(Paper No. 4048.)

“The Yield of Various Catchment-Areas in Scotland.”

By WILLIAM CARSTAIRS REID.

THE rainfall in various parts of the Edinburgh and District Water Trustees' area has been the subject of previous communications to The Institution.¹ The amount of evaporation has been dealt with, to some extent, but no results of systematic observations as to the yield in relation to the rainfall have yet been presented. A great deal of material has, however, been collected upon these and other areas with which the Author is professionally connected, and he proposes in this Paper to discuss the yield of the Talla catchment-area in Peeblesshire, the Glencorse catchment-area in Midlothian, and the Glenfarg and Slateford catchment-areas in Perthshire, leaving various other areas for consideration at a later date.

At the outset it would appear that the remarkable paucity of information available when the Edinburgh and District Water Trustees first thought of utilizing the head waters of the Tweed has served an extremely good purpose, in that it has led to the making of a considerable number of observations which would otherwise not have been commenced, or if commenced might not have been continued.

The merits of the Talla catchment-area were under discussion for a long time before the scheme was presented to Parliament, and in this way quite a number of stream-gaugings had been made before the riparian owners and millowners asserted themselves in regard to the quantity of water available. These observations have been continued until now, and besides this, all possible use has been made of a detailed table of contents of the reservoir during the first filling of the reservoir, and since it has been in use for the supply to Edinburgh and district.

¹ Minutes of Proceedings Inst. C.E., vol. lxxiv, p. 91, and vol. clxvii, p. 102.

The Talla catchment-area has an elevation ranging from 950 feet to 2,625 feet, and an extent of 6,180 acres, as shown in the accompanying map (*Fig. 1*), on which the positions of the various rain-gauges are indicated.

In 1906 an up-to-date evaporation-gauge by Messrs. Negretti and Zambra, fitted with a vernier, was installed near the Talla reservoir embankment, and very careful observations have been taken regularly since then. These are given in Table I of the Appendix. The maximum evaporation observed over a long drought was during the months May–August of the dry summer of 1911, when the average monthly evaporation from the surface of the gauge was 3·6 inches. This represents about $\frac{3}{4}$ million gallons daily from the surface of the reservoir.

The estimated yield of the catchment-area, as shown in Table III, has been arrived at by observing the rise or fall of the water-level in the reservoir from time to time, the quantity sent to town, the quantity sent into the river for compensation, and the quantity run to waste by overflow or otherwise. During the months when no water has run to waste the figures are shown in italics, to indicate that the results may be accepted as fairly correct, large overflows in other months being difficult to measure accurately.

The results of observations of the flow of the Gameshope Burn—a tributary of the Talla—are also tabulated (Table IV). In this case, however, the observations were made by means of an ordinary rectangular weir with a recording instrument, and it is satisfactory to note that the results obtained in this way compare very well with the results obtained by the other method, so far, at least, as regards the flow in the drier months of the year. The formula used in calculating the flow was

$$Q = 4 \cdot 904 L H^{\frac{3}{2}}$$

where	Q denotes the flow in cubic feet per minute;
L	„ length of the weir in feet;
H	„ head over the weir in inches.

An examination of the returns shows that a very satisfactory proportion of the rainfall is returned to the stream.

Professor James Geikie has given the following particulars of the geological formation of the area :—“ Hills composed of Silurian greywacke and shale; lower slopes of hills covered with a sheet of till or boulder-clay of variable thickness. Upper and steeper hill-slopes usually covered with scree-material, i.e., frost-riven debris

of greywacke and shale, along with grit, sand and loamy earth, due to chemical and mechanical action of the atmosphere."

Table V, showing the yield of the Glencorse area, has been arrived at in the same manner as in the case of the Talla area, i.e., by observing the rise or fall of the water-level in the reservoir, and in the same way the figures in italics show the months during which no overflows took place likely to affect the accuracy of the record. The catchment-area is shown in *Fig. 2*, in which the positions of the rain-gauges are indicated.

In the case of the Glenfarg and Slateford catchment-areas (*Fig. 3* and Tables VI and VII) there was the same lack of information in regard to available rainfall, but there was no organized opposition in regard to the quantity of compensation-water proposed in the Provisional Order by which the watershed was secured by the Burgh of Buckhaven. This enterprising burgh, however, only secured the watershed subject to the County Council of Fife being allowed to take over the scheme under the authority of a Provisional Order to be applied for within 2 years. This the County Council decided to do, after arranging for very careful records to be made of the water actually available from the areas proposed to be intercepted. Three complete years' records are now available, and, fortunately, these include 1911—one of the driest experienced in the district for very many years. Hutchison cam recorders by the Glenfield Company were installed, and have been visited regularly by a local joiner, who soon became expert in changing weekly the papers on the drum.

It is an interesting fact that the dry-weather flow of the Slateford Burn is considerably greater than that of the Farg Water, although the catchment-areas adjoin, as shown in *Fig. 3*, and are somewhat similar in character. More land-drainage, however, has been carried out on the Farg area, with the result that the water appears to run off more rapidly. This seems to result in a smaller loss by evaporation. Table II shows the extreme dry-weather flow over various periods and is useful when considering what quantity of water can be made available for a town supply when full storage is not to be provided.

The Edinburgh and District Water Trustees have under consideration the afforestation of the Talla drainage-area, which renders it more desirable that figures should be obtained now for comparison hereafter, so that the effect of afforestation on either the total yield or the yield during the dry months may be determined.

The Gameshope readings are of particular interest in some of the

Fig. 2.

GLENCORSE BURN CATCHMENT-AREA.

early months of various years, the yield having occasionally exceeded the rainfall, on account of the melting of accumulated snow.

The whole of the gauges on the various drainage-areas above referred to are being maintained under the direction of the Author's firm, Messrs. J. and A. Leslie and Reid, and are visited and examined from time to time by the Author, who desires to record his appreciation of the public-spirited manner in which the authorities have continued the observations.

The Paper is accompanied by three maps, from which the Figures in the text have been prepared, and by the following Appendix.

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APPENDIX.

TABLE I.—EDINBURGH AND DISTRICT WATERWORKS : TALLA RESERVOIR.

Records of Rainfall and Evaporation. Level of Gauges 904 feet above Ordnance Datum.

	1906		1907		1908		1909		1910		1911		1912	
	Rain-fall.	Evapora-tion.	Rain-fall.	Evapora-tion.	Rain-fall.	Evapora-tion.	Rain-fall.	Evapora-tion.	Rain-fall.	Evapora-tion.	Rain-fall.	Evapora-tion.	Rain-fall.	Evapora-tion.
January . . .	Inches. 6·63	Inches. 1·27	Inches. 2·04	Inches. 0·10	Inches. 4·42	Inches. 0·10	Inches. 4·92	Inches. 0·05	Inches. 3·41	Inches. 0·00	Inches. 3·02	Inches. 0·33	Inches. 4·44	Inches. 0·47
February . . .	3·59	1·06	3·05	0·00	3·42	0·08	2·45	0·13	7·20	0·00	5·12	0·38	3·72	0·51
March . . .	2·98	0·59	4·20	0·39	6·35	0·12	4·52	0·02	4·77	0·73	2·76	0·79	5·55	0·76
April . . .	1·77	1·99	2·70	1·63	1·78	1·23	3·29	1·70	4·57	1·28	4·90	1·48	0·98	2·21
May . . .	5·82	1·38	4·41	1·78	3·02	2·34	2·82	3·38	2·11	2·81	4·18	4·03	1·21	2·47
June . . .	2·11	3·06	4·22	1·33	2·81	3·14	2·72	3·06	1·55	3·42	3·37	3·70	5·42	1·90
July . . .	2·77	2·47	3·42	2·52	2·16	2·92	5·53	2·38	5·20	3·19	1·50	3·37	3·06	3·41
August . . .	7·07	2·16	5·42	1·63	4·42	2·55	2·80	2·18	6·14	2·42	2·35	3·30	4·60	1·57
September . .	1·02	1·71	0·86	1·53	5·07	0·98	2·82	1·15	1·05	1·38	1·93	1·67	3·01	1·53
October . . .	6·72	0·62	9·22	0·96	1·59	1·03	8·70	1·24	3·89	0·99	4·13	0·90	4·33	0·94
November . . .	4·70	0·30	3·51	0·30	3·35	0·25	1·95	0·01	2·84	0·34	7·87	1·20	3·83	0·55
December . . .	2·98	0·08	4·66	0·28	2·10	0·01	4·39	0·09	5·96	0·36	10·18	1·76	8·96	0·60
Total . . .	48·16	16·69	47·71	13·00	40·49	14·75	46·94	15·39	48·69	16·92	51·31	22·91	49·11	16·95

TABLE II.—EXTREME DRY-WEATHER FLOW.

Lowest Average Flow.	TALLA WATER.		GAMESHOPE BURN.		GLENORSIE BURN.		SLATEFORD BURN.		RIVER FARG.	
	Date.	Cubic Feet per Second per 1,000 Acres.	Date.	Cubic Feet per Second per 1,000 Acres.	Date.	Cubic Feet per Second per 1,000 Acres.	Date.	Cubic Feet per Second per 1,000 Acres.	Date.	Cubic Feet per Second per 1,000 Acres.
During a period of 1 week.	In June, 1911	0.587	In June, 1911	0.435	In September, 1911	0.245	In October, 1911	0.160	In October, 1911	0.085
During a period of 1 month	June, 1910	1.092	June, 1910	0.875	September, 1911	0.347	June, 1910	0.185	September, 1911	0.125
During a period of 4 months	June-September, 1911	2.258	June-September, 1911	2.370	July-October, 1911	0.652	June-September, 1911	0.313	July-October, 1911	0.257
During a period of 5 months	June-October, 1911	2.690	June-October, 1911	2.650	May-September, 1911	0.748	June October, 1911	0.410	June-October, 1911	0.376
During a period of 6 months	May-October, 1911	3.246	May-October, 1911	2.864	May-October, 1911	0.840	May-October, 1911	0.546	May-October, 1911	0.483

TABLE III.—TALLA WATER (PEEELESHIRE).
 Catchment-Area (*Fig. 1*, p. 5), 6,180 acres.
 Elevation of Catchment-Area, 950 to 2,625 feet above Ordnance Datum.
Rainfall and Yield.

Year.	Rain-Gauge.							Average Annual Rainfall.	Annual Precipitation on Catchment Area.	Actual Annual Yield.	Total Loss.
	1 Talla Moss.	2 Loch Craig Head.	3 Ravens-craig.	4 Gameshope Loch.	5 Gameshope Farm.	6 Talla Linn Farm.	7 Quarter Hill.				
	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Million Gals.	Million Gals.	Inches.
1906	45·07	55·85	61·95	61·28	67·65	60·48	49·26	57·36	8,042	7,723	2·27
1907	50·89	61·19	77·15	70·65	76·14	63·09	50·31	64·24	9,006	8,124	6·29
1908	45·39	58·54	66·48	62·59	63·20	54·62	41·97	56·11	7,866	7,065	5·79
1909	48·85	64·05	63·25	61·73	71·94	61·83	46·09	59·68	8,367	7,833	3·82
1910	54·82	59·32	67·98	69·32	77·68	68·91	51·46	64·21	9,002	7,751	8·92
1911	46·54	44·60	65·74	76·20	74·84	67·32	53·67	61·27	8,590	7,514	7·67
1912	56·90	61·57	73·97	81·36	73·58	70·23	50·08	67·67	9,486	8,549	6·70

TABLE III (*continued*).—COMPARATIVE TABLE OF PRECIPITATION AND YIELD MONTH BY MONTH, IN MILLION GALLONS PER 1,000 ACRES.

	1906		1907		1908		1909		1910		1911		1912	
	Precipitation.	Yield.	Precipitation.	Yield.	Precipitation.	Yield.	Precipitation.	Yield.	Precipitation.	Yield.	Precipitation.	Yield.	Precipitation.	Yield.
January . . .	182.8	187.3	46.5	93.4	110.5	129.2	144.9	189.5	102.9	111.3	86.8	107.5	131.3	143.1
February . . .	59.2	69.3	75.0	110.7	76.6	91.7	48.0	63.1	186.4	176.0	132.4	131.3	121.3	102.4
March . . .	69.8	125.4	110.3	126.1	169.5	164.4	115.4	93.8	169.7	188.6	51.1	72.3	178.8	162.5
April . . .	42.4	41.2	76.0	51.6	45.2	80.8	93.3	134.7	133.7	104.7	138.1	127.5	23.9	72.2
May . . .	154.8	139.2	143.7	103.9	80.2	67.0	76.6	49.7	60.4	50.7	108.9	99.6	45.0	24.9
June . . .	62.8	53.7	176.8	134.7	104.6	84.2	70.9	55.4	51.5	17.7	87.4	45.9	170.7	131.0
July . . .	87.8	48.7	100.0	78.4	93.0	47.2	140.8	104.8	161.1	67.4	65.2	31.9	114.8	73.7
August . . .	212.8	161.7	166.0	108.8	136.2	57.7	83.9	50.3	233.2	186.2	98.7	32.8	135.8	92.3
September . . .	39.7	32.7	23.5	30.2	188.0	171.0	72.3	58.6	29.8	35.8	52.6	39.0	75.7	59.9
October . . .	206.8	169.2	260.0	188.3	60.2	57.0	302.6	245.3	99.8	55.7	107.0	73.3	127.0	114.9
November . . .	120.5	117.2	122.2	105.5	110.6	90.8	67.4	60.7	70.4	88.0	190.6	227.5	105.3	110.2
December . . .	61.8	104.0	157.4	182.9	98.4	100.6	137.8	161.6	158.7	172.1	271.2	227.2	305.4	295.9
Totals . . .	1301.2	1249.6	1457.4	1314.5	1273.0	1141.6	1353.9	1267.5	1457.6	1254.2	1390.0	1215.8	1535.0	1383.0

TABLE IV.—GAMESHOPE BURN (PEBBLESHIRE.)

Catchment-Area (*Fig. 1*, p. 5), 3,000 acres.

Elevation of Catchment-Area, 950 to 2,600 feet above Ordnance Datum.

Rainfall and Yield.

Year.	Rain-Gauge.				Average Annual Rainfall.	Annual Precipitation on Catchment-Area.	Actual Annual Yield.	Total Loss.
	3 Ravenscraig.	4 Gameshope Loch.	5 Gameshope Farm.	6 Talla Innis Foot Farm.				
1906	Inches. 61·95	Inches. 61·28	Inches. 67·65	Inches. 60·48	Inches. 62·84	Million Gallons. 4,273	Million Gallons. 4,251	Inches. 0·33
1907	77·15	70·65	76·14	63·09	71·76	4,879	3,982	13·20
1908	66·48	62·59	63·20	54·62	61·72	4,200	3,256	13·83
1909	63·25	61·73	71·94	61·83	61·69	4,399	3,654	10·95
1910	67·98	69·32	77·68	68·91	70·97	4,826	2,936	27·87
1911	65·74	76·20	74·84	67·32	71·02	4,830	3,345	21·83
1912	73·97	81·36	76·58	70·23	75·53	5,136	4,397	10·87

TABLE IV (continued).—COMPARATIVE TABLE OF PRECIPITATION AND YIELD MONTH BY MONTH, IN MILLION GALLONS PER 1,000 ACRES.

	1906		1907		1908		1909		1910		1911		1912	
	Precipitation.	Yield.	Precipitation.	Yield.	Precipitation.	Yield.	Precipitation.	Yield.	Precipitation.	Yield.	Precipitation.	Yield.	Precipitation.	Yield.
January . . .	208.5	217.1	51.9	86.0	120.8	137.8	155.7	157.0	116.7	92.5	101.3	95.6	145.9	184.9
February . . .	67.2	96.6	84.2	110.3	85.0	97.6	47.1	81.3	206.5	135.2	160.2	113.3	138.3	169.2
March . . .	79.3	181.5	121.7	139.7	190.9	148.6	132.8	107.2	182.7	134.3	65.1	60.5	207.4	221.0
April . . .	44.0	48.5	83.8	60.7	47.6	77.7	101.1	147.4	146.2	71.0	159.8	75.1	27.2	87.4
May . . .	162.3	143.5	161.5	118.7	81.8	62.9	80.2	43.2	70.3	33.4	123.8	65.7	51.0	19.7
June . . .	65.7	52.4	200.8	141.0	114.9	54.2	72.8	37.1	53.7	14.2	97.5	40.1	177.7	101.5
July . . .	96.3	47.9	107.7	54.7	109.7	51.2	148.5	86.3	177.7	57.1	79.6	34.9	133.3	58.9
August . . .	228.2	86.9	178.3	96.8	139.9	51.9	93.2	50.3	254.5	157.8	117.6	40.9	147.6	86.8
September . . .	46.0	82.3	23.8	33.4	215.1	170.9	75.2	52.0	31.7	31.0	58.0	39.9	83.6	52.6
October . . .	231.4	192.3	290.8	183.3	69.4	60.9	338.9	252.8	110.4	49.4	115.8	63.1	145.9	87.5
November . . .	127.8	140.9	136.9	10.6	118.5	76.3	71.4	55.8	78.4	66.1	220.1	188.4	112.0	101.2
December . . .	67.8	94.0	179.1	194.1	106.5	92.5	149.4	147.7	180.9	136.9	311.2	297.7	341.8	294.9
Totals . . .	1424.5	1416.9	1628.5	1327.3	1400.1	1085.5	1466.3	1218.1	1609.7	978.9	1610.0	1115.2	1711.7	1465.6

TABLE V.—GLENCORSE BURN (MIDLOTHIAN).
 Catchment-Area (*Fig. 2*, p. 7), 3,825 acres.
 Elevation of Catchment-Area, 750 to 1,750 feet above Ordnance Datum.
Rainfall and Yield.

Year.	Rain-Gauge.				Average Annual Rainfall.	Annual Precipitation on Catchment-Area.	Actual Annual Yield.	Total Loss.
	3 Glen Cottage.	4 Glencorse Filters.	2 Loganlea.	1 Harehill.				
1906	Inches. 45·89	Inches. 43·57	Inches. 45·58	Inches. 46·95	Inches. 45·49	Million Gallons. 3946·8	Million Gallons. 2332·1	Inches. 18·68
1907	42·82	42·52	43·16	42·22	42·68	3703·7	2203·8	17·28
1908	34·81	34·29	34·64	36·02	34·94	3029·1	1857·7	14·64
1909	43·75	43·37	43·14	45·64	43·97	3821·6	2414·8	16·17
1910	37·79	36·90	36·92	38·85	37·61	3257·0	2005·6	14·46
1911	36·59	36·65	36·58	39·93	37·43	3245·0	1667·9	18·22
1912	41·86	41·32	39·92	43·13	41·56	3607·2	2186·5	16·38

TABLE V (continued).—COMPARATIVE TABLE OF PRECIPITATION AND YIELD MONTH BY MONTH, IN MILLION GALLONS PER 1,000 ACRES.

	1906		1907		1908		1909		1910		1911		1912	
	Precipitation.	Yield.	Precipitation.	Yield.	Precipitation.	Yield.	Precipitation.	Yield.	Precipitation.	Yield.	Precipitation.	Yield.	Precipitation.	Yield.
January . . .	118.2	78.2	38.3	28.8	126.5	114.5	109.3	94.6	77.9	77.5	46.5	33.7	48.4	51.2
February . . .	43.1	27.8	52.2	41.1	39.6	32.0	54.1	39.9	90.9	105.1	87.5	57.7	60.2	63.3
March	79.2	62.9	61.0	51.4	110.8	85.8	150.6	118.9	35.8	47.6	50.9	42.3	76.2	43.3
April	30.3	17.6	37.9	18.0	53.6	35.7	67.4	68.3	102.2	53.2	58.3	26.5	9.1	24.9
May	127.6	56.9	85.2	24.8	55.5	38.1	51.8	21.2	51.5	23.8	35.2	17.5	39.5	9.7
June	53.2	24.2	89.4	36.0	36.5	12.6	64.3	18.5	37.6	10.5	92.3	22.6	130.5	40.6
July	39.6	10.1	73.7	28.0	104.8	20.7	109.0	30.2	101.9	16.0	28.8	9.9	59.9	12.5
August	160.5	54.7	95.2	34.2	61.2	12.7	59.3	17.1	124.5	42.9	47.4	6.2	122.2	41.4
September . . .	20.1	14.9	35.8	15.6	84.7	46.5	68.1	19.3	18.6	17.7	39.6	5.6	94.4	29.2
October	197.1	89.2	235.6	141.2	29.8	23.1	138.6	81.9	96.2	31.8	110.3	21.6	95.3	80.3
November . . .	128.6	133.0	43.0	43.7	56.5	32.7	27.8	23.8	70.9	59.1	167.6	117.2	62.4	55.9
December . . .	34.3	40.1	120.9	113.3	32.4	31.2	98.8	97.6	43.7	39.1	83.9	75.2	144.7	119.4
Totals	1031.8	609.6	968.2	576.1	791.9	485.6	999.1	631.3	851.7	524.3	848.3	436.0	942.8	571.7

TABLE VI.—FARG WATER (PERTHSHIRE).

Catchment-Area (*Fig. 3*, p. 8) to Stream-Gauge, 1,437 acres.

Elevation of Catchment-Area, 550 to 1,000 feet above Ordnance Datum.

Rainfall and Yield.

Year.	Rain-Gauge.				Average Annual Rainfall.	Annual Precipitation on Catchment-Area.	Actual Annual Yield.	Total Loss.
	1 Heather- ieleys.	2 Heather- ieleys Quarry.	3 Deuglie.	4 Plains.				
	Inches.	Inches.	Inches.	Inches.	Inches.	Million Gallons.	Million Gallons.	Inches.
1910	40·08	39·14	37·96	37·00	38·54	1,256·5	879·2	11·57
1911	28·71	28·65	26·66	30·88	28·72	936·4	606·0	10·13
1912	39·59	39·28	39·02	40·60	39·62	1,291·6	971·0	9·84

COMPARATIVE TABLE OF PRECIPITATION AND YIELD MONTH BY MONTH, STATED IN MILLION GALLONS PER 1,000 ACRES.

	1910		1911		1912	
	Precipitation.	Yield.	Precipitation.	Yield.	Precipitation.	Yield.
January	55·6	94·4	21·4	23·5	101·8	81·0
February	108·7	67·2	65·3	67·6	60·7	59·5
March	57·3	62·6	34·5	35·1	88·0	70·8
April	101·2	64·8	34·1	15·5	10·7	16·3
May	22·3	14·3	29·5	16·8	31·7	5·8
June	25·4	4·5	49·0	14·1	91·0	19·0
July	91·9	6·5	41·1	3·6	39·4	15·0
August	155·9	121·5	38·9	2·6	119·7	52·7
September	60·2	24·8	37·4	2·0	25·4	24·6
October	46·8	11·3	35·7	8·8	88·2	73·4
November	70·7	61·6	156·0	120·9	54·3	65·1
December	78·4	78·3	108·7	111·2	187·9	192·5
	874·4	611·8	651·6	421·7	898·8	675·7

TABLE VII.—SLATEFORD BURN (PERTHSHIRE).

Catchment-Area (*Fig. 3*, p. 8) to Stream-Gauge, 1,166 acres.

Elevation of Catchment-Area, 650 to 1,200 feet above Ordnance Datum.

Rainfall and Yield.

Year.	Rain-Gauge.			Average Annual Rainfall.	Annual Precipitation on Catchment-Area.	Actual Annual Yield.	Total Loss.
	4 Plains.	5 Whitehill.	6 Shire-end.				
	Inches.	Inches.	Inches.	Inches.	Million Gallons.	Million Gallons.	Inches.
1910	37·00	41·45	40·89	39·78	1,052·3	621·0	16·31
1911	30·88	32·88	33·96	32·57	861·7	526·9	12·65
1912	40·60	41·82	42·31	41·58	1,099·9	771·4	12·42

COMPARATIVE TABLE OF PRECIPITATION AND YIELD MONTH BY MONTH, STATED IN MILLION GALLONS PER 1,000 ACRES.

	1910		1911		1912	
	Precipitation.	Yield.	Precipitation.	Yield.	Precipitation.	Yield.
January	70·2	97·1	23·4	25·5	108·8	71·0
February. . . .	110·9	63·0	81·9	91·2	64·8	56·9
March	62·3	46·6	44·0	41·7	88·6	72·7
April. . . .	102·8	38·3	37·9	20·8	11·7	19·9
May	24·0	7·1	32·2	20·4	34·0	7·3
June	26·2	3·0	51·8	7·0	98·1	22·6
July	91·5	7·6	48·8	4·6	42·1	16·8
August	157·6	101·8	44·4	4·9	122·0	46·8
September	58·6	25·5	39·3	4·0	26·2	26·1
October	47·8	12·3	37·6	13·3	93·8	71·2
November	72·6	61·2	171·5	126·2	56·3	60·7
December	78·0	69·1	126·2	92·3	196·9	189·6
	902·5	532·6	739·0	451·9	943·3	661·6