RAINFALL FOR 1967

River Welland Hydrometric Area

1967	*Market Harborough*	*Caldecott Pumping Station*	*Oakham (River Gwash)*	*Irnham (River Glen)*	*Pode Hole (Fen Area)*
	inches	*inches*	*inches*	*inches*	*inches*
January	0.96	0.98	0.93	0.95	0.66
February	2.59	2.01	2.22	1.92	1.26
March	1.52	1.36	1.38	1.03	0.86
April	1.83	1.74	2.22	2.54	2.19
May	5.09	3.89	4.54	4.64	3.91
June	1.19	0.81	0.91	1.05	1.42
July	1.51	0.97	1.09	0.94	1.23
August	1.56	2.36	1.67	2.33	1.07
September ..	1.79	1.48	1.57	1.92	1.35
October	4.62	3.75	4.57	4.08	3.03
November ..	1.35	1.61	0.86	1.89	1.99
December ..	1.85	1.71	2.05	1.24	1.45
1967 Total ..	25.86	22.67	24.01	24.53	20.42
1966	29.00	24.83	27.55	29.35	26.50
1965	29.53	24.62	32.98	28.68	25.96
1964	18.02	15.85	20.39	18.10	16.77
1963	21.73	19.51	21.84	21.21	20.14
Average 1916-1950	24.33	22.66	24.68	24.45	23.70

Comparative Table

Year	*Per cent of average*
1967	98
1966	114
1965	118
1964	74
1963	87

The following rain gauges were installed during 1967-68. Readings are taken in *millimetres*.

Station	*National Grid Reference*	*Height of gauge above sea level in feet*	*Records began*
Mowsley*	SP 647 891	510	Nov. 1967
‖Tilton-on-the-Hill*	SK 745 057	682	Mar. 1968
Preston*	SK 871 024	454	Nov. 1967
Casterton*	TF 003 094	166	Feb. 1968
Clipsham*	SK 970 161	302	Oct. 1967
Kilsby*	SP 563 710	432	Oct. 1967
West Haddon*	SP 629 719	553	Dec. 1967
Little Houghton*	SP 805 598	259	Oct. 1967
Grafton Underwood*	SP 924 805	295	Dec. 1967
Lilford*	TL 035 828	139	Nov. 1967
Stibbington*	TL 085 986	58	Dec. 1967

* Returns from these stations are made to the British Rainfall Organisation

‖ Gauge read weekly.

No B.R.O. Station Nos. available yet.

RIVER AND STREAM GAUGING

(a) Automatic Gauging Stations recording water level and rate of discharge

Station	*M= Main River T= Tributary*	*National Grid Reference*	*Catchment Area in Sq. Miles*	*Type of Measurement*	*Duration of Records*
WELLAND CATCHMENT					
Kate's Bridge	T	TF 106 149	132	Standing wave flume	9 years
King Street Bridge	T	TF 109 106	132	Standing wave flume	8 years
Tixover	M	SP 971 998	156	Current Meter (over 150 cusec)	6 years
Barrowden	M	SP 948 999	154	Simple Crump-type weir	Records began Oct. 1967
Tallington	M	TF 095 078	273	Compound broad crested weir	Records began Oct. 1967
Lolham Mill Stream	M	TF 096 078	273	Simple Crump-type weir	2 years
West Deeping Mill Stream	M	TF 094 078	273	Simple Crump-type weir	2 years
Belmesthorpe	T	TF 038 097	57.9	Simple Crump-type weir	1 year
Foster's Bridge	T	SK 961 030	26.6	Compound Crump-type weir	Records began Jan. 1968
Manthorpe	T	TF 068 160	57.6	Simple Crump-type weir	Records began Mar. 1968
NENE CATCHMENT					
Orton	M	TL 166 972	631	Weir and sluices (to approx. 1,000 cusecs)	28 years
Orton North Dyke	M	TL 166 972	631	Sharp edged rectangular weir	Records began Nov. 1967
Orton South Dyke	M	TL 166 972	631	Sharp edged rectangular weir	Records began Jan. 1968
Wansford	M	TL 080 995	590	Current meter (over 1,000 cusec)	29 years
Willow Brook	T	TL 067 933	34.6	Standing wave flume	29 years
Harper's Brook	T	SP 983 799	28.7	Compound Crump-type weir	29 years
Harrowden	T	SP 898 715	74.9	Compound Crump-type weir	24 years
Wollaston	M	SP 887 647	249	Weir (below 60 cusec)	24 years
Northampton	M	SP 755 597	220	Current meter (over 1,000 cusec)	Level for 34 years. Discharge occasional for 25 years
St. Andrews	T	SP 747 617	89.9	Standing wave flume	29 years
Upton	T	SP 721 592	86.1	Standing wave flume	28 years
Dodford	T	SP 627 607	41.3	Simple Crump-type weir	23 years

The above returns, other than those for Tixover, Northampton and Wansford (where only intermittent flood discharges are recorded) and Wollaston (where some drought discharges are registered) are published in the Surface Water Year Book.

When the Greatford Flood Relief Channel is in use, the natural discharge of the River Glen at Kate's Bridge is obtained by adding the discharges at Kate's Bridge and King Street.

(b) Recording Stations—water levels

Station	*National Grid Reference*	*River*	*Type*	*Duration of records*
Fosdyke, Spalding	TF 318.323	Welland	Tidal	18 years
Marsh Road, Spalding ..	TF 259.241	Welland	Tidal	Intermittent from December 1953
Marsh Road, Spalding ..	TF 260.240	Welland	Freshwater	14 years
Cowbit Road, Spalding ..	TF 246.217	Welland	Freshwater	15 years
Dog-in-a-Doublet Lock and Sluices	TL 272.993	Nene	Tidal	Intermittent 1946-56. Continuous from December 1957
Lynn Road Piling, Wisbech ..‡	TF 460.103	Nene	Tidal	10 years
Sutton Bridge	TF 482.210	Nene	Tidal	Records substantially complete 1937-48. Continuous from May 1958

‡ Intermittent records are available for an adjacent site (TF 459.103) from 1946 to 1956.

(c) Staff Gauges

Station	*National Grid Reference*	*Normal water level to Newlyn Datum*	*Duration of records*
Dog-in-a-Doublet Lock and Sluices	TL 272.993	9.5	29 years
Guyhirne Sluice, upstream and downstream ..	TF 397.029	Varies with season	29 years
Little Bridge (Moreton's Leam), Whittlesey ..	TL 273.984	Varies with season	28 years
Stanground Sluice	TL 209.974	D/s Varies with season U/s 9.5	62 years
Peterborough Bridge	TL 193.982	9.5	31 years
Water Newton, upstream and downstream ..	TL 110.974	U/s 26.5 D/s 20.7	30 years
Nene Wharf, Oundle	TL 043.888	61.5	35 years
Nene Wharf, Wellingborough	SP 898.663	129.4	34 years
Northampton Generating Station	SP 762.599	183.6	32 years
Northampton South Bridge	SP 755.597	187.7	34 years
Weedon*	SP 632.598	253.3	29 years
Surfleet	TF 279.293	Varies with season	28 years

Water levels are read daily at 09.00 hours G.M.T. at these stations.

* Break in records, February 1967 to March 1968, due to road bridge works.

(d) Low Flow Weirs

Station	*River*	*National Grid Reference*	*Duration of records*
Ashley	Welland ..	SP 819.916	6 years
Burton Coggles ..	West Glen ..	SK 987.261	3 years
Empingham ..	Gwash	SK 955.084	6 years
Ketton	Chater	SK 982.042	7 years
Langton Brook ..	Langton Brook ..	SP 741.910	3 years
Lubenham	Welland ..	SP 715.871	6 years
Medbourne Brook ..	Medbourne Brook	SP 799.931	3 years
*River Jordan	River Jordan ..	SP 741.867	2 years
North Brook	Gwash	SK 957.089	5 years
Stonton Brook ..	Stonton Brook ..	SP 754.924	3 years
North Stream ..	Willow Brook ..	SP 895.901	3 years
Central Stream ..	Willow Brook ..	SP 895.890	3 years
Morcott Brook ..	Chater	SK 917.011	2 years
River Tham ..	West Glen ..	SK 998.180	2 years
Fineshade Brook ..	Fineshade Brook ..	SP 980.999	2 years
King Street, North ..	King Street Drain	TF 106.140	2 years
King Street, South ..	King Street Drain	TF 108.113	2 years
Little Oakley	Harpers Brook ..	SP 891.857	2 years
Billing Brook ..	Billing Brook ..	TL 116.947	1 year
Grendon Brook ..	Grendon Brook ..	SP 883.632	1 year

Readings from these low flow weirs were taken twice weekly from June to October.

* No readings for 1967.

RIVER DISCHARGE

(Details of these stations are included on page 29)

NENE HYDROMETRIC AREA

	ORTON (near Peterborough)								
	1965-66			1966-67			1967-68		
	cusec	*m.g.d.*	*m³/sec.*	*cusec*	*m.g.d.*	*m³/sec.*	*cusec*	*m.g.d.*	*m³/sec.*
April	139.1	74.83	3.9365	776.4	417.7	21.9721	453.8	244.1	12.8425
May	91.13	49.03	2.5790	335.6	180.5	9.4975	922.3	496.2	26.1011
June	56.05	30.15	1.5862	150.9	81.18	4.2705	236.4e	127.2e	6.6901e
July	78.62	42.30	2.2249	118.1	63.54	3.3422	104.0e	55.95e	2.9432e
August ..	55.17	29.68	1.5613	173.8	93.50	4.9185	94.07e	50.61e	2.6622e
September ..	176.6	95.01	4.9978	202.7	109.1	5.7364	94.25e	50.71e	2.6673e
October	124.9	67.20	3.5347	600.9	323.3	17.0055	245.6	132.1	6.9505
November ..	199.1	107.1	5.6345	455.9	245.3	12.9020	339.3	182.5	9.6022
December ..	1,356.	729.5	38.3748	1,112.	598.3	31.4696	353.9	190.4	10.0154
January ..	622.4	334.9	17.6139	552.0	297.0	15.6216	789.3	424.6	22.3372
February ..	1,161.	624.6	32.8563	614.8	330.8	17.3988	497.3	267.5	14.0736
March	408.9	220.0	11.5719	626.2	336.9	17.7215	199.1	107.1	5.6345
Monthly Av'ge.	372.4	200.3	10.5389	476.6	256.4	13.4878	360.8	194.1	10.2106
*1940-60 Av'ge.	304 cusec—163.5 m.g.d.—8.6032 m³/sec.								

e — estimated due to reconstruction of gauging station.

Note.—It is regretted that the data relating to Orton for 1966-67 as contained in the Second Annual Report was subsequently found to be incorrect, and has been rectified in the above table, which explains the discrepancy which will be found on a comparison of the two tables.

	UPTON (Kislingbury Branch)								
	1965-66			1966-67			1967-68		
	cusec	*m.g.d.*	*m³/sec*	*cusec*	*m.g.d.*	*m³/sec*	*cusec*	*m.g.d.*	*m³/sec*
April	27.35	14.71	0.7740	124.8	67.14	3.5318	45.98	24.74	1.3012
May	19.13	10.29	0.5414	54.05	29.08	1.5296	115.7	62.25	3.2743
June	14.09	7.58	0.3987	29.24	15.73	0.8275	36.38	19.57	1.0295
July	18.46	9.93	0.5224	21.77	11.71	0.6161	23.00	12.37	0.6509
August ..	13.73	7.39	0.3885	24.76	13.32	0.7007	18.15	9.76	0.5136
September ..	41.48	22.32	1.1739	22.77	12.25	0.6444	15.46	8.32	0.4375
October ..	29.05	15.63	0.8221	92.57	49.80	2.6197	34.99	18.82	0.9902
November ..	49.16	26.45	1.3912	63.20	34.00	1.7886	55.71e	29.97e	1.5766e
December ..	233.3	125.5	6.6024	172.1	92.59	4.8704	74.33e	39.99e	2.1035e
January ..	96.19	51.75	2.7222	79.52	42.78	2.2504	138.1	74.30	3.9082
February ..	177.3	95.39	5.0176	98.97	53.25	2.8009	74.43	40.04	2.1064
March ..	62.79	33.78	1.7769	88.09	47.39	2.4929	33.21	17.87	0.9398
Monthly Av'ge.	65.17	35.06	1.8443	72.65	39.09	2.0560	55.45	29.83	1.5692
*1940-60 Av'ge.	45 cusec — 24.21 m.g.d. — 1.2735 m³/sec.								

e — estimated. Unable to visit gauging station due to foot and mouth epidemic restrictions.

	ST. ANDREWS (Brampton Branch)								
	1965-66			1966-67			1967-68		
	cusec	*m.g.d.*	*m³/sec.*	*cusec*	*m.g.d.*	*m³/sec.*	*cusec*	*m.g.d.*	*m³/sec.*
April	21.74	11.70	0.6152	87.48	47.06	2.4757	47.32	25.46	1.3391
May	15.34	8.25	0.4341	41.99	22.59	1.1883	119.7	64.40	3.3875
June	10.05	5.41	0.2844	21.79	11.72	0.6167	30.74	16.54	0.8699
July	9.21	4.95	0.2606	13.88	7.47	0.3928	13.50	7.26	0.3821
August ..	8.64	4.65	0.2445	20.29	10.92	0.5742	10.42	5.61	0.2949
September ..	21.14	11.37	0.5983	18.77	10.10	0.5312	12.00	6.46	0.3396
October ..	18.34	9.87	0.5190	61.14	32.89	1.7303	26.40	14.20	0.7471
November ..	37.20	20.01	1.0528	47.15	25.37	1.3343	38.30	20.61	1.0839
December ..	132.4	71.23	3.7469	112.8	60.69	3.1922	44.45	23.91	1.2579
January ..	59.59	32.06	1.6864	54.97	29.57	1.5557	84.53	45.48	2.3922
February ..	109.1	58.69	3.0875	75.36	40.54	2.1327	57.40	30.88	1.6244
March ..	44.90	24.16	1.2707	63.79	34.32	1.8053	29.85	16.06	0.8447
Monthly Av'ge.	40.64	21.86	1.1501	51.62	27.77	1.4608	42.88	23.07	1.2135
*1940-60 Av'ge.	45 cusec — 24.21 m.g.d. — 1.2735 m³/sec.								

*Average based on Water Year.
m³/sec=cubic metre/second.

Comparative Table

Year	*Per cent of average*
1967-68	117
1966-67	153
1965-66	121
1964-65	45
1963-64	81

RIVER DISCHARGE

WELLAND HYDROMETRIC AREA

	River Glen discharge at KATE'S BRIDGE								
	1965-66			1966-67			1967-68		
	cusec	*m.g.d.*	*m³/sec.*	*cusec*	*m.g.d.*	*m³/sec.*	*cusec*	*m.g.d.*	*m³/sec.*
April	17.77	9.56	0.5029	143.7	77.31	4.0667	46.32	24.92	1.3109
May	16.79	9.03	0.4751	66.21	35.62	1.8737	101.4	54.55	2.8696
June	11.30	6.08	0.3198	30.71	16.52	0.8691	34.36	18.49	0.9724
July	3.69	1.98	0.1044	16.95	9.12	0.4797	17.62	9.48	0.4986
August ..	4.24	2.28	0.1200	20.86	11.22	0.5903	13.91	7.48	0.3937
September ..	8.88	4.78	0.2513	26.09	14.04	0.7383	11.13	5.99	0.3150
October ..	9.54	5.13	0.2700	36.23	19.49	1.0253	12.79	6.88	0.3619
November ..	33.78	18.17	0.9560	50.27	27.05	1.4226	27.00	14.53	0.7641
December ..	179.8	96.73	5.0883	103.3	55.57	2.9234	25.32	13.62	0.7165
January ..	121.1	65.15	3.4271	64.14	34.51	1.8152	61.03	32.83	1.7271
February ..	207.9	111.8	5.8836	59.61	32.07	1.6870	46.34	24.93	1.3114
March ..	91.09	49.01	2.5778	59.53	32.03	1.6847	37.07	19.94	1.0491
Monthly Av'ge.	58.82	31.64	1.6646	56.47	30.38	1.5981	36.19	19.47	1.0242
*1961-65 Av'ge.	25.09 cusec — 13.50 m.g.d. — 0.7100 m³/sec.								

* Average based on Water Year.
m³/sec.=cubic metres/second.

Comparative Table

Year	*Per cent of average*
1967-68	144
1966-67	225
1965-66	234
1964-65	97
1963-64	141

When the Greatford Flood Relief Channel is in use, the natural discharge of the River Glen at Kate's Bridge is obtained by adding the discharges at Kate's Bridge and King Street.

Note—It is regretted that the data relating to Kate's Bridge for 1966-67 as contained in the Second Annual Report, was subsequently found to be incorrect, and has been rectified in the above table, which explains the discrepancy which will be found on a comparison of the two tables.

LAND DRAINAGE

1. CAPITAL WORKS

(i) General Account and Progress Report

Welland Outfall LDW: 17319, 17638, 18568, 18821, 19656, 20307, 21011, 21803, 21940, 22606, 22875, 23552. *Estimated Cost:* £480,276.

From time to time adverse weather, scour and settlement retarded the Scheme, but seven years work on raising and strengthening the training walls has produced an impressive outfall channel. Accretion of tidal deposit behind the new work has not been uniform, and on some lengths it was not sufficient to provide adequate protection from adverse weather.

During the year 25,250 tons of stone was transported by barge from Fosdyke, and the use of mechanical handling plant was an advantage.

Fagot protection work continued on the batters between Fosdyke Bridge and Holbeach Outfall Sluice, but there was a further marked deterioration of the banks. As there was difficulty in obtaining sufficient brushwood fagots the Ministry agreed to the substitution of stone, and the short carriage from Fosdyke Wharf enabled substantial progress to be made.

The left hand (or north) training wall terminates about 2,000 yards upstream of the Welland/Witham confluence at Tabs Head, and deterioration resulting from the movement of silt and mussel leys into the channel is to be checked by the formation of a half-tide bank to close off this untrained length. A scheme estimated to cost £100,000 was submitted to the Ministry, and if approved it will be carried out in stages to accord with the rate of accretion of the adjacent salt marsh.

The Boston Port Authority were concerned that the work might have an adverse effect on the shipping channel, but they withdrew their objection after the Hydraulics Research Station at Wallingford advised that would not be so. The help of the Research Station is acknowledged.

River Welland, Crowland and Cowbit Washes Pumping Station, LDW. 22920. *Estimated Cost:* £27,473.

Steady progress was maintained on both contract and direct labour work, and it is anticipated that the pumping station will be completed in the Summer of 1968.

Kirton and Frampton Sea Banks. LDW. 20360. *Estimated Cost:* £40,016.

The Black Sluice Internal Drainage Board's pumping station at Kirton Triangle was not completed until late in the year, and it was considered prudent to defer sealing-off the old outfall and the alteration of the sea bank until the Summer of 1968.

Welland Fascine Works, South Bank. LDW. 21682, 22104, 22870. *Estimated Cost:* £9,295 *for sections* 2, 3 *and* 4.

The scheme comprises fagot protection of the banks in the tidal compartment upstream of Fosdyke Bridge. Work completed on Scheme No. 4. (LDW 22870) increased the safety margin on the severely eroded Cowhirne length, but further extension will be necessary. Scheme No. 5. (£6,598) to deal with erosion upstream of Fosdyke was submitted for the Ministry's approval towards the end of the year.

R. Welland, Tidal Section Pumping Stations. LDW. 17755, 17756, 18051 *and* 18059. *Estimated Cost:* £240,462.

It was necessary to keep down the water level in the North Welland Drains to permit extensive improvements to be carried out in the summer months, and as the Risegate Eau Pumping Station had to be on stand-by throughout that period, work on the concrete apron at the outfall had to be deferred until the Summer of 1968.

R. Welland, Locks Mill to Folly River Fascines. LDW. 20784, 21428, 22103, 23050, 23747 *Estimated Cost:* £31,339.

Fagot protection along the frontage of the Cowbit Wash Cradge Bank was carried out in the Spring and Autumn, when river levels could be lowered without affecting riparian interests. Scheme No. 3. (LDW 22103) was completed and work on Schemes No. 4 (LDW 23050) and 5. (LDW 23747) proceeded.

R. Glen Improvement. LDW. 16111. *Estimated Cost:* £205,279.

The flood protection wall was completed to Bars Bridge where it links up with the embanked reach of the river. It is proposed to build a short length of wall adjacent to Brownlow Crescent, Pinchbeck, where housing and other development prohibit the formation of an earth bank. Attention was given to slips which developed along unprotected lengths of the dredged channel.

Bourne Eau Pumping Station. LDW. 18660. *Estimated Cost:* £45,800.

Demolition of the old gravity sluice at the downstream end of the Bourne Eau was completed.

Car Dyke, North Arm. LDW. 21012. *Estimated Cost:* £20,390.

The scheme to alleviate urban flooding in part of Bourne was almost completed apart from dredging the original channel. Rock was again encountered at places on the route of the diversion. A former railway embankment is yet to be levelled to provide land in substitution for that taken for the diversion.

R. West Glen. LDW. 21683. *Estimated Cost:* £21,518.

Progress on this scheme was retarded by Foot and Mouth disease restrictions. By the end of the year dredging had been completed as far as Little Bytham (about 1½ miles from Creeton), the upper limit of the present work.

R. Gwash Improvement. LDW. 20980. *Estimated Cost:* £23,050.

The scheme was completed during the year. A marked improvement in the drainage of agricultural land and a reduction in flooding in Ryhall is already apparent, and Ryhall Parish Council expressed appreciation.

R. Welland, Market Harborough Flood Alleviation. LDW. 17460. *Estimated Cost:* £176,088.

The Ministry's approval in principle and permission to proceed was received on 14th April, and preparations had been made to enable the Scheme to be started immediately thereafter.

Very satisfactory progress was made. Dredging was carried out near St. Mary's Road Bridge, and at the upstream end above the accommodation bridge at Commons Car Park. The sewer diversions, sheet piling, and excavation and bridge works through the Dainite Rubber Mills and adjacent to the railway embankment were completed. Work near the Commons Car Park was well advanced.

Confined space through the town and the need to maintain an access to various premises imposed severe restrictions on the sheet piling and other constructional work, but the co-operation

and patience of those affected, and particularly of the Urban District Council and their Officers was appreciated. (See illustrations, centre pages.)

Car Dyke—Newark Hill to Eye. LDW. 22752. *Estimated Cost:* £44,078.

Work on the scheme to regrade the Car Dyke to alleviate urban flooding, and to provide greater capacity to take surface water from a development area in Peterborough commenced towards the end of the year. The principal difficulty was to provide a channel of greater capacity through a length of high land in the vicinity of Eye where unstable clayey silt is to be found.

Peterborough Corporation are to contribute twenty one-forty first parts of the cost up to a maximum of £23,000 in view of the local benefit.

R. Nene, Tydd Outfall Sluice Improvement. LDW. 20943. *Estimated Cost:* £27,000.

Improvements to the tidal sluice (constructed in 1859) were completed by contract. In carrying out work below water level on a massive structure of such age and character unforeseen difficulties can arise and result in additional expense, but it is satisfactory to record that the scheme was completed within the original estimate.

R. Nene, Foul Anchor Improvement. LDW. 23492. *Estimated Cost:* £145,294.

Work will commence in the summer of 1968. Severe scour in the tidal river about six miles from the outfall caused slips in the batters, and the damage was extending. Cross sections revealed marked accretion along a length of the bed where scour was known to have occurred. Continuous echo-sounding readings throughout the tidal cycle revealed that bed level varied in extreme cases by as much as eight feet on a single tide. The very friable silt was not sufficient base for the stone work, and it proved to be of no value in sustaining the bank.

R. Nene, Slips near Baths Cottages, Wisbech. LDW. 22580. *Estimated Cost:* £66,034. *Extension of works:* £16,249.

Satisfactory progress was maintained on the contract and direct labour work described in the Second Annual Report. The principal work was on the left hand (or west) side, but a limited length of the right bank was dealt with to prevent further erosion. The Ministry approved an extension of the direct labour work on the left hand bank where the tidal river channel is close to the barrier bank.

R. Nene, Cromwell Road (Upstream) Improvement. LDW. 23419. *Estimated Cost:* £109,600.

The scheme involves the deposit of a substantial stone toe to the batter of the bank, followed by fagot protection to accord with the rate of accretion of tidal deposit. Stone will also be deposited in the river bed to check severe erosion which has occurred. Work proceeded along the left (or West) bank where deterioration was marked. The scheme will afford protection to a length of the A.47 road, and the Divisional Road Engineer recommended the Ministry of Transport to make a contribution not exceeding £5,800 towards the scheme.

A small wharf was constructed near the site for loading stone by mechanical plant, and it will facilitate progress on this scheme, and on other works on the tidal river.

R. Nene, North Barrier Bank (Bank House Farm) Improvement. LDW. 23080. *Estimated Cost:* £10,877.

Improvement work on the North Barrier Bank included duplication of the bank in the vicinity of Bank House Farm, where slips had reduced the protective berm to negligible proportions. The new length of bank consolidated such that it was possible to remove the old bank, the site of which was re-graded to form a protective berm along the tidal river. Excavation work was completed, and it appears that the extent of stone and fagot protection along the frontage will be less extensive than was anticipated.

R. Nene, Bank Protection upstream Dog-in-a-Doublet Sluice Schemes 1 *and* 2. *LDW.* 22540 *and* 23417/4. *Estimated Cost:* £1,575 *and* £4,889.

As was explained in the Second Annual Report, the Scheme will arrest erosion along the non-tidal frontage of the North Barrier Bank and the Whittlesey Wash Cradge Bank. Where the depth of water and other factors made it impossible to use *Unibank* Asbestos Sheeting the deposit of pell mell stone as frontal protection proved satisfactory.

R. Nene, Barnwell Improvement. LDW. 22605. *Estimated Cost:* £19,833.

As explained in the Second Annual Report, this scheme provides a graduated discharge in accordance with the original Nene Improvement Scheme. The work was substantially completed. In January the five air controlled siphonic weir units operated at about design capacity to control the upstream water level in an effective and impressive manner. (See illustrations, centre pages.)

R. Nene, Clifford Hill Improvement. LDW. 21906. *Estimated Cost:* £4,591.
LDW. 22308. *Estimated Cost:* £3,933.

The scheme as described in the Second Annual Report was substantially completed during the year.

R. Nene, Dredging at Northampton. LDW. 23615. *Estimated Cost:* £11,919.

It is necessary to dredge the river through Northampton to provide a flood discharge capacity equal to that of Nunn Mills Sluices. Buildings on both sides of the river prevent the deposit of excavated material on the banks, and it has to be transported by floating craft for disposal.

R. Nene, Upton Mill to Flore Improvement. LDW. 33764. *Estimated Cost:* £39,538.

Reference was made in the Second Annual Report to conditions upstream of Northampton. Urban developments and the trend to convert water meadows to arable land made it necessary to reduce the incidence of flooding by increasing the capacity of the channel. The first stage of the work from Northampton to Flore has been approved by the Ministry, and work will commence in 1968.

R. Nene, Denford Improvement. LDW. 23416. *Estimated Cost:* £14,970.

The scheme is a further stage in providing a graduated flood discharge in accordance with the original Nene Improvement Scheme. Recurrent flooding made work difficult, but the concrete base for the siphon units was installed and progress was made in channel improvements.

Wingland (1954) *Sea Bank. LDW.* 22702. *Estimated Cost:* £2,074.
Sea Bank Improvements. LDW. 23237. *Estimated Cost:* £29,503.

Satisfactory progress was maintained on the scheme to provide a uniform standard of protection along the sea defences. Most of the work along the sea bank of the 1954 enclosure was completed, and spoil was placed along the frontage of the 1951 enclosure where shaping to profile was in progress.

Miscellaneous Works.

The deposit of stone to arrest scour in the River Welland upstream of Tallington Bridge was completed as an extension to the Tallington to Uffington Stabilisation Works (LDW 20247).

Minor works, principally in the completion of fencing were carried out along the South Barrier Bank downstream of Stanground.

Improvements were completed on a length of the river bank at Rush Mills near Northampton (LDW 23445).

(ii) Future works agreed in principle

R. Welland, Stamford/Market Harborough Improvement.

Flooding in May (to which reference is made elsewhere in this Report) provided data relating to the Welland upstream of Stamford, and it substantiated representations made to the Ministry as to the improvements necessary, having regard to current farming practice. It is hoped that authorisation will be received to enable a start to be made in 1968 on the first stage. The Scheme has been revised by the exclusion of some of the water control structures and bridge works to reduce the estimated cost by £55,000 to £170,000.

R. Nene, Cross Guns Pumping Station. Provisional Estimate: £17,000.

The pipes at Cross Guns Pumping Station are carried beneath the North Barrier Bank to discharge into the tidal river Nene about four miles upstream of Guyhirne. Leakage of water occurred when pumping was in progress, and an inspection revealed settlement of the pipes. Details for an improved pipeline were prepared for submission to the Ministry.

R. Welland, Crowland and Cowbit Wash.

Experimental work was carried out at a mill near Oundle on a model air controlled siphonic weir to ascertain a design suitable for the control of flood water in the River Welland along the frontage of the Crowland and Cowbit Wash. The assistance of the Water Engineer of Stewarts and Lloyds Ltd. is acknowledged.

R. Nene, Lilford Improvements.

Design work was prepared for a scheme at Lilford to provide the graduated discharge adopted for the original Nene Improvement Scheme. The incorporation of gauging facilities and the elimination of high level weirs on a narrow and porous tree lined bank created problems which required special consideration.

R. Ise, Pages Mill, Wellingborough. Estimated Cost: £7,400.

The flood discharge is to be improved by widening the overfall channel and providing an air controlled siphonic weir. The Mill owner is to pay for that part of the work which is of special benefit to him.

R. Nene, Northampton.

Irrespective of proposals under the New Towns Act 1965 for development at Northampton, schemes for a new flood channel to by-pass Rush Mills, for improvements between Rush Mills and Wellingborough, and for major dredging work upstream of Rush Mills are now envisaged, and would be programmed as financial resources are available.

According to the lines of the expansion and the extent to which there may be encroachment on the flood plain, improvement to the Brampton Branch, the Kislingbury Branch, the Wootton Brook, and to the River Nene between Rush Mills and Cogenhoe costing some £625,000 may be required if the development is not to adversely affect land drainage interests. Such work can only be carried out if those responsible for the New Town meet the cost.

(iii) Other matters relating to grant aided or other works.

(*a*) *Capital Expenditure Ceiling—Grant Aid.*

The decision in 1966 not to proceed with the Market Harborough Flood Control Reservoir in view of local objections, and to hold funds available in the hope (not fulfilled) that it would be possible to start on the " through the town scheme " before the end of that financial year

resulted in an eventual under-spending of £75,000. It was also in accordance with the Government's request made at that time for a slowing down of capital expenditure by deferring starting dates for six months, but it was taken before the publication of Circular LD 188. The under-spending had a serious and then unforeseen effect on the rolling average, reducing the Capital Expenditure Ceiling from £274,000 to £244,705; the rate of grant was also reduced. Strongest representations made to the Ministry that the Authority had been unduly and seriously penalised by Circular LD 188 were of no avail.

(*b*) *Nene Outfall.*

The annual survey in the vicinity of Elbow Bend was completed. There was some accretion on the ebb channel to the north, but otherwise the tendency to erode continued. The lowest recorded bed level to the south of Big Annie beacon was minus 21 (Newlyn Datum), 4 feet lower than in 1966. The shoal at the end of the training walls was more extensive than in 1966, and about 18 inches higher.

Erosion occurred in the Old Lynn channel west of the Whiting Beacon, and the bed level at minus 45 (Newlyn Datum) of the deep water channel now extends further to the South.

(*c*) *Welland Outfall.*

Discussions took place with the Lincolnshire River Authority with regard to survey work seawards of the confluence of the River Witham and River Welland. There are no records available of the channel movements, and it is probable that a joint survey of the estuary will be carried out.

(*d*) *Northamptonshire County Council Drainage Schemes.*

The County Council were assisted in the preparation of land drainage schemes on subsidiary courses.

Faxton Brook, £3,665.

Work was completed, partly by direct labour and partly by contract.

Strixton Brook, £2,720.

Work was completed by direct labour.

2. MAINTENANCE

Precautions imposed by the outbreak of Foot and Mouth disease restricted much of the seasonal maintenance work, other than in the fen area.

Grass and weedcutting was carried out along 354 miles of main river, of which 51 miles were cut twice to meet local requirements. Ten weedcutting launches and six floating elevators are operated. Contract labour was employed as necessary to supplement direct labour. On selected lengths of channel a hydraulic excavator (with a 6 foot ditching bucket) was used to remove growth and beds of flag to ascertain whether that method used in alternate years could replace annual weedcutting with a substantial saving in labour. On highland tributary channels particularly the cumulative effect of beds of flag and silt was approaching the stage when re-dredging will be necessary.

Maintenance dredging was carried out between Upton Mill and Duston Mill, in the overfall channel at White Mills, on the Cransley tributary of the River Ise, on the Willow Brook, and on the Maxey North Drain upstream of Nine Bridges. An extensive shoal downstream of Irthlingborough Lock was caused by slips in the bank, and some bank protection work will be required to prevent a recurrence.

A wide variety of work arises on the maintenance of banks. Routine patrols and inspections of sea and barrier banks are necessary during adverse tides or flood periods, and there is constant

work in dealing with rats, moles and rabbits. Grass has to be mowed on the slowly diminishing areas of bank which are not grazed, and fagot and stone protection provided on the tidal river banks.

Stone was deposited to check erosion on the Maxey North Drain near Peakirk Bridge and Nunton Lodge Bridge. A survey revealed erosion below design profile, and proposals to stabilise the gravel bed are to be considered.

Inspection, repair and servicing of all sluices, and of the thirty-eight locks was carried out, and steel pointing doors were installed at Higham and Orton Locks. Stone was deposited to check erosion downstream of Lower Barnwell Lock, and work was carried out to safeguard the sluice gates at Stibbington. Erosion in the Coronation Channel (River Welland) downstream of Cowbit Road Sluices continued, and it will be necessary to investigate the cause. Repairs were carried out on the timber pointing doors on the Folly River at the confluence with the River Welland.

The conversion of the former brewery premises adjacent to Head Office into a main stores depot proceeded smoothly, and the accommodation and layout for plant and equipment proved to be satisfactory.

The high standard of workmanship of the fitters and carpenters was maintained, and their ability keeps pace with the increasing range of mechanical aids, and the tasks placed upon them.

The services of the South Holland Land Drainage Board Workshops at Holbeach were utilised as necessary, and this assistance was appreciated.

3. WORK IN INTERNAL DRAINAGE DISTRICTS

(a) Administered Boards

Two Internal Drainage Boards are administered, namely the Nene Valley Drainage and Improvement Commissioners (First District) above Northampton, and the Nene Valley Drainage and Navigation Improvement Commissioners (Second District) from Northampton to Peterborough.

Weedcutting and routine clearance work was carried out on 1½ miles of First District main drains and on 16 miles of Second District drains.

The realignment of the channel adjacent to Skew Bridge near Rushden was completed to accord with the reconstruction of the road bridge by Northamptonshire County Council.

(b) Wisbech District Boards

Due to the extent of piling and fagot work required in the Bevis Lane to Miletree Lane reach, the Wisbech Northside Internal Drainage Board improvement scheme was not completed during the year. It is planned to proceed with the final length at Cox's Lane in 1968.

4. FLOODS

Rainfall for the year was slightly below average, but the month of May was the wettest since 1773. An oval area extending north west from Northampton had 300 per cent, or more, of the average May rainfall, and the highest percentage plotted for the whole of England and Wales was 330 per cent for Ravensthorpe near Northampton. This resulted in the most severe summer flood since the 1939-45 War, if not since that of August 1912. Flooding of such magnitude had not occurred in the Nene subcatchment since November 1954, and in the Welland subcatchment since the winter of 1960. The valleys were flooded with a varying degree of severity down to Peterborough and Stamford, and extensive areas of arable land in the flood plains were inundated. The rainfall was much less severe in the fens, and as the tides were

favourable no significant difficulties arose. The data was assembled and some of the salient features are recorded below.

RAINFALL IN INCHES

SITE N=Nene W=Welland	*Average Rainfall for May*	*Total for May 1967*	*Rainfall 12th-16th May, 1967, inclusive*
Northampton (Ravensthorpe) (N)	1.99	6.57	3.64
Wellingborough (N)	1.89	3.97	1.86
Oundle (N)	1.69	4.43	2.07
Peterborough (Stanground) (N)	1.80	3.09	2.05
Market Harborough (W)	1.87	5.26	2.53
Caldecott (W)	1.74	3.89	1.88
Stamford (W)	1.67	4.48	2.81

R. Welland

It was not feasible to make an accurate quantitative comparison with previous floods in view of the new channels and extensive improvement works provided under the Welland Major Improvement Scheme.

WELLAND SUB-CATCHMENT	*Maximum Discharge May 1967*			*Previous Highest Recorded*		
Site	*Date*	*Cusecs.*	*M.G.H.*	*Date*	*Cusecs.*	*M.G.H.*
Tixover	16th	2,000	45	Feb. 1966	1,130	25.4
Tallington	17th	2,200	50		New site	
River Gwash Belmesthorpe	15th	460	10.3		New site	
River Glen Kate's Bridge	16th	500	11.2	Nov. 1960	570	12.7

R. Nene, Wansford

(Average winter discharge 9 M.G.H., average summer discharge 2.5 M.G.H.)

Date	*Peak Discharge*		*Remarks*
	Cusecs	*M.G.H.*	
January 1939 ..	5,570	124.8	
October 1939 ..	3,590	80.4	Rainfall exceptionally heavy above Northampton. Canal bank failed at Weedon
February 1940 ..	6,040	135.3	
March 1941 ..	3,170	71.0	
March 1947 ..	12,700	284.5	The most severe flood for over 100 years.
November 1954	3,128	70.1	
July 1958 ..	2,260	50.6	This was severe over the catchment of the River Ise
May 1967 ..	3,100	69.4	

The majority of the area was near to saturation early in January, and snow followed by rain on frost bound ground resulted in the following flood discharge:—

R. Nene, Wansford

17th January 1,787 cusecs. 40 M.G.H.

R. Welland, Tallington

17th January 797 cusecs. 17.8 M.G.H.

5. DRAINAGE CHARGES

Drainage Charges have not been levied, but it is probable that the matter will be reconsidered when amendments have been made to Part I of the Land Drainage Act 1961 as proposed in Part III of the Agricultural (Miscellaneous Provisions) Bill.

6. STATUTORY SCHEMES FOR INTERNAL DRAINAGE BOARDS

No petitions for Statutory Schemes were received. It has still not been possible to proceed with the proposed Schemes referred to in the Second Annual Report, but it appears that more far-reaching amendments to some Drainage Districts than had been anticipated may be made.

7. OTHER MATTERS

(*a*) *Extension of Main River*

The Minister was asked to make an Order under section 12(6) of the Water Resources Act 1963 to extend " Main River " by some 14.1 miles as follows: