

(*Paper No. 3228.*)

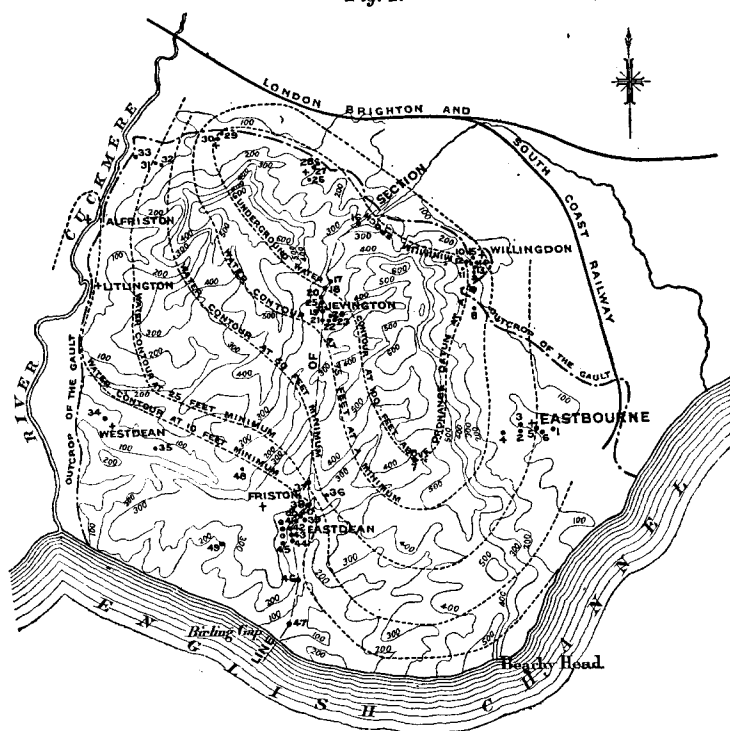
“The Underground Water-Levels of the South Downs between Eastbourne and the River Cuckmere.”

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THE portion of the South Downs of Sussex referred to in the following Paper is the extreme eastern knoll, stretching from Eastbourne and Polegate on the east to the River Cuckmere on the west, and from the English Channel on the south to the Weald on the north, being about 5 miles in extent from east to west, and about 6 miles from north to south, *Fig. 1*. The hills rise considerably from the low land around, the highest portions being the eastern and northern escarpments, the ground having a steep slope towards the marshes and the Weald, and a more gradual one to the south and west. The district is bounded on the south by a lofty range of cliffs, of which Beachy Head is the highest part, being 536 feet above Ordnance datum. Northward from this point the escarpment varies between 500 feet and 600 feet, to Willingdon Hill, which has a height of 665 feet above Ordnance datum. Coomb Hill, at the north-east angle, is 638 feet, whilst Wilmington Hill, at the north-west end of the ridge, is 704 feet above Ordnance datum. The principal valley runs from that of the River Cuckmere by Westdean and Friston Place to Jevington Village, where there is a saddleback in the escarpment, about 290 feet above Ordnance datum; here it meets the deeply cut Wannock (or Filching) Glen, leading to the Weald. The other system of valleys has its seaward termination at Birling Gap, and runs inland through Eastdean Village to Willingdon Hill, with branch valleys, or “bottoms” as they are called locally, extending to the eastern watershed.

The geological formation consists of the upper and lower chalk, resting on the gault, the general dip of the beds being towards the south-west. The outcrop of the gault follows the base of the eastern and northern escarpments. From borings recently taken it would appear that the upper greensand overlying the gault is practically non-existent here.

Fig. 1.



Scale, 1 inch = 2 miles.

PLAN SHOWING UNDERGROUND WATER-CONTOURS.

The average rainfall in the district, deduced from a long series of observations to 1894, is shown in the following Table:—

	Average Rainfall in Inches.	Height above Ordnance Datum in Feet.
Eastbourne (Wilmington Square) .	31·76	39
" (Osborne House) . .	31·09	12
" (The Cemetery) . .	31·35	160
Beachy Head	24·22	515
Birling Gap	25·14	50
Eastdean Village	27·11	180

The district is drained by "bournes" or streams, of which the following are the principal:—

On the eastern side, the bourne at Eastbourne rises below the Parish Church at a level of about 80 feet above Ordnance datum; the flow of this bourne has much diminished in recent years and in summer it has practically ceased to flow. The bournes at Willingdon and Lower Willingdon break at about 100 feet above Ordnance datum.

On the northern side, the principal bourne is that in Wannock Glen, the largest in the district; it rises in a deep wooded gorge under Filching Manor House, at a level of 100 feet above Ordnance datum; in winter it has attained a maximum flow of 127 cubic feet per minute. A smaller bourne rises in Broughton Glen, $\frac{1}{4}$ mile to the north-west of this one and at the same level.

On the western side, the River Cuckmere has cut a deep valley through the range of the South Downs, which drains the district so thoroughly that there are few bournes, and these only of small size, breaking at a level of about 10 feet above Ordnance datum.

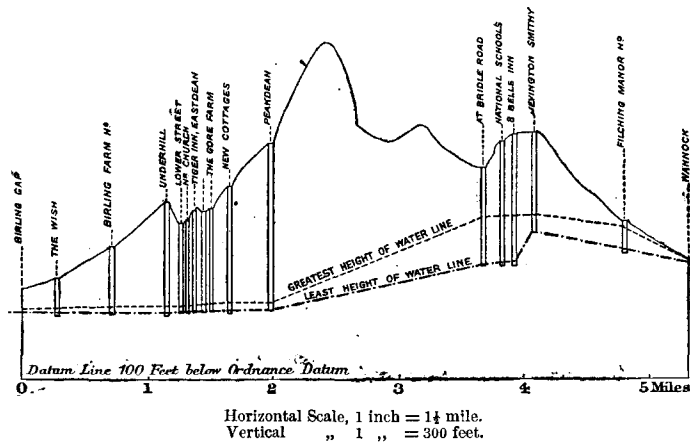
On the southern side, the water escapes by numerous fissures and springs on the sea coast, between high-water and low-water levels, the strongest being those at Holywell, about 1 mile to the west of Eastbourne.

Water Levels.—The results of observations on the height of the water in the various wells in the district, taken by the Author between 1885 and 1899, are summarized in the Appendix, and from these the underground water-contours, showing the lowest levels, have been laid down on the map, *Fig. 1*. The underground watershed roughly follows the highest land at the eastern and northern escarpments. In general, the water slope rises from the sea with an inclination of about 40 feet in 1 mile, thus corresponding with that which obtains in the same downs at Brighton. Inland, towards the marshes and the Weald, the slope is steeper, amounting in places to as much as 100 feet in 1 mile, *Fig. 2*. These underground water-contours roughly follow the surface-contours, but there is one exception. The chalk downs are so drained by the deep valleys of Friston and Eastdean that the minimum plane of saturation is practically level for $1\frac{1}{2}$ mile inland, through the high land at Crowlink, which rises to about 300 feet above Ordnance datum. The range of the water-level in the wells is generally small; but at Jevington, a village in a saddleback on the watershed with a comparatively small drainage area, this range becomes as much as 75 feet.

The underground water finds its way from the watershed to the outlets through the fissures in the chalk, which vary in size between a small crack and a considerable fissure such as that at

Wannock bourne. Some of the wells are situated on considerable underground streams, and these cannot be pumped dry with the ordinary appliances in use. The well at Filching Manor House is sunk on such a fissure, about 100 yards from the pumping-well of the Eastbourne Water Company in Wannock Glen, in the direction of the underground watershed, and although the bottom of the

Fig. 2.



SECTION FROM BIRLING GAP TO WANNOCK.

well is about 20 feet above that of the pumping-well, from which about 250,000 gallons are pumped into Eastbourne per day, repeated measurements show no sign of its depletion, although the bourne in the valley below the well has now practically ceased to flow.

The Paper is accompanied by two tracings, from which the Figures in the text have been prepared.

APPENDIX.

TABLE I.—MEASUREMENTS OF THE CHALK WELLS IN THE SOUTH DOWNS
BETWEEN EASTBOURNE AND THE VALLEY OF THE RIVER CUCKMERE.

EASTERN ESCARPMENT.

Name and Situation of Well.	No. of Well on Plan, Fig. 1.	Height of Well-mouth above Ordnance Datum.	Depth of Well.	Height of Water-Surface above Ordnance Datum.			
				Mean Height.	Greatest Height.	Least Height.	Range.
<i>Parish of Eastbourne.</i>		Feet.	Feet.	Feet.	Feet.	Feet.	Feet.
Gildredge Farm . .	1	64·0	62·0	8·0	..	..	..
Finches Cottages . .	2	135·0	75·0	66·0	..	..	..
Coleman's Well, } Church St. . . . }	3	118·0	58·0	64·0	68·0	60·0	8·0
Upwick Cottages . .	4	145·0	86·0	63·5	66·0	61·0	5·0
Manor House, well } No. 1 }	5	90·0	37·0	56·0	..	..	..
Manor House, well } No. 2 }	6	91·0	45·0	50·0	..	..	..
Peakdean	7	362·0	260·0	109·0	126·0	105·0	21·0
<i>Parish of Willingdon.</i>							
Ratton Farm . . .	8	158·0	91·5	86·0	118·0	69·0	49·0
Red Lion Inn, Willingdon } don }	9	126·0	38·0	93·0	101·0	89·0	12·0
Post-office, Willingdon	10	137·0	55·0	109·5	117·0	98·0	19·0
The Butts, „	11	188·0	91·5	107·0	119·0	98·0	21·0
Willingdon Villa, Willingdon } lingdon }	12	143·0	49·0	105·5	120·0	98·0	22·0
Well of old Post-office, Willingdon Village }	13	146·0	54·0	105·0	117·0	96·0	21·0
Well behind wheelwright's shop, Willingdon Village . . }	14	125·0	36·0	98·2	111·0	91·0	20·0
Well at cottage at Old Inn, Willingdon Village }	15	125·0	30·0	104·5	116·0	97·0	19·0

TABLE I.—*continued.*

NORTHERN ESCARPMENT.

Name and Situation of Well.	No. of Well on Plan, Fig. 1.	Height of Well-mouth above Ordnance Datum.	Depth of Well.	Height of Water-Surface above Ordnance Datum.			
				Mean Height.	Greatest Height.	Least Height.	Range.
<i>Parish of Jevington.</i>		Feet.	Feet.	Feet.	Feet.	Feet.	Feet.
Filching Manor House	16	155·0	52·0	111·0	139·0	104·0	35·0
The Smithy, Jevington Village	17	290·0	161·0	137·4	159·0	130·0	29·0
Well at the Post-office, Jevington Village	18	290·0	161·4	135·2	155·0	130·0	25·0
Draw-well at the National Schools, Jevington Village	19	276·0	198·0	95·7	156·0	81·0	75·0
Eight Bells Public House, Jevington Village	20	285·0	205·0	98·3	157·0	84·0	73·0
Draw-well at turn of Bridle Road over the Downs to Eastbourne, Jevington Village	21	233·0	155·0	94·6	153·0	80·0	73·0
Well in garden of cottage in racing-stables' yard, Jevington Village	22	238·0	156·0	93·4	154·0	83·0	71·0
Well at cottage opposite training-stables, Jevington Village	23	237·0	155·0	97·8	154·0	82·0	72·0
Well at back of cottage above training-stables, Jevington Village	24	243·0	152·0	103·7	153·0	91·0	62·0
Well at the Rectory, Jevington Village	25	245·0	165·0	84·0	86·0	83·0	3·0
<i>Parish of Folkington.</i>							
Draw-well south of Folkington Church	26	180·0	78·0	118·0	125·0	110·0	15·0
Draw-well south of old school, Folkington	27	167·0	68·0	116·0	123·0	109·0	14·0
Well north of old school, Folkington Village	28	154·0	64·0	114·0	118·0	109·0	9·0
<i>Parish of Wilmington.</i>							
Well at Carpenter's shop, Wilmington Village	29	126·0	32·0	109·0	110·0	108·0	2·0
Well east side of street, Wilmington Village	30	131·0	33·0	122·0	124·0	121·0	3·0

TABLE I.—*continued.*

WESTERN ESCARPMENT.

Name and Situation of Well.	No. of Well on Plan, <i>Fig. 1.</i>	Height of Well-mouth above Ordnance Datum.	Depth of Well.	Height of Water-Surface above Ordnance Datum.			
				Mean Height.	Greatest Height.	Least Height.	Range.
<i>Parish of Arlington.</i>		Feet.	Feet.	Feet.	Feet.	Feet.	Feet.
Well at Royal Oak Inn, Milton Village . . . }	31	85·0	82·0	26·0	28·0	23·0	5·0
Well at cottage, junction of roads, Milton }	32	92·0	89·0	33·0	35·0	31·0	4·0
Well at Burghlow Cottages }	33	18·0	16·0	10·0	11·0	9·0	2·0
<i>Parish of Westdean.</i>							
Well in Westdean Village }	34	44·0	40·0	4·0	..	..	..
New Barn Well }	35	52·0	54·0	3·0	6·0	1·0	5·0

CENTRAL DISTRICT.

Name and Situation of Well.	No. of Well on Plan, <i>Fig. 1.</i>	Height of Well-mouth above Ordnance Datum.	Depth of Well.	Height of Water-Surface above Ordnance Datum.			
				Mean Height.	Greatest Height.	Least Height.	Range.
<i>Parish of Eastdean.</i>		Feet.	Feet.	Feet.	Feet.	Feet.	Feet.
Summerdown }	36	239·0	198·0	55·0	58·0	51·0	7·0
Peakdean on the Gore Farm }	37	272·0	265·0	10·2	17·0	Well dry.	..
Well at new cottages below Summerdown }	38	207·0	204·0	9·7	17·0	5·0	12·0
Well at the Vicarage, Eastdean Village . . }	39	176·0	180·0	6·5	14·0	0·0	14·0
Well at the Gore }	40	166·0	164·0	9·0	14·0	4·0	10·0

TABLE I.—CENTRAL DISTRICT—*continued*.

		Feet.	Feet.	Feet.	Feet.	Feet.	Feet.
<i>Parish of Eastdean—continued.</i>							
Well at cottages opposite the Gore Farm-house, Eastdean Village	41	162·0	159·0	8·5	14·0	4·0	10·0
Well opposite the Tiger Inn, Eastdean Village	42	167·0	163·0	6·8	13·0	3·0	10·0
Well centre of field west of Eastdean Church	43	152·0	150·0	8·0	13·0	5·0	8·0
Well at Lower Street, Eastdean Village	44	142·0	140·0	7·4	12·0	3·0	9·0
Well at Underhill, Eastdean Village	45	179·0	178·0	7·3	13·0	2·0	11·0
Well at Birling Farm	46	109·0	107·0	7·5	12·0	4·0	8·0
The Wish Well* at Birling Gap	47	59·0	60·0	2·0	..	..	..
<i>Parish of Friston.</i>							
Friston Place	48	140·0	138·0	12·0	17·0	10·0	7·0
Crowlink Farm	49	195·0	..	10·0	..	..	..

* This well is 23 chains inland from the cliff; it can be pumped dry at low water, but not at high water.

TABLE II.—GAUGINGS OF THE WANNOCK AND BROUGHTON BOURNES.

Date.	Discharge over Weir in Cubic Feet per Minute.	Date.	Discharge over Weir in Cubic Feet per Minute.
WANNOCK BOURNE. ¹		WANNOCK BOURNE (<i>continued</i>).	
23 December, 1895	83	12 August, 1897	3
2 January, 1896	85	31 August, 1897	3
7 January, 1896	92	2 December, 1897	3
14 January, 1896	73	15 December, 1897	3
7 February, 1896	54	17 December, 1897	3
27 February, 1896	106	4 January, 1898	5
2 March, 1896	37	BROUGHTON BOURNE. ³	
2 April, 1896	16	7 January, 1896	11
7 December, 1896	102	14 January, 1896	9
10 December, 1896	106	7 February, 1896	8
11 January, 1897	125	27 February, 1896	6
22 January, 1897	90	2 April, 1896	4
28 January, 1897	90	7 May, 1896	3
3 February, 1897	120	14 May, 1896	3
24 February, 1897	127	16 June, 1896	2
25 May, 1897 ²	13	10 July, 1896	1
3 June, 1897	10	6 August, 1896	0.5
10 June, 1897	9	7 December, 1896	9
17 June, 1897	7	17 December, 1896	15
23 June, 1897	7	21 December, 1896	13
30 June, 1897	6	3 February, 1897	16
8 July, 1897	3	8 February, 1897	20
13 July, 1897	3	24 February, 1897	14
22 July, 1897	3	17 April, 1897	6
27 July, 1897	1		

¹ Gauge-weir 80 feet above Ordnance datum.² In March, 1897, the Waterworks Company commenced pumping at a well sunk in the Glen above the gauge-weir.³ Weir at the spot where the Broughton Bourne breaks, 100 feet above Ordnance datum.

TABLE III.—MONTHLY RAINFALL AT TREVELLA, EASTBOURNE, RAIN-GAUGE
5 INCHES IN DIAMETER, 64·00 FEET ABOVE ORDNANCE DATUM.

Month.	1895.	1896.	1897.	1898.
	Inches.	Inches.	Inches.	Inches.
January . . . . .	..	1·80	2·84	0·91
February . . . . .	..	0·37	2·94	1·60
March . . . . .	..	3·25	4·63	1·66
April . . . . .	..	0·75	2·68	1·16
May . . . . .	..	0·40	1·19	4·29
June . . . . .	..	3·54	2·57	1·85
July . . . . .	..	1·81	0·47	0·33
August . . . . .	..	1·66	3·60	1·55
September . . . . .	..	6·52	4·37	0·84
October . . . . .	..	7·10	0·28	3·22
November	6·76	1·85	2·04	3·06
December	3·53	5·25	3·28	3·24
Total . . . . .	..	34·30	30·89	23·71