little Neck, which is half-way down the lake. It commenced to rain about 11 o'clock, the fall being by no means heavy—a steady rain, with moderate breeze from the north—and continued till 9 a.m. next morning. At this time a strong north-west wind was blowing, against which we had to pull in a heavy sea most of the day before we could get into position to sail home. On our arrival at the north end, we were met by the dark, peaty waters of the flood from the Pine Lake, about three-quarters of a mile from the shore, and reached our landing place in the channel with much difficulty. We found that there had been heavy downpours of driving rain, commencing earlier than with us, and continuing without intermission till 11 a.m. the next morning, the fall registering by 9 a.m. inches.

At the Little Neck, 10 miles south, we

had had a moderate rain of about 70 points at the most up till the time it ceased. At Tinder Bay, about 30 points were registered.

This is, doubtless, a fair instance of the locally heavy rainfall at the north end, and shows the effect the adjacent mountains have on its precipitation around the head of the lake. Four miles to the north, at the Pine Lake, the source of the Shannon Rivulet, the fall must have been much greater, as is proved by the heavy flood which came down this stream about 1 o'clock on the 4th.

The four principal streams, which drain the watershed above the lake, are, commencing at the east—firstly, Breton's Rivulet, which rises in the Dry's Bluff region, and has a southerly course of about 10 miles, until it flows into the lake about a mile to the east of the channel; secondly the Shannon Rivulet, flowing out of the Pine Lake, passing through the Half Moon Marshes, and taking up several tributaries before it reaches the Little Lake, which discharges by the channel into the lake — these tributaries rise in upland marshes which discharge large bodies of water after a night's rain; thirdly, a small stream, Kimberley's Creek, which drains several marshes, and rises in hills to the north, not far from the source of the Shannon Rivulet. This creek falls into the lake a mile to the westward of the channel. Fourthly, Pine Creek, which comes down the valley at the north-west corner of the lake, and through which the track passes to the Nineteen Lagoons. The course of this stream turns northwards at some distance from the outlet, to high marshes, where it rises, and at its bend is joined by a tributary called Kermode's Rivulet, flowing from the slopes of the Stony Tier, a bold and rugged range, dividing the lake valley from the Ouse and Nineteen Lagoons district. Futher south on the lake shore, about two miles, there enters a fifth stream, Brandum's Creek. This, and one or two still smaller creeks to the north of Reynold's Creek, flow from the eastern face of the Stony Tier.

At first sight, this lofty range would appear to furnish an important watershed, and the smallness of the creek flowing from its slopes surprises one. The reason, however, is plain, inasmuch as the range lies out of the track of the heavy north-west rains, and its sides, like those of the Sand Bank Tier, on the east shore, are mostly bare and made up of large fields of talus, in comparison to which the Ploughed Field of Mount Wellington is a pigmy. Consequently the water from heavy falls of rain rushes down at once to the lake, and there is no lodgment in marshes and small morasses as along the north side of the water. In fact, along this shore of the lake, as on the north, numberless rills and streamlets intersect the boggy slopes leading from the mountains to the shore, and materially help to augment the inflow after heavy rain.

On the eastern shore, between Breton's Rivulet and the large bight at the foot of the Sand Bank Tier, there are no creeks of any consequence until the north-east corner of the bight is reached, where there is a stream, bridged over by the Government, which carries a good flow of water after heavy rain, but normally has but little water in it. It is to be regretted that no opportunity was afforded us of gauging this creek. Beyond this at the southern corner of the bight, there is Boggy Marsh Creek, still smaller; but further south there are no creeks of any consequence, and the rainfall becomes very much reduced the more one approaches the extreme south of the lake.

On the slopes of the Sand Bank Tier, the fields of talus are more gigantic than on the Stony Tier, and there is no lodgment for water, with, also, less rainfall than on the latter.

From the above outline we think it may be gathered that, though there are no large feeders at the north of the Great Lake, the rivulets that do exist carry a large body of water to the lake after heavy rain, and that the climate is so wet that the discharge from surrounding mountains is of frequent occurrence throughout the year, except when the lake is frozen over. This happens every year between the latter end of May and the beginning of July; occasionally, however, a thaw sets in in June or July, and the ice is broken up by a gale, when the discharge into the lake from the melting snow, often 2ft. deep, is very considerable.

During our stay of a fortnight we found that the outflow by the Shannon at Swan Bay was very small, and that the many falls of rain at the north end had very little effect on the water level at the south end, only raising it a few inches. The Shannon is dammed up half a mile from the outlet, so as to keep the water in Swan Bay at a convenient level for fishing purposes. The dam has recently been broken by ice floes in the spring, and at the time of our visit had been repaired. The water flows through the stones, there being no "spill," and below the structure, where we could get a good section, the stream was gauged.

The effect, however, which a strong wind, blowing either north or south, has upon the lake level at the opposite end, is remarkable. The lake being very shallow, in proportion to its great area, and the bottom being so extraordinarily level, a sea rises in a few minutes, one might almost say, and the water being forced through the straits, formed by the remarkable peninsulas — locally called "necks" — which are characteristic features of the lake, a rise of over a foot takes place at the extreme ends, after a moderate gale only. This does not affect the question before us, but it was thought it might be a fact of interest to the Fellows of the Society.

The gauging of the streams was taken with a current meter, kindly lent us by the Government Hydrographer of New South Wales, Mr. Halligan. Sections of the stream beds were carefully taken, a site being selected in each case where the bottom was even, and in the case of the larger streams the current was taken at the surface, a foot below it, and near the bottom, and the mean taken as the velocity.

Where it was not practicable to measure the depth at intervals right across, the depth in the centre was estimated proportionately with that near the sides. In every instance care was taken not to overestimate the depth, so that the calculated volumes may be taken as rather under than over the actual ones.

It was thought advisable to ascertain the quantity of water the "feeders" at the north end were capable of supplying to the Lake; we, therefore, decided to gauge them shortly after the flood of the 3rd March, alluded to above. A commencement was made with the "channel" the following day, 22 hours after the fresh was at its height.

The following table gives the result of our measurements:—

Channel from Little Lake. — Time after height of flood, 22 hours. Velocity per minute, in feet, 156. Volume in gallons per minute, 66,812.

Breton's Rivulet, 24 hours, 150ft., 31,171 gals.

Kimberley's Creek, 27 hours, 140ft., 6,344gals.

Pine Creek, 28 hours, 147ft., 34,912gals.

Brandum's Creek, 29 hours, 86ft., 2,150 gals.

Total flow in gallons per minute, 141,-389.

Total flow in gallons per 24 hours, 203,-000,000.

The following day the Shannon Rivulet was gauged about the Little Lake, to ascertain the quantity of water flowing into the latter from this stream, exclusive of that from the many small rills intersecting the marsh land at the foot of the Fluted Tier, overlooking the lake. The Little Lake channel was also gauged. The following were the results:—

Shannon Rivulet—Time after height of flood, 48 hours; velocity per minute in feet, 130; volume in gallons per minute, 46,919.

Little Lake Channel, 46 hours, 127ft., 48,218gals.

On Saturday, the 7th, the fourth day after the flood in the north, we gauged the Shannon below the dam. Some difficulty was experienced in getting a good section, owing to the stony nature of the bottom. We chose a spot where the river was 24ft. wide, and the depth 9in. The result was as follows:—

Shannon River—Time after height of flood, 4 days; velocity per minute in feet, 84; volume in gallons per minute, 9,450.

Total outflow in gallons in 24 hours:—13,848,000.

We ascertained from the police trooper in charge of the meteorological station at Swan Bay, that the flood we had in the north had made very little difference to the lake level at the south end. It was estimated that the fresh would have taken about two days to reach the south, according to which our measurements would have taken about 48 hours after flood, although the actual date gives four days.

The conditions which affect the water supply of the Great Lake may, therefore, be summarised, in conclusion, as follows:

1. A wet climate at the north end, caused by the proximity of high mountains.

2. A watershed of mountain rivulets, which suddenly rise after torrential rains, and which flow through morass-land, holding large quantities of water in wet weather.

3. Repeated heavy falls of rain, which renew the large flow in the creeks, and compensate for the rapid subsidence of the floods.

4. Melting of snow, particularly at the north end.

5. The normally small outflow at the south end, owing to the conformation of the land at the river's starting point, and to the fact of its being dammed as well. This small outflow will compensate considerably for evaporation in the summer season.

Although the question of the lake water being utilised largely as an irrigation supply is beyond the provinces of stating that we take this opportunity of stating that in our opinion the shallowness of the lake, in spite of its large area, and the intermittent nature of its source of supply preclude the carrying out of any extensive scheme without interfering with the features of the lake, unless an embankment were thrown across the glade through which the Shannon commences its course.

The conditions which lead to this assumption are:—In the first place the lake is uniformly shallow; its three great subdivisions—North Lake, East Bight, and South Lake—are, on the bottom, level plains, with maximum depths of 16, 12, and 18ft. respectively; and the Middle Reach, north of South Lake, is shallower still; in the second place, the water entirely round the vast outline of the lake is so low that, at the time of our visit, the boat could in very few places be brought less than 30 yards from the shore. The water was, it is right to mention, 2ft. below normal level. At one spot, it was not a foot deep 600 yards from the shore, and in other places we had to wade 150 yards so as to land. The effect, therefore, of a heavy drain on the lake would be serious with a flat shore of this kind. We conclude with a few remarks on the practicability of using the lake as a reservoir.

The above-mentioned data and calculations will serve to show to what extent the lake acts as a reservoir, turning an intermittent supply into a constant stream.

During the night referred to above, on which we were camped at Kermode's Neck, over two inches of rain fell in a few hours at the north end of the lake, bringing the five principal creeks flowing into that end to a state of high flood. Twenty-four hours after the flood was at its height, the flow of the creeks was gauged; the flood marks would be seen far above the banks, but the creeks, though full, were within their banks.

It must be mentioned here that one creek had been gauged before the rain fell, viz., Kimberley Creek, and there the flow after the rain was fount to be ten times what it was before; the total inflow of all the creeks was about 100 times the inflow of the Hobart water supply at the Gentle Annie falls, just above the reservoir. In a very few days, doubtless the creeks would go back to the previous condition of discharging one-tenth that amount. Then another storm would come along, and another flood.

Let us consider how the outflow from the Great Lake would be affected by this intermittent supply. In the first place, we have the evidence of the Meteorologiial Observer at the south end of the lake that this flood at the north end produced no perceptible difference in the Shannon; we, ourselves, gauged the Shannon when we arrived there four days after the rain, and found the outflow from the Great Lake to be at the rate of 13,000,000gal. for 24 hours.

What then had become of the flood at the north end? A little calculation will serve to show: The area of the Great Lake is approximately 28,400 acres; 200,000,000 gal. spread over this area would approximately amount to a third of an inch in depth.

From this it is apparent that the great extent of the lake is quite sufficient to account for the equalisation of the flow of the Shannon, and its apparent indifference to an occasional flood.

Colonel Legge forwarded the following additional note:—

Please express my regret to His Excellency that I am not present to-night to take part in the discussion on the paper read last meeting on the Great Lake. I trust our investigations will at last throw some light on the vexed question of the supply of water to the Great Lake. Although there is, doubtless, a very heavy discharge through the Shannon in the winter from the lake, there is comparatively little when the water is at summer level, as our investigations show 203,000,000 gallons flowing in during rain, and 13 million flowing out under like conditions, for 24 hours. Therefore, in connection with the use of the lake as a reservoir the question to be considered is loss of water in the summer by evaporation and absorption. The suns rays are powerful in the rarified atmosphere of the lake, and the loss of water from these latter causes is forgotten, more than that by overflow. This is proved by Mr. Buckley, C.S.I., in his interesting paper on the East African Protectorate to be a very important factor in the case of Lake Victoria Nyanza. The maximum discharge from it by the Nile, over the Ripon Falls, is shown to be 30,000 cubic feet a second, which only lowers the lake level about 1¼ inch in a month. On the other hand the reduction in the lake levels is at times so considerable, as shown by the "greoges," that after deducting the loss for overflow at the above amount, it leaves a balance of 7 or 8 inches a month to the effect of evaporation. This astonishing difference is due to the tropical sun, in spite of the large area of the lake, which is more than 2,000 square miles larger than Tasmania, but these results must convince one that even in the lesser degree, due to climate and small size of the Great Lake, the loss in summer by evaporation is very considerable. It would not be difficult to estimate it, if gauges were fixed up by the Government at the Lake. The results would be more interesting to students of the Physical Geography of Tasmania, if to no one else.

Mr. Kingsmill, in opening the discussion, said they had been told there was a great hole somewhere in the Great

Lake, but they were unable to find it, the greatest depth found was 20 feet. The bottom of the lake was level, covered with blue mud. There were three very remarkable islands in the lake. He described the lake and its surroundings from a geological point of view. The rock walls on the shores of the lake constituted a remarkable formation.

Mr. R. M. Johnston said Col. Legge had placed him in possession of several rocks from the shores of the lake, all more or less weathered portions of basalt, of recent eruptive rock, often remarkable for showing structures of radiated pillars. No doubt there had been a damming up of recent eruptions of basalts at the eastern end. He was surprised that a greater body of water was not discharged all the year round from such a large area. He warmly commended Col. Legge's paper as a very valuable one to this community. (Applause.)

His Excellency thought that if Mr. Kingsmill could give them some information as to the waters of the lake in relation to irrigation, it would be useful.

Mr. Kingsmill replied that it was his first visit to that country, and he had not the opportunity of making extended observations. The head waters of the Ouse flowed past the Great Lake, and that river carried a much larger volume of water than the Shannon, which flowed out of the Great Lake. He thought that the waters of the Ouse might be diverted into the Great Lake, and thus a much greater volume of water would flow out of it. It was a question of levelling and surveying. There must be a rapid fall down the valley of the Shannon, which might be made available for water power.

"Agronomy in Relation to Science."

This was the subject of a paper read by the Rev. E. H. Thompson, in which he advocated a systematic nomenclature of our fruits, notably apples and pears, showing how useful a recognised system of nomenclature would be in many directions, particularly in connection with ordering fruit trees true to name, and in marketing as well as manuring, and otherwise cultivating these fruits. A botanical classification would help to reliably observe and determine the various processes of fructification and pollination, and the relation between scion and stock, a subject, he said, about which we practically know nothing, but which must exercise a marked influence on the fertility and vigour of the trees. He suggested a section of the Royal Society dealing with such matters.

Mr. Thos. Stephens sent in some notes on the same subject, commending Rev. E. H. Thompson's paper, and emphasising the importance of it. He hoped the suggestion of forming a section of the Royal Society would be carried out.

Mr. L. Rodway emphasised the importance of improving our fruit, especially seeing that the industry had increased to the output or marketing of about a million cases a year. The knowledge Mr. Thompson intimated was of a very difficult nature to acquire. The Government should establish a central school for the teaching of agriculture and fruitgrowing. There should be a State orchard for experiments, and the imparting of knowledge connected therewith. It was very unfortunate that in regard to fruit we had to depend so largely on popular names. There certainly should be wax models of our principal fruits, correctly formed and coloured, placed in the Tasmanian Museum—(applause)—and growers made to name their fruits in accordance with such models. (Applause.) Mr. Thompson's remarks about the importance of cross-fertilisation he supported, especially in connection with the increase in both quantity and quality of fruit from shy bearers. It was to be hoped the Government would take the matter up as a branch of technical education. (Applause.)

Rev. E. H. Thompson, in replying, said there was hardly an apple grown in Tasmania that was correctly and definitely named by growers as a body. If the Royal Society could not establish a section as he suggested, then a Pomological Society should be formed without delay. (Applause.)

Mr. R. M. Johnston was surprised that such a society had not already been formed.

FLOWERING PLANTS AT KETTERING.

Mr. R. M. Johnston, F.S.S., presented a paper, dealing with the characteristic plants of Kettering and its immediate vicinity, containing a classified list of plants collected within the limits of the township in the month of November, 1902. The greater part of the shrubs and herbs were in flower, and the collections, although far from complete, he said, must be regarded as especially representing the characteristics of the flora of this beautiful seaside locality. No less than 130 species were described.

Mr. Morton hoped the above would be the first of many lists of local plants the society would receive. Teachers of schools might prepare lists with great advantage.

His Excellency, in moving votes of thanks to the readers of papers, said he regarded Mr. Thompson's paper as an extremely valuable one, and he trusted it would be printed, and widely circulated. (Applause.)

The vote of thanks was passed, and the meeting terminated.