

APPENDIX A.

TABLE SHOWING THE MEAN VELOCITIES OF WATER FLOWING IN UNIFORM CHANNELS AND PIPES. CALCULATED FROM DU BUAT'S FORMULA.

FALL in feet per mile		HYDRAULIC mean depth (see page 79) and velocities in inches per second																											
Fall	Inclination One in	$\frac{1}{4}$ inch	$\frac{1}{2}$ inch	1 inch	1 $\frac{1}{2}$ inch	1 $\frac{3}{4}$ inch	2 inches	2 $\frac{1}{2}$ inches	3 inches	3 $\frac{1}{2}$ inches	4 inches	4 $\frac{1}{2}$ inches	5 inches	5 $\frac{1}{2}$ inches	6 inches	7 inches	8 inches	9 inches	10 inches	11 inches	12 inches	15 inches	18 inches	24 inches	30 inches	36 inches	42 inches	48 inches	
F. L.																													
0 1	63,360	.57	.73	.85	.96	1.07	1.24	1.40	1.55	1.68	1.80	1.91	2.02	2.13	2.23	2.41	2.58	2.75	2.90	3.05	3.19	3.57	3.92	4.54	5.09	5.59	6.04	6.47	
0 2	31,680	.90	1.13	1.33	1.49	1.66	1.94	2.19	2.41	2.61	2.81	2.98	3.15	3.32	3.47	3.76	4.03	4.28	4.52	4.75	4.97	5.57	6.12	7.09	7.94	8.71	9.42	10.08	
0 4	15,840	1.36	1.71	2.01	2.26	2.52	2.94	3.34	3.65	3.96	4.25	4.52	4.78	5.02	5.26	5.69	6.10	6.49	6.85	7.19	7.53	8.44	9.27	10.73	12.03	13.20	14.27	15.27	
0 6	10,560	1.72	2.17	2.55	2.86	3.18	3.72	4.19	4.62	5.01	5.37	5.72	6.04	6.35	6.65	7.20	7.72	8.20	8.66	9.10	9.52	10.67	11.72	13.57	15.21	16.69	18.05	19.31	
0 8	7,920	2.02	2.55	3.00	3.37	3.75	4.38	4.94	5.44	5.90	6.33	6.74	7.12	7.48	7.83	8.48	9.09	9.67	10.21	10.72	11.21	12.57	13.81	15.99	17.92	19.66	21.27	22.76	
0 10	6,336	2.30	2.90	3.40	3.83	4.25	4.97	5.60	6.17	6.70	7.18	7.64	8.08	8.49	8.88	9.63	10.32	10.97	11.58	12.16	12.72	14.27	15.66	18.15	20.33	22.31	24.13	25.82	
1 0	5,280	2.54	3.21	3.77	4.24	4.71	5.51	6.21	6.84	7.42	7.96	8.47	8.95	9.41	9.84	10.67	11.43	12.15	12.83	13.48	14.09	15.81	17.36	20.11	22.53	24.72	26.73	28.61	
1 6	3,520	3.19	4.03	4.73	5.32	5.91	6.91	7.79	8.58	9.31	9.91	10.63	11.23	11.80	12.35	13.38	14.34	15.25	16.10	16.91	17.68	19.83	21.78	25.23	28.27	31.02	33.54	35.90	
2 0	2,640	3.75	4.73	5.55	6.25	6.94	8.11	9.14	10.07	10.93	11.73	12.47	13.18	13.86	14.50	15.71	16.84	17.90	18.90	19.85	20.76	23.28	25.63	29.62	33.18	36.41	39.38	42.14	
2 6	2,112	4.24	5.35	6.29	7.07	7.86	9.18	10.35	11.40	12.37	13.28	14.12	14.93	15.69	16.42	17.79	19.04	20.26	21.40	22.48	23.51	26.36	28.95	33.53	37.57	41.22	44.58	47.71	
3 0	1,760	4.69	5.92	6.96	7.83	8.70	10.16	11.45	12.62	13.69	14.69	15.63	16.52	17.36	18.17	19.69	21.10	22.42	23.68	24.88	26.02	29.18	32.04	37.11	41.58	45.63	49.34	52.81	
3 6	1,508	5.12	6.46	7.59	8.53	9.48	11.08	12.48	13.76	14.92	16.01	17.03	18.00	18.92	19.79	21.46	23.00	24.44	25.81	27.11	28.35	31.77	34.92	40.45	45.32	49.73	53.78	57.55	
4 0	1,320	5.51	6.95	8.17	9.19	10.21	11.93	13.44	14.81	16.07	17.26	18.35	19.39	20.38	21.33	23.11	24.77	26.32	27.80	29.20	30.54	34.59	38.79	43.59	48.81	53.56	57.92	61.98	
5 0	1,056	6.24	7.88	9.25	10.41	11.56	13.51	15.23	16.73	18.21	19.53	20.78	21.96	23.08	24.16	26.17	28.05	29.81	31.48	33.07	34.59	38.79	42.59	49.34	55.28	60.66	65.60	70.20	
6 0	880	6.91	8.72	10.25	11.53	12.80	14.96	16.86	18.58	20.16	21.63	23.01	24.32	25.56	26.75	28.98	31.06	33.02	34.86	36.62	38.30	42.95	47.16	54.63	61.22	67.17	72.64	77.74	
7 0	754	7.54	9.51	11.17	12.57	13.96	16.32	18.39	20.26	21.98	23.59	25.09	26.52	27.87	29.17	31.60	33.87	36.00	38.02	39.93	41.76	46.84	51.43	59.58	66.76	73.25	79.21	84.77	
8 0	660	8.12	10.25	12.04	13.54	15.05	17.58	19.82	21.84	23.69	25.42	27.04	28.58	30.04	31.43	34.06	36.50	38.80	40.97	43.04	45.01	50.48	55.42	64.21	71.94	78.94	85.37	91.35	
9 0	587	8.68	10.95	12.86	14.47	16.07	18.78	21.17	23.32	25.31	27.54	28.89	30.67	32.41	34.06	36.39	38.99	41.45	43.77	45.97	48.08	53.92	59.21	68.59	76.85	84.32	91.19	97.59	
10 0	528	9.21	11.62	13.65	15.36	17.06	19.94	22.47	24.76	26.87	28.53	30.67	32.41	34.06	35.65	38.63	41.40	44.00	46.46	48.80	51.04	57.24	62.85	72.81	81.58	89.52	96.81	103.60	
11 0	480	9.72	12.27	14.41	16.21	18.01	21.04	23.72	26.13	28.35	30.42	32.37	34.20	35.95	37.62	40.76	43.69	46.44	49.03	51.51	53.87	60.41	66.33	76.84	86.10	94.47	102.17	109.33	
12 0	440	10.21	12.89	15.22	17.07	18.92	22.11	24.91	27.45	29.79	31.96	34.00	35.93	37.77	39.52	42.82	45.90	48.78	51.51	54.11	56.59	63.47	69.68	80.72	90.45	99.25	107.33	114.86	
13 2	400	10.78	13.60	15.98	17.98	19.97	23.34	26.30	28.98	31.44	33.74	35.74	37.93	39.87	41.72	45.19	48.44	51.49	54.37	57.11	59.73	66.99	73.55	85.21	95.48	104.76	113.29	121.25	
15 1	350	11.63	14.68	17.24	19.40	21.55	25.18	28.38	31.27	33.93	36.40	38.73	40.92	43.02	45.01	48.76	52.27	55.56	58.67	61.61	64.45	70.38	76.94	88.66	100.41	109.02	117.04	124.82	
17 6	300	12.70	16.02	18.83	21.18	23.53	27.50	30.99	34.15	37.05	39.75	42.29	44.69	46.97	49.16	53.25	57.08	60.67	64.07	67.29	70.38	78.94	87.65	99.69	109.44	117.83	126.80	134.86	
21 1	250	14.10	17.80	20.91	23.52	26.13	30.53	34.41	37.91	41.14	44.14	46.95	49.62	52.16	54.58	59.12	63.38	67.37	71.13	74.71	78.15	87.65	99.69	109.44	117.83	126.80	134.86	142.86	
26 4	200	16.04	20.21	23.78	26.75	29.72	34.72	39.13	43.12	46.79	50.20	53.41	56.44	59.32	62.08	67.25	72.08	76.62	80.91	84.97	88.88	99.69	109.44	117.83	126.80	134.86	142.86	150.82	
35 2	150	18.96	23.92	28.11	31.62	35.13	41.04	46.26	50.97	55.30	59.34	63.13	66.71	70.12	73.37	79.48	85.20	90.56	95.62	100.44	105.06	117.83	126.80	134.86	142.86	150.82	158.62	166.42	
42 2	125	21.09	26.62	31.27	35.18	39.08	45.66	51.46	56.71	61.53	66.02	70.23	74.22	78.01	81.64	88.43	94.79	100.76	106.40	111.75	116.89	131.10	143.92	156.75	169.58	177.38	185.18	192.98	
52 8	100	24.06	30.35	35.66	40.11	44.57	52.07	58.69	64.67	70.17	75.29	80.09	84.64	88.97	93.10	100.85	108.10	114.91	121.33	127.43	133.29	149.50	164.12	179.63	194.15	208.67	223.19	237.71	
66 0	80	27.46	34.64	40.70	45.79	50.87	59.44	66.99	73.81	80.09	85.93	91.42	96.61	101.54	106.26	115.10	123.38	131.15	138.48	145.44	152.13	170.63	187.31	203.99	220.67	237.35	254.03	270.71	
88 0	60	32.60	41.13	48.33	54.36	60.39	70.37	79.53	87.63	95.09	102.02	108.54	114.70	120.56	126.16	136.67	146.50	155.74	164.44	172.71	180.66	202.62	222.44	242.26	262.08	281.90	301.72	321.54	
132 0	40	41.60	52.49	61.67	69.37	77.07	90.06	101.50	111.84	121.65	130.20	138.51	146.38	153.86	161.00	174.4													

APPENDIX B.

TABLE SHOWING SUPPLY PER MINUTE, DAY, AND YEAR, AND DRAINAGE AREA REQUIRED FOR A GIVEN POPULATION.

Population		Per minute		Per day		Per year	Drainage area at 12" depth running off per annum
At 20 gallons per head per day	At 30 gallons per head per day	Gallons	Cubic feet	Millions of gallons	Cubic feet	Millions of gallons	
Number	Number						Square miles
5,000	3,333	69.44	11.14	.1	16,406	5.857	.21
10,000	6,667	132.89	22.29	.2	32,092	11.714	.42
15,000	10,000	203.33	33.43	.3	48,139	17.571	.63
20,000	13,333	277.78	44.57	.4	64,185	23.427	.84
25,000	16,667	347.22	55.71	.5	80,231	29.284	1.05
30,000	20,000	416.66	66.86	.6	96,277	35.141	1.26
35,000	23,333	486.11	78.00	.7	112,323	40.998	1.47
40,000	26,667	555.55	89.14	.8	128,369	46.855	1.68
45,000	30,000	625.00	100.29	.9	144,416	52.712	1.89
50,000	33,333	694.44	111.43	1.00	160,462	58.567	2.10
62,500	41,667	868.05	139.28	1.25	200,579	73.209	2.62
75,000	50,000	1,041.67	167.14	1.50	240,692	87.853	3.15
87,500	58,333	1,215.28	194.99	1.75	280,808	102.495	3.67
100,000	66,667	1,388.89	222.86	2.00	320,924	117.137	4.20
112,500	75,000	1,562.50	250.71	2.25	361,040	131.779	4.72
125,000	83,333	1,736.11	278.57	2.50	401,158	146.421	5.25
137,500	91,667	1,909.72	306.43	2.75	441,273	161.063	5.77
150,000	100,000	2,083.33	334.30	3.00	481,386	175.706	6.30
162,500	108,333	2,256.94	362.15	3.25	521,502	190.348	6.82
175,000	116,667	2,430.55	390.01	3.50	561,617	204.990	7.35
187,500	125,000	2,604.16	417.86	3.75	601,732	219.632	7.87
200,000	133,333	2,777.77	445.73	4.00	641,848	234.275	8.40
225,000	150,000	3,124.99	501.45	4.50	722,079	263.559	9.45
250,000	166,667	3,472.22	557.16	5.00	802,310	292.843	10.50
275,000	183,333	3,819.44	612.88	5.50	882,541	322.127	11.55
300,000	200,000	4,166.66	668.59	6.00	962,772	351.412	12.60
325,000	216,667	4,513.88	724.30	6.50	1,043,003	380.696	13.65
350,000	233,333	4,861.11	780.00	7.00	1,123,234	409.982	14.70
400,000	266,667	5,555.55	891.46	8.00	1,283,697	468.549	16.81
450,000	300,000	6,250.00	1,001.89	9.00	1,444,159	527.118	18.92
500,000	333,333	6,944.40	1,114.30	10.00	1,604,621	585.687	21.02
1,000,000	666,667	13,888.90	2,228.60	20.00	3,209,242	1,171.374	42.04
1,500,000	1,000,000	20,833.30	3,343.00	30.00	4,813,863	1,757.061	63.06
2,000,000	1,333,333	27,777.70	4,457.30	40.00	6,418,484	2,342.748	84.08
2,500,000	1,666,667	34,722.20	5,571.60	50.00	8,023,105	2,928.435	105.10
3,000,000	2,000,000	41,666.60	6,685.90	60.00	9,627,726	3,514.122	126.12
3,500,000	2,333,333	48,611.10	7,800.00	70.00	11,232,347	4,099.809	147.14
4,000,000	2,666,667	55,555.50	8,914.60	80.00	12,836,968	4,685.495	168.16
4,500,000	3,000,000	62,500.00	10,028.90	90.00	14,441,389	5,271.181	189.18
5,000,000	3,333,333	69,444.40	11,143.20	100.00	16,046,213	5,856.868	210.20

APPENDIX C.

TABLE SHOWING THE SIZE, WEIGHT, SAFE HEAD, AND STRENGTH OF CAST-IRON WATER-PIPES.*

Internal Diameter of Pipe in inches	Thickness of Metal in inches	Length of Pipe in work in feet	Depth of Socket in inches	Thickness of Joint in inches	Weight of Pipe in lbs.	Deviation which may be al- lowed in Weight in lbs.	Safe Head of Water in feet	Bursting Pressure in lbs. per sq. in. tensile strength taken at 15,000 lbs. per sq. in.	Internal Diameter of Pipe in inches	Thickness of Metal in inches	Length of Pipe in work in feet	Depth of Socket in inches	Thickness of Joint in inches	Weight of Pipe in lbs.	Deviation which may be al- lowed in Weight in lbs.	Safe Head of Water in feet	Bursting Pressure in lbs. per sq. in. tensile strength taken at 15,000 lbs. per sq. in.
1 1/2	.250	6	2.75	.20	42	2	1,150	5,000	12	.875	9	3.00	.33	1,040	30	503	2,187
2	.250	6	2.75	.20	56	2	863	3,750	14	.625	9	3.00	.33	890	24	308	1,339
3	.250	9	2.75	.20	80	3	575	2,500	14	.750	9	3.00	.33	1,060	30	370	1,607
3	.375	9	2.75	.20	120	4	863	3,750	14	.875	9	3.00	.33	1,230	35	431	1,875
3	.500	9	2.75	.20	165	6	1,150	5,000	14	1.00	9	3.00	.33	1,400	40	493	2,142
3	.625	9	2.75	.20	210	7	1,438	6,250	15	.625	9	3.00	.33	945	27	288	1,250
4	.250	9	2.75	.26	110	4	431	1,875	15	.750	9	3.00	.33	1,125	32	345	1,500
4	.375	9	2.75	.26	160	6	647	2,812	15	.875	9	3.00	.33	1,315	35	403	1,750
4	.500	9	2.75	.26	210	7	863	3,750	15	1.00	9	3.00	.33	1,495	40	460	2,000
4	.625	9	2.75	.26	260	8	1,078	4,687	16	.625	9	3.50	.33	1,005	28	269	1,171
5	.250	9	2.75	.26	135	5	345	1,500	16	.750	9	3.50	.33	1,200	35	323	1,406
5	.375	9	2.75	.26	195	7	518	2,250	16	.875	9	3.50	.33	1,395	39	377	1,640
5	.500	9	2.75	.26	270	8	690	3,000	16	1.00	9	3.50	.33	1,595	45	431	1,875
5	.625	9	2.75	.26	330	10	863	3,750	18	.625	9	3.50	.33	1,125	32	239	1,041
6	.375	9	2.75	.26	230	7	431	1,875	18	.750	9	3.50	.33	1,340	36	288	1,250
6	.500	9	2.75	.26	255	8	575	2,500	18	.875	9	3.50	.33	1,530	42	335	1,458
6	.625	9	2.75	.26	385	11	719	3,125	18	1.00	9	3.50	.33	1,745	50	383	1,666
6	.750	9	2.75	.26	470	14	863	3,750	21	.625	12	3.50	.33	1,750	50	205	892
7	.375	9	2.75	.26	275	8	370	1,607	21	.750	12	3.50	.33	2,075	56	246	1,071
7	.500	9	2.75	.26	360	10	493	2,142	21	.875	12	3.50	.33	2,410	68	288	1,250
7	.625	9	2.75	.26	450	13	616	2,678	21	1.00	12	3.50	.33	2,855	70	328	1,428
7	.750	9	2.75	.26	540	15	739	3,214	24	.625	12	3.50	.33	1,980	54	180	781
8	.375	9	2.75	.26	310	9	323	1,406	24	.750	12	3.50	.33	2,350	65	216	937
8	.500	9	2.75	.26	410	12	431	1,875	24	.875	12	3.50	.33	2,800	70	251	1,093
8	.625	9	2.75	.26	510	15	539	2,343	24	1.00	12	3.50	.33	3,185	80	288	1,250
8	.750	9	2.75	.26	610	18	647	2,812	30	.75	12	3.50	.33	3,080	78	173	750
9	.375	9	2.75	.26	345	10	288	1,250	30	1.00	12	4.00	.33	3,940	105	230	1,000
9	.500	9	2.75	.26	450	13	383	1,666	30	1.125	12	4.00	.33	4,205	110	259	1,125
9	.625	9	2.75	.26	560	16	479	2,083	30	1.25	12	4.00	.33	4,955	112	288	1,250
9	.750	9	2.75	.26	680	18	575	2,500	36	.75	12	4.00	.33	3,675	100	144	625
10	.375	9	2.75	.26	380	10	259	1,125	36	1.0	12	4.00	.33	4,785	111	192	833
10	.500	9	2.75	.26	500	15	345	1,500	36	1.125	12	4.00	.33	5,195	113	216	937
10	.625	9	2.75	.26	620	18	432	1,878	36	1.25	12	4.00	.33	5,900	125	239	1,041
10	.750	9	2.75	.26	775	20	518	2,250	42	.75	12	4.50	.33	4,365	110	123	535
11	.500	9	2.75	.26	545	15	313	1,363	42	1.0	12	4.50	.33	5,645	120	164	714
11	.625	9	2.75	.26	630	18	332	1,704	42	1.125	12	4.50	.33	6,300	130	185	803
11	.750	9	2.75	.26	815	24	470	2,045	42	1.25	12	4.50	.33	6,940	140	205	892
11	.875	9	2.75	.26	960	27	549	2,386	48	.75	12	4.50	.33	4,980	112	108	468
12	.500	9	3.00	.33	595	17	288	1,250	48	1.0	12	4.50	.33	6,450	132	144	625
12	.625	9	3.00	.33	740	20	359	1,562	48	1.125	12	4.50	.33	7,180	142	162	703
12	.750	9	3.00	.33	890	22	431	1,875	48	1.25	12	4.50	.33	7,615	150	180	781

* Latham's 'Sanitary Engineering.'

APPENDIX D.

TABLE SHOWING THE COST OF CAST-IRON PIPES FROM 2 TO 48 INCHES DIAMETER, GIVING THE LENGTH OF EACH PIPE, THICKNESS, SAFE-HEAD, WEIGHT PER PIPE, AND COST PER YARD, AT £5 PER TON AND ALSO £1 PER TON.

NOTE.—The weight includes a proportion for socket for each length of pipe, allowing the clear length of each pipe when laid to make the length specified in the table; thus each pipe would be about 6 inches longer from out to out than specified. The safe head is that to which the pipes may be constantly exposed. The proof head may be double the tabular amount, if the circumstances require.

Bore of Pipes	Thick-ness of Metal	Length of each Pipe	Safe Head	Weight of each Pipe	Cost of Pipe per Yard at £5 Per Ton	Cost of Pipe per Yard at £1 per Ton	Bore of Pipes	Thick-ness of Metal	Length of each Pipe	Safe Head	Weight of each Pipe	Cost of Pipe per Yard at £5 per Ton	Cost of Pipe per Yard at £1 per Ton
Inches	Inches	Feet	Feet	Cwts. qrs. lbs.	£ s. d.	s. d.	Inches	Inches	Feet	Feet	Cwts. qrs. lbs.	£ s. d.	s. d.
2	$\frac{1}{4}$	6	—	0 1 8	0 0 9 $\frac{3}{4}$	0 2	12	$\frac{7}{8}$	9	918	9 1 8	0 15 6 $\frac{1}{2}$	3 1 $\frac{1}{4}$
2	$\frac{3}{8}$	6	—	0 2 0	0 1 3	0 3	14	$\frac{5}{8}$	9	535	7 3 25	0 13 3	2 7 $\frac{1}{2}$
3	$\frac{1}{4}$	9	1,000	0 3 0	0 1 3	0 3	14	$\frac{3}{4}$	9	642	9 1 26	0 15 9 $\frac{3}{4}$	3 2
3	$\frac{3}{8}$	9	1,500	1 0 14	0 1 10 $\frac{1}{2}$	0 4 $\frac{1}{2}$	14	$\frac{7}{8}$	9	750	11 0 1	0 18 4	3 8
3	$\frac{1}{2}$	9	2,000	1 2 0	0 2 6	0 6	14	1	9	857	12 2 7	1 0 11 $\frac{1}{4}$	4 2 $\frac{1}{4}$
3	$\frac{5}{8}$	9	2,500	1 3 14	0 3 1 $\frac{1}{2}$	0 7 $\frac{1}{2}$	15	$\frac{5}{8}$	9	500	8 1 24	0 14 1	2 9 $\frac{3}{4}$
4	$\frac{1}{4}$	9	744	0 3 27	0 1 7 $\frac{1}{2}$	0 3 $\frac{3}{4}$	15	$\frac{3}{4}$	9	600	10 0 8	0 16 9 $\frac{1}{2}$	3 4 $\frac{1}{4}$
4	$\frac{3}{8}$	9	1,128	1 1 19	0 2 4 $\frac{1}{2}$	0 5 $\frac{3}{4}$	15	$\frac{7}{8}$	9	700	11 3 1	0 19 7	3 11
4	$\frac{1}{2}$	9	1,500	1 3 17	0 3 2	0 7 $\frac{1}{2}$	15	1	9	800	13 1 13	1 2 3 $\frac{1}{2}$	4 5 $\frac{1}{2}$
4	$\frac{5}{8}$	9	1,872	2 1 15	0 3 11 $\frac{3}{4}$	0 9 $\frac{1}{2}$	16	$\frac{5}{8}$	9	468	9 0 0	0 15 0	3 0
5	$\frac{1}{4}$	9	600	1 0 26	0 2 0 $\frac{3}{4}$	0 5	16	$\frac{3}{4}$	9	565	11 2 27	0 19 6 $\frac{3}{4}$	3 11
5	$\frac{3}{8}$	9	900	1 3 5	0 2 11 $\frac{3}{4}$	0 7 $\frac{1}{4}$	16	$\frac{7}{8}$	9	652	12 1 26	1 0 9 $\frac{1}{2}$	4 1 $\frac{3}{4}$
5	$\frac{1}{2}$	9	1,200	2 1 12	0 3 11 $\frac{1}{4}$	0 9 $\frac{1}{2}$	16	1	9	—	14 1 0	1 3 9	4 9
5	$\frac{5}{8}$	9	1,500	3 0 0	0 5 0	1 0	18	$\frac{5}{8}$	12	412	13 1 20	0 16 9 $\frac{1}{2}$	3 4 $\frac{1}{2}$
6	$\frac{3}{8}$	9	750	2 0 10	0 3 6	0 8 $\frac{1}{2}$	18	$\frac{3}{4}$	12	500	16 0 0	1 0 0	4 0
6	$\frac{1}{2}$	9	1,000	2 1 6	0 3 10	0 9 $\frac{1}{4}$	18	$\frac{7}{8}$	12	583	18 1 26	1 3 1 $\frac{1}{4}$	4 7 $\frac{1}{2}$
6	$\frac{5}{8}$	9	1,250	3 1 26	0 5 9 $\frac{1}{2}$	1 1 $\frac{1}{4}$	18	1	12	666	20 3 8	1 6 0 $\frac{1}{4}$	5 2 $\frac{1}{2}$
6	$\frac{3}{4}$	9	1,500	4 0 26	0 7 0 $\frac{1}{2}$	1 4 $\frac{3}{4}$	21	$\frac{5}{8}$	12	360	15 2 16	0 19 6 $\frac{1}{2}$	3 10 $\frac{3}{4}$
7	$\frac{3}{8}$	9	640	2 1 24	0 4 1 $\frac{1}{4}$	0 9 $\frac{3}{4}$	21	$\frac{3}{4}$	12	428	18 2 4	1 3 2	4 7 $\frac{3}{4}$
7	$\frac{1}{2}$	9	857	3 0 27	0 5 4 $\frac{3}{4}$	1 1	21	$\frac{7}{8}$	12	500	21 2 4	1 6 11 $\frac{3}{4}$	5 4 $\frac{1}{4}$
7	$\frac{5}{8}$	9	1,068	4 0 2	0 6 8 $\frac{1}{4}$	1 4	21	1	12	572	25 0 0	1 11 3	6 3
7	$\frac{3}{4}$	9	1,284	4 3 14	0 8 1 $\frac{1}{2}$	1 7 $\frac{1}{2}$	24	$\frac{5}{8}$	12	312	17 2 20	1 2 1 $\frac{1}{4}$	4 5
8	$\frac{3}{8}$	9	564	2 3 14	0 4 9 $\frac{1}{2}$	0 11 $\frac{1}{2}$	24	$\frac{3}{4}$	12	374	21 0 0	1 6 3	5 3
8	$\frac{1}{2}$	9	750	3 2 19	0 6 1 $\frac{1}{2}$	1 2 $\frac{3}{4}$	24	$\frac{7}{8}$	12	400	25 0 0	1 11 3	6 3
8	$\frac{5}{8}$	9	936	4 2 9	0 7 7 $\frac{1}{2}$	1 6 $\frac{1}{4}$	24	1	12	500	28 1 24	1 15 7	7 1 $\frac{1}{2}$
8	$\frac{3}{4}$	9	1,128	5 1 27	0 9 1 $\frac{3}{4}$	1 10	30	$\frac{3}{4}$	12	300	27 2 0	1 14 4 $\frac{1}{2}$	6 10 $\frac{1}{2}$
9	$\frac{3}{8}$	9	500	3 0 12	0 5 2	1 0 $\frac{1}{4}$	30	1	12	400	35 3 12	2 4 9 $\frac{3}{4}$	8 11 $\frac{1}{2}$
9	$\frac{1}{2}$	9	666	4 0 8	0 6 9 $\frac{1}{2}$	1 4 $\frac{1}{4}$	30	1 $\frac{1}{8}$	12	450	37 2 8	2 6 11 $\frac{3}{4}$	9 4 $\frac{3}{4}$
9	$\frac{5}{8}$	9	832	5 0 4	0 8 4 $\frac{3}{4}$	1 8 $\frac{1}{4}$	30	1 $\frac{1}{4}$	12	500	44 1 0	2 15 3 $\frac{3}{4}$	11 0 $\frac{3}{4}$
9	$\frac{3}{4}$	9	1,000	6 0 12	0 10 2 $\frac{1}{4}$	2 0 $\frac{1}{2}$	36	$\frac{3}{4}$	12	249	32 2 16	2 0 9 $\frac{1}{2}$	8 1 $\frac{3}{4}$
10	$\frac{3}{8}$	9	450	3 1 20	0 5 8 $\frac{1}{2}$	1 1 $\frac{1}{4}$	36	1	12	333	42 3 0	2 13 5 $\frac{1}{4}$	10 8 $\frac{1}{4}$
10	$\frac{1}{2}$	9	600	4 2 0	0 7 6	1 6	36	1 $\frac{1}{8}$	12	375	46 1 16	2 18 0	11 7 $\frac{1}{4}$
10	$\frac{5}{8}$	9	750	5 2 8	0 9 3 $\frac{1}{2}$	1 10 $\frac{1}{4}$	36	1 $\frac{1}{4}$	12	412	52 2 14	3 5 9 $\frac{1}{4}$	13 1 $\frac{3}{4}$
10	$\frac{3}{4}$	9	900	6 3 24	0 11 7 $\frac{1}{4}$	2 3 $\frac{3}{4}$	42	$\frac{3}{4}$	12	216	39 0 0	2 8 9	9 9
11	$\frac{1}{2}$	9	525	4 3 17	0 8 2	1 7 $\frac{3}{4}$	42	1	12	228	50 1 20	3 3 0 $\frac{1}{2}$	12 7 $\frac{1}{4}$
11	$\frac{5}{8}$	9	684	6 0 12	0 10 2	2 0 $\frac{1}{4}$	42	1 $\frac{1}{8}$	12	312	56 1 0	3 10 3 $\frac{3}{4}$	14 0 $\frac{3}{4}$
11	$\frac{3}{4}$	9	816	7 0 6	0 11 9	2 4 $\frac{1}{4}$	42	1 $\frac{1}{4}$	12	360	62 0 0	3 17 6	15 6
11	$\frac{7}{8}$	9	960	8 2 8	0 14 3	2 10 $\frac{1}{4}$	48	$\frac{3}{4}$	12	187	44 2 0	2 15 7 $\frac{1}{2}$	11 1 $\frac{1}{2}$
12	$\frac{1}{2}$	9	500	5 1 9	0 8 10 $\frac{1}{2}$	1 9 $\frac{1}{4}$	48	1	12	250	57 2 12	3 12 0	14 4 $\frac{3}{4}$
12	$\frac{5}{8}$	9	625	6 2 13	0 11 0 $\frac{1}{4}$	2 2 $\frac{1}{2}$	48	1 $\frac{1}{8}$	12	280	64 0 12	4 0 1 $\frac{1}{2}$	16 0 $\frac{1}{4}$
12	$\frac{3}{4}$	9	750	7 3 23	0 13 3 $\frac{1}{4}$	2 7 $\frac{3}{4}$	48	1 $\frac{1}{4}$	12	312	68 0 0	4 5 0	17 0

N.B.—The thickness, weights, and safe head are taken from Beardmore's Tables.

APPENDIX E.

SPECIFICATIONS OF WATERWORKS.

Gosport Waterworks: Wells. Brompton, Chatham, Gillingham, and Rochester Waterworks: Service Reservoir. Lambeth Waterworks: Decimus Burton Road Reservoir. Dublin Corporation Waterworks: Socket Pipes and other Castings; Pipe-laying, &c. Bideford Waterworks: Impounding Reservoir; Filter Beds and a Covered Service Reservoir; Cast-iron Socket Pipes and Glazed and Unglazed Socket Pipes; Laying and Jointing Mains; Sluice Valves, Hydrants, &c. Dundee Waterworks: Store and Compensation Reservoir. Rotherham Waterworks: Reservoir; Filter Beds; Pure Water Basin; Overflows; Earthenware and Cast-iron Pipe Conduits and other Works. Aberdeen Waterworks: Inlet Tanks; Aqueduct; Reservoirs; Filters; Cast-iron Aqueducts; Cast-iron Pipes and Pipe-laying Embankments, with Dry-Rubble Hearting Culverts; Hydraulic Engine and Pumps and Buildings; Engines; &c. Canterbury Waterworks: Cast-iron Pipes. Halifax Corporation Waterworks: Flood and Waste Watercourses; Waste Weirs; Two Reservoirs; Shafts; Tunnels; Pipe-laying Basin; Diversion of Fulshaw Stream; Pipe-laying; Weirs, &c.

GOSPORT WATERWORKS.

SPECIFICATION

To be observed by the Contractor in making, sinking, and maintaining a Well and Boring at or near Bury Cross, in the parish of Alverstoke, for the Gosport, Forton, and Anglesey Water Consumers' Company.

THE WELL.

The contractor shall sink, where shown, a well 10 feet in diameter in the clear, and of the depth of 25 feet from the surface, and line or stein the same with hard, square, and well-burnt stock bricks, set in Portland cement, 14 inches work, and laid as shown by the drawings. The cement to be gauged half-and-half with clear, sharp sand. The annular portion of the bottom to be made as shewn in section, of solid brickwork in cement. The well is then further to be sunk 45 feet from the bottom of the same, and lined with cast-iron cylinders throughout, so as to exclude all land springs and top or surface water; the cast-iron cylinders are to be 7 feet diameter in the clear, and the metal to be 1 inch in thickness. They are to be cast in lengths of 5 feet each, with top and bottom flanches, with the exception, however, of the lower length, the bottom of which is to have a sharp 'chisel edge.' The flanches shall be 4 inches in width, with 1-inch bolt-holes, 9 inches apart, and strengthened by at least 1 bracket between each bolt-hole. These cylinders shall be put together and maintained perfectly watertight, the joints being made with white hempen plaited gasket, well soaked in tallow, or the patent improved 'flexile packing,' screwed between the flanches. The cylinders shall be kept as vertical as possible, and left with the chisel edge thoroughly and securely entered into the clay at the bottom of the well, which well shall be well secured, and floored with strongly ribbed cast-iron plates, placed and properly fastened beneath the lower flanch, which is to be cast upon the bottom cylinder 12 inches above the chisel edge for this purpose, as shown by the drawing. The contractor shall provide, set up, and work (if necessary), a steam-engine of sufficient power, with requisite pumps, for raising and discharging the water, and all the means necessary for keeping down the water in the well, during the execution of his contract. The water raised by the engine to be discharged into the watercourse adjacent to the works.

THE BORING.

The contractor shall bore, or otherwise make or cause to be made, a shaft or bore-hole from and in the bottom of the aforesaid well, to the clear depth of 240 feet, measured from the bottom of the aforesaid well, or to such other depth as shall be found requisite to ensure an abundant supply of pure water, at the rate of not less than 500,000 gallons per day of 12 hours. The bore-hole or shaft shall be sufficiently large to admit of a cast-iron or copper pipe of 18 inches clear internal diameter being inserted at its *lowest* point or greatest depth, and until the water-bearing stratum is entered at least 15 feet, and the aforesaid satisfactory supply or quantity is obtained.

THE PIPES OR TUBES.

Pipes or tubes shall be inserted into and left remaining within the bore-hole, and shall be of cast-iron, and not less than 1 inch in thickness of metal (with the exception of the lowest 15 feet, which shall be of copper, and of 18 inches diameter), and of such clear internal diameter as to admit of the extreme depth being attained as described, and with the aforesaid copper pipe of 18 inches diameter; the upper portion of the pipe also shall, when finished, come up through and stand 3 inches above the flooring or bottom of the well, having an enlarged end or flanch cast, or otherwise fixed upon it, 3 inches below the top, which flanch shall rest upon the bottom or floor plates of the well when all is finished, as shown in the drawings.

The iron pipe shall be in 9-ft. or 10-ft. lengths, the joints to be made flush on the inside, and watertight, and the pipes connected together by wrought-iron collars. The lower portion of the pipe or tube, at least to the extent of 15 feet, as before stated, shall be of copper, $\frac{3}{16}$ of an inch thick, and 18 inches internal diameter, and perforated with holes not less than $\frac{1}{8}$ of an inch diameter, and not more than 2 inches apart, horizontally or vertically, and a limited number of perforations in any or all the lower 5 pipes, if so required by the engineer.

The contractor shall make good and finish watertight the bottom or floor of the well, around and to the bore-pipe, and shall find at his own expense all necessary means for pumping out water, or keeping dry the well or other works, during the time of boring or fixing the pipe.

The contractor shall, after the boring is completed, make good a curb of brickwork in Portland cement, around the top of the iron cylinders, flush, and also another curb of brickwork flush with the invert or pavement, as the case may be, of the intended vault of the engine-house, and at least 27 inches deep by 3 feet wide each; and finally, the contractor shall clean out and leave clear

MAKE GOOD BOTTOM
OF WELL.

the well and bore-hole to the bottom of all and any accumulation of whatever kind of solid matter, whether chalk, flints, sand, gravel, shells, clay, &c.

N.B.—The tender must be sealed, and endorsed with the words 'Tender for Well, &c.' on the outside.

JAMES PILBROW, *Engineer to the said Company.*

FORM OF TENDER.

To the Gosport, Forton, and Anglesey Water Consumers' Company.

GENTLEMEN,— will undertake and agree to sink, make, complete, and maintain a well, and to make and maintain an 18-inch bore-hole in the same, at or near 'Bury Cross,' in the parish of Alverstoke, for the Gosport, Forton, and Anglesey Water Consumers' Company, according to the true intent and meaning of the foregoing specification, at and for the sums following (that is to say):—

The well to be made in the land of the said Company, near 'Bury Cross,' first to the depth of 25 feet, and of the size or clear diameter of 10 feet, and lined or steined with brickwork in cement, as described in the specification, and to a further depth of 45 feet of a clear diameter of 7 feet, and throughout this whole further depth lined with cast-iron cylinders, as required and described by the specification, for the sum of

and will also make or bore the bore-hole 240 feet in depth below the bottom of the said well, of a clear diameter to admit of and insert therein the cast-iron and perforated copper pipes of 18 inches internal diameter, as described in this specification, for the sum of

and, if so required, will continue the said bore-hole and tubes of the same diameter, and to be the same diameter of 18 inches at the bottom, when completed to such further depth, &c. &c., at the rate of

for every foot so bored and tubed beyond the said depth of 240 feet from bottom of well, but not exceeding in depth 100 feet beyond the aforesaid 240 feet, and will also

cleanse and finish according to the drawings and specification, and find the means for pumping out the water, and all other necessary works connected herewith, required by the clerk of the works and duly authorised by the engineer, and will keep in good order, maintain, and cleanse the same for the effectual delivery of water for twelve months from the delivery of the said works to the Company. Making a total amount of

for the whole of the works, materials, tools, matters, and things, as contained in or referred to by the annexed specification.

remain, Gentlemen, your obedient servant,

Name

Address

Date

Names and Addresses of Sureties proposed.

References.

BROMPTON, CHATHAM, GILLINGHAM, AND ROCHESTER WATERWORKS.

SPECIFICATION

To be observed by the Contractor for constructing, making, and completing a Service Reservoir, &c., for the Brompton, Chatham, Gillingham and Rochester Waterworks' Company.

GENERAL CONDITIONS.

SIGN SPECIFICATION,
DRAWINGS, &c.

The contractor shall, at the request of the Company, sign the specification, together with the several plans, sections, and general and detail drawings which accompany the same, each of which shall be construed according to its true intent and meaning, although each and every part of the works intended thereby may not be mentioned or described therein; and they shall be deemed and considered the data upon which the contract to be entered into by the said contractor shall be founded.

The engineer shall also have, at all times, full powers and authority, either by himself or the clerk of the works, to make and issue such further drawings, and to give such further instructions and directions, as may appear to him necessary and proper for the guidance of the said contractor. The contractor shall receive, execute, and obey, and be bound by the same, according to the true intent and meaning thereof, as fully and effectually as though they had been mentioned in this specification.

The engineer or clerk of the works shall have full liberty to require the discharge of any workman whom they or he may consider not performing his work according to his or their approval, or who is in other respects objectionable upon the works; and the said contractor, or his foreman, shall accordingly immediately discharge such man or men. The engineer may, in like manner, compel the discharge of the foreman.

ADDITIONS, DEDUC-
TIONS, &c.

No additions, deductions, alterations, or deviations made or permitted in, to, or from the construction of the works, or any part of them, shall annul or invalidate the contract; but the value of the same shall be ascertained, and added to or deducted from the sum to be paid to the contractor, as the case may require, by and according to the judgment of the engineer; the said judgment to be made upon the admeasurements and valuations of the engineer, who, in making such valuations, shall use and take into consideration the prices mentioned in the schedule of prices annexed to the tender of the contractor, as far as, in the opinion of the said engineer, the case may apply. The contractor shall not sub-let any portion of the work undertaken by him, or contained in this specification.

The company shall not become liable to the payment of any charges in respect of any additions, deductions, alterations, or deviations, unless the instructions to perform the same shall have been given in writing by the engineer to the Company, and unless the contractor shall make in writing a claim to the same; such written claim to be delivered to the secretary of the Company, and copies sent to the engineer. The contractor shall send in such claim before commencing the said extra work, and shall specify therein the description and quantity of the work to be done, the labour to be employed, and the materials to be used, as well as the prime cost of such labour and materials.

MEASURING.

All admeasurements, whether made by the engineer or the clerk of the works, to be so made and taken as to express only the net quantity in work, notwithstanding any custom, rule, or practice whatsoever to the contrary.

In case of any dispute or discrepancy about the several things herein described as the grounds or data of this contract, then this specification shall have precedence of, and shall be held to be more correct and binding than, the drawings. In like manner, detail drawings shall be held to be more correct and binding than general drawings; and drawings made to a large scale, or for special

instruction, shall be held to be more correct and binding than drawings made to a smaller scale, or for general instruction; subject however, in case of doubt or dispute, to the determination and conclusive decision of the engineer, as is more particularly mentioned hereinafter.

The amount mentioned in the tender of the contractor shall be the consideration for, and shall be accepted by him in full satisfaction and discharge of all and every description of work done, executed, and performed in, about, and incident to the works mentioned, described, or referred to, or intended to be referred to, in this specification.

FENCING, &c. The contractor is to provide and fix any temporary fencing that may be required for the protection of the work, and prevention of accidents.

DAMAGES. The contractor shall be liable for any damage that may be sustained by the occupiers of the adjoining premises, in consequence of trespasses committed by his workmen, or of carelessness or neglect in the execution of any part of the work.

EXCAVATIONS. The ground is to be excavated to the depth necessary for, and as shown in the drawings, for the reservoir, to get in the footings of the walls, counterforts, piers, inverts, &c.

GRAVEL. The contractor will be allowed to use any gravel that may be found fit and proper for the concrete; and he must leave the remaining portion of the excavated earth so arranged round and over the reservoir as will be more particularly directed during the execution of the works.

WATER. The Company will furnish the water necessary for the contractor's purposes, subject to such regulations as shall be thought necessary, upon the contractor paying the cost of sapping, furnishing the necessary pipes, stop-cocks, &c.

PROVIDE MATERIALS. The contractor shall find and provide all materials whatsoever, which are or may become proper for, or incident or necessary to, the full and complete execution of the several works in all their parts, although the same or any portion of them may have been omitted, or may not be particularly mentioned or described in the specification or in the drawings. The materials to be found and provided by the said contractor shall be of the description of, and equal in quality with, samples to be deposited by him, and kept in the office of the Company; and shall, when finished, be of the full dimensions expressed or implied in this specification, and of the drawings herein referred to, notwithstanding any local or other custom to the contrary, such materials to be applied by the said contractor in a good, workmanlike, and thoroughly substantial manner.

SITE, &c. The reservoir (to be built at or near the summit of the hill, or land adjacent to the Star Windmill) shall be formed and constructed to the dimensions as shown in the plans and sections, built in cement and old English bond, and well grouted at every course.

ARCHING, &c. The reservoir is to be covered with one course (of radiating bricks, if they can be procured), set in cement; and three manholes to be left in the arching of the reservoir as shown, covered with a 4-inch York curb, 9 inches wide, and 2½-inch fir cover, well tarred, and provided with iron staples, bars, locks, and keys, as directed by the engineer. The four side walls shall, when finished, be 'rendered' internally with cement ½-inch thick and 11 feet high all round. Gauge,—2 of cement to 1 of sharp sand.

RENDERING, &c.
FLOORING, &c. The bottom or inverts of the reservoir shall be formed with stock bricks as shown, the earth first excavated and levelled truly to the depth required, to admit of 6 inches concrete to be placed over so much of the bottom and under so much of the walls, counterforts, and piers as is shown by the drawings or as shall be directed by the engineer; then first shall be laid a course of bricks flat in cement, which shall be secondly completely and thoroughly rendered with cement over the whole extent, with an uniform thickness of half an inch; thirdly, on this shall be laid a second course of bricks on edge, set in cement, then again rendered half an inch with cement, and another course of bricks flat, and thoroughly grouted or floated with liquid cement after finishing, and 'rendered,' as the side walls, ½-inch thick. The cleansing pits shall be formed in the situation and of the dimensions shown in the drawings, and also 'rendered' in cement ½-inch thick.

BRICKWORK. The whole of the brickwork of the reservoir shall be built with sound, hard, well-burnt and well-formed stock bricks, equal to a sample deposited in the engineer's office. No joint shall rise more than a quarter of an inch. The whole of the work to be set in cement.

CEMENT AND CONCRETE. The cement to be used in the works must be 'Portland,' and of a quality to be approved by the engineer; and the contractor, before commencing the works, must furnish the name of the merchant from whom he intends to procure his cement and lime. All sand must be sharp and clean, and mixed with the cement in proportions of two to one by measure. The concrete must be composed of six measures of clean gravel, one measure of sharp sand, and one measure of ground strong 'stone lime,' to be first mixed in a dry state, and then thoroughly incorporated with as little water as may be sufficient for that purpose, to be used with a fall of not less than 10 feet.

The contractor shall construct an overflow drain from the reservoir, of size and materials as shall be directed by the engineer or clerk of the works. And shall also provide and fix a galvanised iron wire guard to mouth of service main, as approved by the engineer, and carefully build in the two pipes for rising and service main where directed.

STONE. The caps of the piers, &c., shall be of 'Portland stone,' the base stones of piers shall be 'York,' of the form and dimensions as given in the drawings.

TIMBER. All oak to be of English growth, and all timber, where oak is not required, to be of well-seasoned Memel, free from knots, shakes, and other defects.

BOUNDARY FENCING. The contractor shall place partly around the reservoir an oak and fir fence, and one 10-foot gate, well hung, with lock, key, &c., but not exceeding 540 feet run in all (and if required shall erect so much in addition as may be ordered by the engineer, at the schedule prices), and as described by the drawings. The fence and gate to be well tarred with at least two coats.

COMPLETION. The contractor shall truly fulfil and satisfactorily complete his undertaking in all its parts on or before the 1st day of July next, on which day, if so required, or if not so required, then on such other day (not being earlier) as may hereafter be demanded by the Company, he shall deliver up possession of the said works to the Company in a sound, workmanlike, and complete condition; and the Company may thenceforth use the same for their own purposes, in such way and manner as they shall think proper.

MAINTAINING. The contractor shall be responsible for, and shall effectually maintain and uphold in a good, substantial, and sound condition, all the said works, matters, and things, for the term of eighteen months, from and after the time of delivering up such works to the said Company. He shall also be liable for, and shall pay and make good to the Company, or other persons who may be legally entitled thereto, all costs, losses, damages, and expenses they or any of them may incur, be put to, or become liable for, by reason or in consequence of any failure of the works.

FAILURE. If the contractor shall fail in the due performance of his contract by the said 1st of July next, or by any other day to which the period of completion may have been extended, he shall be liable to pay and forfeit to the Company, by way of liquidation of damages, the sum of five pounds for each and every day that may elapse between the 1st day of July next, or such day as aforesaid, and the time of the delivery of the works in complete condition.

SECURITY. The contractor shall find two good and substantial securities, in a penal sum equal to one-fourth of the amount of his contract, for the due fulfilment of the same in all its parts, according to the true intent and meaning of this specification.

PAYMENT. The contractor shall be entitled to payment for his works in the following manner, namely: To a monthly instalment, as nearly as may be equal to three-fourths the amount of work executed the preceding month; to a further instalment of one-eighth of the amount of work executed when the works are delivered to the Company; the balance of the amount, whatever that may be, to be paid to the contractor three months after the delivery of the works, deducting 5 per cent. off the gross amount of work executed, which latter sum of 5 per cent. shall be retained by the company until the responsibility of the contractor shall cease as regards the maintenance of the works. No sum, however, shall be considered to be due or owing to the contractor, nor shall he make any demand upon the Company for or on account of any work executed by him, unless the engineer to the Company shall certify the amount thereof, nor unless such certificate shall have been presented to the secretary of the Company; nor shall such sum or sums of money be considered payable to the contractor till seven days after such certificate shall have been presented.

DISPUTE.

It is hereby further stipulated that in case of any doubt, dispute, or difference of opinion arising with respect to the meaning or intention of the contract or this specification, or in relation to the interest of the parties to the contract, or either of them, every such doubt, dispute, or difference of opinion, shall from time to time be referred to and decided by the engineer, whose decisions and awards may be made from time to time and as often as may be required; and the decision so made shall be binding, final, and conclusive upon both parties, notwithstanding any rule of court, either in law or equity, to the contrary.

TENDER.

The tender shall be made on a printed copy of the form annexed, and shall be delivered at the office of the Company on or before Tuesday, the 22nd instant.

A reference to works or public bodies, which and for whom the person or persons tendering may have executed or constructed works of a similar nature must accompany the tender.

The Company do not bind themselves to accept the lowest or any of the tenders.

N.B.—The tenders must be sealed, and endorsed with the words 'Tender for Reservoir' on the outside.

JAMES PILBROW, *Engineer to the said Company.*

London: 34 Great St. Helen's, 2nd April, 1862.

FORM OF TENDER.

To the Directors of the Brompton, Chatham, Gillingham, and Rochester Waterworks Company.

GENTLEMEN,— will undertake and agree to execute, perform, and complete the whole of the works for the making and constructing the reservoir, &c., and provide all materials according to the true meaning and intent of the foregoing specification, and the plans, sections, and drawings; at and for the sum of pounds

And will also undertake to execute an agreement, to be prepared by and at the expense of the Company, for the due fulfilment of the several conditions expressed or implied in or by the specification hereunto annexed, and in and by such other covenants as may in such agreement be contained.

And will also perform any additional work required by the engineer, or allow for any deviations or deductions from the works mentioned in the said specification, or intended so to be, at, for, and according to the following schedule, viz.:—

	£.	s.	d.
1. Excavation			at per cubic yard
2. Brickwork, set in cement, including all materials			ditto
3. Portland stone, dressed and set			per cubic foot
4. York stone, dressed, squared, and laid complete			per superficial foot
5. Concrete, as specified			per cubic yard
6. Labourers			per day
7. Bricklayers			ditto
8. Carpenters			ditto
9. Masons			ditto
10. Horse, cart, and driver			ditto
11. Stock bricks			per thousand
12. Portland cement (best)			per bushel
13. Sand, clean sharp			per yard
14. Flooring to reservoir, as specified			per yard sup.
15. The post and rail fencing, oak posts and fir rails, as shown in drawings			per yard lineal

remain, Gentlemen, your obedient servant,

Name

Address

Date

REFERENCES.

1.

2.

LAMBETH WATERWORKS.

SPECIFICATION

Of a Reservoir and Cottage, and other work required to be executed for the Lambeth Waterworks Company, on their land in Decimus Burton Road, in the County of Surrey, on the Beulah Estate, South Norwood, agreeably with the accompanying drawings, marked 'Lambeth Waterworks, South Norwood Extension, Contract No. 32, Drawings Nos. 1 and 4 inclusive.'

No. 29 Great George Street, Westminster, 20th February 1860.

GENERAL DESCRIPTION.

The works comprised in this contract are the excavation and embankment for, and the construction of, a covered reservoir, with brick inverts, side walls, and covering arches, surrounded by concrete and clay puddle, and the laying, jointing, and fixing the necessary pipes, cocks, and ironwork for the same; together with the making of a gravel trench, a drain tank, and an 18-inch barrel-drain from the Company's land to 'Collier's Water;' the building of a cottage and the performance of sundry other works, as shown in the drawings and hereinafter more particularly detailed and described.

SITE, LEVELS, &c.

The reservoir, the cottage, and other works are to be constructed on the Company's land at the west side of Decimus Burton Road, as shown on drawing No. 1. The high-water line of the reservoir is to be 47 feet 6 inches above the B.M. cut on the finger-post near the Sion Nursery, and all other levels are to be arranged with reference to the said high-water line.

The contractor to take especial care, by the erection of temporary fences, to prevent all injuries to the lands, roads, and property adjacent to the site of the works, and to prevent trespass during the execution of the works. He is likewise, at his own cost, to procure the necessary licences from the road trustees and their surveyors for breaking up and restoring the roads, &c. &c., wherever the works of the contract are carried on. All obstructions to the traffic to be carefully avoided as far as practicable. Temporary footways to be formed where necessary, fencing and hoarding erected, lights placed and maintained at night, and works well watched. The surplus earth to be removed daily, and every precaution taken to protect the public.

PIPES AND IRONWORK.

The whole of the cast-iron pipes, cocks, sluices, joint-rings, bolts, nuts, spindles, guides, ladder bars, covering plates, and other

iron apparatus, to be provided by the Company, and deposited at their works at Brixton Hill. The contractor to cart them from that station when required, as well as to provide the hoop-iron hereinafter specified to be bedded in the walls.

PIPE-LAYING.

The 18-inch stand pipes, the 9-inch overflow-pipes, and the screen-box, are to be fixed to the sluice-cocks, and the cast-iron flap hung as shown, the ladder bars, spindle guides, and the flange and socket pipes to be built in the walls; and socket pipes laid therefrom into the puddle road, at least 6 feet beyond the boundary of the Company's land (with the exception of the drain pipe, which is to be laid into the circular drain tank as shown). The contractor to find lead and yarn, &c. &c., for the purpose of properly laying the same, to the satisfaction of the engineer or his superintendent.

EXCAVATION AND FILLING IN.

The trenches are to be cut as shown in Drawings Nos. 1 and 3, for raising Company's land, to be 3 feet wide on the top, tapering down to 18 inches, and are to have regular falls towards the drain tank; a strong *tile and sole* drain of approved make to be laid in the bottom, and the trenches filled up with coarse gravel.

The ground is to be excavated in the various places to the several depths, &c., necessary for the construction of the reservoirs and trenches, the cottage, and the tank and works, and for the laying the pipes, &c. Faulty and unsound places to be made good with hard dry material, as may be directed by the engineer or his superintendent. Filling in—horizontal courses of 6 inches, each course being well rammed.

EMBANKING.

The embankment to be formed in horizontal courses of 6 inches, due allowance being made for the settlement and consolidation of the material. The better to effect this, they are to be formed in excess of the finished dimensions. Slopes to be trimmed to their inclinations, and the turfing, &c., performed. The embankment to be composed of at least one-fourth gravel, cinders, brick rubbish, burnt ballast, or similar hard and suitable material, to be provided by the contractor and spread in thin courses, as will be directed. In backing up the puddle walls, powdered lime is to be sprinkled over each course, to the extent of 1 foot from the clay.

BURNT BALLAST.

The toes of the embankment, as well as the retaining walls, are to be made of well-burnt ballast, as shown on drawings Nos. 2 and 3, for which purpose the clay is to be removed to some convenient part of the land and burned on the most approved plan, when one part of lime is to be added to every 20 parts of ballast, and mixed as shall be directed at the time.

TURFING SLOPES.

Previous to the excavations, the vegetable mould to be preserved for covering the top and slopes of the reservoir, which is to be done in thickness not less than 6 inches, and turfed in a proper manner, to be well beaten and watered. Turf to be provided by the contractor at his own cost. All other newly raised surfaces to be sown with good grass seed, and attended to as required.

CLAY PUDDLING.

Floor puddle to be laid in 6-inch courses, and covered with concrete as soon as practicable. The upright wall puddle to be carried up in 6-inch courses with the brickwork, keeping clean the surface of each course before the other is added. Wherever pipes pass through, the puddle must be watered and closely worked to the metal, and all precautions taken. Clay puddle, 12 inches thick, to be laid over the arches and spandrels, as shown on Drawing No. 3.

CONCRETE.

Concrete over the floor puddle, under the inverts, in the spandrels of the walls, and on the covering arches of the reservoirs, in the foundations of the cottage, to the several forms and dimensions shown on Drawings Nos. 2, 3, and 4.

BRICKWORK.

The reservoir to be of brickwork, in mortar, with upright walls, inverted and covering arches, sluice-tank, and drain, as shown on drawings. Inverts to be laid in concrete with a regular fall of 6 inches towards the open drain channel, which is to incline 3 inches towards the sunk sluice-tank. The footings to all the longitudinal and cross walls to be laid in concrete, and carried up five courses, when the inverts are to be formed by laying two rings of brickwork with mould-boards cut to the required curves; the bricks for the skewbacks are then to be cut and laid solid in mortar, and the longitudinal walls built thereon.

The cambered side-wall of a duplicate reservoir, with a portion of the cross-walls to act as buttresses, are to be built and the concrete filled in as shown on Drawings Nos. 2 and 3.

A 3-feet circular drain tank to be built as shown in Drawing No. 1, from which the 18-inch barrel drain is to be made. Spaces to be left between the bricks, on the side next the gravel trench, for the passage of water. Three manhole-tanks, of similar construction, though of less depth, are to be built in the positions marked H, J, and K, Drawing No. 1.

COTTAGE.

A cottage is to be built, of the plan, &c., as shown on the Drawings Nos. 1 and 4. Bricks of uniform shape and colour for the fore-work, moulded ditto for the plinth and window jambs, and Suffolk whites set in cement for the weathered sills. The courses of brickwork forming the chimney caps to be laid in cement, and all the flues to be pargetted.

The whole of the brickwork throughout the works is to be flushed up solid and the joints as thin as possible, consistently with sound work, and struck at the time the bricks are laid; bats are not to be used except for keeping bond, nor will grouting be permitted, as the workmen will use a small quantity of water (in hand-cans, to be provided by the contractor), for the purpose of softening the mortar used in flushing up the work.

BRICKWORK IN CEMENT.

The two rings of brickwork to the 6-feet openings in the cross-walls to be laid in cement, as well as the gathering and other work to the manholes, flat bottom to the drain channel, &c., and all brickwork in contact with and surrounding the pipes and ironwork to the extent of 1 foot from the metal.

HOOP-IRON.

Hoop-iron is to be inserted in every sixth course of brickwork (unless otherwise directed), in the proportion of one length to one brick in thickness of wall, the ends to be connected in every case where practicable. Iron to be 1 inch broad, and to weigh not less than $1\frac{1}{2}$ lb. to 10 feet.

Proper skewback bricks are to be provided for the springing of the 9-inch covering arches, without cutting, and putlock holes are to be left in and through the upper part of longitudinal walls for the support of the centering.

CENTERING.

The centering for turning the concrete arches to be sufficiently strong to bear workmen and materials, and fixed as will be directed, but not struck until the concrete in the spandrels is well set, when the whole of the six centres is to be advanced simultaneously.

ROOFING.

The roofs of the cottage are to be constructed of fir timber, in the manner and to the scantlings shown on drawings No. 4, to be entirely boarded over with inch yellow deals shot at the edges, laid close and securely nailed to rafters, the whole covered with Countess slates, laid with 3-inch lap, and fastened with copper nails; proper tilting fillets are to be fixed on the eaves, and Staffordshire tiles set in cement on the ridges.

All the spaces above the ceiling laths of the bedrooms are to be filled in to a depth of 7 inches with dry cocoa-nut refuse fibre, and safed over with $\frac{1}{2}$ -inch rough boarding nailed to the collars.

Four-inch cast-iron gutters on wrought-iron brackets, and 3-inch cast-iron rain-water pipes, with heads, are to be provided and fixed as shown. The lead flushings are not to be of less than 5 lbs. to the foot, and fastened with copper nails.

JOINERS' WORK.

All the doors, windows, frames, closets, &c., are to be of the best yellow deal, securely fixed and hung, and provided with strong and approved locks and other fastenings.

MASONRY.

Yorkshire stone of approved quality for coping is to be provided, worked, rebated, tooled, dowelled, and set round the manhole to reservoir, to receive the cast-iron covering plates, as shown on drawing No. 3. Three-inch York landings, not less than 3 feet 6 inches square, are also to be provided and properly bedded on the four circular tanks.

BARREL-DRAIN.

An 18-inch brick barrel-drain, to be made from the drain tank on Company's land, as will be directed, along the Decimus Burton Road and White Horse Lane to Collier's Water, a distance of 2,178 lineal feet, more or less. Haunches of the drain are to be covered with concrete up to the crown of the arch.

Eleven ventilators are to be constructed in the following manner:—6-inch stone pipes built in the end walls of the reservoir immediately under the soffit of the covering arches, as shown on drawings Nos. 2 and 3. To be neatly jointed with cement, and laid level through the puddle and embankment, so that the top of the socket of outside pipe shall be flush with the face of the slope.

Three-inch perforated drain-pipes to be provided and laid on the clay puddle in the spandrels of the covering arches, and down the slopes to the gravel trench, as will be directed.

PLASTERING.

All the ceilings and internal walls of the cottage to be plastered (rendered and set) with good lime and hair; twice coloured or whitened, as may be directed. Cement skirting, 12 inches deep, with a $\frac{3}{4}$ -inch projection, to be run round all the rooms.

STOVES, &c.	The washhouse also to be ceiled, but the walls are only to belimewhited two coats.
	A strong range, with oven and boiler, for the kitchen, a good register stove of an approved pattern for parlour, three common ditto for bedrooms. Galvanised-iron copper, with fittings, to be provided and set in a solid and workmanlike way.
LIME-WHITING. PIPES.	A Bath-stone chimneypiece to be provided and fixed in the parlour, as shown.
	The inside of all cast-iron pipes to be scoured until free from sand, &c., then to be whitened with a coat of hydraulic lime and water, mixed to the consistency of cream, used hot and dried off quickly, and finished off to the satisfaction of the engineer or his superintendent.
PAINTING.	The whole of the exposed parts of pipes and ironwork to be used in reservoir (not to be whitened) are to be prepared with boiled oil before fixing, and painted with not less than two coats of good paint, of approved colour, after fixing.
	All the wrought woodwork of the cottage, both inside and out, to be painted with four coats of good oil-paint, and finished an approved colour.
GLAZING.	The sashes and casements to be glazed with strong seconds crown glass, bedded in good oil putty. Rough unpolished plate glass is to be used for the fixed lights and the toolshed.
QUALITY OF MATERIALS.	
CLAY PUDDLE.	The clay puddle to be tough and tenacious, free from mould, sand, or gravel; chopped on a stage, watered, turned, and tempered, to the satisfaction of the engineer or his superintendent.
CONCRETE.	The concrete to be of hydraulic lime one part (fresh burnt and ground), and of sharp clean sand two parts, and of gravel five parts, or of broken stone, mixed in small quantities on a stage, wheeled to place of deposit, evenly spread, and well beaten with the back of a shovel.
GRAVEL.	The gravel or broken stone used in the concrete to be hard and sharp, screened (if necessary), and freed from loam or dirt; all stones more than 2 inches cube to be broken.
BRICKS.	The bricks to be the best new hard-burnt well-shaped sound stocks, fit for waterwork. Soft bricks or bats will not be received.
MORTAR.	The mortar to be composed of one part of hydraulic lime fresh burnt, measured before slaking, and three parts of clean sharp sand, properly mixed.
CEMENT.	The cement to be Portland one part, and two parts of clean washed sand.
TIMBER.	The timber to be of the best quality, free from sap, shakes, dead knots, and all other imperfections.

DUBLIN CORPORATION WATERWORKS.

SPECIFICATION

To be observed by the Contractor or Contractors for the making and delivering certain Cast-iron Socket Pipes and other Castings required by the Waterworks Committee of the Corporation of Dublin.

1. The cast-iron pipes required will probably consist of the quantities and sizes named in the following schedule, and must be made in accordance with the particulars stated in the schedule and specification, and according to drawings annexed or hereafter to be furnished.

SCHEDULE.

Length in yards when laid	Internal Diameter of Pipe	Length of each Pipe	Thickness of Metal	Depth of Socket	Mean Weight of each Pipe	Number of Pipes	Total Weight of Pipes	Permitted Deviation in Weight
	inches	ft. in.	inch	inches	cwt. qr. lb.		tons cwt. qr. lb.	
6,500	27	12 5	1 1/16	5	34 0 0	1,625	2,762 10 0 0	2 per cent.
500	24	12 5	1 1/16	5	25 0 0	125	156 5 0 0	"
600	18	9 4 1/2	1 1/16	4 1/2	12 1 19	200	124 3 3 20	2 1/2 per cent.
600	12	9 4 1/2	1 1/16	4 1/2	6 3 13	200	68 13 0 24	3 per cent.
6,700	9	9 4	1 1/16	4	5 0 16	2,233	574 5 2 24	"
3,500	6	9 3 1/2	1 1/16	3 1/2	2 1 27	1,166	145 6 1 0	4 per cent.
700	5	9 3 1/2	1 1/16	3 1/2	1 3 24	233	22 18 1 9	"
24,500	4	9 3	1 1/16	3	1 1 20	8,166	583 6 2 19	"
11,500	3	9 3	1 1/16	3	1 0 10	3,833	208 15 2 10	"
55,100						Total . .	4,646 4 2 22	

2. All pipes above 12 inches diameter shall be of the kind or description usually called 'socket pipes,' and have wide sockets for lead joints. Those of 12 inches and lesser diameter to have principally turned and bored joints, from 5 to 20 per cent. of each size according to circumstances, having wide sockets. All pipes above 4 inches in diameter to have 3/8 of an inch for the joint. The pipes of 4 and 3 inches to have 1/4 of an inch for the joint.

3. Such special or irregular castings as may be required for laying or connecting the whole must be made in conformity with this specification, and with drawings and instructions hereafter to be furnished or given by Mr. Parke Neville, Civil Engineer, and Engineer to the Corporation of Dublin, or such other engineer for the time being as may be employed by the Corporation.

4. Each pipe to be marked outside the sockets with D.C.W.W., in Roman letters, 1 1/2 inch long and 1/2 inch projection, and to have the thickness of the castings distinctly cast on figures upon the outside, beneath such letters. Consecutive numbers, according to each size and weight of each pipe, down to those of 9 inches diameter, inclusive, to be conspicuous by being painted on the outside before delivery.

PIPES TO BE CAST
VERTICALLY IN DRY
SAND.

5. The straight pipes shall be cast in dry sand moulds, and the curved pipes in loam or dry sand; and they are to be cast vertically, and without the use of core nails, chaplets, or thickness pieces, or any substitute therefor; and the contractor is (unless as hereinafter expressed) to provide turned iron patterns for all straight pipes that he will use, boxes and core bars and barrels for making thereof, the flanges, sole plates, spindles, and cores of which shall be accurately turned, faced, and truly fitted and joined. The sand shall also be sufficiently fine and fresh to produce a smooth and perfect surface, and all the moulds and cores shall be properly black-washed and carefully dried. The pipes at and over 18-inch bore to be cast with the socket downwards, and the contractor is to be at liberty to line the moulds and cores by any machine approved of by the engineer, and found to be capable of producing work as perfect as that produced by iron patterns and careful manual labour.

QUALITY AND
STRENGTH OF
METAL.

6. The metal shall be made from mine pig, without admixture of cinder iron or other inferior material, and shall be stout, tough, and close-grained (and be re-melted in the cupola or air furnace), and of such strength that a bar of 1 inch square and 38 inches long, weighing not more than 10lbs., will, when supported at points 36 inches apart, and loaded in the middle, sustain a weight of not less than 700 lbs.

PIPES TO BE PERFECT.

7. The pipes shall be free from scoria, sand-holes, air-bubbles, cold-shuts, laps, washes, and other imperfections of casting; and shall be truly cylindrical in the bore, straight in the axis, smooth within and without, and internally of the full specified diameter; and they shall have their inner and outer surfaces as nearly as possible concentric. They shall be perfectly fettled and cleansed, so that no humps or rough places shall be left in the barrels or sockets, and the runners to be carefully cut off, so as to preserve a square angle on the inner edge of the sockets, against which the lead joint is to be made; and also to ascertain that the sockets will, in all cases, receive the spigots, and that the spigots will in all cases enter into the bottom of the socket, to ensure which condition a circular iron template, of proper dimensions, shall be passed to the bottom of every socket, and a circular ring, of proper dimensions, shall be passed over every spigot. The contractor must, moreover, observe that the inside of the sockets must not be conical, and that the diameter of such sockets must not be enlarged beyond the size indicated on the drawings, as otherwise the expense of jointing will be unnecessarily increased, on which account it is required that all pipes shall be occasionally put together with iron wedges of sizes representing the proper thickness of the joint, as shown on the drawings annexed to this specification. The contractor will be charged with, and must pay and defray, any and all losses, charges, and expenses to or for which the Corporation or their Committee may be put to or be liable by reason of any neglect with respect to the forms of the sockets and spigots; and for the better prevention of chills and cracks consequent thereon, the contractor must undertake the pipes will not be removed too hastily from the moulds, or be laid while hot upon cold or damp earth, or be exposed while in a heated state to rain or weather.

SPECIAL CASTINGS.

8. The curved pipes and other special castings shall be executed accurately, as shown on drawings which will be furnished to the contractor by the engineer. They must not be made of greater thickness than the straight pipes, unless and then only in such manner as shall be directed; and every care must be taken to ensure that these pipes will properly joint with the straight pipes and other castings with which they may be intended to connect by actually placing such curved pipes in proper connection with standard straight pipes of a like diameter.

PIPES TO BE COATED.

9. All pipes are to be carefully coated inside and out with coal-pitch and oil, according to Dr. R. A. Smith's patent process (or such other system as may be approved of by the engineer), the coating to be applied at the proper heat, and in a proper manner, and before any rust sets in, and the operation to be performed under the inspection of an officer or person appointed and paid by the Waterworks Committee.

EXAMINATION AND 1 ROOF

10. The whole of the pipes to be subject to proof by hydrostatic pressure, according to the following

SCHEDULE.

Diameter of Pipe	Thickness of Pipe	Proof Pressure equal to a column of water	Or lbs. per square inch	Maximum Pressure in feet to which Pipes will be subjected in work
inches	inch			
27	$1\frac{1}{8}$	500	260	250
24	$1\frac{1}{4}$	500	217	240
18	$\frac{3}{4}$	500	217	240
12	$\frac{1}{2}$	500	217	240
9	$\frac{3}{8}$	500	260	240
6	$\frac{1}{4}$	600	260	250
5	$\frac{1}{4}$	600	260	250
4	$\frac{3}{8}$	600	260	250
3	$\frac{1}{2}$	600	260	250

Every pipe shall be carefully examined, and duly proved by careful and experienced workmen, and to the satisfaction of the inspector to be employed and paid by the Waterworks Committee; the pressure to be clearly and accurately indicated, to the satisfaction of the inspector, by a mercurial gauge, spring steelyard, or dial index, connected with the air-vessel, to be attached to the force-pump of the proving machine; and while under pressure the pipe is to be repeatedly and sufficiently struck in all its parts with a hammer suitably proportioned to the strength of the pipe under examination, and it will be preferred that the pressure shall be maintained by a pump continuously worked by a steam-engine rather than by manual labour; and such examination shall be conducted under cover from rain, and during the time of making the same the pipe shall be and be kept externally dry, so as to exhibit the more readily the effects of the pressure applied; and all the pipes which are found to be defective or unsound, or not in accordance with the conditions of this specification, shall be forthwith destroyed or removed from the contractor's premises, so as not to be liable to be intermixed with sound pipes; and on no account whatsoever shall any defective pipe be attempted to be stopped, repaired, or amended, in any way or manner whatsoever, or to be delivered with or as a sound pipe, unless by and with the consent in writing of the said engineer; and so soon as any pipe shall have undergone proof, and have been ascertained to be perfect in other respects, such pipe shall be weighed and callipered, and if of proper weight and regular thickness (within the prescribed limits) shall be legibly marked in oil paint on the outside thereof with figures, to indicate such weight; and for the prevention of mistake or confusion, with respect to the maker, in the event of the pipes being cast at several foundries, every pipe shall bear on the outside thereof, and cast thereon, such plain Roman capital letters as shall serve to designate or distinguish the foundry at which such pipes were made.

FOUNDRY WORK MAY BE INSPECTED.

11. The Waterworks Committee or their engineer shall be at liberty, if they or either of them so think fit, to send an inspector to examine the foundry work, and to be present from time to time at, and to assist in proving the pipes; and the contractor shall afford such inspector every facility and such tools as he may need for the due performance of his duty, and shall, if and when so required, furnish to such inspector such and so many test bars of the metal actually used in casting the pipes as he shall demand, and such test bars or any of them shall, if so required, be submitted to the engineer or his agents, to be by him submitted to proof, or otherwise shall be proved by such inspector, and the result of such proof shall be accepted by both parties as evidence of the strength of the metal employed in the manufacture of such pipes; and the engineer may, if he so please, again examine and test the pipes under pressure, and in the manner aforesaid, after they shall have been delivered, and may then also reject such pipes as shall, upon such second examination and trial, appear defective or unsound, or not in accordance with the conditions of this specification, or which may be lighter than the weight specified in the schedule herein, and the pipes so rejected shall be removed by and at the cost of the contractor, and shall be by him forthwith replaced with other pipes of good and sufficient quality and weight, to the satisfaction of the said engineer. Provided always, in case of pipes delivered from shipboard, the proving must take place before pipes are carted from quay or wharf.

PLACE OF DELIVERY.

12. The pipes shall be conveyed and delivered by and at the expense of the contractor, if cast in England or Scotland, upon such water-side, wharf, docks, or places situated on the Grand Canal Docks, in the city of Dublin, or other quay at Dublin Harbour, as the Waterworks Committee or their engineer may, from time to time, appoint; if the pipes be cast in Dublin, they are to be conveyed and delivered by and at the expense of the contractor, to or at such place situated within the boundary of the city or borough of Dublin as the Waterworks Committee or their engineer may direct.

RATE OF DELIVERY.

13. The pipes shall be delivered as follows, namely: at least one-tenth part in value in each of the months of March, April, May, June, July, August, September, and October, now next ensuing, and each such delivery shall consist of pipes of such several sizes as the engineer shall, from time to time, direct; and all branch-pipes, bend-pipes, taper-pipes, hydrant-pipes, and other special castings, shall be made and delivered as soon as possible after the receipt of the orders therefor, and, unless directed to the contrary, shall have precedence of all other works, and on no account whatever is the progress of the pipe-laying operations of the said Waterworks Committee, or their engineers, agents, or workmen, to be delayed or impeded by reason of the neglect or inattention of the contractor herein; and in

case the engineer should be of opinion that the contractor has not used due diligence in making and delivering such pipes and special castings, or any of them, it shall be in their discretion to order and purchase the same, or any substitute for the same, elsewhere, and to deduct or cause to be deducted any extra charges thereby incurred from any sum or sums of money which may then be or may afterwards become due or owing to the said contractor; and any pipes so ordered or purchased shall be considered to form part of the number to be supplied by the said contractor.

SECURITY.

14. The said contractor shall find two good and sufficient sureties in a penal sum equal to one-fourth of the amount of the accepted tender, or any accepted portion thereof, and shall, together with such sureties, enter into a bond in such penal sum conditioned for the due and complete fulfilment of the contract entered into by the said contractor.

TERMS OF PAYMENT.

15. The contractor shall be entitled to payment for his work in the following manner (that is to say): To an instalment amounting to ninety per cent. of the value of the pipes and castings from time to time made and delivered in manner aforesaid within one month from the time of the delivery thereof, and to the balance arising upon such contract within three months from the date of completion of the contract. Provided always that the said engineer shall have power to reject all or any of such pipes in case the same shall, in his judgment, be of inferior quality, or otherwise not made in conformity with this specification; and provided also that such instalments or balance, or any portion thereof, respectively, shall not be considered to be due or owing to the said contractor, unless and until seven days after the said engineer shall have given his certificate, in writing, that the said contractor is reasonably entitled thereto; but, nevertheless, such certificate shall only be deemed to authorise a payment on general account, subject to and pending the future complete fulfilment by the said contractor of the terms and conditions of this specification and of the contract founded thereon.

QUANTITIES MAY
BE ALTERED.

16. The quantities and sizes of pipes mentioned in the schedule annexed hereto are believed to be nearly the quantities and sizes which will be actually required. But the engineer shall nevertheless have the power to vary, extend, or diminish the stated quantities or thicknesses, provided that the gross weight of the contract be not increased or diminished by such alteration more than 10 per cent., when and as occasion may from time to time require; and in case of any dispute or difference of opinion arising with respect to the meaning or intention of the contract, or of this specification, or of the balance finally accruing to the said contractor, or otherwise in relation to the interests of the parties to the contract, or either of them, such doubt, dispute, or difference of opinion shall from time to time be referred to and be decided by the said engineer, whose decision or decisions and awards may be made from time to time and as often as may be required, and shall be final and conclusive upon both parties in the matters to which such decisions and awards shall respectively relate, and this submission to reference may be made a rule of any of Her Majesty's superior courts of law or equity in Ireland.

TENDER, HOW TO
BE MADE.

17. The tender shall be made by a principal or principals, or by a duly authorised agent, according to the form annexed, and shall truly set forth the distinctive names and situations of the foundries at which the pipes are intended to be manufactured, and the same shall be delivered with specification attached (enclosed in a sealed envelope, endorsed 'Tender for Pipes'), at the Waterworks Office, City Hall, Dublin, addressed to Sir Drury Jones Dickinson, Secretary to the said Committee, on or before the
and the person or persons making any accepted tender, or any tender a portion of which shall be accepted, shall be entitled to receive a notification (through the post or otherwise) of the acceptance of such tender within one month then next after; but the said Corporation or Waterworks Committee do not bind themselves to accept the lowest or any other tender, although they intend to do so unless there should appear to them satisfactory and sufficient reasons to the contrary; and the cost of preparing the necessary contract or contracts, and surety bond or bonds, is to be paid by the party or parties who get the contract or contracts to the city law agent, who is to prepare such contracts and bonds respectively.

PARKE NEVILLE, C.E., *Engineer to the Corporation of Dublin.*

City Hall, Dublin, January 1864.

FORM OF TENDER,

Containing the Schedule referred to in the foregoing Specification (to be filled up without alteration), and to be delivered with the Specification attached and also unaltered.

To the Waterworks Committee of the Corporation of Dublin.

GENTLEMEN,

1864.

will undertake to supply the Waterworks Committee of the Corporation of Dublin with pipes and other castings, in conformity with the terms and conditions contained in the foregoing specification, and at and for the prices or sums mentioned in the following

SCHEDULE.

Probable quantity	Internal Diameter of Pipe	Probable number of Pipes	Mean Weight of Pipes	Permitted Deviation	Rate per ton, if plain Sockets	TOTAL AMOUNT			Addition per ton, if Bored and Turned Joints
tons						£	s.	d.	
2,763	27	1,625	34 0 0	2 per cent.					
157	24	125	25 0 0	"					
125	18	200	12 1 19	2½ per cent.					
69	12	200	6 3 13	3 per cent.					
575	9	2,233	5 0 16	"					
145	6	1,166	2 1 27	4 per cent.					
23	5	233	1 3 24	"					
584	4	8,166	1 1 20	"					
209	3	3,833	1 0 10	"					
4,650									

Branches, bends, taper-pipes, hydrant-pipes, cock and hydrant casings, and other similar } per cwt.
hollow castings and other special castings }

and beg to state that such pipes and castings are intended to be made at foundry, situated at
and propose and agree that in case this tender shall be accepted
by a resolution of the Town Council, communicated to in writing by the town clerk or law agent of the
Corporation, within a week after same shall be passed, forthwith to enter into a regular sealed contract with the Corporation of Dublin
for the execution of the said several works, and to perfect the necessary bonds, when prepared by the law agent of the Corporation,
and to give the required security for carrying out the same, and name
of
and
of
my sureties.

Gentlemen, your

DUBLIN CORPORATION WATERWORKS.

SPECIFICATION

To be observed by the Contractor in laying and satisfactorily completing the thirty-three inch and twenty-seven inch Main Pipes, and other works connected with such Main Pipes, for the Dublin Corporation.

SPECIAL NOTICE.

1. It is particularly requested that no person will propose to undertake the performance of the works described in this specification unless he is already properly qualified by *practical skill and experience*, acquired as a master contractor in the construction of extensive public works of a similar or analogous kind, and is in all other respects fully competent and responsible to and for the performance of the contract.

2. It is to be distinctly understood that the conditions of the specification are intended to be rigidly enforced, and especially that extra charges or claims in respect of extra works *will not be allowed*, unless the works to which they relate are clearly without the spirit and meaning of the following specification, nor unless such works are ordered in writing, and claimed for in the prescribed manner, the intention being that the works to be performed shall be fully and completely executed, except as hereinafter is expressly mentioned to the contrary, for the amount set forth in accepted tender.

3. It is intended that all extra works shall be paid for in full as soon as possible after such works are executed; it is therefore requested that the claims for the same may be promptly and clearly made out in manner prescribed, in order to avoid delay and the possibility of dispute.

It is hereby specified, declared, stipulated, and provided as follows, namely:—

INTERPRETATION.

1. That, in this specification, the word 'Corporation' shall be held to mean the Right Honourable the Lord Mayor, Aldermen, and Burgesses of Dublin. The word 'Committee' shall mean 'The Waterworks Committee,' appointed by the Municipal Council to carry out 'The Dublin Corporation Waterworks Act, 1861.' The word 'Contractor' shall be held to mean one or more contractor or contractors, or any firm or firms of contractors, jointly or severally engaged (or proposing to be engaged, as the case may be) in the works, or any portion of the works, to which this specification refers, and shall include his and their heirs, executors, and administrators; and the word 'Engineers' shall be held to mean Mr. Parke Neville, Civil Engineer, and Engineer to the Corporation of Dublin, and Sir John Macneill, Advising and Consulting Engineer, or such other engineers for the time being as may be employed by the Corporation of Dublin from time to time, and at any time during the continuance of the contract entered into by the said contractor.

DATA OF CONTRACT.

2. That this specification, together with the several plans, sections, and general and detail drawings which accompany the same, or are referred to therein, and to which the said contractor must, whenever required by the law agent to the said Corporation, affix his signature (each one of which shall be taken and construed according to its true intent and meaning, although each and every part of the works intended thereby may not be mentioned or described therein), shall be deemed and considered the only grounds or data upon which the contract entered into by the said contractor shall be founded; and, except as aforesaid, the contractor shall obtain for himself, and on his own responsibility, all information which may be necessary for the purpose of making his tender and for entering into the contemplated contract.

COMPLIANCE WITH ACT.

3. That the said contractor shall conform and be subject to, and shall comply with, the restrictions and provisions contained in the Act of Parliament, and Acts incorporated therewith, to the extent to which it may affect others than the Corporation, or in which others than the Corporation are interested; and he must give all such notices (if any) as are required by law to be given to any parties or persons entitled to such notices in respect of the operations to be performed under this contract.

ALTERATIONS, &c.

4. That no additions, deductions, alterations, substitutions, or deviations, made or permitted in, to, or from the construction of the said works, or any of them, shall annul or invalidate the contract entered into by the said contractor; but the value of the same (if any) shall be ascertained and be added to or deducted from the amount of the contract, as the case may require, by and according to the judgment of and the admeasurements and valuations to be made by the engineers, or either of them, who, in making such valuations, shall use or take into consideration the prices for analogous constructions mentioned in the schedule appended to the tender made by the said contractor, so far (but so far only) as such prices shall, in the opinion of the said engineers, or either of them, be applicable thereto, and shall have regard, amongst other considerations, to any deficiency in the quantity, quality, or disposition of the materials or labour employed in or about any such additions, alterations, substitutions, or deviations, respectively, or in or about any other of the works mentioned or referred to in the contract, for which purpose any defect or inferiority in the quantity or quality or disposition of the materials or labour employed, shall be held and deemed to be a deviation from the work intended by the contract, and shall be made the subject of such allowance in respect of the defect or inferiority of the quantity, quality, or disposition of the materials and labour so employed as the said engineers, or either of them, shall consider just and equitable.

FURTHER INSTRUCTIONS, &c.

5. That the said engineers, or either of them, shall have full power and authority, from time to time, and at all times, by themselves respectively, and by their clerk of the works, assistant, or inspector, for the time being, if any such be at any time or times appointed, to make and issue such further drawings, and to give such further instructions and directions, as may appear to him or them, or either of them, necessary or proper for the guidance of the said contractor and the good and sufficient execution of the works according to the terms of this specification; and the said contractor shall receive, execute, obey, and be bound by the same, according to the true intent and meaning thereof, and as fully and effectually as though they had accompanied or had been mentioned or referred to in this specification; and the said engineers, or either of them, may also alter or vary the levels or position of any of the works contemplated by this specification, or order any further and other works not contemplated by this specification or the contract, or may order any of the works contemplated thereby to be omitted; or may order any work, or any portion of work, executed or partially executed, to be removed, changed, or altered, and, if needful, that other work shall be substituted instead thereof; but the said Corporation shall not become liable to the payment of any charges in respect of any such additions, alterations, or deviations, unless the instructions for the performance of the same shall have been given in writing by the said engineers, or either of them, or, in case of trifling works or alterations not exceeding in any case ten pounds, on the order of the said clerk, assistant, or inspector, and shall be claimed for in writing by the said contractor (the claim to contain the description and quantity of the work done, labour employed, and materials used, and the prime cost of such materials and labour respectively) within the week in which such work is executed and such materials used, and before the same are placed out of view or beyond check or admeasurement, nor unless the value of any altered or varied works, or any further works, shall, whenever practicable, have been determined and settled before such altered or varied or further works shall have been commenced, such value, in case of dispute, to be ascertained and fixed by the said engineers, or either of them, who shall determine in all cases whether such previous agreement were practicable or not; and in all cases where he shall consider the same to have been practicable, the contractor shall not be entitled to make any claim in respect of such altered or varied or further works, unless such previous agreement were made.

WORKS SUBJECT TO SPECIFICATION.
NET QUANTITIES.

6. That all work done and materials provided by the contractor shall be deemed to be subject to the provisions of this specification and of the contract.

7. That all measurements, whether by the contractor or engineers, or either of them, shall be so made and taken as to express only the actual net quantity in work, notwithstanding any contrary custom or practice whatsoever.

IN CASE OF DIS-
CORDANCE.

8. That in case of any discordance or want of agreement between or amongst the several things herein described, as the grounds or data of the contract, then this specification shall have precedence of, and be held to be more correct and binding than, the drawings, and, in like manner, detail drawings shall be held to be more correct and binding than general drawings, and, in like manner, drawings made to a larger scale, or for special instruction, shall be held to be more correct and binding than drawings made to a smaller scale, or for general instruction; but subject, nevertheless, in case of doubt or dispute as to any of the matters aforesaid, to the determination and conclusive decision of the said engineers, as hereinafter is more particularly mentioned.

MATERIALS, &c.

9. That the said contractor shall find, provide, and apply all labour, machinery, engines, pumps, pipes, shores, drains, culverts, rails, tools, tackle, implements, staging, scaffolding, planking, centering, piling, fencing, winding machinery, and all other materials whatsoever, which are or may become proper or necessary for, or incident to, the full and complete execution of the several works in all their parts, although the same, or any portion thereof, may have been omitted, or may not be particularly mentioned or described, or otherwise referred to in this specification, or the said drawings (*save and except the permanent iron pipes, iron valves, iron sluices, iron gratings, and the wrought and cast iron appendages connected therewith*), which the said Corporation shall and will, at their own expense, by themselves and their other contractors, find and provide, as hereinafter mentioned.

BEST MATERIALS.

10. That such materials so to be found and provided by the said contractor shall be respectively the best of their kind, and be applied by the said contractor in a good, workmanlike, and thoroughly substantial manner.

FULL DIMENSIONS.

11. That the several works, when finished, shall be in all their parts of the full dimensions expressed or implied by this specification, and the drawings therein referred to, any local or other custom to the contrary notwithstanding.

EFFECTS OF PRICES.

12. That the sums and prices mentioned and set forth in the tender of the said contractor shall (subject to the conditions of this specification, and of the contract entered into by the said contractor) be the consideration, and shall be accepted by him in full satisfaction and discharge of and for all and every description of work done, executed, and performed in and about and incident to the works mentioned and described, or otherwise referred to in this specification, and in the drawings therein referred to, or intended so to be, whether the same shall be incident or necessary to the ultimate completion of the works, or be required only for the temporary purposes of the said works during the progress thereof, or be required for effecting or carrying out any of the provisions of the said Act of Parliament, or any duty or charge thereby or otherwise imposed on the said Corporation; and that no claim or demand shall be made, set up, or preferred against the said Corporation by reason of any alleged or supposed variations or additions, or otherwise, unless the same shall have been ordered and claimed in manner herein directed, and shall also in the opinion of the said engineers, or either of them, be wholly without the original meaning and intention of this specification.

LIABILITIES.

13. That the said contractor shall pay, make good, and defray all damages, costs, charges, expenses, and losses whatsoever occasioned by the acts or omissions of the said contractor, his agents, servants, or workmen, or consequent thereon, or arising by reason of the execution of the works contemplated by this specification, or by reason of the exercise by the contractor of the powers of the Corporation, and whether the same shall happen to the property of the Corporation or to any other person or persons, body or bodies, or his or their property, rights, or interests, and shall hold the said Corporation harmless in respect thereto, and in case the said Corporation shall pay, or be liable (in consequence of any primary responsibility incurred by them in the premises) to pay, any sum or sums of money in discharge of any such damages, costs, charges, expenses, or losses, they shall be at liberty to deduct the same from the amount from time to time or at any time due or accruing to the said contractor, or to recover the same by action at law or otherwise from the contractor, as they may be advised. And in case of any action, suit, or proceeding being brought or instituted against the Corporation, or any of their officers or servants, in respect of any such actual or alleged acts or omissions, or any loss, damage, or injury, by reason thereof, or consequent thereupon, the contractor shall fully indemnify them and each of them therefrom, and forthwith pay to them or him all costs, charges, damages, and expenses which they or he shall or may have been put to or have incurred in reference thereto; and the said Corporation may, if they shall see fit, compromise any such action, suit, or other proceeding, or any claim in respect of any such loss, damage, or injury as aforesaid, on such terms as they shall think fit; and the contractor shall thereupon forthwith pay to them the sum or sums of money paid by them upon the occasion thereof, and shall in every case pay to them such sum or sums as shall fully indemnify them according to this stipulation; and in case the contractor shall neglect or refuse to pay any such sum or sums as aforesaid, the Corporation shall be at liberty to deduct the same from the amount from time to time or at any time due or accruing to the said contractor, or to recover the same by action at law or otherwise from the said contractor, as they may be advised.

SUNDRY
LIABILITIES.

14. Provided always that with regard to the necessary and unavoidable injury to be done to the tenants of cultivated lands, the Corporation will bear and defray all compensation in respect to such injury for a width not exceeding 20 feet, and for such length as may be traversed by the main pipe through such cultivated lands.

EXTENT OF
CONTRACT.

15. That the first portion of the contract will commence at relieving tank at the northern end of the tunnel, at point shown on plans and section sheet, No. 1, and situate in the townland of Callow Hill, Upper, in the parish of Upper Newcastle, and the county of Wicklow, and thence extending along a line now set out from the said tank to the site of a certain intended reservoir, to be built or constructed on lands situate in the townland of Tipperstown, in the parish of Stillorgan, and county of Dublin, and is more particularly shown on drawings, sheets Nos. 1 to 20 inclusive, and will comprise a distance of 30,336 yards or thereabouts, to be laid with cast-iron socket pipes, 33 inches internal diameter, and 12 feet long in work, and will also include all outlet pipes, cocks, valves, and other appendages, and all pipes to be laid in and near the said distributing reservoirs, together with all cocks and appendages to be laid in and about the storage reservoir and filter-beds situate near to Roundwood; and all pipes, cocks, and appendages to be laid in and about the several relieving tanks to be constructed on the line of the said 33-inch main pipe; also the construction of the three relieving tanks situate in the townlands of Kilmurry South, Kilcroney (near river Dargle), and Rathmichaels, respectively, and shown on drawings, sheets Nos. 8, 11, and 16, and on detail drawings, sheets Nos. 27, 28, and 29.

16. Of this length 20,660 yards or thereabouts will be through fields and private properties, and 9,676 yards along the county roads.

17. That the further portion of this contract will commence at the aforesaid reservoir, in the townland of Tipperstown, in the parish of Stillorgan, and will terminate on the northern side of the Grand Canal, in Leeson Street, within the borough of Dublin, and will comprise a lineal distance of 8,272 yards or thereabouts, which is to be laid with a double line of cast-iron socket pipes, 27 inches internal diameter, and 12 feet long in work, together with all necessary special castings, cocks, valves, and other appendages, complete for use; together with all pipes, cocks, and appendages to be laid in and about the said Stillorgan distributing reservoirs. The entire of this line of pipes will be laid along the county roads, and is more particularly shown on drawings, sheets Nos. 21 to 26 inclusive.

PLACE OF
DELIVERY.

18. That the pipes and other materials to be provided by the Corporation are, or will be, from time to time conveyed by the Corporation or their contractors, and be by them deposited at the water-side, docks, or places situate on the Grand Canal Docks, in the city of Dublin, or other quay at Dublin Harbour, or at the wharfs of the Dublin and Wicklow Railway Company, near their engine works, Grand Canal Street, Dublin, or at or near the Carlisle Pier, Kingstown; and the contractor shall receive them there, and take charge of such pipes and materials, and thenceforth be responsible for the safe custody thereof, but subject, nevertheless, to the direction and control of the Corporation, or their engineers, and their necessary intervention, for the purpose of inspecting, weighing, proving, and enumerating such pipes, and other materials, or any of them, if and when they shall think fit so to do.

CARRIAGE OF PIPES
TO SITE OF WORKS.

19. That the contractor shall, at his own cost, convey the pipes, cocks, and other materials, from the places of delivery hereinbefore mentioned to the different points on the line of works where such pipes, cocks, and other materials, are to be used. And should any of the pipes or materials be injured or broken during the time such pipes or materials are under the control or custody of the said contractor, or in transit between the places of delivery hereinbefore mentioned and the situations where such pipes and

materials are to be used, the contractor will be held responsible for the same, and the value of such pipes or materials; and the amount to be paid by the contractor for such injury shall be fixed by the said engineers, or either of them, and the amount they return shall be payable by the said contractor to the said Corporation, may be retained by them to pay themselves out of any moneys which may be in their hands, and to which the contractor would otherwise become entitled, or may be recovered in the manner hereinbefore described.

EXCAVATION OF TRENCHES.

20. That the contractor shall form the whole of the trenches which now are, or which may, from time to time, be hereafter required in such situations in the fields, through private properties, on such sides of streets, highways, public roads, and places as shall be directed by the engineers, or either of them, or the clerk, assistant, or inspector, or as may be settled and determined by and between the Corporation and the persons owning such properties, or having control of such streets, highways, public roads and places, and shall act in accordance with, and shall in all other respects conform to, the provisions of the Act of Parliament hereinbefore mentioned, so far as the works entrusted to his care shall require.

21. And he shall, before proceeding to dig out the soil of any such trench, carefully take up and lay aside, so as not to become intermixed with other matters, all turf, vegetable mould, and productive soil of the said fields, as also the pebble-paving, pitching, metalling, or other hard surface or crust of the said streets, public highways, roads, and places respectively, and shall then excavate the ground (unless with special leave or order to the contrary) to the depths shown on the sections, and to such greater depth or depths as may be found necessary to pass incidental obstructions, and to secure such ease and regularity of inclinations as the engineers, or either of them, or the clerk, assistant, or inspector, shall from time to time determine upon, or as may be necessary for forming junctions, fixing sluice, stop, and other cocks. Provided always, that if by reason of any unforeseen difficulties the contractor has to excavate the trench to a greater depth than shown on the section, he shall be allowed for such extra depth according to the price mentioned in the tender made by him. The trench is generally to be 6 feet deep, except at the points shown on the sections; the said contractor must, therefore, give in his tender an average price per lineal yard for rock and for clay, or gravel, as this may occur, for excavating the trench and laying the pipes to the depths shown on the sections. The contractor must also satisfy himself as to the character and stratification of the ground through which the pipes are to be laid.

22. That the contractor may, at his own cost, make arrangements with the landowners and other parties interested to deviate from the line as now set out, so as to avoid the deep cuttings, subject to the approval of the engineers, or either of them.

REFILLING, &c.

23. That after laying the pipes, as hereinafter described, the contractor shall fill in the earth under and around the pipes, and carefully tread and beat the same, so as to effectually secure them in their proper situations; he shall then fill in the earth to the height of one foot above the pipes, and ram the same until it shall obtain solidity, and afterwards fill in and ram at every addition of 9 inches till only sufficient space or room be left to receive the vegetable or other productive soil, or other hard road material, as the case may be, which had been removed from the surface, the whole of which, respectively, after being properly freed from intermixture with other materials, must then be replaced, with such additional quantity (if any) as may be requisite for the due and proper restoration of the original surface; and in the case of streets, public highways, and places, the contractor shall finish and leave the same in good order and to the satisfaction of the county surveyors, or others having control of such roads.

REPAIRING, &c.

24. That if the surface material consist of the soil of the fields only, then it must, in the first instance, be left higher than the adjacent land by about $1\frac{1}{2}$ inches for every foot of cover on the pipe, but if the surface material consist of gravel or broken stones, it must, in the first instance, be left higher in the middle of the trench than at the sides by about 1 inch for every foot of cover on the pipe; and if it consist of pebble-pavement or stone-pitching, then it must, in the first instance, be left higher in the middle than at the sides by about half an inch for every foot of cover on the pipes—such degree of roundness being given after the hard material shall have been carefully rammed down; and all regular pavements must be accurately coursed with and appear like the other adjoining and undisturbed portion of the street or road.

25. That the contractor must also be responsible for, and must repair and make good to the satisfaction of the said engineers, and of the county surveyors having control of the public highways, all sinkings and defects of workmanship which may become apparent within three months after the execution of the work, and shall at the end of that period ram down all pavings, pitchings, or broken stone surfaces left projecting, as aforesaid, till they shall become, as nearly as possible, level with the rest of the street, public highway, or road; or if the surface has sunk below the regular level, he is to bring it up by the use of proper and approved material.

REMOVAL OF RUBBISH.

26. That immediately after the trench is filled, and the surface replaced, the contractor shall remove all superfluous earth, rubbish, and other materials, and restore the *lands for the use of the owner*, and all roadways to the use of the public, as soon after as may be, and, until this is done, the contractor shall be and remain liable in respect to all damage and expenses to which the Corporation would be primarily liable or be put in consequence of accident or injury to person or property.

PROTECTION FROM ACCIDENT.

27. That, as a further precaution against accidents, the contractor shall place and maintain a sufficient number of lights and watchmen during the night, whenever and wherever a trench is open in or near any street, public highway, or private road, and shall properly fence and guard the same; and the contractor shall also be liable for any loss or injury the landholders, through whose land the trenches shall be opened, may sustain from cattle, sheep, &c., falling into them.

REPAIRS OF SEWERS, FENCES, ROADS, &c.

28. That the contractor shall also at his own expense alter, divert, repair, restore, and make good all sewers, bridges, drains, tunnels, pipes, goods and property, pavements and other works, which he may disturb or injure during the progress of his work, or which may be broken or damaged by his servants, agents, or workmen, or by or in consequence of his or their operations; he shall also make good all ditches and fences that he may have to break through and cut down, to plant quicks where directed in new-made ditches; he is also to rebuild all works in the best manner; but in all cases he is to construct a stile for the convenience of the workmen or officers of the Corporation to pass over the fences (the total number of stiles required will be about 135), and where the trench passes across the Dargle and valley of the Cookstown river, he is to build retaining walls, or breast walls in mortar, to support the new roads made by Lord Monk, in the Dargle, and Mr. Barrington at Fassaroe, as will be more particularly directed by the engineers, or either of them, or the clerk, assistant, or inspector, at the time the works are executing, and for building such walls the contractor will be paid at the rate of 8s. per cubic yard by measurement; he is also to repair and make good the artificial water-course belonging to Mr. Barrington at Fassaroe, so that it shall be as effective for the purposes intended as before the works herein specified were executed, and where the public or county roads are to be raised, the contractor must raise the boundary walls of such roads to a height above the raised road to correspond with the heights they now are above the present level of the roads. He shall also metal the raised roadways and footpaths to the satisfaction of the engineers, or either of them, and of the county surveyors or other parties having control of the roads.

CERTAIN COMMUNI- CATIONS TO REMAIN OPEN.

29. That for the purpose of expediting the execution of the work, the contractor may have two or more trenches open at the same time; but it is necessary to the convenience of the public that the several thoroughfares leading to the same or neighbouring points shall not, at one and the same time, be interrupted or obstructed; the contractor is therefore required to give notice, from time to time, at the office of the engineers to the Corporation, of his wish or intention to open trenches in more than one thoroughfare at the same time, and shall not proceed thereon unless and until the consent of the engineers for the time being shall have been obtained.

PIPE-LAYING.

30. That the pipes, before being laid, shall be brushed through to remove any soil or stones which may have been left therein, and shall then be placed singly in the trench, and then bedded firmly on the solid earth; and when the trench may have to be cut through rock, a layer of earth, of about six inches deep, is to be placed between the bottom of the pipe and the rock, and they are to rest firmly on their bed throughout their whole length, and all to be driven properly home, and shall be jointed in the manner following (that is to say)—

- 1st. One complete lap (at least) of white hempen spun yarn shall be forced to the bottom of the socket.
- 2nd. As many laps, of either white or tarred hempen spun yarn (tightly driven) as may be required to leave the vacancy for lead, of the depths shown in the following schedule.
- 3rd. As much lead as the engineers, or either of them, may direct to suit the different pressures (and being not less on the average for each joint than the quantity stated in the following schedule), as is necessary to fill up the remainder of the socket, and leave a projection for caulking down.

SCHEDULE.

Diameter of Pipe	Minimum depth of Lead in each Socket Joint. Depth of Lead increasing with the pressure to be on Main	Minimum weight of Lead in each Joint in lbs.
inches		
33	2 $\frac{1}{2}$	38
"	2 $\frac{3}{4}$	40 $\frac{1}{2}$
"	2 $\frac{1}{2}$	42 $\frac{1}{2}$
"	2 $\frac{3}{4}$	46 $\frac{1}{2}$
27	2 $\frac{1}{2}$	31 $\frac{1}{2}$
"	2 $\frac{3}{4}$	33 $\frac{1}{2}$
"	2 $\frac{1}{2}$	35

LEAD TO BE RUN
INTO SOCKETS WITH
CLASP-RING.

31. That the lead must be run into the socket with a jointed clasp-ring; the whole of such lead must be poured into the joint (which must be carefully dried for the purpose) at one running, and must be at least three times 'set up' with properly proportioned caulking-irons, and with light sledge-hammers; and it is specially directed that each joint-maker shall employ a proper striker to assist him in caulking the joint, instead of depending on his own blow; and after being well and firmly set up, the lead fringe must be pared off, and the joint left neat and even with the socket of the pipe.

COCKS TO BE FIXED.

32. That the contractor must fix without extra charge (except as by the tender is provided) all cocks, bends, branches, hydrants, fire-pipes, air-valves, plugs, casings, covers, taper-pipes, and other like castings and appendages indicated on the said drawings, or which the engineers may direct to be inserted during the progress of the work, and must place a pitched pavement of 3 feet square round all hydrants and other discharge-pipes; the stones of which pavements shall be squared on the sides and ends, and be of granite, or other such materials as the engineers, or county surveyors having the control of the streets and public highways, shall from time to time direct or approve.

33. The flanch-cocks must be jointed with rings of sheet-lead, of the full diameter and breadth of the flanches (and weighing 7 lbs. to the superficial foot), and red lead; the bolts will be provided by the Corporation. The air-cocks must be screwed on to the manhole doors, with one lap of yarn and red lead between flanch of cock and manhole cover, and the contractor must tap the manhole covers to receive the thread of the air-cock screws.

RELIEF TANKS.

34. That the relief tanks shall be constructed as shown on drawings, sheets Nos. 27, 28, and 29. The tank at Kilmurry South must be lined in the bottom, back of retaining walls, and on slope (to a vertical height of 3 feet above top waterline), with clay puddle, properly worked in manner described for clay puddle on Contract No. 4. The retaining walls shall be built of coursed rubble-work in mortar, coped with dressed ashlar stone, coping 2 feet 6 inches wide by 12 inches thick; the bottom of tank and slopes, for a vertical height of 3 feet above top water line, shall be pitched with squared pitching, 6 inches thick; the upper part of slopes of cutting and slopes of embanking must be soiled 9 inches thick, and seeded; the side walls of well for self-acting valve and cleansing pipe shall be coursed rubble, coped with dressed ashlar stone coping; the floor to be 9-inch flagging, closely jointed; the floor for inlet pipe shall also be 9-inch flagging; the platform for self-acting valve shall be constructed of red Memel or Riga timber, the bearers to be 9 inches by 6 inches, and covered with 3-inch planking; ashlar steps shall also be placed on slope, as shown; the overflow tunnel shall be constructed of brickwork, 3 feet internal diameter, and 9 inches thick.

The tank at Kilcronney (near the river Dargle) and the tank at Rathmichaels will be in rock, and will therefore not require any pitching or soiling of the slopes; the self-acting valve, platform, and overflow tunnel will be similar to the above, and all the tanks shall have boundary walls built of random rubble-work, set in mortar and coped with a semicircular stone coping; the walls shall be of an average height of 7 feet 6 inches above the surface of the ground, and shall be founded 18 inches below the surface of the ground; the thickness at the top shall not be less than 16 inches, and the sides shall each batter not less than $\frac{1}{2}$ inch to a foot vertical, and there shall be at least two substantial through stones, alternately placed in every yard superficial; and at each tank two openings shall be left 4 feet wide for entrance doors, and the contractor must provide such doors (with bolt and lock to each door), properly hung.

GENERAL CONDITIONS.

MODE OF PERFORM-
ANCE.

35. That the said contractor shall do and perform his contract in all its parts according to the true intent and meaning of this specification, and of the drawings referred to therein, and of the further drawings, instructions, and directions which he may from time to time receive from the said engineers, or either of them, or the said clerk, assistant, or inspector, who shall, and each and every of them shall, have full liberty from time to time, and at all times, to inspect and examine the materials and workmanship; and who shall and may at any and every such time reject any or all the materials or workmanship which to them, any, or either of them, may seem defective or unfit, or improper for the several purposes to which they are applied, or intended to be applied, or not in accordance with the description mentioned in or intended by this specification, or the said drawings, instructions, or directions, respectively.

REMOVAL, &c., OF
REJECTED MATE-
RIALS.

36. That the said contractor shall forthwith remove all and every such materials and workmanship so rejected as aforesaid; and when required so to do by the said engineers, or either of them, or the said clerk, assistant, or inspector, shall forthwith remove and carry away all such rejected materials from the works and lands of the Corporation, and shall from time to time, and as often as may be required, replace the same rejected materials and workmanship, or any part thereof, respectively, with such other and of such better and such sufficient quality, and of such suitable description, as shall be satisfactory to the said engineers, or the said clerk, assistant, or inspector, and until they shall be satisfied therewith.

IN CASE OF RE-
FUSAL.

37. That in case the said contractor shall neglect or refuse to comply with the foregoing conditions, it shall be lawful for the said engineers, or either of them, or the said clerk, assistant, or inspector, employed by or on behalf of the said Corporation, and by their agents, servants, and workmen, to remove the materials and workmanship so rejected, or any part thereof, and to replace the same with such other materials and workmanship as shall be satisfactory to him or them, and for the said Corporation, on the certificate of the said engineers, or either of them, to deduct the expenses thereby incurred, or to which the said Corporation may thereby be put or be liable, or which may be incident thereto, from the amount of any money which may be or become due or owing to the said contractor, or to recover the same by action at law or otherwise from the said contractor as the said Corporation may determine.

NOT TO ASSIGN OR
SUB-LET.

38. That the said contractor shall not assign his contract, or any part thereof, to any other person, without the consent of the Corporation, signified in writing under the hand of the town clerk, nor shall he under-let to or make any sub-contract with any other person or persons for the execution of any portion of the works, with the exception of rock or earth excavation, with the consent in writing of the said engineers, or either of them, nor shall he by himself or his agent give any gratuity or advantage of any kind whatever to any person employed by or for the said Corporation or their said engineers.

SETTING OUT.

39. That the said contractor shall assist in and shall find and provide all necessary tools, labour, and materials for setting out the said works, and shall be responsible for the correct setting out of the several works, and for the accuracy of the levels and dimensions of such several works, and of every part thereof, and shall from time to time make all such borings, shafts, and trial pits as the engineers, or either of them, or their clerk, assistant, or inspector, shall require.

SUPERINTENDENCE.

40. That the contractor shall give all necessary personal superintendence during the execution of the said works, and shall constantly employ, on each part thereof, at least one good and competent foreman, careful and skilled in the trades and calling required by this specification, to manage and direct in the absence of the contractor; and such foreman shall, on behalf of the contractor, receive and have charge of such several drawings, writings, papers, specifications, and documents as may be delivered to and for the use of the said contractor, or for his guidance; and such foreman shall also, on behalf of the contractor, receive, execute, and obey all such instructions and directions as may be given by the said engineers, or either of them, or the said clerk, assistant, or inspector, and shall not be changed without the consent of the said engineers, or either of them, but may, nevertheless, be objected to or dismissed by the said engineers, or either of them, if and when he shall see fit so to do, and, therefore, the contractor shall forthwith employ another good and competent foreman in his stead, and so from time to time and as often as occasion shall require.

SKILLED WORKMEN.

41. That, in like manner, the said contractor shall employ in and about the execution of the said works, or any of them, only such clerks, foremen, superintendents, agents, and workmen as are careful and skilled in their various trades and callings; and the said engineers, or either of them, shall be at full liberty to object to or dismiss any person employed by the said contractor in or about the execution of such works who shall, in the opinion of their engineers, or either of them, misconduct himself, or be incompetent to, or negligent in, the due and proper performance of his duties, or any of them.

IN CASE OF DEFECTIVE WORK OR NEGLIGENCE.

42. That in case any such person shall direct or execute any unsound, unskilful, or imperfect work, or shall place the same upon an insecure or insufficient foundation, or shall not sufficiently secure and protect the same against immediate and future injury, whether arising or to arise from weight, pressure, action of water, or otherwise, any and every such person, on being required by the said engineers, or either of them, or the said clerk, assistant, or inspector, shall, at the expense of the said contractor, forthwith alter, amend, pull down, or remove such work, or cause the same to be altered, amended, pulled down, or removed, and shall also forthwith rectify or reconstruct, or cause the same to be rectified or reconstructed, in whole or in part, and according to such directions as he or they may receive.

DILIGENCE AND DESPATCH.

43. That the several works shall be, from time to time, and in proper sequence, commenced and carried on with due diligence, and as much expedition, and in such manner, as the said engineers, or either of them, or the said clerk, assistant, or inspector, shall require; and particularly in all cases in which a flow of water shall or may interfere with or impede, or render the execution of any of the works more difficult or more expensive—such works shall be carried on day and night without intermission; and the contractor shall provide, and at all times apply an ample amount of pumping power, pumps, and machinery, to keep the foundation and other works clear of water, and to enable all necessary operations to be promptly and efficiently performed; and in case the contractor shall, in the opinion of their engineers, or either of them, or their clerk, assistant, or inspector, fail to do so, or shall neglect to provide, to the satisfaction of the said engineers, or either of them, or of the said clerk, assistant, or inspector, an adequate supply of proper or sufficient materials, or a sufficient number of qualified workmen to execute the said works, or any of them, with the due diligence and expedition, and in the manner so required, then the said engineers, or either of them, or the said clerk, assistant, or inspector, shall be at liberty, and they are hereby respectively authorised, in their discretion, to employ other contractors or workmen in and about the said works, or any of them, and to provide the necessary implements and materials; and the Corporation may charge the extra expenses (if any) incurred thereby to the account of the contractor, and deduct the same from any sum or sums due or to become due to him, or recover the same by action at law, or otherwise.

SUSPENSION OF PROGRESS.

44. That the said contractor shall, without recompense, claim, or demand, delay or suspend the progress of the works, or any part thereof, if, and when, and so often as he shall be so required by the said engineers, or either of them, and for such time or times as may, in the judgment of the said engineers, or either of them, be necessary for the purposes or advantage of the undertaking, and shall, whenever directed by the said engineers, or either of them, or the said clerk, assistant, or inspector, and upon all other needful occasions, at his own expense, properly cover down and secure so much of the said works as may be liable to sustain injury from weather or otherwise, and shall at all times, during the continuance of his contract, and forthwith when required, properly make good any damage or injury which such works or any part thereof may sustain, to the full satisfaction of the said engineers.

PRECAUTIONS.

45. That the said contractor, and each and every such person, shall take every necessary, proper, timely, and useful precaution against accident or injury to the works, or any of them, or to any person or property, by the action or pressure of water, and whether the same arise from or be occasioned by floods, springs, rain, streams, accumulation, disruptions, leakage, frost, or other natural or artificial causes whatsoever or howsoever; and shall forthwith repair, make good, and defray any loss, damage, cost, charge, or expense by or in consequence of any such accident, or by or in consequence of the operations of the said contractor, occasioned to the said Corporation, or to the said works, or any of them, or to any person or persons injuriously affected thereby; and shall indemnify, save harmless, and keep indemnified the said Corporation from and against the same, and from and against all actions, suits, claims, and demands whatsoever, by reason or on account thereof. And the said Corporation may deduct the expenses thereby incurred or to which the Corporation may thereby be put or be liable, or which may be incident thereto, from the amount of any money which may be or become due or owing to the said contractor, or may recover the same by action at law, or otherwise, from the said contractor.

POSSESSION OF SITES.

46. That the Corporation will, on or before the first day of November 1862, give the contractor the use of so much of the sites of the works as may, in the opinion of the engineers, or either of them, be required in order to enable the contractor to commence and to continue the execution of the works; and will from time to time, as the works proceed, give the contractor the use of such further portions of such sites as their engineers respectively may from time to time consider proper in that behalf, but the non-delivery in manner aforesaid of the use of such sites, or any part thereof, shall not vitiate or affect the contract, or any provision therein or in this specification contained, or entitle the contractor to any increased allowance in respect of money, time, or otherwise, unless (and then only to the extent to which) the engineers may grant him any extension of time under the provision for that purpose hereinafter contained.

COMPLETION.

47. That the said contractor shall truly fulfil and satisfactorily complete his undertaking, in all its parts, on or before the thirtieth day of June 1864, on which day, or on such other day (not being earlier) as may be allowed in writing by the engineers, or either of them, in pursuance of the power hereinafter for that purpose contained, he shall deliver up the said works, except as aforesaid, in a sound, watertight, workmanlike, and complete and useable condition, to the said Corporation, who may thenceforth use the same for the purpose of the said waterworks in such way and manner as they shall think proper, provided that the Corporation may from time to time, and at any time prior to the said thirtieth day of June 1864, without prejudice, take and use for the purpose of the undertaking any and all such portions of the works as the engineers, or either of them, shall, by writing under their respective hands, from time to time authorise to be taken and used for the purposes of the undertaking.

EXTENSION OF TIME.

48. Provided always, that if by reason of the non-delivery of a sufficient quantity of any materials to be provided by the said Corporation at the times when the same may be required for use, or by reason of the non-possession of any site or sites required for the purposes of the undertaking, or by reason of any additions to or enlargements of the works (which additions or enlargements the said engineers are hereby respectively authorised to make), or for any other just cause arising with the said Corporation, or with their respective engineers, or their clerk, assistant, or inspector, or in consequence of any unusual inclemency of weather, or by reason of invasion, civil commotion, or general or local strikes, or combinations of workmen, or for want, or alleged want, or deficiency of any

orders, drawings, or directions, or by reason of any difficulties, impediments, obstructions, oppositions, doubts, disputes, or differences whatsoever and howsoever occasioned, the contractor shall, in the opinion of the engineers, or either of them, have been unduly delayed or impeded in the completion of his contract, it shall be lawful for the said engineers, or either of them, if they so think fit, to grant from time to time, and at any time or times, by a writing under his hand, such extension of time, either prospectively or retrospectively, and to assign such other day or days for or as for completion as either may seem reasonable, without thereby prejudicing or in any manner affecting the validity of the contract, or the sufficiency of the tender, or the adequacy of the sums or prices therein mentioned; and any and every such extension of time shall be deemed to be in full compensation and satisfaction for and in respect of any and every actual and probable loss or injury sustained or sustainable by the said contractor in the premises, and shall in like manner exonerate him from any claim or demand on the part of the said Corporation for and in respect of the delay occasioned by the cause or causes in respect of which any and every such extension of time shall have been made, but not further or otherwise, nor for or in respect of any delay continued beyond the time mentioned in such writing or writings respectively.

DELIVERY WHEN
PROVISIONAL AND
WHEN COMPLETE.

49. And provided further, that such delivery at the time aforesaid, or at any subsequent time, shall be a delivery only if the engineers, or any of them, shall accept the same, on behalf of the Corporation; and when so accepted, shall not be deemed a full, complete, sufficient delivery by the said contractor to the said Corporation, and but only a permissive use of the said works for the purposes of the said Corporation, unless and until a certificate in writing, under the hands of their engineers, or either of them, shall have been given to the said Corporation, to the effect that the several works constructed by the contractor, and all other the works constructed for and directed to be executed, are in a sound, watertight, workmanlike, and complete and useable condition, and that the contractor has, in the opinion of their respective engineers, reasonably fulfilled and completed his contract and undertaking.

PERIOD OF LIABILITY.

50. That the said contractor, notwithstanding such permissive use, and any act, matter, or thing done, permitted, happening, or suffered in pursuance or during the continuance of such permissive use, shall be responsible for, and shall effectually maintain and uphold in good, substantial, sound, perfect, and watertight condition all and every part of the said works for a period of twelve calendar months from and after the day of the date of such last-mentioned certificate, and shall be liable for and shall pay and make good to the said Corporation, or other persons or parties (being legally entitled thereto), all losses, damages, costs, and expenses they or any of them may incur, or be put to, or be liable to or for, by reason or in consequence of the operations or of the failure of the works of the said contractor, or any of them, during the time the said contractor is responsible therefor, and shall indemnify, save harmless, and keep indemnified the said Corporation from and against the same, and from and against all actions, suits, claims, and demands whatsoever, by reason or on account thereof, or the said Corporation may deduct the amount of such losses, damages, costs, or expenses from any amount in their hands due to the contractor.

IN CASE OF BANK-
RUPTCY, &c.

51. That it shall be lawful for the said Corporation, in case the said contractor shall fail in the due performance of any part of his undertaking, or shall become bankrupt or insolvent, or shall compound with his creditors, or propose any composition to his creditors for the settlement of their debts, or shall carry on or propose to carry on his business under inspectors, on behalf of his creditors, or shall commit any act of bankruptcy, or shall, in the opinion and according to the determination of the said engineers, or either of them, exercise such due diligence and make such due progress as would enable the works to be efficiently completed at the time or in the manner aforesaid, to determine the contract, so far as respects the performance of the same under the direction of the said contractor, by a notice in writing, under the hand of the town clerk to the said Corporation (but without thereby affecting the obligations, liabilities, and the responsibilities of the said contractor, the whole of which shall, unless otherwise agreed in writing to the contrary, and except as otherwise hereinafter mentioned, continue and be in force as fully, and to the same extent, and for the same period, as if the contract had not been so determined, and as if the works subsequently executed had been executed by or on behalf of the said contractor, and without thereby creating any trust in his favour or in favour of his sureties), and to enter upon and take possession of the said works, and of the plant, tools, and materials of the said contractor, and use or sell, or use and sell, the same as the absolute property of the Corporation. And all the powers of the engineers, with respect to the determination of any doubts, disputes, and differences, and with respect to the settlement of the contract, and the determination of the sum or sums, or balance of money, to be paid to or received from the said contractor, and otherwise in respect to the said contract, shall be and continue in force with respect to the same as though such contract had not been determined.

PLANT.

52. That the plant, tools, and materials provided by the contractor shall, in all cases, from the time at which they or any of them may be brought upon the works and lands of the Corporation, or lands adjacent thereto, and during the construction and until the completion of the said works, become and continue the property of the said Corporation, and the contractor is hereby prohibited from removing the same or any part thereof during the progress of the works, without the consent in writing of the said engineers.

RE-LETTING.

53. That in case of the contract being so determined as aforesaid, the Corporation may re-let the undertaking of the said contract, or any part thereof, and upon such conditions as they may think fit, or from time to time may engage workmen, and provide all such materials, implements, and apparatus, and employ the same in such manner as the said engineers, or either of them, may think necessary and proper for completing the said works, or any of them, or for repairing or remedying, or endeavouring to repair or remedy, any defects which may appear therein; and when the contract shall have been so determined, or so soon thereafter as their engineers, or either of them, may think convenient, the said respective engineers shall fix and determine, either *ex parte*, or by or after reference to the parties, or either of them, or after such investigation or enquiries as he may think fit to make or institute, and shall certify what amount (if any) was at the time of the determination of the contract reasonably earned by or would reasonably accrue to the contractor in respect to work actually done, and in respect to the value of any materials, implements, and tools provided by the contractor, and taken to by the Corporation; and the amount thereof, after allowing for all sums then already paid to the contractor on account, shall remain in the hands of the Corporation, without interest, until twelve months after the date of the engineers' certificate of the final completion of the works, as herein provided; and the said engineers, or either of them, shall be at liberty to authorise, by their or his certificate, the said Corporation to deduct the damages, losses, costs, charges, and expenses, in his opinion, incurred by them in consequence of the premises, or to which they may be put, or be liable, together with the forfeitures (if any) incurred by the said contractor, from any sum or sums of money which would otherwise become due and owing to the said contractor; and in case such sum or sums of money shall not be sufficient to defray such damages, losses, costs, charges, expenses, and forfeitures, then the contractor shall forthwith pay the deficiency to the Corporation, and it shall be lawful for the said Corporation to recover the same from the said contractor by action at law, or otherwise; and any doubts, disputes, or differences arising or happening with respect to the determination of the contract, or in consequence thereof, shall be settled and decided as hereinafter prescribed with respect to any other doubts, disputes, or differences arising or happening under the contract.

FAILURE TO COM-
PLETE.

54. That in case the said contractor shall fail in the due performance of his contract by and at the time or times hereinbefore mentioned or referred to, or at other the day or days to which the period of completion may have been extended, he shall be liable to pay to the said Corporation, as and for liquidated damages, the sum of one pound per centum on the amount of the accepted tender for each and every week which may elapse between the appointed and actual time of completion and delivery hereinbefore mentioned or provided for, or the said Corporation may deduct the same from any moneys in their hands due or to become due to the said contractor.

SURETIES.

55. That the said contractor shall find two good and substantial sureties, to the satisfaction of the Corporation, to be jointly and severally bound with him in a sum as near as may be, but not exceeding, one-fourth of the amount of the accepted tender, for the due fulfilment of his contract in all its parts, according to the true intent and meaning of this specification, and for the due completion and delivery of the works at the time herein mentioned, or at the time to which the time hereinbefore mentioned may be hereafter

extended, and the names and abodes of such sureties, and a consent in writing, signed by them, to become bound as such sureties, shall accompany the tender to be sent in as hereinafter mentioned.

PAYMENT.

56. That the said contractor shall be entitled to payment for his work in manner following (that is to say):—To a monthly instalment equal to eighty per cent. of the *prima facie* value of the amount of work executed in the then preceding month; to a further instalment of ten per cent. of the *prima facie* value of the amount of work executed when such works are completed and delivered to and accepted by the said Corporation in manner aforesaid, and to the balance, whatever the same may be found to amount to, so soon as the responsibility of the said contractor shall cease and determine, and shall have been entirely fulfilled; provided that no sum or sums of money shall be considered to be due and owing, nor shall the contractor make any claim against or demand upon the said Corporation for or on account of any work executed by him, unless the contractor shall have delivered in respect thereof a true and proper claim or claims, nor unless the said engineers, or either of them, shall have certified or recommended the amount to be provisionally paid as such instalment or balance to the said contractor, and that the said contractor is reasonably entitled to such instalment or balance respectively, nor unless such certificate shall have been presented to the secretary of the aforesaid Waterworks Committee; nor shall any such sum or sums of money be considered payable to the said contractor until the expiration of seven days after such certificate shall have been so presented; nor shall any omission to pay the amount of such certificate at the time the same shall be payable be held or deemed to vitiate or avoid the contract, but in such case the contractor shall be entitled only to interest thereon at and after the rate of five pounds per centum per annum for such time as such omission shall continue, but which shall not in any case exceed one month.

INTEREST ON
BALANCE.

57. That the said contractor shall, on the due performance of his contract, be entitled to receive from the said Corporation (or their Water Committee) interest at the rate of five pounds per centum per annum upon such sum as shall remain in the hands of the Corporation from the time of delivery and acceptance as aforesaid to the time at which the responsibility of the said contractor shall have terminated.

DRAWINGS TO BE
RETURNED.

58. That the contractor shall return to the custody of the engineers, or either of them, at the time of the delivery up of the works to the Corporation, and before he receives the instalment payable thereon, all plans, drawings, writings, papers, specifications, and documents which may be delivered to him, or for his use; and in the meantime the said respective engineers, and such party as they may respectively appoint, and the said clerk, assistant, and inspector, shall have full access thereto, at all times, and for all purposes, and the same shall be kept at or near the sites of the works.

CONTRACT.

59. That the contractor shall, if so required, enter into a formal indenture of contract (binding himself, his heirs, executors, and administrators) with the Corporation, for the due fulfilment of his undertaking. Such contract to be prepared by the law agent to the Waterworks Committee, and at the cost of the contractor.

DISPUTES, &c., HOW
TO BE SETTLED.

60. That in case of any doubts, disputes, or differences arising or happening, touching or concerning the said works, or any of them, or relating to the quantities, qualities, description, or manner of work done and executed, or to be done and executed by the said contractor, or to the quantity or quality of the materials to be employed therein, or in respect to any additions, deductions, alterations, or deviations made in, to, or from the said works, or any part of them, or touching or concerning the meaning or intention of this specification or of any part thereof, or of the contract entered into by and between the said Corporation and the said contractor, or of any plans, drawings, instructions, or directions, referred to in this specification or the contract, or which may be furnished or given during the progress of the works, or touching or concerning any certificate, recommendation, order, or award which may have been made by the said engineers, or either of them, or in anywise whatsoever relating to the interests of the said Corporation or of the said contractor in the premises, such doubts, disputes, or differences shall from time to time be referred to and be settled and decided by the said engineers, who shall be competent to enter upon the subject-matter of such doubts, disputes, or differences, with or without formal reference or notice to the parties to the said contract, or either of them, and who shall judge, decide, order, and determine thereon, and that whether the contract be then existing, completed, or determined; and who shall have full power and authority to correct or amend any clerical or verbal inaccuracy therein, or in any certificate, order, or award made by him in relation thereto; and to the said engineers respectively shall also be referred the settlement of the said contract, and the determination of the sum, or sums, or balance of money, to be paid to or received from the said contractor by the said Corporation; and (subject as aforesaid) the directions, decisions, admeasurements, valuations, certificates, recommendations, orders, and awards of the said engineers, or either of them (which said directions, decisions, admeasurements, valuations, certificates, recommendations, orders, and awards respectively, may be made from time to time), shall be final and binding upon the said Corporation and the said contractor respectively; and the said contractor shall not commence any action at law, or file any bill in equity, or institute any proceeding at law or in equity, or otherwise against, or make any claim upon, the said Corporation in respect of any matter or matters in relation to which the directions, decisions, admeasurements, valuations, certificates, recommendations, orders, and awards, or any or either of them, is or are to be given or made by the said respective engineers, until such directions, decisions, admeasurements, valuations, certificates, recommendations, orders, and awards, or any or either of them, as the case may require, shall have been given or made by him; and in case the said engineers, or either of them, shall be put to any costs, trouble, loss of time, or expenses by or in consequence of any suit, bill, claim, or proceeding, and whether as a party thereto or otherwise, and shall make any claim or demand in respect thereof, such claim or demand shall be paid and satisfied, with full costs, as between attorney and client, jointly by the Corporation and contractor as expenses mutually incurred in carrying into effect and winding up the contract entered into by and between the said Corporation and the said contractor; and it shall be competent for the said engineers, or either of them, to recover the same by action at law or otherwise from either, and for either to pay for and on behalf of, and recover a moiety of such claim or demand so paid and satisfied from the other; and neither the contractor nor the said Corporation shall, or shall have any power or authority to revoke, annul, or interfere with the power and authority of the said engineers; and if either party shall, in the opinion of the engineers, or either of them, attempt so to do, or to hinder or delay the said engineers from making any certificate, order, or award, it shall be lawful for the said engineers respectively, if and when they shall respectively see fit so to do, to proceed *ex parte*, and any certificate, order, or award which may be made by them respectively thereafter shall be final, binding, and conclusive on the parties, notwithstanding the determination of the contract, or any attempted revocation by either of them, or otherwise. And it shall also be competent for the said engineers, or either of them, for the better determination of any doubt, dispute, or difference, if and whenever they shall so think fit respectively, or at the instance and request of either of the parties to the contract, to call to his or their assistance, and, if needful, to act as his or their assessor or assessors, any barrister, attorney-at-law, or other disinterested person or persons, and the fees and charges of any and every such barrister, attorney-at-law, or other such disinterested person or persons, shall be deemed to be part of the costs and charges in the reference; and for finally concluding the said Corporation and the said contractor in the matters aforesaid, this submission to reference may at any time be made a rule of any of Her Majesty's Superior Courts in Ireland, on the application and at the expense of the said Corporation or of the said contractor respectively, pursuant to the statute in that case made and provided, and the costs and charges (if any) attending any such reference shall be in the discretion of the said respective engineers, and shall be paid and satisfied according to his or their order or award. And after the making of any certificate, order, or award, certificates, orders, or awards, such Superior Court may, as often as it sees fit, refer back the matters so referred as aforesaid or any part of them, to the said engineers, or either of them, and with, upon, and subject to such directions, powers, and terms as to the said Court may seem proper.

TENDER, HOW TO
BE MADE.

61. The tender, as in manner hereinafter specified, shall be made on a printed copy of the prescribed form, and, with the schedule of prices thereunto annexed duly filled up and signed by each party desirous of becoming contractor, must be delivered, with specification attached (enclosed in a sealed envelope, endorsed 'Tender for Reservoir and other Works'), at the Waterworks Office, City Hall, Dublin, addressed to Sir Drury Jones Dickenson, Secretary to the Waterworks Committee, on or before the tenth day of

September 1862, and the same will be considered, and the determination of the Corporation thereon will be announced to the contractor, under the hand of the secretary to the said Waterworks Committee, within one month from that date; but the Corporation, nevertheless, do not bind themselves to accept the lowest or other tender, although they will do so unless there should appear to them satisfactory and sufficient reason to the contrary.

City Hall, Dublin, June, 1862.

PARKE NEVILLE, C.E., *Engineer to Corporation of Dublin.*
JOHN MACNEILL, *Consulting and Advising Engineer.*

PREScribed FORM OF TENDER.

To the Waterworks Committee of the Corporation of Dublin.

CONTRACT No. 3.

1862.

GENTLEMEN,

will undertake to lay 3,336 lineal yards, or thereabouts, of 33-inch pipes, which line of pipes is to commence at the northern termination of a proposed tunnel, to be situated on the lands of Callow Hill Upper, in the parish of Upper Newcastle, and county Wicklow, and to terminate at a certain intended reservoir, to be built on the lands of Tipperstown, in the parish of Stillorgan, county of Dublin; also 8,272 lineal yards, or thereabouts, of a double line of 27-inch pipes (equal to 16,544 lineal yards of pipes), which double line of pipes are to commence at the above-named reservoir, on the lands of Tipperstown, and to terminate on the northern side of the Grand Canal, in Leeson Street, near Eustace Bridge, in the city of Dublin, including carriage of all pipes from Dublin or Kingstown to line of works, and all excavations, and all works incidental to laying said pipes of all kinds whatsoever, in conformity with the terms and conditions contained in the foregoing specification, and at and for the prices or sums mentioned in the following schedule. And propose and agree, that in case this tender shall be accepted by a resolution of the Town Council, communicated to in writing by the town clerk or law agent of the Corporation, within a week after same shall be passed, forthwith to enter into a regular sealed contract with the Corporation of Dublin for the execution of the said several works, and to perfect the necessary bonds when prepared by the law agent of the Corporation, and give the required security for carrying out the same, and name of as sureties.

Gentlemen, your

Name or names
Occupation

Residence

Yds. ft. in.

Price £ s. d. £ s. d.

SCHEDULE REFERRED TO.

* 30,336	0	0	run.	The laying down and satisfactorily completing the pipes, 33 inches diameter, including all incidental works whatsoever; the fixing of all stop cocks (which are measured as straight pipes in the above length), and all sluice and air cocks, at per lineal yard
† 8,272	0	0	„	The laying down and satisfactorily completing a double line of pipes, 27 inches diameter (equal to 16,544 lineal yards of pipes), including all incidental works whatsoever; the fixing of all stop cocks (which are measured as straight pipes in the above length), and all sluice and air cocks, at per lineal yard
				Excavations below levels, marked on sections, at per cube yard

ROUNDWOOD RESERVOIR.

4 No.				Fixing and jointing 24-inch cocks in tunnel, under main embankment, Roundwood Reservoir, as shown on plans
147	0	0	run.	Jointing 24-inch pipes in tunnel, under do. do. (socket joints)

FILTER-BEDS.

7 No.				Fixing and jointing 24-inch cocks (flanch joints)
2 No.				Fixing and jointing 30-inch cocks (flanch joints)
2 No.				Fixing and jointing 18-inch cocks (flanch and socket joints)
147	0	0	run.	Jointing 33-inch pipes through filter-beds (trench excavated ready to receive pipes)
152	0	0	„	Jointing 18-inch pipes (trench excavated ready to receive pipes)

STILLORGAN RESERVOIR.

3 No.				Fixing and jointing 33-inch cocks (flanch and socket joints)
6 No.				Fixing and jointing 27-inch cocks (flanch and socket joints)
115	0	0	run.	Jointing 33-inch pipes from boundary wall of reservoir, through embankments, and connecting pipe between reservoir (trenches excavated ready to receive the pipes)
834	0	2	„	Jointing 27-inch pipes through reservoir, and to boundary wall of same; also the cleansing pipes (trenches excavated ready to receive pipes)

NOTE.—The contractor must include in the prices for the above work the carriage of the cocks and pipes from the places of delivery named in the specification, page 6, to the situations where such cocks and pipes are to be used.

The contractor will also have to assist in fixing the self-acting valves at the relief tanks.

	L. yds.	in.
* Of this length there will be about 21,567 with 2½ depth of lead in joint.		
Do. do.	4,825 do.	2½ do.
Do. do.	2,528 do.	2½ do.
Do. do.	1,416 do.	2½ do.

30,336

...

The number of stop-cocks on this main will be 6 (to be placed in any position on the line the engineers, or either of them, may direct), with 5 self-acting valves, 21 12-inch sluice-cocks, and 20 air-cocks.

	L. yds.	in.
† Of this length there will be about 3,222 with 2½ depth of lead in joints.		
Do. do.	725 do.	2½ do.
Do. do.	4,325 do.	2½ do.

8,272

...

The number of stop-cocks on these mains will be 6 (to be placed in any position on the line the engineers, or either of them, may direct), with 10 12-inch sluice-cocks, and 8 brass air-cocks.

RELIEF TANK AT KILMURRY, SOUTH.

Yds.	ft.	in.			Price	£	s.	d.	£	s.	d.
330	0	0	run.	Fence walls in mortar, as described in specification							
				Two framed and ledged doors, 7 feet by 4 feet, with bolt and lock to each door, and hung complete, including painting, 3 oils							
10,507	0	0	cube	Excavations in tank, part to spoil, and remainder in embankments							
574	0	0	„	Materials and labour to clay puddle							
1,593	0	0	sup.	Soiling and seeding slopes of excavations and embankments							
57	0	0	„	Metalling roadway on top of bank with gravel, 6 inches thick							
158	0	0	run.	Turf margin to ditto, 1 foot 6 inches wide							
867	0	0	sup.	Squared pitching in bottom of tank and on slopes, 6 inches thick							
235	0	0	cube	Coursed rubble-work in retaining walls in mortar							
693	0	0	„	Ashlar stone coping to ditto							
5	0	0	„	Coursed rubble-work in walls, self-acting valve well in mortar							
0	29	0	„	Ashlar stone coping to ditto							
221	0	0	sup.	9-inch flagging bottom of well, and at inlet pipe							
293	0	0	cube	Ashlar steps from top bank to bottom of tank, with curb on each side 6 inches x 1 foot 6 inches, and steps to self-acting valve platform							
19	0	0	„	Fir timber in framework of self-acting valve platform, including painting, 3 oils							
85	0	0	sup.	3-inch planking to ditto							
370	0	0	run.	Brick culvert for overflow, 3 feet diameter, 9-inch brickwork in mortar							
				Fixing 12-inch cleansing-cock inside tank							

TANK AT KILCRONEY (near River Dargle.)

290	3	0	run.	Fence wall in mortar, as described in specification							
				Two framed and ledged doors, 7 feet by 4 feet, with bolt and lock to each door, and hung complete, including painting, 3 oils							
4,638	0	0	cube	Excavation in tank, part to spoil, and remainder in embankments							
78	0	0	sup.	Soiling and seeding slopes of embankments							
85	0	0	„	Metalling roadway of top of bank with gravel, 6 inches thick							
233	0	0	run.	Turf margin to ditto, 1 foot 6 inches wide							
	24	No.		Cutting steps in rock, 4 feet wide, 8 inches tread, and 8 inches rise							
19	0	0	cube	Ashlar stone in steps							
20	0	0	„	Fir timber in framework of self-acting valve platform, including painting, 3 oils							
90	0	0	sup.	3-inch planking, ditto, ditto							
144	0	0	run.	Brick culvert for overflow, 3 feet diameter, 9-inch brickwork in mortar							
				Fixing 12-inch sluice-cock inside tank							

TANK AT RATHMICHAELS.

200	0	0	run.	Fence wall in mortar, as described in specification							
				Two framed and ledged doors, 7 feet by 4 feet, with bolt and lock to each door, hung complete, including painting, 3 oils							
6,783	0	0	cube	Excavation in tank, all run to spoil							
	32	No.		Cutting steps in rock, 4 feet wide, 8 inches tread, and 8 inches rise							
20	0	0	cube	Fir timber in framework of self-acting valve platform, including painting, 3 oils							
90	0	0	sup.	3-inch planking to do.							
804	0	0	run.	Brick culvert for overflow, 3 feet diameter, 9-inch brickwork in mortar							
				Fixing 12-inch sluice-cocks inside tank							
				Add to cover, and include all contingencies whatsoever							
				Amount of tender, £							

BIDEFORD WATERWORKS

SPECIFICATION

Of Works, to be observed by the Contractor in the construction of an Impounding Reservoir and Outlet Works, at Gamerton, in the parish of Bideford, for the Bideford Local Government Board.

BALDWIN LATHAM, C.E., *Consulting Engineer.*
EDWIN D. LATHAM, *Borough Engineer.*

INTERPRETATION
CLAUSE.

The term engineer in this specification shall mean the consulting engineer or the borough engineer, and the term resident engineer shall allude to any person appointed by the engineer or by the Local Government Board to superintend the execution of the works.

TOOLS, &C.

The contractor shall provide all tools, implements, tackle, &c., and all timber for shoring, that may be required to carry out the works successfully and without interruption or delay, and shall pay or provide for all carriage or cartage of materials.

CARTAGE.
MATERIALS.

The contractor shall provide all materials and labour required to carry out the works (except earthenware pipes, the cast-iron pipes, cylinders, valves, and other iron and brass work) which shall be used permanently on the works.

QUALITY OF MATERIALS.

The whole of the materials used in the works specified shall be of the best quality and description of their several sorts, and shall be applied in the most workmanlike and substantial manner, to the entire satisfaction of the engineer, or of any resident engineer that may be appointed to superintend the works.

REJECTION OF MATERIALS OR WORK.	The engineer or resident engineer shall have full power and authority to reject any materials brought upon the works which, in his or their opinion, are unsound or unfit for the works, or to cause any work which is improperly or imperfectly done, or that may have been damaged during the progress of the work to be reconstructed or replaced, at the contractor's expense; and if in any case the contractor refuse or neglect to remove any work or materials that may have been condemned by the engineer or by the resident engineer, and in case the contractor shall not proceed with diligence with his contract, to the satisfaction of the engineer, then the said engineer or resident engineer shall have full power and authority, after the lapse of two days' notice, given to the contractor or his sureties, or left at any or either of their residences, to suspend the further execution of the works by the contractor, and to take the whole or any part of the contract out of the contractor's hands, and to employ any other person or persons to perform the same or to provide proper materials. The cost of such work or materials shall be deducted from any moneys that may be or become due to the contractor or shall be paid by the contractor or his sureties.
SUSPENSION OF WORKS.	The engineer shall have full power and authority to wholly refrain from executing or temporarily suspend, the works, or part thereof, at any period; but on resuming operations, the time of such suspension shall be allowed to the contractor over and above the time specified for the completion of the works; but in case the contract is not resumed, the engineer shall value the amount of work executed or material provided and any damage the contractor may sustain from the inconvenience of the stoppage, and the award of the engineer shall be final and binding upon all the parties concerned in the contract.
CONTRACTOR TO PAY EXPENSES.	The contractor shall not execute any stonework or concrete-work during any inclement weather, and the time of such suspension shall be allowed to the contractor, but in no case shall any additional time be allowed to the contractor, unless he has the written order of the resident engineer, which must be countersigned by the engineer authorising the suspension of the works.
RESUMPTION OF WORKS.	The contractor shall not be allowed to sub-let his contract, or any part thereof, without the approval and consent of the engineer, but shall appoint competent foremen to superintend the various branches, who shall receive and act upon all orders of the engineer or his deputy.
NON-CONTINUATION OF WORKS.	This specification and the drawings referred to herein, and numbered from 1 to inclusive, shall be considered the ground and data upon which the contract is based, but any alterations in, additions to, or deductions from the works specified herein, shall not invalidate the contract, but such alterations shall be valued by the engineer (in accordance with the schedule of prices agreed upon and attached to the contract), and shall be added to or deducted from the amount of the contract, as the case may be.
INCLEMENT WEATHER.	No allowance shall be made to the contractor for any extra work, unless he can produce the written order of the engineer authorising such extra works; and in every case where such extra work would be concealed from view when complete, it shall be measured at the time of execution by the engineer or his deputy, and the contractor shall give the engineer or his deputy sufficient notice to enable him to see such works before they are concealed from view, and such work shall not be covered until the engineer or his deputy has inspected and measured them.
SUB-LETTING.	The contractor shall repair, at his own cost, any damage the works may sustain during the time they are in his hands, so that at the termination of his contract the works may be complete without any extras being chargeable to the Bideford Local Government Board.
FOREMEN OF DEPARTMENTS.	Should there be anything omitted from this specification or the drawings referred to herein which is usually considered necessary for the execution and completion of works of this class and description, the contractor shall supply or execute whatever may be wanting, and shall not obtain any advantage from such omissions.
SPECIFICATION AND DRAWINGS TO BE DATA OF CONTRACT.	The contractor shall maintain all the singular and several works in perfect repair, order, and condition for a period of six calendar months, dating from their completion, as certified by the engineer.
ALTERATIONS.	The whole of the works herein specified, together with any extra works, shall be completed within a period of five calendar months, dating from the signing of the contract; and if the contractor fail to complete the works in the specified time, he shall forfeit the penal sum of three hundred pounds (£300), and a further sum of five pounds for each and every week during which the contract shall remain incomplete after the specified time, and in addition to these penalties shall pay for the extra time of the resident engineer. Such penalties shall be deducted from any moneys that may be or become due to the contractor or his sureties, or shall be recoverable from them.
EXTRA WORK.	The contractor shall fence or otherwise protect any open cutting, dangerous place, or any deposit of earth or materials, that may endanger the public or interfere with the safety of cattle.
DAMAGE TO WORKS.	If any accident occur either to person or property in carrying into execution the provisions of this specification, the contractor shall be liable for all damages, and shall compensate the Bideford Local Government Board to the full amount of any charges or expenses they may have incurred by reason of any such accidents. Such amount shall be deducted from any moneys that may be or become due to the contractor, or shall be paid by the contractor or his sureties, or shall be recoverable from them.
OMISSIONS.	If any dispute or difference of opinion arise during the progress of the works, or afterwards, respecting the true intent and meaning of any part of this specification or the drawings referred to herein, the case shall be submitted to Mr. B. Latham, the consulting engineer, and his award shall be final and binding upon all parties concerned.
MAINTENANCE OF WORKS.	The engineer shall have full power to issue such further instructions as he may deem necessary for the guidance of the contractor and the contractor shall be bound by them.
TIME OF COMPLETION.	The contractor shall be bound by the instructions of the resident engineer, or the local surveyor in the absence of the engineer, and they, or either of them, shall have full power to dismiss from the works any of the contractor's men who, in his or their opinion, are unfit for the work, or who have conducted themselves improperly; and if the contractor fail to remove any man so dismissed, it shall be considered a breach of contract, and render the contractor and his sureties liable to the full penalties imposed in case of non-completion of the contract.
FENCING.	The contractor shall enter into a contract under seal for the due performance of his contract, and provide two sureties, who shall be bound with him in a bond of three hundred pounds (£300) for the due performance of his contract, and he shall be further bound in all the penalties imposed by the conditions of this specification, and for the satisfactory completion and maintenance of the works.
LIABILITY OF CONTRACTOR FOR ACCIDENTS.	The contractor shall receive payment of his contract in monthly instalments, on the certificate of the engineer, at the rate of eighty (80) per cent. on the value of work executed, and a further sum of 10 per cent. on the full amount of the contract at the completion of the works, as certified by the said engineer, and the balance after the expiration of six months from the date of the certificate of completion. The whole of the payments shall be subject to any charges or deduction to which the contractor may be liable.
DISPUTE.	The contractor shall not become liable to the penalty imposed by this specification for not completing the works in the specified time, provided the sole cause of delay arises from strikes among the workmen employed; but the contractor shall not obtain any relief from the penalties imposed by this specification, until the engineer has certified that the sole cause of delay is due to strikes.
FURTHER INSTRUCTIONS.	All dimensions mentioned in this specification or figured on the drawings in all cases allude to the works when completed.
POWER OF RESIDENT ENGINEER AND LOCAL SURVEYOR.	Quantities of the several works have been taken out by Messrs. Hovenden & Heath, and a copy of such quantities, schedule of prices, and of this specification will, upon application to the engineer or clerk of the Local Government Board, be furnished to any person tendering, and the contractor shall pay the usual surveyor's fees for the quantities and the cost of lithographing the quantities, schedule of prices, and the specification, out of the first instalment in payment of his contract. The quantities taken out will not be guaranteed by the Bideford Local Government Board or by the engineer, and neither the engineer nor the Board will be bound by the said quantities, except so far as relates to items specially mentioned in the quantities.
SURETIES AND CONTRACT.	The iron pipes, valves, and castings will be delivered by the manufacturer at the railway station, Bideford, or on the quay at Bideford, and the contractor shall take charge and custody of all pipes, valves, or castings delivered at the railway station or on the quay. The contractor must see that none but sound pipes are delivered, as he will be held responsible for every article after delivery; and in case any article is broken, damaged, or missing, the contractor shall be held responsible for it, and shall replace it with other pipes or goods of the same description and make, or he shall pay the full value of the article.
PAYMENT.	
STRIKES.	
DIMENSIONS.	
QUANTITIES.	
CUSTODY OF PIPES.	

TEMPORARY OFFICE.	The contractor shall supply a convenient movable wooden office for the sole use of the resident engineer, or any person appointed by the engineer or Local Government Board to watch over their interests. Such office shall have a boarded floor, and shall be provided with a desk and boards and two chairs or stools, and a stove if required, and it shall be properly ventilated. It shall not be less than 8 feet x 6 feet inside dimensions, and 7' 6" high. It shall be painted inside, and rendered as comfortable and fit for use as possible. The contractor shall cause the said office to be kept clean and in good condition during the progress of the works, and shall also provide all fuel required and cause a fire to be lighted whenever required. At the completion of the works, the building shall remain the property of the contractor.
MATERIALS BROUGHT ON TO THE WORKS.	All materials, tackle, implements, timber for shoring, tools, &c., brought by the contractor to the works shall be deemed the property of the Local Government Board for the time being, and shall not be removed during the progress of the works without the written order of the engineer; and in case of suspension of the works by the engineer for any act or default of the contractor, or of the work being taken out of the hands of the contractor, the same shall be subject to be used in and about the completion of the works.
CEMENT.	The cement used in the works shall be fresh-burnt Portland cement, and shall be capable, when mixed alone with water and seven days' immersion in water, of bearing a tensile strain of 200 lbs. to the square inch of section.
SAND.	All sand used for mixing with the cement, or in making concrete, shall be clean, sharp, silicious, free from all saline or organic matter.
CONCRETE.	All concrete specified to be used in the works—except it is otherwise specified—shall be composed of clean stones, as angular as possible, and broken so as to pass through a $1\frac{1}{2}$ " sieve, sand, and Portland cement, which shall be mixed by measure in the following proportions, viz.: one part cement, two parts sand, and four parts broken stones. For the concrete under the puddle wall, lime shall be substituted for cement.
LIME.	Local burnt lime shall be used where specified, and the lime shall be steam-slaked to powder two days before being made up into mortar, and well covered with sand, and the mortar shall be made up in an approved mortar mill and used the same day as made, and in mixing not more than two parts sand to one of lime shall be allowed.
DRAWINGS.	The reservoir to be constructed on the site shown on the plans at the Port Stream, at Gamerton, near Bideford. The whole of the works shall be executed in strict conformity with the drawings and such instructions that from time to time the engineer may deem it expedient to furnish.
PUDDLE WALL.	The excavation for the reception of the puddle wall shall at every point be carried down to solid and watertight strata.
CONCRETE UNDER PUDDLE WALL.	The floor of the trench for the puddle wall shall be covered with a layer of concrete one foot thick.
EXCAVATION.	No material shall be excavated within 100 feet of the site of the dam, except such as is taken out of the trenches for the puddle wall and culvert. The contractor shall excavate the site below the water-line in the reservoir, in order to procure materials for the construction of the dam.
SELECTION OF MATERIALS.	The materials excavated from within the reservoir shall be selected for their respective positions. The finer material shall be used next the puddle wall, and also under the pitching stone of the internal slope of the dam. The dam, when complete, shall be 12 feet wide at the top, and the outer slope shall have an inclination of two horizontal to one vertical. The inner slope of the dam shall have an inclination of three horizontal to one vertical.
OUTER SLOPE.	Under the outer slope of the dam the loose earth shall be cut out in footings, as shown on the section.
INNER SLOPE.	The earth under the inner slope of the dam shall be covered with a layer of puddled clay two feet thick.
DISPOSITION OF MATERIALS IN DAM.	The whole of the materials composing the dam shall be deposited as shown by the dotted lines on the transverse section—that is, they shall have a uniform rate of inclination towards the central puddle wall.
UNIFORMITY OF CONSTRUCTION.	The dam shall be carried in uniform layers not exceeding two feet in thickness, and one layer shall be complete before another is commenced.
PUDDLE.	The contractor shall cause each layer of earth to be well trod or rammed before the succeeding layers are commenced. The contractor shall provide sufficient puddle of good quality to be applied where shown. The puddle shall be formed of good tenacious clay, dug back, wrought, chopped up with spades, and ground in an approved pug mill.
PUDDLE WALL.	The contractor shall form a puddle wall in the centre of the dam; such wall shall be made of puddle as specified, and shall be four feet in thickness at the top, and shall incline out towards the bottom of the dam at the rate shown on the section.
INNER FACE OF DAM.	The contractor shall puddle the inner face of the dam with a layer of puddle two feet in thickness, and shall afterwards cover this puddle face with a layer of fine selected material one foot thick.
PITCHING.	The contractor shall pitch with stone from out of the reservoir the whole of the internal slope and the top of the dam; the stone used in this work shall not be less than one foot in depth, and shall be securely and well placed on the dam, no large joints under any circumstances being permitted.
CULVERT.	The trench for receiving the stone culvert shall be excavated to the depth shown on the plan; and when the stonework is completed, the trench shall be filled in with clay puddle as shown.
STONEWORK.	The contractor shall provide all stonework required for the construction of the culvert and waste weir; the stones for the culvert shall all be dressed and cut to the proper radius, and shall be set in cement; the cement used for this purpose shall be mixed with not more than two parts of sand.
OPEN CONDUIT.	The stonework of the open conduit from the waste weir shall be grouted in cement.
FOUNDATION FOR CYLINDERS.	The contractor shall form the foundation for the cast-iron well pit with well coursed masonry set in cement. The contractor shall fix the cast-iron cylinders composing the well pit, and shall also lay the two lines of iron pipes through the dam, and all pipes above the parish road at the foot of the dam. The contractor shall be careful to make all the joints of the well pit watertight. The contractor shall secure the cylinders composing the well pit to a cast-iron bed plate that will be provided. The contractor shall fix round the top of the cylindrical well the cast-iron cap, as shown in the drawings.
JOINTING PIPES.	The contractor shall joint all the pipes entirely on lead; the contractor shall fix all the outlet pipes from the cylinder well and all valves, and shall provide valve spindles of $1\frac{1}{2}$ " wrought iron for facilitating the working of the different valves; such valve spindles shall all be carried up to the top of the well pit, and shall be secured to the sides of the well with proper collars, in such a manner that no weight is thrown on to the valves.
KEYS FOR VALVES.	The contractor shall provide keys for opening and closing the valves, and shall provide and fix in the well proper footholds and hand-irons.
GIRDER BRIDGE.	The contractor shall supply two trussed timber girders to form a foot bridge from the top of the dam to the top of the well pit, the roadway of which shall be planked with $1\frac{1}{2}$ " board on $4\frac{1}{2}$ " x 3" joist: the timber used for this purpose shall all be wrought red pine, of the best quality. The contractor shall construct in the floor of this bridge a proper trap-door for the well. This bridge shall be constructed in accordance with the drawings—the contractor providing all the ironwork and bolts that may be required in its construction.
FIXING BRIDGE.	The contractor shall fix the girders, &c., forming the bridge to the well pit; one end shall be securely fixed to the well pit, the other shall bear upon a foundation made for it on the top of the dam, and the contractor shall construct this foundation in proper coursed masonry set in mortar.
FOUNDATIONS FOR BRIDGE.	The contractor shall construct a manhole or well pit in stonework or masonry at the outer end of the brick culvert running through the dam, and shall provide a proper cover for the same, and lay a drain from the same, as shown. This pit shall be sufficiently large to enable the insertion of a pipe at any time, and shall be made as shown in the detailed drawings.
MANHOLES.	The contractor, during the construction of the work, shall divert the stream running down the valley outside the reservoir, and shall keep the reservoir free from water so long as required by the engineer.
DIVERSION OF DAM-SIREAM.	

OVERFLOW WEIR.	The contractor shall construct the overflow weir of the reservoir and the conduit therefrom as shown; the drain for this conduit shall be properly pitched and afterwards grouted with lime mortar. The contractor shall provide all stonework that may be required in the construction of the weir and waste conduit.
CUT DOWN AND REMOVE ALL TREES.	The contractor shall cut down all trees, hedges, furze, or other growth, and remove the same; the contractor shall also be required to remove any peat out of the site of the reservoir that may be found. No timber shall become the property of the contractor. The contractor shall properly fence the land marked out on the plans with four-rail larch fencing, as shown in detail on the drawings, and shall supply and fix four gates and posts.
FENCE.	
DRINKING-PLACES FOR CATTLE.	The contractor shall excavate and construct four proper places in the stream above the reservoir for the supply of water to cattle. The contractor shall, if required, undertake the excavation required in making the open and covered conduits for the collection of water, and shall drive the adit at B in the plan near the site of Woodville, and convey the water from the south-west portion of the area coloured pink on the plan, which work shall be valued by the schedule attached to the contract.
ADIT.	The adit at Woodville shall be driven through the rock, stone, slate, clay, or other material, and, when finished, it shall have a clear opening of 4' 6" high, and 2' 3" wide. The contractor shall timber any unsound place in the roof or side of the adit, and shall lay on the floor of it a 15" pipe, and shall make all joints with the pipe for the purpose of admitting any water from the strata through which the adit will pass, and shall cover over the pipes when laid.
	The contractor shall, if required, drive subsiding adits or galleries out of the main adit, for the purpose of collecting or securing the water.
LAND DRAINS.	The contractor shall open the ground for the purpose of putting in any land drains for collecting water, or for forming any covered conduit; and, when the pipes are laid, the contractor shall carefully fill up the trenches, taking care not to damage the pipes, and the works executed under this portion of his contract shall be paid for as specified.
OPEN CONDUITS.	The contractor shall excavate, when required, any open conduits that may be required for the collection of water; these conduits shall not be less than thirty inches in depth, and have a minimum depth of twelve inches, with side slopes of 1½ horizontal to one vertical. The contractor shall put in any pipes or stone drains at points to form bridges, and the length of each bridge of stone drains shall be taken and valued by the schedule as covered conduit.
STONE DRAINS.	The contractor, when required, shall excavate the ground and put in rubble-stone for the purpose of forming drains for the collection of water.
NOT TO INTERFERE WITH ANY OTHER CONTRACTOR.	In carrying out this contract the contractor shall do nothing that shall interfere with or incommode the contractor who may be employed in the construction of the filter-beds and covered service reservoir, and the contractor shall not be allowed to disturb the ground near the site of the proposed filter-beds and covered service reservoir.
FIXING AIR-PUMP.	The contractor shall fix in the well pit of the reservoir a gun-metal pump, that will be provided for the purpose of exhausting the syphons or keeping the cylinders free from water; and he shall supply all the 2" lead suction pipes, and fix all the cocks that may be required for the purpose.
PAINTING.	The contractor shall paint all the iron and woodwork, three coats, in good oil colours, as will be directed, and shall cause to be painted in the interior of the wells the numbers and indexes of the various valves.
DEPTH OF EXCAVATION IN RESERVOIR.	The contractor, in excavating in the interior of the reservoir, shall not, at any point, excavate deeper than the existing surface at the foot of the interior slope of the dam.
LEVEL OF WORK AT COMPLETION.	The material forming the dam must be carried up to such a height as will leave, after subsidence, the whole of the works at the determination of the contract at the levels and of the dimensions shown on the drawings.

SPECIFICATION

Of Works, to be observed by the Contractor in the construction of Filter-beds and a covered Service Reservoir at Gamerton, near Bideford, for the Bideford Local Government Board.

BALDWIN LATHAM, C.E., *Consulting Engineer.*
E. D. LATHAM, *Borough Engineer.*

[The General Conditions are similar to those in the Specification for the Storage Reservoir, page 313.]

WATER IN WORKS.	The contractor shall keep at his own cost the whole of the excavations free from water, should there be any influx or accumulation during the progress of the works; and if any pumping is required, the contractor shall do it as part of the contract.
TURF, &C., ON SITE.	The whole of the turf and vegetable soil upon the site of the filter-beds and covered reservoir shall be removed and carefully laid aside, and shall afterwards be distributed uniformly over the ground and slopes of the works when completed; and when distributed and levelled, the contractor shall sow all the ground with good grass seed of approved mixture.
EXCAVATION AND FILLING IN.	The excavation shall be made in the present surface where required, and the ground shall afterwards be made up to the required heights and dimensions, and in the mode shown on the drawings. The material required for making up to the several works shall be taken from within the water area of the proposed impounding reservoir, but no material shall be excavated within one hundred feet of the site of the dam, nor shall any excavation be carried below the level of the existing surface at the foot of the interior slope of the reservoir. The material forming the embankment must be carried to such a height as will leave after subsidence the whole of the works as on the elevation shown on the drawings. Any clay, gravel, stone, or sand of suitable quality which may be found in any excavation may be set aside and afterwards used for the purpose of making puddle and mortar, and for the purpose of metalling the surfaces, and for the formation of the filtering strata, but all such additional materials as may be required for such purposes shall be provided by and at the expense of the contractor.
CLAY, GRAVEL, &C.	
STONE.	The stone used in the work shall all be procured within the site of the impounding reservoir, and the contractor shall get quarry and work the same, or may procure stone and dress it elsewhere, if, in the opinion of the engineer it is advisable.
WATER.	The contractor shall procure any water he requires for mortar, cement, puddle or other purposes.
LIME.	The lime to be used in the work shall be local brown lime, and when used for mortar it shall be steam slaked to powder two days before being made into mortar, and well covered with sand and mixed in an approved mortar mill, in the proportion of not more than two parts sand to one of lime.
CEMENT.	The cement used in the works shall be fresh-burnt Portland cement, and shall be capable, when mixed alone with water and after seven days' immersion in water, of bearing a tensile strain of 200 lbs. to the square inch of section.
SAND.	The sand used for mixing with the cement or in making concrete shall be clean, sharp, and silicious, free from all saline or organic matter.
CONCRETE.	The concrete specified to be used or that may hereinafter be ordered to be used in the works shall be composed of clean stones, as angular as possible, and broken so as to pass through a ½" sieve, sand, and Portland cement, which shall be mixed by measure in the following proportions, viz.: one part cement, two parts sand, and four parts broken stones.

WALKS ROUND
FILTERS.
PUDDLE.

The contractor shall form walks round the filter-beds 3 feet wide, and metalled with a layer of gravel or fine broken stone 2 inches thick.

The puddle shall be of good quality, and shall be used where shown on the drawings. All the puddle shall be formed of good tenacious clay, dug back, wrought, chopped with spades, and ground in an approved pug mill. The puddle shall be placed in position in layers not exceeding 8 inches in thickness, and shall be trodden into position, and a copious supply of water shall be used, if requisite, to ensure complete saturation of the clay, each layer of puddle being cut and thoroughly incorporated with the preceding layer.

FILTER-BEDS EX-
CAVATION, &C.
PUDDLE, &C.
COPINGS.
STEPS.
STONES ON SURFACE
OF SAND.
PERFORATED PIPES.
MUD PITS.

The filters shall be excavated and embanked as shown on the plans, and the interior slope of the filters shall afterwards be puddled and pitched with stones not less than 9 inches thick, and when the stone pitching is completed, it shall all be well grouted in lime grout. A rough stone coping about 18 inches wide and 6 inches thick shall be set round the edges of the filter-beds. The contractor shall supply and fix the stone steps leading down the slope of the filters. These steps shall each be 3 feet long. The contractor shall supply two Yorkshire or Kilrush flagstones, 3 feet by 3 feet, for fixing on the surface of the sand, to prevent it being washed by the influx of the water into the filters. The contractor shall lay the perforated pipes forming the filter tunnels, and shall lay all the iron pipes and joint them with lead, and shall fix all valves, mouth-pieces, and other works, providing all the lead for jointing.

The contractor shall construct the mud pits and valve wells, and all manholes required, as shown on the drawings. The floors of the mud pits shall be puddled in a manner similar to the filter-beds.

FILTERING STRATA.

The contractor shall supply and place in the filter-beds all the filtering strata required for the filters, which shall be composed of washed gravel and river or sea sand of the following gauges and description:—

1st. Gravel 12" thick which will pass through a 2" mesh, but not through a $1\frac{1}{4}$ ".

2nd. Gravel 4" thick which will pass through a $1\frac{1}{4}$ " mesh, but not through a $\frac{3}{4}$ ".

3rd. Gravel 4" thick which will pass through a $\frac{3}{4}$ " mesh, but not through a $\frac{3}{8}$ ".

4th. Gravel 4" thick which will pass through a $\frac{1}{4}$ " mesh.

5th. Sand 3 feet thick, well washed, and free from gravel, dirt, or weeds.

The whole of each layer or stratum shall be evenly spread and completed before the commencement of a second layer.

COVERED RESER-
VOIR.
STONWORK.
CONCRETE.
PUDDLE.

The contractor shall construct in properly coursed stonework the arched service reservoir as shown on the drawings, making all the excavation necessary and embanking where required. The concrete used in the foundations of the reservoir shall be made with cement.

The puddle shall be the same as specified for the work generally, and the stonework shall be set in mortar, with as close joints as practicable, considering the nature of the work.

FLOOR.
WALLS, &C. TO BE
CEMENTED.

The floor of the reservoir shall be pitched with stones 9" deep, which shall be grouted in cement, and on this pitched floor two courses of terra-cotta tiles, laid and bedded in cement, shall be laid. All the walls, piers, &c., in the interior of the reservoir to the height of the springing of the arches of the roof shall be cemented with Portland cement one inch in thickness.

OVERFLOW.

The contractor shall lay an overflow pipe from the reservoir, and shall lay all the cast-iron pipes required to connect the reservoir with the town water mains. The contractor shall fix all sluice valves and other things required in making the connections with the town water mains. The contractor shall make two manholes in the reservoir, and build up the side walls of these manholes to the height of the surface of the ground, and shall supply and fix on each manhole one of Burton, Sons, & Waller's chequered wrought-iron manhole covers, with safety gratings. The contractor shall build in the wall of the reservoir under each manhole a sufficient number of proper iron footholds and hand-irons. The contractor shall fix all covers for sluices and valves, and shall provide blocks of elm for fitting the covers of the sluice valves, and shall supply and fix $1\frac{1}{2}$ " wrought-iron spindles for all valves that require them, and proper keys for opening or closing the valves.

SLUICE VALVES, &C.
MANHOLES.

The contractor shall lay an overflow pipe from the reservoir, and shall lay all the cast-iron pipes required to connect the reservoir with the town water mains. The contractor shall fix all sluice valves and other things required in making the connections with the town water mains. The contractor shall make two manholes in the reservoir, and build up the side walls of these manholes to the height of the surface of the ground, and shall supply and fix on each manhole one of Burton, Sons, & Waller's chequered wrought-iron manhole covers, with safety gratings. The contractor shall build in the wall of the reservoir under each manhole a sufficient number of proper iron footholds and hand-irons. The contractor shall fix all covers for sluices and valves, and shall provide blocks of elm for fitting the covers of the sluice valves, and shall supply and fix $1\frac{1}{2}$ " wrought-iron spindles for all valves that require them, and proper keys for opening or closing the valves.

FOOTHOLDS.
COVERS FOR VALVES.
SPINDLES AND KEYS.

In constructing the arched reservoir, the arches of which shall be turned on proper centres, care shall be taken that there are always in use a sufficient number of centres to sustain the weight from side to side of the reservoir.

CENTERING.

The contractor shall make the openings in the roof of the arched reservoir, and shall lay the pipes in the slopes of the filters, and supply and fit up to all these openings or pipes proper ventilating trunks, made of oak or elm, which shall be made as shown on the drawings, and shall afterwards be painted with three coats, in good oil colour.

VENTILATORS.

The contractor shall fix round the circular mud pits rough curbs, circular or plain, and similar to the curb set round the filter-beds. The contractor shall also pitch round the manhole covers of the covered reservoir, for a distance of 2 feet all round, with stone 6" deep and 3" thick.

CURBS TO MUD
PITS.
PITCHING ROUND
MANHOLE OF RE-
SERVOIR.

SPECIFICATION

Of Works, required to be observed by the Contractor in the manufacture and supply of Cast-iron Socket Pipes, and their appendages, to be used in the Bideford Waterworks, for the Bideford Local Government Board.

BALDWIN LATHAM, C.E., *Consulting Engineer.*
E. D. LATHAM, *Borough Engineer.*

INTERPRETATION
CLAUSE.

The term engineer in this specification shall mean the consulting engineer or the borough engineer, and the term resident engineer shall allude to any person appointed by the engineer or by the Local Government Board to superintend the execution of the works.

DRAWINGS AND
INSTRUCTIONS.

The whole of the pipes shall be made in accordance with the drawings and such further instructions as the engineer may deem advisable.

EXTRA WORKS.

No claim for extra works will be allowed, unless such works have been expressly ordered by the engineer in writing.

DECISION OF
ENGINEER IS FINAL.
CARTAGE.

In case of dispute as to the true intent and meaning of any part of this specification, or of the drawings referred to herein, the matter shall be submitted to the engineer, and his opinion shall be final and binding on all parties concerned.

The contractor to pay or provide for the carriage of all pipes, &c., to Bideford, and shall pay all tolls, dues, and fees that shall be charged on the same.

DISCHARGE OF
CONTRACTOR.

The engineer shall have full power at any time to discharge the contractor from the performance of his contract, provided the workmanship or material is not satisfactory to him.

NEGLECT OR
REFUSAL OF CON-
TRACTOR.

In the event of the contractor refusing or neglecting to supply proper material and work after notice from the engineer, the engineer shall have full power to employ any other person to supply such material or work, and the cost of such material or work, if sufficient money does not remain in hand to pay the same, shall be paid for by the contractor, or his sureties, or may be deducted from any money that may be or become due to the contractor.

GUARANTEE OF
PIPES.
DEFECTIVE PIPES.

The contractor shall guarantee all pipes; and if any pipes, through any defect, burst or become fractured in the work within six months after being laid, the contractor shall supply other pipes in the place of the defective pipes, free of charge, and shall also pay the Local Government Board the cost of laying the same.

TESTING.	All pipes shall be tested in a proper machine before leaving the contractor's works to the various pressures, as set forth in the schedule of particulars.
SPECIAL PIPES.	All branches, bends, and other special pipes and castings, shall be made in accordance with the instructions and drawings hereafter to be furnished by the engineer.
MODE OF CASTING.	Pipes of three inches diameter and under may be cast horizontally, but all pipes of greater diameter shall be cast vertically, with the socket end downwards, and without the use of core nails.
QUALITY OF METAL.	The metal to be used shall be free from cinder or other inferior iron, and shall be strong, tough, and close-grained, and the pipes when cast shall be free from scoria, air-holes, or other imperfections of casting.
PIPES TO BE CYLINDRICAL.	All pipes shall be truly cylindrical, and the spigot end of every pipe shall fit into the socket, leaving only the thickness of joint specified, which thickness of joint is the maximum size. The spigot end of each pipe shall be furnished with a projecting fillet, which shall fit into the socket, leaving not more than one-sixteenth of an inch clearance all round the pipe. All special pipes shall be truly shaped, and care shall be exercised to see that they joint properly with the straight pipes. The sectional area of every pipe shall be truly concentric, and any pipe in which the thickness of metal varies in any one place more than a fourth of the specified thickness shall be rejected.
BELTS, &C.	All pipes under 4" diameter laid in the town shall be supplied with a sufficient number of belts; the pipes cast vertically shall have blocks cast on the sockets, in order that they may be tapped without weakening the pipes.
WEIGHT.	All pipes shall be as nearly as possible of the weight set forth in the schedule of particulars, and any pipe deviating more than the specified number of pounds from the prescribed weight shall be rejected.
INSPECTION.	The engineer or the Local Government Board shall, if they think it expedient, send a man, or men, or may go themselves, at any time to inspect the manufacture or testing of the pipes, and the contractor shall afford them every facility, in order to enable them to carry out their inspection satisfactorily.
CLEANING OF PIPES COATING PIPES.	The whole of the pipes shall be well cleansed before leaving the contractor's works, and shall be coated when hot with Dr. Angus Smith's composition.
DELIVERY.	The whole of the pipes shall be delivered at Bideford within three months of the contractor receiving the order or signing the contract.
DISTINCTIVE MARKS OF PIPES.	The contractor shall deliver and unload, free of cost, the whole of the pipes at Bideford railway station, or on the quay at Bideford. Pipes of the same size and of different thicknesses shall be lettered A, B, C, as the case may be. The letter A shall only be applied to the thickest pipes, the letter B to the pipes of medium thickness, and the letter C to the thinnest pipes.
PAYMENT.	The contractor shall receive payment of his contract at the rate of 80 per cent. on all goods delivered, and a further sum at the rate of 50 per cent. on the balance at the completion of the works; but the final balance shall not be paid until six months after the completion of the works, as certified by the engineer, and all payments shall be subject to any deductions or charges that may have been incurred by the Local Government Board.

SCHEDULE OF PARTICULARS.

	Diameter of Pipes	Thickness of Metal	Length of Pipe in work	Depth of Socket	Thickness of Joint	Weight of Pipe	Deviation allowed	Test in ft. of Water
	inches	inch	feet	inches	inch	lbs.		
Bands on pipes, two belts on each pipe, 2½" wide	1½	1/4	6	2½	3/16	42	1½	600
Three belts in each, 3" wide	2	1/4	6	2½	3/16	56	2	600
	3	1/4	9	2½	3/16 full	84	3	600
	4	5/16	9	2½	3/16 full	135	4	600
	5	3/8	9	2½	3/16 full	201	5	600
	6	7/16	9	2½	3/16 full	248	6	600
	7	7/16	9	2½	1/4	319	7	600
	C8	3/8	9	2½	1/4	312	8	300
Three belts on each pipe, 3" wide	B8	7/16	9	2½	1/4	366	9	400
	A8	1/2	9	3	1/4	416	10	600
	10	1/2	9	3	1/4	505	12	500

FORM OF TENDER.	The contractor shall state the sum he will undertake to supply all the pipes in accordance with the several quantities that have been taken out; he is also to state the price per lineal yard of each size and description of pipe, and the price per ton for special castings, such as branches, bends, &c. No bend or junction pipe shall exceed in weight the specified weight of a straight pipe of the like dimensions.
JUNCTION PIPES, &C.	
POWER TO TEST.	The Bideford Local Government Board and their engineers reserve to themselves the power of testing any pipes that may be brought on to the works, and if any pipes are found defective, it shall be at the option of the Local Government Board or the engineer to reject the whole of the pipes furnished by the contractor.
SURETIES.	The contractor shall provide two sureties, who shall be bound with him for the due performance of his contract.
CASTINGS FOR WELL.	The contractor shall supply the casting for the cast-iron well, to be used at Gamerton Store Reservoir. The cylinders composing this well will be 4 feet internal diameter, and 1 inch thickness of metal, and weighing 14 cwt. 1 qr. 17 lbs. per yard. The contractor shall supply all the special pipes and other castings required in connection with this well, &c., at the reservoir.
TEST OF CYLINDERS.	The castings for the cylinders for the well shall be subject to the same regulations as for ordinary pipes, but they shall not be tested with a pressure above 100 feet head of water.
TIME FOR DELIVERY.	The contractor shall supply all the pipes and castings under the provisions of this contract within three months of signing the contract, but the cylinder for the well he shall supply within one month of receiving the order, and in case of failure he shall forfeit the penal sum of five hundred pounds.
CHAMBER TO WELL.	The contractor shall take special care that the chamber at the bottom of the 4-feet cylinders for the well at the is a perfectly sound casting, and the contractor shall form this chamber as shown on the drawings, providing all the necessary apertures for the pipes, &c., as may be required. The chamber shall be 1½" thick of metal.
OPENINGS IN CYLINDERS.	The contractor shall leave openings in the cylinders for the well, in order that the inlet pipes and valves may be made to discharge the water of the reservoir in the interior of the cylinders.
CAP TO CYLINDER. BED PLATE.	The contractor shall supply and fit the cast-iron cap required for the upper cylinder of the well, and shall supply a cast-iron bed plate, 6 feet 6 inches square, and 2 inches thick, to form the foundation plate and floor of the cylinder well.
DRILL ALL HOLES. SUPPLY ALL NUTS, SCREWS, &C.	The contractor shall drill all holes in the bed plate and in the flanges of the cylinders that may be required, and shall supply all the bolts, nuts, and screws that may be required in fixing the cylinders, and in securing them to the cast-iron bed plate.
QUANTITIES. LITHOGRAPHY. PAYMENTS BY INSTALMENTS.	The contractor shall pay Messrs. Hovenden & Heath their usual fee for taking out the quantities, and the contractor shall pay for the lithography, the quantities, schedule of prices, form of tender, and this specification. Such payments shall all be made out of the first instalment in payment of the contract. Any excess or diminution in the quantities beyond the quantity quoted shall be paid for or shall be deducted from the amount of the contract, as the case may be.

SPECIFICATION

To be observed by the Contractor in the manufacture and delivery, at Bideford, of glazed and unglazed Socket Pipes and Drainage Tiles required by the Local Government Board for use upon their Waterworks.

BALDWIN LATHAM, C.E., *Consulting Engineer.*
E. D. LATHAM, *Borough Engineer.*

INTERPRETATION CLAUSE.	The term engineer in this specification shall mean the consulting engineer or the borough engineer, and the term resident engineer shall allude to any person appointed by the engineer or by the Local Government Board to superintend the execution of the works.
PLACE OF DELIVERY.	The contractor shall deliver all the pipes at a dépôt, near the site of the Store Reservoir, at Gamerton, within a distance of two miles from the Bideford railway station.
PAYMENT.	The contractor shall receive payment at the rate of his schedule of prices for such pipes only as are delivered over to the Local Government Board, or to the contractor for constructing the drains, sound and in perfect condition.
LOCALITY OF MANUFACTORY.	The contractor shall state distinctly in his tender the name and locality of the place at which the pipes are to be manufactured, or in case the pipes are not manufactured at the place at which the material is procured, he shall also state the name of locality from which the material used in the manufacture is procured.
THICKNESS.	All glazed pipes to be supplied shall either be made of fire-clay or stoneware; and in case the pipes are made of fire-clay, they shall have the following thickness of material when burnt and delivered on the works :—

Size of Pipes	Thickness of Material
3"	3/8"
4"	1/2"
6"	3/4"
9"	4/5"
10"	1"
12"	1 1/10"
15"	1 1/8"
18"	1 1/2"

If the glazed pipes are of stoneware, they shall have the following thickness when burnt :—

Size of Pipes	Thickness of Material
3"	3/8"
4"	1/2"
6"	5/8"
9"	3/4"
10"	7/8"
12"	1"
15"	1 1/8"
18"	1 1/4"

DISPUTES.	The engineer shall decide in case of dispute as to whether pipes are to be classed as fire-clay or stoneware. Unglazed sockets or butt joint pipes made from local or other clays shall have the following thickness :—
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Size of Pipes	Thickness of Material
2"	5/16"
3"	3/8"
4"	1/2"
6"	3/4"
9"	7/8"
12"	1"
15"	1 1/4"

MODE OF MANU- FACTURE.	All pipes supplied by the contractor shall be moulded under pressure, and the socket of every pipe shall be pressed on or formed with the body of the pipe, and care shall be taken that the sockets are truly concentric with the pipes.
GLAZING.	The pipes shall be well glazed all over, and the contractor shall state in his tender if the pipes are intended to be glazed with glass or salt glare; all pipes not well or uniformly glazed will be rejected, and all pipes not perfectly burnt will be rejected.
FIRE-CRACKS.	All pipes having any fire-cracks which the engineer may consider injurious shall be condemned, and their places supplied by other pipes.
FLAWS.	The whole of the pipes shall be free from flaws of any description and shall be truly made, and any pipe delivered by the contractor which is not of true shape and section shall be rejected.
PIPES TO BE PER- FECTLY STRAIGHT.	All pipes must be perfectly straight in the direction of their length, and the spigot ends of all pipes, bends, junctions, syphons, or other traps, must fit the socket end of all the pipes of their respective sizes perfectly and truly.
	All junctions, bends, syphons, or other special pipes, shall be of the same thickness of material at every part of their section as is required for straight pipes of the same diameter, and every junction, bend, or other special pipe not of the proper or uniform thickness shall be rejected.

The sockets of all pipes shall be of the following depths :—

Size of Pipe	Depth of Socket
3"	1 1/2"
4"	1 3/4"
6"	2"
9"	2 1/4"
10"	2 1/2"
12"	2 3/8"
15"	2 1/2"
18"	2 3/8"

MODE OF FORMING JUNCTIONS, &c.	All junctions and bends shall be formed in the following manner :—The centre from which a branch on a main is struck must be upon a line at right angles to the centre line of the main pipe, the inside of the main pipe meeting the inside of the branch at a tangent
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on a radius line from which it is struck; the ends of all curved pipes must be in the direction of the radius of the curves with which they are described.

The contractor shall supply the 10-inch and 6-inch perforated and glazed socket pipes that will be required to be used in the filter-beds. Every pipe shall be pierced with holes $\frac{3}{8}$ of an inch diameter, and at a distance of not more than $2\frac{1}{2}$ inches apart. The straight pipes and junctions required for this purpose shall have the same thickness as specified for glazed pipes of like quality and material.

CARTAGE.

The contractor shall pay the carriage or cartage of all pipes from his works to the railway station or to the quay at Bideford, and shall unload the pipes after they have arrived at his own expense, and shall pay all dues and fees chargeable on them.

PAYMENT.

The contractor shall receive payment of his contract upon the certificate of the engineer at the rate of ninety (90) per cent. on the value of the pipes supplied, and the balance at the expiration of six months, dating from the completion of the order given by the engineer. The whole of the payments due or likely to become due to the contractor shall be subject to any deductions by reason of any expenses having been, or likely to be, incurred by the Local Government Board by reason of the non-performance of the contract on the part of the contractor.

REJECTED PIPES.

Any pipes that may be rejected by the engineer shall be at once removed by the contractor and other pipes of approved quality supplied in their place, and if the contractor refuses or neglects to remove any imperfect or damaged pipes within three days after notice in writing to that effect left at the last residence of the contractor, the engineer may cause the same to be removed, and other pipes of approved quality supplied in their place, and the cost of such removal or other expenses incurred in the purchase of pipes of approved quality shall be paid by the contractor or his sureties.

ENGINEER'S POWER.

The engineer shall have full power in all matters relating to the contract, and any dispute as to the true intent and meaning of any part of this specification shall be settled by the engineer, without the intervention of any other person.

TIME OF DELIVERY.

The contractor shall deliver the whole of the pipes required within three months of receiving the order. The contractor shall commence to deliver the larger sized socket pipes required, and so on, in the order they may be required by the contractor for the construction of the drains, and if at any time the contractor for the construction of the drains is, in the estimation of the engineer, delayed by the non-delivery of the pipes required, then the contractor for the manufacture and delivery of the pipes shall compensate the contractor for the construction of the sewers. But in no case shall the contractor for the manufacture of the pipes be liable to pay the contractor for the construction of the sewers, unless the contractor for the construction of the sewers has given the contractor for the manufacture of the pipes timely warning of his requirements, but in no case shall the contractor for the manufacture of the pipes require a longer notice than ten days.

PENALTY.

If the contractor fail to deliver the whole of the pipes required in the specified time, he shall forfeit to the Bideford Local Government Board the penal sum of one hundred pounds (£100), which money shall be deducted from any moneys that may be or become due to the contractor, or shall be paid by the sureties.

SURETIES.

The contractor shall provide two or more sureties, who shall be bound with him for the due performance of his contract.

SAMPLE PIPES.

The contractor at the time of tendering, or before tendering, shall deposit at the office of the clerk of the Bideford Local Government Board a sample of 6", 9", 12", and 15" pipes, and the pipes delivered by the contractor under his contract shall in all respects equal the sample pipe deposited. Each pipe that may be deposited at the time of tendering shall be distinctly marked with the name and address of the person tendering, and the locality at which the pipe is manufactured, and the material procured.

CONTRACTOR TO PAY FOR LITHOGRAPHING THE QUANTITIES.

The contractor shall pay the cost of lithographing this specification, and the surveyor's charges for getting out the quantities of pipes required. These charges shall be all paid out of the first instalment due on the contract.

SPECIFICATION

Of Works required in laying and jointing the Cast-iron Water-mains, &c., in the Bideford Waterworks, for the Bideford Local Government Board.

BALDWIN LATHAM, C.E., *Consulting Engineer.*
E. D. LATHAM, *Borough Engineer.*

INTERPRETATION
CLAUSE.

The term engineer in this specification shall mean the consulting engineer or the borough engineer, and the term resident engineer shall allude to any person appointed by the engineer or by the Local Government Board to superintend the execution of the works.

TOOLS, &c.

The contractor shall provide all tools and implements required.

DELIVERY OF PIPES.

The various sized pipes, valves, and other articles shall be delivered to the contractor at the Bideford railway station or on the quay at Bideford.

CONTRACTOR TO BE
ANSWERABLE FOR
PIPES DELIVERED.

The contractor shall cart all the pipes and other articles to their respective positions. The contractor shall be answerable for the safe custody of all pipes, bends, special castings, valves, fire-cocks, &c., after delivery; and in the event of any such material being damaged while in his possession, he shall make good the defects or supply other goods in the place of those damaged; and in case any pipes are wilfully or accidentally broken in laying or jointing, the contractor shall make good the same.

JOINTING OF PIPES.

The contractor shall provide all lead for jointing pipes that may be required. The whole of the pipes shall be jointed in lead alone, that is to say, cold rings of drawn lead shall be first driven in the socket of every pipe until it is half filled, then melted lead shall be run in, and the whole shall be caulked up, and every joint after it is caulked shall be full of lead, and any joint not so full shall be melted out and remade.

FIXING ZINC PLUGS,
&c.

The contractor shall exercise great care in joining the pipes that no lead gets into the interior of the pipe. The contractor shall fix all fire-plugs and their covers and cases, all sluice-valves and their covers and cases, all air-valves, flushing-cocks, and index plates, &c. The covers of all valves shall be set in sufficient brickwork to ensure a good foundation. The covers of all valves shall not, in any case, take a bearing on the water-mains. The contractor shall supply the wood block required for the sluice valve covers, and the wood used for the purpose shall be elm. The contractor shall fix all air-valves that may be directed, in the same way as specified for other valves. The contractor shall excavate the trenches for all pipes, and the several fire-cocks and valves, to the following depths:—

Size of Main	Depth
2"	2' 6"
3"	2' 6"
4"	2' 6"
5"	2' 9"
6"	2' 9"
7"	3' 0"
8"	3' 0"

SURFACE MATERIAL.

The contractor shall carefully preserve the surface material taken from all trenches, and when the trenches are refilled, this material shall be placed on the top of the trench. The contractor shall refill all trenches, and shall well ram the same so that they are filled up solid;

and in the case of roads or streets the surface material shall be sifted, so that nothing but good road material is put into the trench within one foot of the surface.

MAINTENANCE OF WORKS.	The contractor shall maintain all the trenches he may have excavated in a state of perfect repair for a period of six months after the completion of the works, and any trench that is at any time in an imperfect state may be repaired by the surveyor of roads of the district, and the cost thereof shall be paid by the contractor or his sureties, or may be deducted from any moneys that may be or become due to him. The contractor shall properly guard, fence, watch, and light any of the holes that may be dangerous to the public, the contractor shall be answerable for any damage that may arise either to person or property by reason of the carrying out of these works, except compensation for the right to enter private gardens, and the contractor shall pay the Local Government Board for any cost or damage to which they may have become liable by reason of the neglect of the contractor or his servants.
WATCHING, &c.	
SURETIES.	The contractor shall provide two responsible sureties, who shall be bound with him for the due performance of his contract.
PAYMENT.	The contractor shall receive payment of his contract in monthly instalments, upon the certificate of the engineer, at the rate of eighty (80) per cent. on the value of the works executed, and the remaining portion after the lapse of six months, dating from the completion of the works. The whole of the payments shall be subject to such deductions and damages that the contractor or his sureties are liable to pay; any dispute arising out of the contract shall be settled by the engineer, without the interference of any other person, and the engineer's decision on every matter connected with the contract shall be final and binding on all parties concerned.
DEDUCTIONS.	The contractor shall complete the whole of the works of this contract within six months of signing the contract, under the penalty, in case of failure, of forfeiting the penal sum of five hundred pounds (£500).
COMPLETION. PENALTY.	The contractor shall pay Messrs. Hovenden & Heath their usual fee for taking out the quantities, and the contractor shall pay for the lithographing of the quantities, schedule of prices, form of tender, and specification; such payments shall all be made out of the first instalment in payment of the contract. Any excess of work or diminution from the amount stated in the quantities shall be paid for or be deducted from the amount of the contract, as the case may be.
QUANTITIES, &c. CONTRACTOR TO MAKE PAYMENTS.	

SPECIFICATION

To be observed in the manufacture and delivery at Bideford of Sluice-valves, Hydrants, Covers, Cups, &c., to be used in the Bideford Waterworks, for the Bideford Local Government Board.

BALDWIN LATHAM, C.E., *Consulting Engineer.*
E. D. LATHAM, *Borough Engineer.*

INTERPRETATION CLAUSE.	The term engineer in this specification shall mean the consulting engineer or the borough engineer, and the term resident engineer shall allude to any person appointed by the engineer or by the Local Government Board to superintend the execution of the works.
DEPOSIT SAMPLE.	All persons who shall tender for the supply of any material required in the performance of this contract shall furnish, when required, a sample of the goods for which he or they tender, and every article not in accordance with this specification, or equal to the sample deposited, shall be rejected.
DELIVERY OF GOODS.	The contractor shall deliver all goods, carriage free, at the Bideford railway station or on the quay at Bideford, and shall unload the same and pay all dues, tolls, and fees that may be chargeable on the same.
SLUICE-VALVES.	All sluice-valves of every description used shall be on the high-pressure principle, and shall have solid gun-metal spindles, and shall have double-scraped faces of gun-metal, and shall be made in accordance with the drawings.
HYDRANTS.	All hydrants or fire-cocks shall be on the high-pressure principle, and constructed in accordance with the drawings.
BALL-VALVE.	The contractor shall supply the extra ball-valve for the fire-cocks for each fire-valve he may deliver.
BENDS.	The contractor shall supply all the bends that may be required for each hydrant for connecting it with a straight pipe.
	The contractor shall supply all the 10-inch sluice-valves for the interior of the well at the reservoir; all those valves shall be specially made for their respective positions, and those that are to be fixed in the sides of the cylinders shall have properly curved flanges at one end, and a bell-mouth opening at the other. The contractor shall take care that the bolt-holes in these curved flanges correspond with the bolt-holes made in the curved flange pipes that will meet the valve on the outside of the cylinder.
	The contractor shall supply a 2-inch gun-metal cock, to be fixed in the bottom of the well for the purpose of draining it at any time that may be required.
	The contractor shall supply, ready for fixing, a gun-metal air-pump, 3½-inch in cylinder and 12-inch stroke, for the purpose of exhausting the syphons of air.
	The contractor shall supply all the levers, rods, spindles, cranks, stays, and supports requisite for the fixing and efficient working of this air-pump.
TESTING.	The contractor shall supply two ground gun-metal plug-valves for fixing in the suction-pipes of the air-pump before mentioned.
AIR-VALVES.	Every fire-cock or hydrant and sluice-valve shall be tested to a pressure equal to 600 feet head of water, and no article shall be used unless the contractor guarantees that it has been tested.
CASES AND COVERS.	The contractor shall supply three air-valves, as shown in the drawings, and which are to be fixed on the 8-inch delivery main.
INDEX PLATES.	The contractor shall supply all cases, covers, and braces that may be required for every sluice-valve, fire-plug, or other valves, and such cases and covers shall be made as directed by the engineer, and shall have the letters B. W. W. cast on the same; all loose covers shall be provided with fastenings or chains, and on the covers of the fire-cocks the date shall be cast. The contractor shall supply a number of index plates for fixing to a wall or building, in order to indicate the place of every fire-cock or valve, and the letters V or F. P. and Ft. in. shall be cast on the same. The plates shall all be painted white, and the letters shall be painted black.
POWER OF ENGINEER.	The engineer shall have power to reject any material that he may think unfit or unsuited for the work, and the contractor shall supply other of approved quality.
REFUSAL OR DELAY.	In case the contractor refuse or delay to supply proper articles or materials after being requested by the engineer, then the engineer shall have power to order them from any other maker, and any extra charge incurred shall be paid by the contractor.
STAND-PIPES.	The contractor shall supply two double-headed strong copper stand-pipes, with threads for the screws of the London Fire Brigade pattern.

DUNDEE WATERWORKS.

SPECIFICATION

Of the work to be done in forming a Store and Compensation Reservoir in Crombie Den, for the Dundee Water Company.

DESCRIPTION OF WORK.	The work to be included in the proposed contract consists of forming an embankment across and along the south-west side of Crombie Den, up to a little above the present Sluice Keeper's house, with an arched culvert, sluice shaft, and open channel for the outlet—a waste weir, and its channel—taking down and rebuilding of water-tight masonry, that portion of the present Crombie Aqueduct which will be under the new embankment, and building a sluice shaft there—forming a road from the public road near Crombie Mill to meet the embankment, and extending along the outside of the embankment as far as the intended Sluice Keeper's house, all as shown in the drawings Nos. 1, 2, 3, 4, 5, and 6.
STRIPPING.	The whole area of the reservoir that is to be covered with water is to be stripped of all turf and other vegetable matter to the average depth of 2 inches. The trees requiring to be rooted out will be the property of the contractor. The area to be covered by the embankment is to be stripped of all turf, moss, or loamy soil, so that the embankment shall rest on the solid. The average depth of the excavation may be assumed to be, and it is scheduled at, 18 inches; should it turn out to be more or less, an addition or deduction will be made accordingly.
DISPOSAL OF STRIPPING.	The stuff from the stripping may be used so far as required in soiling and turfing the slopes and top of the embankment, and in filling up excavations for stuff outside of the reservoir. The remainder must be deposited in heaps somewhere near the reservoir, or spread on the adjoining ground, as shall be directed, within one hundred yards of the reservoir or of its embankments.
LEVEL AND DIMENSIONS OF EMBANKMENT.	The finished top of the embankment is to be 25 feet above the level of the crest of the intake-weir to the present Crombie Aqueduct, and the crest of the waste-weir is to be 5 feet below the top of the bank. The top of the embankment is to be 10 feet broad, the inside slope is to be 3 horizontal to 1 perpendicular, and the outside slope $2\frac{1}{2}$ horizontal to 1 perpendicular. Those dimensions apply to the finished surfaces, including soiling and pitching.
MODE OF FORMING EMBANKMENT.	The embankment, with the exception of the puddle hereinafter described, is to be formed in regular layers not exceeding 6 inches in thickness when spread out, and sloping down to the centre from the sides at the rate of 1 in 12. It is to be formed of the best materials that can be got within the area of the reservoir, and from the excavation of the waste-weir and outlet channel, cutting the slopes not steeper than 4 horizontal to 1 perpendicular, and leaving a bench of not less than 50 feet between the top of the cutting and the main embankment, and not less than 12 feet between it and the foot of the side embankment. The most clayey and earthy portion that can be got is to be used for the heart of the embankment, but more especially for the inner side, or that between the puddle wall and the water. The most stony or gravelly portion is to be used for forming the slopes, but more especially for the portion of the embankment outside of the puddle wall. Every layer is to be pressed or trodden down by having carts or barrows to pass over it, without rails or planks, which are not allowed to be used; and if necessary to give it solidity, there is also to be a heavy roller passed repeatedly over each layer, or it must be well pounded down by beaters. In dry weather the stuff is to be thoroughly moistened by having water poured over it. In any case when a layer of stones may be laid on the embankment, each stone is to be laid on its flattest bed, the most rounded side or pointed end being placed uppermost, no stone being placed closer to another than 4 inches. The next layer must consist of such material as will blind and entirely fill up the crevices, and the whole must be made a compact mass, so as not to be liable to subsidence.
PUDDLE TRENCH.	In the centre of the embankment there is to be a trench for receiving a puddle wall, excavated to such a depth as may be necessary to get to a good foundation, and one foot farther into solid and water-tight material.
PUDDLE WALL.	There is to be a puddle wall formed of good clay from the bottom of the trench up to within one foot of the top of the embankment. It is to be eight feet wide at the top, and is to batter one-eighth of the height on each side down to the base of the embankment, and it is to diminish in the trench from the width of the stripped surface to one-half of that width at the bottom. The length and depth of the puddle trench will vary according to the nature of the ground, and as shall be directed, but they may be assumed to be of the extent shown on the plans and sections, and as scheduled. Any alterations in those dimensions will be paid for or deducted, as it may increase or diminish the quantity, at scheduled prices, viz., for excavating the trench in earth, clay, or gravel—for excavating it in rock—for clay puddle—and for refilling any portion of the trench which may be ordered to be filled up with ordinary banking; but no extra digging or refilling will be allowed for any part of the trench which, from carelessness or otherwise without good reason, may be made unnecessarily wide. For any depth of the trench below the lowest point shown on the sections, an extra rate will be allowed, and must be stated in the schedule, for excavating and pumping only, increasing for each additional yard in depth, the excavation and pumping of each yard of such additional depth being reckoned at its own respective price.
CLAY.	The puddle is all to be formed of the most tenacious and retentive clay that can be found within the area of the reservoir, or elsewhere in its vicinity; but if the contractor take it from anywhere else than from the Company's ground, he must level, slope, re-soil, and dress off the excavation, and otherwise satisfy the claims of the proprietor and tenant from whose ground the clay may be taken, unless it can be shown that it cannot be procured of suitable quality or sufficient quantity there, or orders be given him to take it elsewhere. If there be not clay enough on the Company's ground, or if the engineer should order the contractor to procure it elsewhere, the obligation as to sloping, re-soiling, and dressing will still remain on the contractor, but the Company will pay for the privilege of taking the clay, and for surface damage. The clay for puddle is to have all stones weighing more than half a pound picked out of it, and it is to be properly cut, wetted, soured, and worked up before being put into the trench or embankment.
PITCHING SLOPE OF EMBANKMENTS.	The puddle is to be formed in layers of 3 inches thick, and each layer is to be hard pounded by beaters so as to be solid, of uniform consistency and perfectly watertight, and it is to be kept on a level always 6 inches higher than an adjoining portion of the embankment. The surface of the puddle when dry must be properly watered before another layer is put on. After the embankments have been all formed, and have had time to consolidate thoroughly, so that there may be no further subsidence, the inner or water face is to be covered with a layer of stones 6 inches deep, broken so as to weigh not above half a pound, and well blinded with quarry chippings or gravel, and over that to the distance of 85 feet down the slope of the main embankment, and down to the foot of the side embankments, there is to be a pitching of hammer-dressed rubble stones, solidly set by hand on edge, without pinnings on the face, 7 inches deep at the bottom, increasing to 10 inches at the water-line, and again diminishing to 8 inches at the top of the bank, and then all well blinded with gravel. The bottom and sides of the channel leading to the recess for the sluice-shaft are to have 8-inch pitching. The bottom surface of the pitching stones is to be not less than two-thirds of the upper surface, and the beds and joints are to be squared for 3 inches from the face; all the inner face of the main embankment below the line 85 feet from the top, is to have rough undressed pitching set by hand 7 inches deep. Pitching, dressed or undressed, as may be directed, is to be carried up the natural banks of the reservoir adjoining the embankment, if required, at scheduled rates, but that is not included in the lump tender. Specimens will be shown of the pitching required for the face of the embankments.

FILLING SLOPES.

The outer face and the top of the embankments are to be covered by a layer, 3 inches thick, of broken stones, not exceeding half a pound each, and then covered with soil or turf to the depth of 9 inches over these broken stones, and all neatly dressed off, and made perfectly straight, and sown with clover and rye-grass seeds. The slopes of the weir and outlet channels above the pitching, which are to be $1\frac{1}{2}$ horizontal to 1 perpendicular, are to be similarly soiled, dressed, and sown.

OUTLET CULVERT.

There is to be a trench formed for the outlet culvert, in the solid ground, and an arched culvert of ashlar masonry built in it as shown, 256 feet in length, 2 feet 6 inches in width, and 4 feet in height in the clear. The foundation course is to be 9 feet in breadth, of hammer-dressed stones 9 inches deep, and well bonded. The invert is to be 13 inches deep in the centre, of stones radiated in the joints; side walls, as shown, of ashlar, well bonded by one header through the wall to every two stretchers, averaging together 15 inches in the beds, and having good flat-bedded hammer-dressed backing, with a radiated semicircular arch 15 inches deep, all flush in mortar, and lipped and pointed without. Over this arch there is to be another arch of hammer-dressed rubble 9 inches deep, well grouted, and the whole of the culvert inside of the puddle wall is to be covered with a thickness of 3 feet of good well-pounded clay, worked as the other puddle, and formed in layers of 3 inches. Where the culvert crosses the puddle trench there are to be side walls brought up from the bottom.

OPEN CHANNEL.

At the outer end of the culvert there is to be an open channel, the walls of which are to be founded on hammer-dressed through stones, 9 inches thick, and built of good square scabbled ashlar, header and stretcher averaging 15 inches on the beds, and chisel-draughted, lipped, and pointed with cement, and backing of good flat-bedded rubble, and are to have a droved coping 2 feet broad, 15 inches thick, with a whinstone dowel $3 \times 3 \times 4$ inches sunk into each joint. The floor is to be paved with stones 9 inches deep, hammer-dressed as before described for the upper portion of the culvert, set on a bed of broken stones 3 inches thick, and thoroughly grouted with mortar.

SLUICE SHAFT.

At the inner end of the culvert there is to be a sluice shaft, as shown, 6 feet square inside, and 59 feet 6 inches in height from the floor to the top of the pavement coping. It is to be founded on a course of hammer-dressed stones 15×11 feet, and 16 inches deep, set on edge and well bonded. Over this course there is to be a hewn pavement floor 10 feet $\times$ 6 feet 6 inches, and 6 inches thick, of stones 6 feet 6 inches long the one way, and not less than 2 feet broad the other, and joggled in the joints, and lipped and pointed with cement. All the inside of this shaft, as far up as the level of the embankment is to be ashlar, consisting of headers and stretchers averaging 15 inches in the beds, and backed with good hammer-dressed rubble, but the part above the embankment is to be all of parapet ashlar 18 inches in the beds. The whole of the ashlar of the shaft is to have a chamfered groove $1\frac{1}{4}$ inch square in both beds and joints 9 inches from the outer face, and grouted full of mortar. It is to be all chisel-draughted on the arrises, fair scabbled on the beds and joints and in the inside face, and hammer-knigded or pick-dabbed outside. There are to be two arches formed in the shaft, of the same section as the outlet culvert, and left open until the embankment is completed, after which they are to be closely built up with ashlar, an opening being left in the one for the sluice, and the outlet pipe being built into the other, both being made thoroughly water-tight. There are to be four whinstone dowels $3 \times 3 \times 4$ inches in each course of the ashlar of the shaft above the surface of the embankment, half sunk into the upper and lower beds of the stones, and there are to be four scrap-iron bars $1\frac{1}{2}$ inch square, welded together to form a square of 7 feet 6 inches, with the corners rounded off, placed as shall be directed, and each half sunk into the upper and lower beds of two entire courses of the shaft, and grouted in with cement. The shaft is to be covered by three stones 9 feet 3×2 feet 6 inches each, and 6 inches thick, and by two smaller stones respectively 3 feet 9 and 3 feet long, and 1 foot 9 inches broad, and 6 inches thick, to form a hatchway, which is to be provided with a hinged-wrought iron hatch, as shown, $\frac{3}{4}$ inch thick, and lock and key. Besides the dimensions here given, the stones are to be large enough to be joggle-jointed; they are all to be scabbled on the lower beds and joints, and droved on the upper surface and outsides; and there are to be ten wrought-iron cramps $1\frac{1}{2} \times \frac{5}{8}$ inch thick, and 12 inches long, sunk and batted in with lead. There is to be a wrought-iron railing round the top of the shaft, consisting of ten uprights and two horizontal bars, as shown.

SLUICE RECESS.

Two inside walls of average thickness of 3 feet, forming the inlet or recess for the sluice, 6 feet apart, of good square scabbled, ashlar, header and stretcher averaging 15 inches on the beds, and chisel-draughted, lipped, and pointed with cement, and backing of good flat-bedded rubble. Square-knigded coping 2 feet broad, and 15 inches thick, with a whinstone dowel $3 \times 3 \times 4$ inches half sunk into each joint. These walls are to be founded on hammer-dressed through stones, 9 inches thick, and there are to be three hewn lintels 15×12 inches, and let 6 inches into each wall to keep them asunder. The floor is to be paved with hammer-dressed causeway, 9 inches deep, set on a bed of levellings 3 inches deep, and all set and grouted with mortar as before described.

Should the masonry shown and specified for the culvert, shafts, and other masonry not reach to the solid, the additional depth must be made up of good flat-bedded hammer-dressed rubble laid flush in mortar, and an extra price is to be stated for that work, including its excavation.

WASTE-WEIR.

The waste-weir is to be 30 feet in width, with side walls 3 feet in height above its surface.

The curb-stone is to have a foundation of hammer-dressed through stones, 2 feet 6 inches across, and not less than 2 feet long, and 10 inches thick, dressed fair on the upper bed and joints, with a chamfered groove $1\frac{1}{4}$ inch square in each, run full of mortar.

The curb is to be 2 feet in height, and 18 inches in breadth, and in lengths of not less than 3 feet. It is to be all square-scabbled, except the upper surface, which is to be droved, and there is to be a chamfered groove $1\frac{1}{4}$ inch square in the lower bed, and in each joint run full of grout, that in the joints being of Portland cement. The side walls are to be 2 feet 3 inches thick, with a face of ashlar well bonded with headers and stretchers averaging 15 inches in the beds, and with good flat-bedded rubble backing. The coping is to be 18 inches broad, and 9 inches thick, droved on the upper surface; all the rest of the ashlar is to be chisel-draughted and fair scabbled.

WASTE-WEIR
CHANNEL.

The weir channel, which diminishes in width to 8 feet at the lower end, is to be pitched with square hewn stones, 18 inches deep, so far as the side walls extend, viz. for $17\frac{1}{2}$ feet from the curb. Below that it is to be hollowed out 6 inches in the middle and is to have similar pitching 12 inches deep, all set on a bed of levellings or broken stones thoroughly grouted with mortar, and the sides are to be similarly pitched for 3 feet 6 inches up the slopes, which are to be 1 in height to 1 horizontal. There are to be eight ring-courses of square and radiated stones, 21 inches broad, 18 inches deep, and not less than 2 feet long, chisel-draughted, and scabbled on three faces and the joints, with a chamfered groove down each joint run full of cement. There is to be a pitched apron extending 45 feet inside of the weir curb-stone, being of stones 12 inches deep for a length of 16 feet, and 9 inches for the remaining length, with pitched slopes beyond the end of the side walls to join the inner face of the embankment, all squared as before described. A good junction is to be made of the weir and outlet channels.

PROVISION IF WEIR
CHANNEL BE ROCK.

Lest any part of the surface of the weir or outlet channels should turn out to be rock sufficiently hard and solid to stand without pitching, a price per superficial yard is to be stated for levelling and dressing the rock, and in that case so much of the pitching as may be omitted will fall to be deducted.

REBUILDING
CROMBIE
AQUEDUCT.

A trench is to be excavated out of the ground over that portion of the aqueduct near the Sluice Keeper's house, which is to be covered by the embankment, and the aqueduct there, 120 feet in length, is to be taken down and rebuilt of the same inside dimensions as the present, viz. 4 feet in width, 2 feet in height up to the springing, with a hollow in the invert of three inches, and a rise in the arch of 12 inches. This is all to be rebuilt of ashlar, as shown, with radiated 15-inch invert—side walls with bonded ashlar face 15 inches deep, and good rubble backing, and an 18-inch arch. Over that is to be a rubble arch 9 inches deep, all well grouted, and all the aqueduct inside of the puddle wall of the embankment is to have a covering of good well-worked clay, 2 feet 6 inches thick, formed in 3-inch layers. Where the aqueduct crosses the puddle trench, there are to be side walls brought up from the bottom.

CIRCULAR SHAFT.

At the inner end of the aqueduct there is to be a circular shaft 5 feet 6 inches diameter inside, and $26\frac{1}{2}$ feet in height above the floor, divided by a wall through the centre, with opening for the sluice. The foundation of the shaft is to be a course of hammer-dressed stones, 12 inches deep, not less than 3 feet long, and well bonded, and over that there is to be a hewn pavement floor 6 inches thick, in

one entire length the one way, and having a hold of not less than 9 inches under the walls. The joints of the pavement are to be joggled and set in cement. The shaft is to be ashlar inside, and for as much outside as is not covered by the embankment. The backing is to be of good flat-bedded rubble, with the ashlar face inside averaging 15 inches in the beds. The circular wall above the embankment, and the whole of the division wall are to be of parapet ashlar. There is to be a chamfered groove in the beds and joints of ashlar $1\frac{1}{4}$ inch square, grouted with cement. The arch of the culvert is to extend through the walls of the shaft.

The ashlar is to be all chisel-draughted round the arrises, and scabbled between, except the outside, which is to be hammer-kniged or picked-dabbed. There are to be three whinstone dowels, $3 \times 3 \times 4$ inches, in each course of ashlar above the surface of the embankment, half sunk into the upper and lower beds of the stones, and there are to be four circular rings, 7 feet in diameter, of scrap iron $1\frac{1}{4}$ inch square, each half sunk into the upper and lower beds of two entire courses of the masonry, and grouted in with cement. The shaft is to be covered with pavement stones 6 inches thick, drove on the surface and outside, which is to project $1\frac{1}{2}$ inch over the walls, being all in one whole length across, except the two smaller stones, leaving an opening for a hatch, and they are to be joggled-jointed. There are to be footsteps cut in the masonry inside of the shaft, and a wrought-iron hand-bar, 1 inch diameter down to the bottom, batted to the stone. There is to be a pipe for the Kingswell water built into the wall as shown.

HATCH.

The hatch is to be of wrought iron $\frac{3}{8}$ inch thick, and hinged with iron batts, run in with lead, and provided with a lock and key. There is to be a wrought-iron railing round the top of the shaft, with ten uprights and two horizontal bars, as shown.

DESCRIPTION OF
MASONRY.

The whole of the masonry of the culverts, shafts, walls, and waste-weir, &c., but not reckoning the pitching of the embankment, is to be set flush in lime mortar, each course being grouted, and the ashlar is to be lipped for 2 inches in, and pointed with Portland cement. All the stones, excepting inverts and pitching, are to be laid on their natural beds. The ashlar is to be full and square in the beds and joints, is to consist of two stretchers to one header, and when described as averaging 15 inches in the beds, the stretchers are to be not less than 12 inches, and the headers are to average 2 feet into the wall. The rubble outer surface of the aqueduct, culvert, and the back of the rubble of the shafts, are also to be pointed with cement. The pitching of the weir and outlet channels are all to be pointed with Portland cement, except the curb and the portion of the weir channel 45 feet above and $17\frac{1}{2}$ feet below the curb, which are to be caulked with cement of iron borings and sal ammoniac.

ROAD.

The road extending from the public road near Crombie Mill to the new site of the Sluice Keeper's house, 940 yards in length between these two points, is to be cut and embanked as shown on the plan and sections; and where there is no cutting or embanking shown, the soil is to be removed from under the metal, and the proper level made up with hard material. The breadth is to be 18 feet at the bottom of the cuts, and 20 feet at the level of the forming of the embankments, the slopes being all 2 horizontal to 1 perpendicular. The banking is to be formed in layers not exceeding 12 inches in depth, each layer being carted over in forming the next. The turf and soil to be taken off and laid aside, and the slopes of the cuttings and embankments are to be soiled 6 inches deep, and all neatly dressed and sown with clover and rye-grass seeds. The dimensions are to measure from the surface of the turf when finished. There is to be a ditch or water-channel on both sides of the road when in cutting, and also along the whole of the foot of the embankment where the road adjoins the embankment, 9 inches wide at bottom, with slopes of $1\frac{1}{2}$ horizontal to 1 perpendicular, and 6 inches of minimum depth, made with sufficient falls to carry off the water. After the roadway has all been formed, and the embanked parts have had time to consolidate, it is to be covered by a layer of whinstone metal $13\frac{1}{2}$ feet wide, and 6 inches thick, broken to 1 lb. weight, and over that there is to be a layer 12 feet broad and 3 inches deep, broken to $\frac{1}{2}$ lb. This metalling is all to be rolled and well blinded with fine gravel, and the sides are to be made up to the level of the metal.

METALLING OF ROAD

The contractor is to keep in repair the road already specified during the whole time of the construction of the works, and throughout the stipulated time for maintaining them, and is to fill up the ruts, and provide any metal that may be required to leave it in good order after he is done carting over it.

QUALITY OF STONE.

The whole of the ashlar rubble masonry and pitching is to be of freestone of a hard, solid, and durable quality, such as may be approved of by the engineer; and before any offer be accepted, the offerer must state what stone he purposes using, and must produce specimens of it.

MORTAR.

The mortar is to consist of three parts Arden lime well and newly burnt, but not slackened, one part iron-mine dust, and two parts of clean sharp sand, all well mixed up and ground together in a mortar mill, or the lime and mine-dust may be ground together dry, and mixed with the sand in a pug mill.

CEMENT.

The cement is all to be of the best quality of Portland. All beds and joints of ashlar, and of all surfaces under water, and all exposed surfaces of masonry, though not already specially described, are to be lipped and pointed with best Portland cement.

TIMBER-WORK IN
SHAFT.

In the inside of the outlet shaft there are to be four uprights in one length, consisting each of a Memel log 13 inches square, bolted through the wall by fifteen 1-inch screw bolts to each, with cross-bearers, platforms, and ladders, down to the bottom, all properly bolted, and as particularly shown on drawing No. 5, two of them being checked 6 inches at the lower end for the projection on the masonry. There are to be two upright standards planed, and two sluice-guides and covers outside of the shaft, as shown, of Memel fir, each in one length. Each standard to have twelve $\frac{3}{4}$ -inch screw bolts through the wall, and each guide and cover to have eleven similar bolts through the standard.

SLUICE.

An African teak outside sluice is to be provided, 1 foot 6 inches square, and 4 inches thick, fitting close, and put together with $\frac{1}{2}$ -inch copper clench bolts; and four guide-bars are also to be provided, of British oak, 1 foot 6 inches long, and 6×4 inches broad.

IRON GRATING.

Outside of this sluice there is to be an iron upright grating 20 feet in height, and a hinged grated cover 6 feet in breadth over all. The grating is to consist of wrought-iron vertical bars $1\frac{1}{4}$ inch diameter, with spaces of $1\frac{1}{2}$ inch between, and eight curved horizontal bars $3\frac{1}{4}$ by $\frac{5}{8}$ inch, punched or bored out for the uprights, and built with claws into the stone. The cover is to be framed and rivetted together as shown, having side and cross bars $3\frac{1}{4} \times \frac{5}{8}$ inch, and $1\frac{1}{4}$ inch round bars.

PIPES AND SLUICES.

The contractor is not to provide the ironwork of the pipes, iron sluices, gratings, &c., but he is to put the pipes in their places, and build them in, and is otherwise to cut raglets or batt holes, and to do all the other jobbing required for fitting and fixing the iron or timber work; and he is to furnish all the iron bolts, bars, cramps, &c., required for the masonry and the carpenter's work. He is to prepare seats for, and is to give facilities for erecting, but is not to provide, two girder gangways to the sluice-shafts.

QUALITY OF
TIMBER.

The timber not otherwise specified is all to be of good red Memel fir, free from sap, shakes, or large knots. It is to be all coated with a mixture of coal and vegetable tar, put on hot, except the ladders, which are to have three coats of oil paint, as are likewise the iron railings.

The contractor must provide and maintain, if necessary, a steam-engine of sufficient power and pumps for keeping the puddle trenches and the excavation for the base of the embankment clear of water. The road must be commenced immediately after the contract is entered into, and completed with all due expedition. The culvert, the lower portion of the sluice-shaft, the recess for the sluice, the channel down to the waste-weir channel, and the channel of the waste-weir itself, from the junction of the culvert channel to its lower end at the burn, are the first works of the reservoir to be undertaken, those being necessary for the passage of the water before any considerable progress can be made with the lower part of the puddle trench or with the embanking, but the excavation of the trench into the sides of the den above the level of the burn may be proceeded with at the same time. The rebuilding of the Crombie Aqueduct is to be done at the driest season, and the water must not be stopped from running through more than one month.

PERMISSION TO TAKE
STONES.

The Water Company will allow the contractor, under the restrictions hereinafter specified, to take stones, free of dues, within the ground acquired by them for the reservoir, subject to the control of the engineer as to the manner and place of working, and will also allow him the benefit of all their privileges under The Water and Land Clauses Act, or by agreement, for taking stones in the neighbourhood, on payment by him to the proprietors of any dues which the Company would be required to pay if taking the stones

themselves, and on his otherwise conforming to the conditions for restoring the surface, &c.; but offerers must satisfy themselves as to the extent of the Company's rights and powers, and of the supply and quality of stones which may be obtained.

FORM OF TENDERS.

Tenders are to be given to execute the work for a lump sum, but they must be accompanied by a detailed estimate, having all the prices and quantities stated and calculated so as to make up the gross amount of the tender.

ALTERATIONS.

The contractor is not to have it in his power to sub-let any of the work without authority from the Water Company. The directors shall have it in their power to make any alterations in the form, dimensions, or arrangements of the work which they may deem fit during its progress, and those alterations shall be calculated and paid for, or deducted, according as they may increase or diminish the expense, agreeably to the scale of prices given in the detailed tender, so far as those will apply, and where they do not, at prices as nearly as possible conformable, to be fixed by the engineer; but no alteration shall be allowed or paid for, unless a written order be given for them by the engineer, or by the manager of the Water Company.

TIME OF COMPLETION.

The whole of the work described in this specification must be completed, the ground all dressed off, waste materials and rubbish removed, and the reservoir be made fit to have the water stored in it by the 31st October 1863; and as the contract has been made and the price agreed upon on this distinct understanding, it is stipulated and agreed that the Company shall be entitled, with the approval of the engineer, to store water in the reservoir immediately after the said 31st October, whether the works be entirely finished or not; and further, that the Company shall be entitled to payment from the contractor of £100 for each week thereafter that may be required to finish it, should it not be so by that time, and which sum shall not be regarded as penalty, but as a pactional and agreed-on sum payable by the contractor to the Company, not subject to modification in any court of law; and the Company shall be authorised to retain the said sum of £100 for each said week from the sums in their hands, or to prosecute the contractor for the amount, if there shall not be a sufficient amount in their hands, due to the said contractor, to meet the said weekly payments. The contractor is to take all risk from floods, &c., during the time the works are in progress; he is to maintain the works for the space of one year after their completion; is to guarantee the embankment free from leakage for that time; and is to point or repair anything that may be deficient about the works before they are finally taken off his hands.

PAYMENTS.

Payments will be made at the rate of £450 for every £500 worth of work performed and materials delivered, on a certificate being granted to that effect by the engineer; but he shall be authorised to withhold the certificate, notwithstanding that there may be work and materials sufficient to make up the amount of an instalment, should the work not be carried on regularly and satisfactorily, or should the materials not be of proper quality.

The balance will be paid at the expiry of twelve months after the completion of the work, provided it be then all standing in good order, and water-tight; but 5 per cent. per annum will be allowed on all sums retained as security from the dates of the respective certificates until they be paid in full.

The contractor must confine himself within the limits of the ground purchased by the Water Company, and in the event of his occupying any ground beyond these limits otherwise than for procuring materials which cannot be procured within the area of the reservoir, or excavation for the waste-weir, he must pay damages for it, and he must be responsible for all injury done by his workpeople to any of the adjoining lands.

The contractor is to provide and maintain any temporary fences that may be required by the proprietors or tenants to keep sheep or cattle from straying upon the works. The workmen are to be prohibited from trespassing on the neighbouring lands, from disturbing the sheep or cattle, and killing, disturbing, or otherwise injuring the fish or game. The contractor is to be held liable for any damage which may be proved to have been done by his workmen, and to dismiss from the works, and to punish, so far as he has power, all trespassers and poachers. No dogs are to be allowed to be kept about the works.

PROVIDING MATERIALS.

The contractor is to provide all materials, centres, planks, carts, barrows, and other implements, and all labour necessary to carry on and complete the works described in the specification; and is to take upon himself all risk and responsibility of every sort. The materials are all to be of the best quality of their respective kinds, and the whole work is to be done in a good, substantial, and workmanlike manner, agreeably to the spirit of the drawings and specifications, and to the satisfaction of the principal or resident engineer of the Water Company, either of whom shall have power to stop the work, or to cause any part to be taken down and constructed anew, should it not be done, in the first instance, to his satisfaction.

Should the contractor refuse or neglect to attend to the directions given by the superintending engineer, or should the work not be carried on regularly and satisfactorily, or with sufficient vigour to ensure the completion within the specified time, the directors of the Water Company shall have it in their power to take it out of his hands, and to contract anew, or otherwise to employ other parties to do it, at his risk and expense. The contractor must become bound either to be always on the work himself, or to have some qualified and responsible person there, who shall be duly authorised to act and to receive instructions for him, and any orders or directions given to this person shall have equal validity as if given to the contractor himself. No foreman or other person shall be allowed to remain in charge of any part of the work who refuses or neglects to attend to the instructions given to him by either the principal or resident engineer.

The directors are not to be held bound to accept the lowest offer.

The contractor must find security to their satisfaction for the due performance of the contract, and for payment of the sum of £100 for each week the work shall remain unfinished after the 31st day of October 1863, no abatement from the said sum of £100 weekly being in any case made. He must enter into a regularly stamped contract, containing all the ordinary legal clauses, and must pay one-half of the expense thereof.

Should any dispute or difference of opinion arise between the Water Company and the contractor regarding anything in the contract, the same shall be referred to the decision of the principal engineer as arbiter, and, failing him, to a person to be appointed by the Sheriff of Forfarshire, either of whose decision shall be final and binding on all parties.

Edinburgh, 8th September 1866.

JAMES LESLIE.

ROTHERHAM WATERWORKS.

SPECIFICATION

Of Work to be done in the Construction and Formation of Storage Reservoirs, Flood-water Channels, Filter-beds, Pure-water Basin, Overflows, Earthenware and Cast-iron Pipe Conduits, Manholes, and other works, for the Rotherham and Kimberworth Local Board of Health.

INTERPRETATION
CLAUSE.

The following words, when used in this specification, shall be considered as having the meanings hereby ascribed to them. 'Local Board:' the Local Board of Health for the district of Rotherham and Kimberworth, in the West Riding of the county of York. 'Diameter:' the clear internal diameter of any pipe, valve, or culvert. 'Contractor:' one or more contractor or contractors for the works

herein specified, and shall include his or their heirs, executors, and administrators. 'Clerk:' William Whitfield, solicitor, of Rotherham. 'Engineer:' John Lawson, civil engineer, of London. 'Resident engineer:' of , or other the clerk, engineer, or resident engineer duly authorised to act as clerk, engineer, or resident engineer in connection with the works. 'The Works:' any works shown on the drawings or referred to in this specification or in the bill of quantities or schedule, or which may be found necessary during their progress.

MONTH.

The word 'month' shall mean calendar month.

EXTENT OF
CONTRACT.

This contract is to be considered as comprising the providing, working, and maintaining, at the expense of the contractor, all necessary steam-engines, pumps, or other power or machinery; as also of providing, at the like expense, all materials, implements, labour, and cartage; the forming and maintaining of all coffer-dams, temporary embankments, conduits, and other works necessary in the construction and completion of embankments for a road diversion and storage reservoir, with valve wells, inlet and outlet culverts, overflows, flood and waste water-channels, inlet weirs, and all other works in connection therewith, as shown on the plans, sections, and drawings, or described in the specification, and enumerated in the bill of quantities, or which may be ordered from time to time by the engineer or resident engineer; the whole of the works to be completed in accordance with this specification at the prices set forth in the bill of quantities and schedules.

The position of the different works are shown on the general plan, No. 1; their details are given on drawings Nos. 2, 3, 4, 5, 6, 7, and 8.

DESCRIPTION OF MATERIALS TO BE EMPLOYED IN THIS CONTRACT.

EARTHENWARE PIPES, &c.

EARTHENWARE
PIPES, &c.

The pipes are to be of stoneware fire-clay, or other material approved of by the engineer.

BURNING, &c.

BURNING, &c.

The material must be burnt perfectly through its whole thickness, and the surface of the pipes externally and internally must be smooth, perfectly glazed, free from air-blows, fire-blisters, cracks, and every other imperfection. The material shall not be less in thickness than *one-tenth* the diameter of the pipe.

STRAIGHT PIPES.

STRAIGHT PIPES.

The straight pipes must be true in sectional form, and straight longitudinally, the material being of an equal strength and thickness throughout the entire body of each pipe. The joints are to be square on section and true in circumference. The pipes, when laid and jointed in the work, to form a conduit free from every obstruction, especially such as must arise from joining pipes together, not true in longitudinal or sectional form.

JUNCTION PIPES.

JUNCTION PIPES.

The side junctions are to be formed at an angle not exceeding 45°. No square junctions will be allowed in the work, unless specially ordered.

BENDS AND CURVED PIPES.

BENDS AND CURVED
PIPES.

All bends and curved pipes are to be true segments of a circle, and must form a perfect curve when jointed together.

JOINTS.

JOINTS.

The pipes are to have socket joints not less than 2 inches in depth, or to have butt joints as may be ordered by the engineer.

TEST.

TEST.

The pipes are to be capable of resisting a pressure of 100 lbs. on the square inch applied externally or internally, and the engineer reserves to himself the right to reject all pipes which may be found incapable of resisting such pressure.

BRICKS.

BRICKS.

The bricks to be used in the works must be hard, sound, perfect in form, free from lime, fire-cracks, blisters, clinkers, or other imperfections, and must be well burnt throughout their entire substance.

The whole of the bricks must be handed out of the carts and carefully stacked on the ground for use.

The bricks, previous to use (if dry) must be well wetted by being placed under water, in a tub to be provided by the contractor for that purpose.

Bricks in any way shaken, imperfect, or weathered, will be rejected, as also all bricks broken before use.

Bricks of proper radii shall be provided and used for all circular work of less than 2 feet radius.

STONE.

STONE.

No stone shall be used in any of the works specified, or other works to be executed for the Local Board, unless the same shall be first approved of by the engineer; stone of the hardest quality shall be selected, and it shall be free from flaws or other imperfections, and must be sound throughout.

SAND.

SAND.

The sand to be used, whether for mixing with cement or lime, is to be sharp and clean sand, approved by the engineer. It must (if required by the engineer or resident engineer) be washed before use, so as to free it from loam, soil, and dirt of every description.

ASHES.

ASHES.

The ashes to be mixed with cement or lime are to be clear and sharp smithy or furnace ashes, sifted through a fine wire or hair sieve previous to use.

CEMENT.

CEMENT.

The cement to be used in the works shall be Portland cement of the best quality, capable of setting perfectly hard in water. It must in all cases be used fresh and at the first mixing; a second softening or retempering will not be allowed.

The cement for brickwork or masonry must be mixed as follows:—

Cement, by measure, four parts; clean washed sharp sand, { To be well mixed in a dry state on a clean board, and then have sufficient
two parts; clean sifted smithy or furnace ashes, one part. { water added to allow of its being tempered for use.

LIME AND MORTAR.

LIME AND MORTAR. The whole of the lime to be used in this contract, or in any of the works to be executed for the Local Board, shall be the best blue lias or other approved hydraulic lime. It must either be burnt on the ground or be obtained fresh from the kilns and brought to the works only in such quantities as will allow of its being used perfectly fresh and active. Old or 'dead' lime must not on any account be used or brought upon the ground.

Mortar mills, in which the whole of the mortar required must be mixed and ground, shall be provided and fixed on the works by the contractor, at his own cost. The mortar mill is to consist of a cast-iron pan and two cast-iron rollers; the rollers to be not less than 4 feet in diameter, and to be driven at the rate of 20 revolutions per minute by steam power. The mortar pans and mortar shed to be under a roof cover.

The lime is to be as fresh as possible, immediately slaked and covered over with a proper proportion of sand, which, with the other ingredients, must be put into the pan and ground as specified.

The proportions are to be as follows:—

Four parts lime, new slaked; six parts clean and sharp sand; } Mixed dry and ground with a due quantity of water for the
two parts sifted ashes. } space of twenty minutes.

HOW MORTAR AND CEMENT ARE TO BE USED.

The mortar and cement shall be mixed and tempered on clean surfaces to such a consistency as will allow of a trowelful being taken up and spread for use on the work, and shall be preserved free from any foreign matter until used. Boards must be provided for the reception of the mortar and cement on the works, and they shall in all cases be used whilst fresh.

In using mortar or cement, the surface of the wall or other work shall be free from dirt; and if dry, such surface shall be damped. The mortar or cement shall then be spread evenly over the surface, so as to allow the stone or brick set in it to have a full bed of one-eighth of an inch in thickness, after forcing any excess betwixt the surfaces; all joints must be flushed perfectly full, and any surplus brought to the face of the work shall be neatly taken off with a trowel.

GROUT.

GROUT. The grout shall in all cases be made by diluting the mortar until it is of such consistency as will allow of its pouring and penetrating the work; it shall not be diluted beyond this.

CONCRETE.

CONCRETE. Concrete to be made of clean gravel, or stones broken to pass through a 1½-inch ring, sand, and fresh unslaked ground lime.

Clean gravel or broken stones	Four parts.
Sand	One part.
Lime	One part.

To be mixed dry, raked down, and such a quantity of water added as to slake the lime.
The concrete to be well pounded when in place.

GRAVEL.

GRAVEL. The gravel or broken stone to be used in the filter-beds shall be clean, and free from loam, soil, sand, and other matter. The lower bed or coarse gravel shall consist of stone about the size of walnuts, the next layer shall consist of sifted stones about the size of Barcelona nuts, and the upper layers of stones about the size of beans and peas respectively.

CLAY PUDDLE.

CLAY PUDDLE. The material for puddle shall be carefully selected tough and strong clay.
All soft, miry, and puffy clay will be rejected. The clay shall be without a mixture of sand, stone, soil, or other objectionable matter, and shall be worked as hereinafter described. The clay shall be thoroughly 'puddled' before it is laid in the works. The contractor will have to satisfy himself as to the locality from which he can obtain the clay, as it is not expected that any suitable material will be found on the ground of the Local Board.

MANHOLE COVERS.

MANHOLE COVERS. These materials will be provided by the Local Board, and will be delivered to the contractor at the store of the Local Board. The contractor must cart the materials to the works, and will be held responsible for all articles delivered to him.

FENCING.

FENCING. The area of the ground given up to the contractor for any of the works shall be temporarily fenced, when required, with posts and rails of such height, strength, and character as shall prevent accident, damage, or injury to any person, cattle, sheep, lambs, or property of any description, during the progress of the works. This work will be paid for at the price inserted in the schedule, but shall be maintained by the contractor at his own cost until the works are completed, and an order in writing for its removal has been given to the contractor by the engineer.

SPOIL LAND.

AM land required for the deposit of surplus excavation will be provided by the Local Board, but the contractor must, if required, securely fence the land to be so occupied. After this is done, the whole of the soil shall be carefully taken off and laid on again. The inclination of the slopes of spoil banks shall not be more than 3 to 1, unless otherwise directed by the resident engineer. Existing fences, drains, and water-courses will have to be restored, and new ones introduced where necessary.

ASHLAR-WORK.

ASHLAR-WORK. Any ashlar required must be drafted and boasted on the beds and joints; the faces must be drafted round with a 2-inch chisel, and the remainder boasted off, the tool marks being vertical from the bed. All ashlar must have breadth of bed at least equal to the depth of the stone on face or in course. The beds and joints must carry their width from front to back. 'Through' or 'bond' stones must be in length, at the least, twice and a half the thickness of the stone or course, and each such stone must carry the full length and depth of the face through to the back. The joints and top beds must be hewn to the full width of the stone to be set on both sides and above. The bottom bed must be dressed over its whole area.

All ashlar must be set in a bed of mortar, evenly spread to one-quarter of an inch in thickness; the joints must be mortared as described for the beds, and must be flushed full of mortar. The beds of the ashlar must not be pinned with slate or other material, but the stone must be worked so as to set fair and true without such aid.

'Hewn ashlar' will be boasted on face as described. 'Rough-faced ashlar' will have pitched margin lines round the face, the beds and joints worked as in hewn ashlar.

BLOCK-IN-COURSE.

Block-in-course work will consist of stones from 9 inches to 15 inches in depth of face, and not less than the thickness of the course on bed. There must be one 'through' or 'header' at the least to each square yard of facework, and no stone must be less in length on the face than once and a half the depth.

Coursed and scabbled block-in-course must be truly out of winding; the beds and joints square from the face, and one with the other. The beds and joints must be close picked down, and evenly sketched off to within half an inch of the arris lines, as pitched.

BLOCK-IN-COURSE, HEWN.—The stones for this class of work will be of the dimensions and character as described above. The beds, joints, and faces, in place of sketching, will be random-boasted.

The stone must be mortared and set as described for ashlar.

COURSED WALL-STONE.

Any coursed stone below nine inches in thickness will be classed as wall-stone.

The dimensions of the stone are to bear the same proportion to the thickness of the course as is described for block-in-course; but there must be two 'throughs' or 'headers' to each square yard of wall-stone facework. The wall-stone must in all cases be square, and out of winding, sketched on beds and joints: the faces pitched off, and the rough sketched down to within a quarter of an inch of the pitching. The stone to be mortared and set as described for ashlar and block-in-course.

RUBBLE-WORK.

RUBBLE-WORK.

Rubble-work will consist of stone rough from the quarry. The ordinary class of stone must be self-bedded, and in size and weight must be just within the capacity of an ordinary man's strength to lift. The stones to be set with their broadest and truest sides downwards, in a full bed of mortar. All inequalities amongst the larger stones to be levelled up with smaller stones and with clean spalls. The whole to be set full and flush in mortar and well grouted.

Where rubble wall is required alone, the face of the work must be preserved true and fair, and there must not be less than two 'bond stones' or 'throughs' to each square yard of facework. No bond stone or through to be less than one foot six inches in length of bed; the face must be truly squared from the bed, out of winding, and close picked down, so as to set fair in the work. The work from face to back shall be levelled up in courses every two feet at least.

Where rubble is used to back up ashlar or wall-stone, each course of such work must be levelled up truly, flushed with mortar, and grouted into one compact mass, before a second course is commenced.

DRY WALLING.

This work is to be built of the same description of stone, and otherwise in every respect, as described for 'rubble-work,' except the use of mortar.

COPINGS, ARCH-STONES, OVERFLOWS, OR OTHER HEWN MASONRY.

Stone for any of the above-named purposes must be furnished from the quarry to the dimensions given from time to time. The beds and joints to be truly squared, or otherwise shaped (as may be required), and scabbled truly and evenly to dimensions.

TOOLED FACES must be random-tooled in 'bats' or strokes, five to the inch. The tooling to be square from the beds.

DRAFTED AND BOASTED FACES.—This work must have a chisel draft of one and a half inch wide; the 'bats' or strokes, five to the inch, to be square from the beds; the draft is to be nicked in, and the rest of the face rough boasted off.

Drafted and punched or picked faced work must be as for drafted and boasted facework, excepting that the space within the drafts must be close punched or picked off as required.

FLAGGING.

All flags or paving required shall be the best York flags, and shall be obtained at the quarries approved by the engineer; each flag shall be properly squared, and when two or more are to be set together, they shall be closely and accurately jointed. The flags shall be laid in a bed of mortar, and the joints flushed full of mortar.

PITCHING.

Brick pitching or paving for the reservoirs, filter-beds, and other works will be $4\frac{1}{2}$ deep, the bricks being laid in mortar, the joints being flushed perfectly full of mortar, and neatly pointed.

The contractor will have to take up and relay at his own cost any pitching which may be affected by slips, unequal settlement, or any other cause which may give it an undulating or irregular surface.

Pitching for the overflows and byewashes shall be of ashlar, worked to the proper radii and forms, drafted and boasted and set as described for ashlar. The pitching in floodwater channels will be hammer-dressed pitching, set dry, and raked in with gravel.

PROTECTION TO THE WORK DURING FROST.

During frost, the walls and other work of stone and brick must be protected by a covering of straw or stable litter 6 inches in thickness, or by matting. The covering to be properly secured and weighted on the walls, so as to prevent any injury to the mortar or cement from frost. The material to be provided and work to be done at the contractor's cost.

POINTING.

The whole of the brickwork and masonry shall be neatly pointed, at such time as the engineer may direct. The cost to be included in the schedule price for brickwork or masonry.

WOODWORK.

The timber used shall be (unless expressly ordered to the contrary) Memel or Baltic of the best quality, thoroughly seasoned, perfectly sound, free from sap and shakes. All the balks and scantling shall be sawn all round, and properly planed and dressed, so as to be of uniform dimensions, straight, and square, or as may be required. All the joints shall be made with white lead or chopped hair and Stockholm tar. The work shall be done and fixed in a neat and workmanlike manner. The whole shall be finished with three coats of good oil paint, of such colour and at such times as the engineer may direct.

SLUICES AND FRAMES.

Sluices and frames shall be made of English oak, elm, or Memel, as the engineer may direct. The contractor must fill in his prices for English oak sluices and framing.

IRONWORK.

The cast iron must be of the very best grey metal, and the castings entirely free from air-blows and flaws of every description. The quality shall be such that a bar 1 inch square and 4½ feet between the supports shall carry 500 lbs. before breaking. Trial bars (if required) shall be cast under the direction of the engineer, in any way he may think proper.

The wrought iron must be of the best scrap or No. 3 bar iron.

WROUGHT-IRON CRAMPS.

The joints of the coping must be secured with wrought-iron cramps 9 inches in length after the ends are turned down, and a quarter of an inch thick, the cramps to be turned down 1½ inch at each end, let in flush, and run full with lead. All cramps must be made as above, or as otherwise directed, and the iron to be used shall be the best wrought iron. Cramps will be paid for according to the schedule.

DESCRIPTION OF WORKMANSHIP.

The contractor shall commence the work by stripping from the site of the embankment the soil and loose material, and clearing away all fences, brushwood, &c., and, if ordered, the site of the embankment shall then be drained by means of drains 3 feet deep and 1 foot 6 inches wide, filled with broken stone, which will be set out by the resident engineer.

The waste-water and flood-water channels will then be formed, and the inlet weirs on the two brooks. The contractor will then have the water entirely under his control, and may proceed with the excavation for the puddle trench and the outlet culvert.

The excavated material from the puddle trench, from the waste-water and part of the flood-water channels will go into the embankment. In some places, as shown on the general plan and in the cross-sections, the material from the flood-water channels will go to form a small embankment on the reservoir side. The puddle trench must be excavated to the dimensions, depths, and with the slopes shown on the sections, and its sides must be securely timbered, and it must be kept free from water, by pumping or otherwise, at the contractor's expense.

The quantity of excavation to be paid for shall be calculated from the widths shown on the plans and sections, or set out by the resident engineer, and the actual depth to which the trench shall, under his directions, be carried.

The seat of the embankment, as well as the bottom of the puddle trench, must be prepared for the reception of the materials by 'stepping,' or 'benching,' as the same approaches the sloping ground, or otherwise, as may be directed.

Puddle to be used in the puddle bank shall be composed of carefully selected clay or marl, and shall be well tempered before it is placed in the work. The puddle shall be neither too wet nor too dry, but of such consistency as will allow of its being filled into the trench, and then worked into a water-resisting consistency. The puddle shall be filled into the trench, and shall be continued in entire layers over the whole area of the trench and puddle bank, in thickness not exceeding 6 inches, and each layer shall be cut, worked, and trodden into a solid and compact mass in itself and with the puddle bank; and in any case when a layer of puddle has been lying exposed for any length of time, the surface shall be cleansed and the entire layer reworked before a further layer is added to it.

The main embankment, when completed and consolidated, shall have a finished top 15 feet wide, 6 feet above top-water level.

The slopes to be 3 to 1 inside and 2 to 1 outside, that is, 3 and 2 horizontal respectively to one vertical. The embankment shall be formed out of the material excavated on the site of the reservoir, as will be pointed out or as may be directed from time to time by the resident engineer, and from the outlet culvert, byewashes, &c. The material shall be evenly spread over the whole site in concave layers, as shown in the drawings. Stones containing one-fourth of a cubic foot or upwards must not be used or buried on the inside of the puddle wall, and all large lumps or clods of earth shall be crushed or broken down as the work proceeds.

The material to be excavated from the site of the reservoir will consist of clay, soil, sand, and gravel; and the contractor shall make such arrangements in carrying on the excavations as will admit of these several descriptions of material being thoroughly mixed in forming the embankment.

The whole of the material shall be placed in the banks by means of carts or barrows, in layers, as shown on the cross-sections.

The finest and most retentive material must be placed on each side of the puddle wall, in layers, as shown on the sections. This selected material goes in at a separate price in the bill of quantities. The embankment must be carried up to such height above the finished level as will allow of subsidence, and from time to time this level must be maintained so as to finish at the proper height.

The sides of the excavations made within the reservoir site for materials for the embankment are to be trimmed to such slopes as may be directed by the resident engineer, the cost of this work to be included in the price per cubic yard of earthwork in the embankments.

The embankments must be truly finished to the slopes, as figured on the section. The outside slope must be soiled and sown with grass seeds at the proper season. The seeds to be of such quality and in such proportions as the engineer may direct. The soil to be 9 inches in depth, square from the face of the embankment.

The inner slope of the embankment must be protected with broken stone at the lower part, the upper portion being pitched with coursed stone or 'pitching' 12 inches deep, scabbled out of the stone of the district and set dry, laid on a layer of broken stone 6 inches in thickness. The dimensions are shown on the section. The pitching to be covered with gravel to fill in the interstices of the stones and to be maintained in proper line, slope, and level.

The top of the embankment is to be finished on the inside with a rubble wall faced with wall-stone, as shown on the drawing, and on the outside with a scabbled curb-stone metalled between with broken stone 12 inches deep, to be finished of an uniform surface slightly convex.

The whole of the work as to height, width, and slopes of embankment, pitching, soiling, and roadway, to be given up at the expiration of the term of maintenance in the most perfect order and condition, and in accordance with the sections and plans.

The contractor shall remove or level all surplus material from the embankment and from the adjoining lands at the completion of the works, and shall duly slope, fence, or otherwise protect any spaces from which materials may have been excavated for the works.

The contractor will be held liable for damage or trespass to any adjoining lands or property during the progress of the works.

OUTLET CULVERT.

The outlet culvert will be of brickwork, 3 feet internal diameter, set in cement. The ground shall be excavated to the exact contour of the intended culvert; and the whole of the brickwork shall be flushed full of cement. For the first 9 feet length from the valve well this culvert is to encase a cast-iron pipe, as shown on the drawings. The culvert will discharge into the waste-water channel from the north side of the reservoir, the supply pipe to the screening chamber being supplied from a sump or well formed in the culvert, as shown on the drawings. The excavation for this culvert will be open cut, to be afterwards filled in between the valve well and the puddle wall with puddle up to the surface. Outside the puddle wall to the byewash the

culvert will be covered with a ring of concrete 1 foot 6 inches thick; under the byewash the trench cut for the culvert will be refilled with concrete; and the culvert will, if necessary, be founded on concrete its whole length.

VALVE WELL—(DRAWING No. 5).

The valve well will be constructed of brickwork in cement in the position shown on the general plan, and of the form and dimensions given on the drawings. It will be divided in the centre by a wall forming one half into a wet well and the other into a dry well; the excavation to be got out truly to the form and of such a size as to allow of 15 inches of concrete being placed round the brickwork up to the surface of the ground. If not founded on the rock, the well must be built on a bed of concrete 2 feet in thickness.

At the heights shown on the drawings, or as may be hereafter pointed out, two 2-feet barrel-culverts will be built running out from the wet well to the proper levels inside the reservoir; a third 2-feet circular opening will be formed in the same well above the natural surface of the ground. In the wet well, cast-iron frames, supported by projecting flanges, will be built to support the screen plates. These frames must be fixed truly vertical and parallel, and the joints must be made fair and without one length projecting in the slightest in front of its neighbour. A short length of one of the screen plates will be fixed in the bottom of the well, as shown on the drawing.

At the respective positions indicated, three iron pipes will be built in the division wall, each terminating (in the wet well) with a cup bored out to receive a ball or plug, a boss being cast in the bend to support a small iron pipe carried up to the top of the well on which the balls will slide. These plugs are for the purpose of closing the pipes in case the valves require removal when there is water in the reservoir.

In the dry well the valves are fixed, being supported on the girders that carry the pedestals for the valve spindles.

The supply pipes are arranged as is shown on the drawing, and discharged into the outlet culvert before described.

The centres of the three valves must be fixed truly in a line parallel to the division wall, so that the spindles may work vertically through the slotted girders which carry the pedestals, these girders to be carefully fixed in the position indicated.

The whole of the walls of the well will be finished by a neatly dressed stone coping, 12 inches thick, splayed on the outside, and rebated inside, to carry the covering planks. The coping stones will be kept together by means of cement dowels, as shown.

The covering planks, 3 inches thick, will be fastened by means of two flat iron bars, 2 inches by half an inch, secured to staples let into the coping stones. Step-irons will be fixed in each well, and hand-irons in the coping opposite. Wall-stone may be substituted for brickwork on the outside of the valve well, above the ground, at the engineer's discretion.

INLET CULVERTS.

The supply culverts will be 2-feet barrels, of 9-inch brickwork in cement. The bottom of the excavation must be neatly got out, so as to give the whole lower half of brickwork a solid bearing.

The culverts will finish with a face wall backed with puddle, and the trenches will be filled up with puddle to a depth of 3 feet after the culverts are in.

BYEWASHES (DRAWING No. 2).

A byewash will be constructed on each side of the reservoir, as shown on the general plan, the exact lines and levels being given on the ground by the resident engineer.

They will be 6 feet wide inside, having side walls of coursed wall-stone backed with rubble, and ashlar pitching in the bottom, set upon concrete. The pitching must be well squared and shaped throughout its full thickness and grouted in with cement. The side walls will have a stone coping scabbled square and true at bottom and joints, and rock-faced on sides and top, with an inch draft.

OVERFLOWS (DRAWING No. 3).

There will be an overflow at each end of the embankment 20 feet long; they will be constructed as shown on the drawings, the side walls of wall-stone backed with rubble and having a stone coping, and the overflow itself of neatly dressed ashlar steps and pitching, set on a bed of concrete.

FLOOD-WATER CHANNELS (DRAWING No. 6).

These channels will be continuations of the byewashes from the overflows up to the two heads of the reservoir. The excavated material will be disposed of either by being taken to the main or road embankment, or by being formed into small side embankments, as the nature of the ground requires. The channels will be of the section shown, and formed with 9-inch hammer-dressed pitching, set dry.

If the channels are altogether in cutting, a cess of 2 feet will be left on the outside, and the ground above trimmed to a slope of $1\frac{1}{2}$ to 1, or as may be directed.

INLET WEIRS (DRAWING No. 6).

Inlet weirs will be constructed at the upper end of the flood-water channels, where top-water level runs out in the streams. These are shown on the drawings, and are formed with brick side and centre walls, and a brick dam covered with 6-inch York flags, grooved to receive a 9-inch timber sill built into the side walls. The top of this sill, in the case of the flood-water channels, will be fixed at top-water level.

The sill for entrance to reservoir will be fixed 2 feet below top-water level, having a timber frame carried up about 5 feet higher, in which will be placed three wooden sluices, worked by racks and pinions, and arranged as shown on the drawings.

CONDUITS.

EXCAVATIONS, &c.

The ground for the conduits shall be excavated in open trenches for the necessary widths and depths. Tunnelling will not be allowed, unless expressly ordered by the engineer.

The contractor shall, in commencing to dig the trenches, carefully take up, lay aside, and preserve for reinstatement, all turf, soil, metalling, gravel, and other surface material of roads and places.

The material excavated is to be laid as compactly as practicable, and to be neatly trimmed up.

The sides of all excavations must be supported with suitable timber, at the contractor's own cost, whenever this precaution may be considered necessary by the engineer.

The trenches must be neatly formed and cleanly trimmed to the contour of the pipe or invert to be laid. All irregularities in the trenches resulting from bad workmanship or otherwise shall be filled, at the cost of the contractor, with concrete or gravel firmly rammed in.

LAYING AND
JOINTING PIPES.

Previously to the pipes being lowered into the trenches, they shall be fitted together and matched on the surface.

Whenever directed, the contractor shall excavate the trench to a depth of 6 inches below the level at which the pipes or invert are intended to be laid, and 4 inches wider than the pipes or invert on each side. The space below the intended level of the pipes or invert shall then be filled in with concrete, so as to form an impervious and uniform bed for the pipes.

This work shall be paid for at the schedule of prices.

The drawings show four methods of laying and jointing these pipes, viz. :—No. 1. To construct an invert $4\frac{1}{2}$ inches in thickness extending to the centre of the pipe, to be formed of properly radiated bricks, and built in hydraulic mortar. Butt-jointed pipes, in 3-feet lengths, are then to be laid in a band of mortar at each joint, 9 inches broad and half an inch in thickness. The pipe must be carefully pressed into the mortar and a ring of brickwork 9 inches in length, built in mortar, must be laid over the upper part of the joint. The space intervening between the bands of mortar must be grouted full of mortar; the trench must then be carefully filled to 6 inches above the brick joints with the finest material excavated, and the remaining portion of the trench must be filled in layers, not exceeding 6 inches in thickness, each layer being carefully rammed.

The paving, or other surface formation which may have been disturbed, shall be replaced to the satisfaction of the engineer, and of any other person having control over the several public and private places interfered with. This shall apply not only to the line of trench, but to the surface of the road or ground on both sides of the conduit wherever it may be affected by the works. As the pipe trenches are filled in, the contractor shall, at his own cost, immediately cart away all superfluous earth and other materials from the site, and leave all roads free and clear of refuse and dirt, and in good order.

No. 2.—This plan consists of a chair or sleeper, of brickwork in mortar, 9 inches in length, placed at each joint, the upper part and the filling-in being similar to No. 1.

No. 3 will have an invert of concrete in place of brickwork, extending 6 inches below and on each side of the pipe. The pipes at the joints will rest upon chairs or sleepers of brickwork, with a band of brickwork as in Nos. 1 and 2.

No. 4 will be formed of socket pipes, jointed with Portland cement, as shown. In all cases the same stipulations as to filling in, restoring the surface, and removing surplus earth, will apply.

RESERVOIRS, FILTER-BEDS, &c.

The contractor shall strip the soil from the site, and shall excavate the ground for the reservoirs, filter-beds, and other works, to the required depths and form, the material excavated being used as far as necessary in the formation of the embankments. In forming the embankments, the material shall be spread in even layers of not more than 6 inches in thickness over the entire area. Each layer shall be well beaten, all clods of earth broken, and the entire area well watered before another layer is put on.

The slopes must be truly formed as shown on the drawings. After the embankments have become thoroughly consolidated, puddle shall be laid over the entire bottom and inner slopes of the reservoirs and filter-beds to a depth of 12 inches, in 3 layers of 4 inches each, the clay to be well tempered before it is brought on the ground, and each layer of puddle to be thoroughly worked into the layer below. After the puddle has been completed in the bottom, and to a sufficient height up the slopes, a layer of concrete 12 inches thick shall be spread over the surface, and upon this the brick paving in mortar ($4\frac{1}{2}$ inches deep) shall be laid. Proper provision must be made for inlet, outlet, and cleansing pipes, and overflows. The slopes of cuttings and embankments must be neatly trimmed and be covered with soil to a depth of 9 inches. In the tender the contractor must fill in a price for excavation. There will also be a price for earth in embankments. These two prices will cover the entire cost of this work.

The tanks for distributing water on the surface of the filtering materials shall be of cast-iron, resting on brickwork in mortar. The castings shall be made in accordance with such detail drawings as may be furnished to the contractor during the progress of the works.

Drains in the filter-beds will be formed of side-walls of brick, set dry, the smaller drains being covered with quarles or flags, as may be directed.

ROAD DIVERSION.

The diversion of the public road leading from the turnpike near Packman's Bridge towards Ulley will be set out by the resident engineer, and will be in the position shown on the general plan. It must be formed truly in the manner and to the levels that will be given, and covered with 9 inches of hard metalling, blinded with fine gravel.

An embankment will be formed to carry this road over one arm of the reservoir; it will be of earthwork of the section shown on drawing No. 4, and must be formed in concave layers, not more than 1 foot 6 inches in thickness, the outer slopes being protected by a layer of broken stone 12 inches thick. A 5-feet barrel-culvert will be constructed under it (see same drawing). The roadway will be protected on each side the embankment by a rubble-stone wall in mortar, capped with a heater coping.

FENCING.

The land belonging to the Local Board will be protected by a fence of the following construction, viz. Larch posts 6 feet 6 inches long, semicircular in section, 6 inches by 3 inches at small end, will be fixed 9 feet apart from centre to centre. To these posts will be stapled seven galvanised wires, the upper three being of seven strands, and the lower four of five strands. Half-way between the posts a prick post 3 inches by $1\frac{1}{4}$ inch, and 3 feet 6 inches long, will be driven into the ground, and the lower four wires will be stapled to it. Oak straining posts 8 inches by 8, and 7 feet long, will be fixed as directed by the resident engineer, and strutted up on each side with an ordinary fence post, having its lower end resting against a flag 15 inches square and 4 inches thick. The wires will be secured to the straining posts by means of galvanised iron eye-bolts 1 foot 6 inches long and $\frac{5}{8}$ thick.

A price must be filled in for a fence wall of dry stone, with 'jim-crow' coping in mortar, 5 feet above the ground, 2 feet thick at bottom, and 1 foot 4 inches at top.

BRICKWORK.

The bricks to be used shall be of the character hereinbefore described, and when necessary every brick shall be well saturated with water before use.

No broken bricks will be permitted to be used, externally or internally, unless absolutely necessary as closers. No difference of workmanship will be allowed in the inside and outside work. Every course shall be bedded in mortar, and set with a mallet wherever the resident engineer directs. The whole of the joints shall be flushed up solid with mortar, and the outside joints neatly pointed and drawn. No joint of mortar shall exceed one-eighth of an inch in thickness, and the work shall be laid in English or Flemish bond (as the engineer or resident engineer directs) and be well grouted.

MANHOLES.

Manholes shall be excavated and constructed simultaneously with the conduit on which they are placed, and in strict accordance with the drawings, or with directions given by the resident engineer.

The inverts shall be formed of brickwork in cement or of ashlar stone chisel-dressed to the contour of the lower portion of the pipe passing through them.

The side walls shall be of brickwork in mortar. The beds and joints shall be flushed full of mortar, and the inside of the manholes shall be flat-pointed.

If stone covers are used, the stones shall be chisel-dressed to receive the metal covers and shall have openings corresponding to those in the iron frames.

Step-irons not more than 1 foot apart shall be provided by the contractor, and built into the manholes as may be directed. The step-irons shall be not less than 14 inches long, extending through the brickwork and projecting 5 inches into the manholes.

The iron covers shall be fixed so as to be level with the road or street.

If the metal covers rest directly on the brickwork, they shall have a true and even bed prepared for their reception.

CAST-IRON PIPES.

Cast-iron pipes must be true in form, the metal being of an uniform thickness throughout; and shall be of the lengths and forms shown on the drawings.

Socket joints will be formed with spun yarn and lead; the lead being not less than $2\frac{1}{2}$ inches in depth, well caulked.

Flange joints will be made with a ring of gutta-percha, the flanges being heated sufficiently to soften the gutta-percha before the joint is bolted up.

Pipes will be delivered to the contractor at the Board's yard. He must cart them to the ground, and will be held responsible for all pipes delivered to him. The stipulations as to excavations, laying and jointing cast-iron pipes, and other works, as set forth in the specification for Contract No. 2, will apply equally to this contract.

SIGHT RODS.

The contractor shall, at his own cost, provide, paint, fix, and maintain sight rods in such places as the resident engineer may point out, and shall preserve the same from injury or alteration so long as they are required.

SLUICE-VALVES.

Sluice-valves to have double gun-metal faces and strong gun-metal screws, the stuffing-boxes being secured by gun-metal bolts and nuts. To be of the best and most approved construction.

The spindles from valves to top of well will be of wrought iron, $1\frac{1}{4}$ inch diameter, turned in a lathe to fit the pedestals for a length of 12 inches at each pedestal.

BRIDGE.

A footbridge is to be constructed and fixed as shown on the drawings, from the top-bank to the valve well.

The top and bottom flanges of each girder will be T irons of the dimensions given in the cross-section (drawing No. 7), rolled in one length. The vertical stiffeners will be L irons rivetted in the middle of their length with a proper wrought packing piece between. The diagonals will be L or flat iron, as shown.

The ends of the girders will be stiffened by means of a $\frac{1}{2}$ -inch plate, 1 foot 3 inches wide, rivetted between L irons, and there will be a 1 foot 3 inch plate, $\frac{1}{2}$ -inch thick, tying the two girders together at each end, and acting as a bearing-plate on the walls.

The girders will be strutted from the outside, as shown, by L-iron struts, bearing on horizontal L irons rivetted to the bottom flange of each girder, and produced outwards about 2 feet; 3-inch by 3-inch wooden bearers will be bolted to transverse L irons rivetted under each girder, and the flooring will be formed of 2-inch battens spiked to these bearers. The whole of the work to be of the best quality as to material and workmanship, the rivets $\frac{5}{8}$ inch diameter, and the holes drilled. The bridge will be bolted down by two $1\frac{1}{2}$ -inch bolts, 3 feet long, to the abutment on the embankment, and rest without fixing in a recess of the masonry on the valve well.

ATTENDANT'S COTTAGE.

EXCAVATION.

The ground to be excavated to the depth of 12 inches below floor level over the whole area of the building, and the trenches for the foundations to be got out as shown on the drawings; the material excavated to go into the main embankment.

DRAINS.

A 6-inch stoneware pipe drain will be laid as may be marked out by the resident engineer, from the sinkstone, having 4-inch branches to the downspouts; these drains will be laid with regular gradients, and be jointed with clay.

BRICKWORK.

The sleeper walls will be built as shown, or as may be ordered. The walls of the building will be of 9-inch brickwork in mortar, of the best local ordinary bricks. There will be bands of different coloured bricks, as shown on the drawings, and the window and door heads will be turned with good cutters, if the ordinary bricks are not suitable. Bond-timber, as directed, to be built in the $4\frac{1}{2}$ -inch partitions.

Solid tooled, weathered, and throated stone sills to be fixed to all windows, 4 inches longer than the respective openings, and to bear the average sectional scantling of 6 inches by 9 inches. The external doors to have steps of tooled stone 10 by 7 inches, mortised for doorcases. The porch to be paved with one flag 4 inches thick, set on brick.

Hearthstone to be rubbed and properly set on brick fenders.

A stone or stoneware sink, 2 feet 9 inches by 1 foot 6 inches, to be provided and fixed in the scullery, on brick bearers, with bell-trap and connection to the drain by means of a grate fixed outside the external wall. A 10-gallon boiler to be fixed on a proper brick seating, with grate and flue, in the scullery. The scullery to be flagged with $2\frac{1}{2}$ -inch flags, neatly squared and jointed, and set on a bed of sand.

The flues to be 9 inches by 9 inches, properly pargetted, and to have wrought-iron chimney bars to each opening $2\frac{1}{2}$ inches by $\frac{1}{2}$ inch, with 9-inch bearing, and turned up at each end. Chimney copings to be of tooled stone, and if of more than one stone to be securely cramped together.

The fireplaces to have plain stone mantels in parlour and kitchen, and wooden ones in bedrooms. The grates in the bedrooms to be of the value of 7s. 6d. each, in the parlour 20s., and the kitchen range £3.

CARPENTER AND JOINER.

All the timber to be of the best yellow Memel, Riga, or Dantzic fir, sound and free from sap and all defects.

The roof to be constructed as shown on drawings; wall plate, 4 inches by 3 inches; purlins, 8 inches by 5 inches; ridge, 7 inches by 2 inches; common rafters (12 inches apart), $3\frac{1}{2}$ inches by $2\frac{1}{4}$ inches; collars, 3 inches by $2\frac{1}{4}$ inches; ceiling joists, 3 inches by $2\frac{1}{4}$ inches in kitchen and south bedroom, 5 inches by $2\frac{1}{4}$ inches in parlour and north bedroom.

Insert over all internal openings good stout lintels, bedding 9 inches upon each side.

The underside of rafters at eaves to be boarded with $\frac{3}{4}$ -inch boards, and a 5-inch by 1-inch fascia board to be fixed to end of rafters, to which gutter will be screwed.

Provide and fix 2-inch ridge roll.

Floor joists throughout to be 5 inches by $2\frac{1}{2}$ inches, laid on sleeper joists $4\frac{1}{2}$ inches by 3 inches. The boarding to be 1-inch yellow battens, straight joint.

Provide and fix 6-inch skirting in all rooms.

The front door to be 2 inches framed; four panelled.

The scullery external door to be $1\frac{1}{4}$ -inch plain-ledged door. Parlour door $1\frac{1}{2}$ -inch frame, four-panels. Other internal doors 1-inch plain ledged. All doors fitted with fastenings. External doors with good lock and bolts.

The windows to be hung in deal-cased frames, double hung with fastenings, complete.

The roof to be covered with seconds Bangor countess slates; to be laid to a regular gauge with 3-inch lap, copper-nailed and pointed beneath. The ridge to be covered with 6-lb. lead. Chimney flashings 5 lbs.

To lath, set, and white all ceilings. Render and set the walls of parlour, bedrooms, and kitchen. Whitewash scullery and pantry.

Provide and fix $4\frac{1}{2}$ -inch cast-iron moulded eaves-gutter, connected with $2\frac{1}{2}$ -inch downspouts as shown.

All the external wood and ironwork to have four coats of good oil paint, being previously well knotted, finishing with a plain oak tint; the internal woodwork to have three coats. The windows to be glazed with good crown glass.

SOILING.

The slopes of spoil banks, or other land to be soiled, shall be carefully dressed or trimmed to the required inclination, and then covered with the turf or soil previously obtained from the surface of the ground and preserved for the purpose.

After the soil is laid on to the specified thickness, and as soon as the proper season will admit, it shall be sown with rye grass and clover seed, not less than 20 lbs. of rye grass and 10 lbs. of clover seed being sown at each acre. Where the engineer may require it, the slopes must be neatly faced with turf or soil, not less than 8 inches in thickness, laid with the green sward outwards.

GENERAL STIPULATIONS AND CONDITIONS.

POWER TO VARY WORK.

The descriptions of works required by the Local Board to be executed by the contractor are set forth in this specification and in the drawings, and the nearest approximations to the actual quantity of work required to be executed are set forth in the bill of quantities; but the engineer reserves to himself the power to vary, extend, or diminish the quantities of work without vitiating the contract, and also to make any alterations in the quantity, description, or character of the works which he may think proper, and the contractor shall not have any claim upon the Local Board for any such alteration other than for the actual work done, calculated according to the particular price for such work as inserted in the schedule or bill of quantities.

Should there be any discrepancies between the wording of this specification and the dimensions written on the drawings, or between the written dimensions and the diagrams they refer to, in all cases the contractor shall be regulated by the wording of the specification, in preference to the written dimensions, and by the written dimensions in preference to the diagrams.

MATERIALS, IMPLEMENTS, AND LABOUR PROVIDED BY THE CONTRACTOR.

The contractor shall, at his own cost and charges, furnish all earthenware pipes, cast-iron pipes, sluices, valves, fencing, stone, bricks, timber, ironwork, cement, lime, sand, ashes, puddle, centering, barrows, planks, carts, mortar mills, steam engines, pumps, and all other implements, materials, and also all horse and manual labour necessary for the full and complete performance of his contract, including the erection and maintenance of all necessary hoarding, coffee dams, temporary embankments, fences and bridgeways for the local traffic, and he shall in like manner furnish lights and watchmen, and everything necessary for the safety of the public, and for the protection of adjoining properties. If any materials or implements shall be brought on the ground for use which the engineer or resident engineer may deem to be of inferior description or improper to be used in the work, the same shall be removed forthwith by the contractor upon his receiving notice to do so, and if the directions of the engineer or resident engineer be not complied with within 24 hours after the contractor or his agent has received a written notice to that effect, the engineer or resident engineer shall be at liberty to remove the same, at the expense of the contractor.

CONTRACTOR RESPONSIBLE FOR FINISHED ACCURACY OF WORK.

The works will be set out by the resident engineer, who will also give the proper depths and particulars on the ground, and the contractor will be held responsible for the works being completed in accordance with the lines and levels so given.

The contractor shall not absent himself from the works without leaving a fully authorised agent to act in his absence; and he shall not relet, sublet, or assign this contract, or any portion of it, without the consent of the engineer in writing.

THE CONTRACTOR TO BE RESPONSIBLE FOR ALL TRESPASSES AND DAMAGES.

The contractor shall be responsible for any trespass on lands, &c., and for all damage to property arising out of his contract, and, in the event of accident to any person or persons, damage to property, injury to cattle, or damage or injury of any description to any person or thing arising from carelessness, neglect, or the want of due precaution on the part of the contractor or his workmen in carrying on the works, or from non-compliance with the conditions and stipulations of this specification, in respect of lighting, watching, fencing, or otherwise, the contractor shall indemnify the Local Board from all claims on account thereof; and if the Local Board are called upon to pay any money in respect thereof, the sums so paid shall be charged to the contractor as so much money paid to him on account of his contract, and the contractor shall not be at liberty to dispute or question the right of the said Local Board to make such payment for him, or on his account, notwithstanding the same may have been made without his consent or authority; any decision or determination in law, or otherwise, to the contrary, notwithstanding.

NOTICE TO COMMENCE WORKS.

The Local Board will arrange with the owners and occupiers of property, and give the contractor possession of the necessary lands. The contractor must commence the works within three days from the time a written notice signed by the engineer shall have been served upon him, or have been posted to his usual place of residence; he shall not commence without such notice.

EXTRA WORKS, HOW ALLOWED.

The contractor may be required to perform and execute extra work or day work, and if so, the resident engineer shall first give the contractor an order in writing for such work, which shall be paid for as extra according to the schedule of prices; but if it be work for which a price is not mentioned in the schedule, then, and in such case, a price shall be agreed upon by the engineer and the contractor, in writing, before commencing the work. Extra charges will not be allowed unless the same are certified by the engineer as being extra the contract. The contractor must send in to the resident engineer, weekly, a written statement showing the quantity and value of all extra work ordered and executed in the preceding week.

CONVENIENCE OF TRAFFIC TO BE CONSIDERED.

To prevent accident to the public during the progress of the works, proper and safe cross-passages, with proper hand-railing, are to be made by the contractor, at his expense, and these must be maintained by him for the use of the occupiers of adjoining property, as also for the general public; and whenever it may be practicable to provide for the through traffic of roads or streets by the erection of bridgeways or formation of temporary roads, such works shall be constructed, by the contractor, at his own expense.

The contractor must at his own expense provide temporary bridges for all the footpaths and roads intercepted, and also for the occupation of the lands passed through.

PROTECTION OF BUILDINGS, &c.

The contractor shall, at his own expense, shore, sling, protect, alter, divert, restore, and make good, as may be necessary, all houses and buildings of every kind, water-pipes, gas-pipes, sewers, drains, walls, fences, or other properties which may be disturbed or injured during the progress of the work, and he shall also at the like expense provide extra timbering and labour where required, as also carefully fence, protect, light, and watch places made (by reason of the works) dangerous to the public.

TIMBER LEFT IN TRENCHES.	In any case in which the engineer or resident engineer may direct that timbering shall be left in a trench, the sum of 1s. 6d. per cubic foot will be paid for such timber; but if the necessity for leaving it in has, in the opinion of the engineer, arisen from carelessness or neglect on the part of the contractor, the timber so ordered by the engineer or resident engineer to be left in the trench or trenches will not be paid for. No timber will be paid for unless it be ordered to be left in by the engineer or resident engineer.
GOOD FOUNDATIONS TO BE SECURED.	Where ground will not present a sufficiently firm foundation for the brick invert or pipes, the contractor shall excavate to such increased depth as may be necessary, and shall make the trench good to the required form and level with concrete, or with such other material for securing a good foundation as the engineer may see fit to direct; all increased work arising therefrom will be paid for as an extra, if done upon the written order of the engineer.
FLOW OF WATER TO BE CONSIDERED. PUMPING, &C.	The contractor shall at his own cost provide for the flow of sewers, drains, or watercourses which may be interrupted during the progress of the works, and shall restore and make good all connections, as may be directed. The contractor shall at his own expense fix and provide proper and sufficient pumps for pumping out, and shall pump out or otherwise remove, any water which may exist or be found at any time in the trenches comprised in this contract, and shall form all dams or other works necessary for keeping the excavations clear of water during the progress of the works.
EXAMINATION OF WORK. WORKS MAY BE EXAMINED BY THE ENGINEER. DISMISSAL OF INCOMPETENT PERSONS	No work shall be covered in until it has been examined by the resident engineer and directions given by him to that effect. Whenever the engineer shall require it, proper openings or excavations down to any pipe shall be made, to allow of full examination, and if the work shall in any respect be found defective, all expenses of such examination and of making good shall be defrayed by the contractor; but if found to be in a satisfactory condition, such expenses shall be allowed. Any person employed by the contractor on the works who shall appear to the resident engineer to be incompetent, or to act in an improper manner, may be discharged by the engineer, and such person shall not be again employed upon the works without permission from the engineer.
NO ALLOWANCE FOR UNAVOIDABLE DELAY OF WORKS.	Should it be deemed necessary, on account of the inclemency of the weather, or from any other legitimate cause, to suspend the works, or any portion of them, the engineer shall have power to direct such delay, without any extra allowance being demanded by the contractor, but the period during which the works may be so suspended shall be allowed to the contractor in computing the time for the completion of the work.
NOTICE TO CONTRACTOR FOR DEFECTIVE WORK, &C., AND PROCEEDINGS THEREON.	All articles of value or antiquity found in the works must be delivered to the clerk to the Board. If, at any time, it shall appear that the works, or any portion of them, are not being executed in a sound and workmanlike manner, or with due diligence, or if the contractor shall, from bankruptcy, insolvency, or any cause whatever, be prevented or delayed in proceeding with the works in accordance with this specification, it shall be lawful for the Local Board, after three days' previous notice, signed by the engineer, of their intention to do so, to take possession of all plant, implements, and material upon the works belonging to the contractor, and to employ any other builder, workman, or other person, by contract, measure and value, day work, or otherwise, to proceed with the said works, and to complete the same. And on the expiration of the said notice, the contract shall, at the option of the Local Board, become void as to the contractor, but without prejudice to any right of action which the contractor may be subject unto for any voluntary neglect in not proceeding with the works in accordance with this specification.
DIRECTION OF WORKS.	The works are to be constructed under the direction, superintendence, and to the absolute satisfaction of the engineer, whose judgment as to the manner in which the work is executed, or the quality of the workmanship or materials, or otherwise touching the execution of the work, shall be absolute and without appeal; and, in case of any difference between the Local Board and the contractor, either during the progress or after the completion of the works, as to any matter of charge or account, as between the Local Board and the contractor, the decision of the engineer shall be final and binding on all parties.
DATE OF COMPLETION.	The time fixed for the completion of the works comprised in this contract is two years from the date of the engineer's order to commence, and the contractor shall pay as liquidated damages £5 for every day that any part of the works shall, by his default, remain unfinished after that time, whether the works shall be in course of completion by the contractor or by the Local Board, or by others on their behalf.
MEASUREMENT OF WORK.	The work as it proceeds will be measured up monthly by the resident engineer. The contractor will be at liberty to accompany him, in order that they may agree on the measurements; should he neglect to do so, the resident engineer's measurement shall be taken as final and conclusive. Only the net measurements of work will be allowed, notwithstanding any local or other usage or custom to the contrary.
CERTIFICATE.	The final certificate for the contract will be made out by measurement based upon the actual quantity and description of all the work executed by the contractor, as measured and calculated according to the prices in the bill of quantities or in the schedule, the former in all cases being taken wherever in the opinion of the engineer they may be applicable.
CONTRACTOR TO KEEP WORKS IN GOOD ORDER. PAYMENTS.	The contractor shall maintain and keep in repair and good order the whole of the works for twelve months after the completion of the whole. No payment will be made to the contractor until work to the value of 10 per cent. on the total amount of the tender has been executed; this sum will be retained in the hands of the Local Board until the expiration of the term of maintenance, when it will be paid to the contractor, along with simple interest, at the rate of 4 per cent. per annum, calculated from the time when such amount of work had been executed and measured; provided that in no case the period of payment of interest shall exceed three years. After this retention has been made, the works will be paid for in full, according to the prices in bill of quantities or schedules.
CONTRACTOR TO SIGN CONTRACT DEED.	The contractor will be required to enter into a contract for the execution of the works according to the foregoing conditions, which contract will fix and specify a pecuniary penalty (to be named by the Local Board) to be paid by the contractor as a liquidated and ascertained amount in case the terms of the contract are not duly performed, and such contract must be signed by the contractor as soon as tendered for that purpose.
CONTRACTOR TO FIND TWO SURETIES.	The contractor will also be required to find two sufficient sureties, to the satisfaction of the Local Board, to join him in a bond in a sum of money (to be fixed by the Local Board) for the due performance and fulfilment of such contract. The bond and contract deed to be executed at the same time.
CONTRACT DEED AND BOND TO BE PREPARED BY CLERK TO LOCAL BOARD.	The contract deed and bond will be prepared by the clerk to the Local Board, at the joint and equal expense of the Local Board and the contractor.

CONDITIONS TO BE OBSERVED IN TENDERING.

TENDERS, &C., TO BE MADE OUT ON PRINTED FORMS.	The tender, bill of quantities, and schedule of prices, must be made out upon forms furnished by the engineer, and must be signed by a principal or by a declared agent acting on his behalf, and the whole of the requirements, as set forth in such forms, must be complied with, or the tender cannot be received.
TENDERS TO BE SEALED.	Tenders to be sealed and endorsed with the words 'Tender for Waterworks Contract, No. 4,' and, together with the bill of quantities and schedules of prices, must be addressed and forwarded (post paid) to the clerk of the Local Board, on or before the date named for the reception of the same, as set forth in the advertisement.
CONTRACTOR TO INFORM HIMSELF FULLY AS TO SPECIFICATION.	Should there be any doubt or obscurity as to the meaning of any portion of this specification, the contractor is requested to set forth the particulars of such doubt in writing, and submit the same with his tender, in order that the obscurity may be removed before the acceptance of his tender, for should any misunderstanding arise as to the meaning of this specification during the progress of the

works, the decision of the engineer as to the true intent and meaning of any dimensions, clause, word, sentence, or sentences, shall be conclusive and binding.

N.B.—The Local Board do not bind themselves to accept the lowest or any tender.

Parties tendering must do so at their own cost.

The contractor whose tender is accepted will have to pay to the engineer the sum of ten guineas towards the cost of printing the particulars.

MESSRS. LAWSON AND MANSERGH, ENGINEERS.

ABERDEEN WATERWORKS.

GRAVITATION SUPPLY FROM CAIRNTON.

SPECIFICATION

Of Works and general Conditions of Contract, as embodied in the Contract for the Execution of the Works entered into between the Commissioners under 'The Aberdeen Police and Waterworks Act, 1862,' on the one part, and Mr. Easton Gibb, Civil Engineer in Aberdeen, the Contractor and his Sureties, on the other part, dated 1st and 2nd April 1864, and registered in the Books of Council and Session, 4th April 1864.

The contract bears as follows:—

That the said Easton Gibb shall well and substantially, and in a good, lasting, and workmanlike manner, make, execute, construct, and complete an aqueduct for conveying water from the river Dee, at Cairnton, to Aberdeen, with reservoirs, filters, tanks, conduits, pipes, engine, and other works appertaining thereto, required to be provided, constructed, and maintained for the commissioners, in accordance with the drawings, nineteen in number, marked 'Aberdeen Waterworks Extension, Contract No. 1,' signed by all the parties hereto of even date herewith as relative hereto, and subject to the general conditions of contract hereinafter contained and agreeably to and in terms of the specifications following, namely:—

GENERAL DESCRIPTION OF WORK.

1. The works comprised in this contract are the excavation for, and construction of, a grating tank, with inlet sluice, gauge weir, and other appurtenances, at and contiguous to the river Dee, at Cairnton; the excavation for, and the construction of, an aqueduct thence to the reservoir at Invercannie, including a driftway or tunnel; the excavations and embankments for, and the formation of, the above-named reservoir, with clay puddling, stone pitching, inlet, outlet, and other tanks, by-pass conduit, fencing, roads, and other works; the excavations and embankments for, and the construction of, an aqueduct from the said reservoir to the low-service reservoir at the Brae of Pitfodels, near Aberdeen, including overflow and drain tanks, drains, culverts, pipes, piers, and abutments, the formation of roads, and sundry other works; the excavations and embankments for, and the formation of, the above named low-service reservoir at the Brae of Pitfodels, with tanks, walls, pipes, ironwork, and other things complete; the excavations and embankments for, and the construction of, the high-service reservoir at the Hill of Pitfodels, near to Aberdeen, with walls, tanks, pipes, and other works; the providing, erecting, and working for one month, as provided for in Article 25th hereof, of an hydraulic engine, with pumps and apparatus, near to St. Devenick's Suspension Bridge, over the river Dee, for raising water to the said high-service reservoir, together with the building for containing the said engine and pumps and the works in connection therewith; the providing, laying, and jointing of sundry lines of cast-iron pipes and apparatus from the aqueduct to the engine, and thence to the reservoirs; also from the reservoirs to the city of Aberdeen; together with all the minor works, operations, and provisions appertaining to the undertaking, in accordance with this specification, the general conditions of contract hereinafter contained, and the said drawings, and as hereinafter more particularly detailed and described.

GENERAL LEVELS.

2. The datum line on the general section No. 2 of the said drawings is 35 feet below the top of the front-door sill of the water-house at Union Place, Union Street, Aberdeen. The invert of the grating and inlet tank at the river Dee, at Cairnton, is to be 158 feet, and the invert of the aqueduct commencing from and out of the said tank is to be 156½ feet above the said datum line. The aqueduct, including the tunnel or driftway, is thence to fall 1 foot to the Invercannie Reservoir, the invert being 155½ feet above datum at this point.

The high-water line of the Invercannie Reservoir is to be 160 feet above the datum line, and the invert of the aqueduct commencing at the filtered-water tank, and also at the junction tank for the by-pass pipe, is to be 143 feet 3 inches above the same. The aqueduct is to fall from this point to the low-service reservoir at the Brae of Pitfodels with a gradual and uniform rate of inclination of 2 feet in the mile, excepting for the last two miles, in which the fall is to be 18 inches only per mile, the invert near to the said reservoir being 107½ feet above the datum line. The high water of the same reservoir is to be 111 feet, and the high water of the high-service reservoir is to be 346 feet above the said datum line, and the levels of all other parts of the works are to be arranged as shown on the said drawings and sections with reference to the above-named levels, or as will be further directed during the execution of the works.

DETAILED STATEMENT OF WORKS.

3. The following is a statement of the various works, with the approximate distances of the same, as measured along the line of aqueduct, from the end of the tunnel near the river Dee, at Cairnton, towards Aberdeen, as marked on the general plan and sections Nos. 1 and 2 of the said drawings, and explaining also the number of the drawing on which the details of the work will be found. It must be understood, however, that this statement is only intended to facilitate reference, and is not meant to embrace the entire works, and that the omission of any work or any detail thereof from the same is not to exonerate the contractor from the performance of everything comprehended in the contract in accordance with the drawings and specification:—

Approximate distance from end of Tunnel near river Dee, at Cairnton, mls. fur.		DESCRIPTION OF WORK.	Shown on Drawings Nos.
mls. fur.	mts. fur.		
		Grating and inlet tank at the river Dee, at Cairnton, with part of aqueduct thence to mouth of tunnel	1, 2, 3.
0 0	to 0 3½	Tunnel 5 feet high by 4 feet wide, 740 yards or thereabouts long, with fall of 1 foot per mile	1, 2, 4.
1 0		Invercannie Reservoir and Filters, with inlet and outlet tanks, overflow and drain tanks, by-pass pipe fencing, roads, and other works	1, 5, 6.
1 2		Overflow and drain tank, and 8 yards of 24-inch barrel-drain, and conduit mouth at river	1, 2, 4.

Approximate distance from end of Tunnel near river Dee, at Cairnton. mils. fur. mls. fur.		DESCRIPTION OF WORK.	Shown on Drawings Nos.
1	2	Cast-iron aqueduct and bridge, 35 feet span, over Burn of Cannie, with abutments, embankments, roads, railings, and other works	1, 2, 8.
1	2 to 1 3	Turnpike road to be raised 6 feet 6 inches at deepest part	1, 2.
1	6 $\frac{3}{4}$	One 40-inch diameter pipe, 12 feet length, to be inserted in aqueduct, arch under road to be raised, and bed of stream paved	1, 2, 4.
1	7 $\frac{3}{4}$	Stream to be lowered, and 32 feet of culvert, with head walls built under aqueduct. One 40-inch pipe, 12 feet length, to be inserted in aqueduct	1, 2, 4.
2	3 $\frac{1}{2}$	Overflow and drain tank, and 55 yards of 2 feet diameter barrel-drain, with conduit mouth	1, 2, 4.
2	7	48 yards of 40-inch cast-iron pipes, with junction tanks	1, 2, 4.
3	7 $\frac{1}{4}$	Stream to pass over aqueduct in 18-inch glazed stoneware pipes, 5 yards long, with head walls, and one cast-iron pipe 40 inches diameter	1, 2.
4	5 $\frac{1}{2}$	Overflow and drain tank, with 2-feet barrel-drain 40 yards long, with head walls	1, 2, 4.
4	5 $\frac{3}{4}$	Embankment with dry rubble hearting, two stone culverts respectively 5 feet and 2 feet diameter, and 16 yards and 14 yards long, for Burn of Bennie and mill lade to pass under aqueduct	1, 2, 7.
4	6	Public road to be raised 1 foot	1, 2.
5	2 $\frac{1}{2}$	Culvert 18 inches diameter, 8 yards long, with head walls for stream under embankment	1, 2.
5	5 $\frac{3}{4}$	Culvert 5 yards long, with head walls for stream under embankment	1, 2.
6	0 $\frac{3}{4}$	one 40-inch diameter cast-iron pipe	1, 2.
6	2 $\frac{1}{2}$ „ 6 3 $\frac{1}{2}$	Road to be raised	1, 2.
6	3 $\frac{3}{4}$	Culvert 2 $\frac{1}{2}$ feet diameter, 14 yards long, with head walls for stream to pass under aqueduct, and one 40-inch cast-iron pipe	1, 2.
6	5 $\frac{3}{4}$	Overflow and drain tank, and 28 yards of drain 24 inches diameter, with conduit mouth at stream	1, 2, 4.
6	6 „ 6 6 $\frac{1}{2}$	Cast-iron pipes 36 inches diameter, under Crathes Burn, embankments, &c.	1, 2, 9.
7	3 $\frac{1}{2}$	Culvert 4 feet diameter, 17 yards long, with conduit mouths and walls for mill stream to pass under embankment, and two 40-inch cast-iron pipes	1, 2.
7	6 $\frac{1}{2}$	Culvert 24 inches diameter, 15 yards long, with conduit mouths for stream to pass under embankment	1, 2.
8	5 $\frac{1}{2}$	Culvert 24 inches diameter, 33 yards long, with conduit mouths for stream to pass under embankment	1, 2.
9	1 $\frac{1}{4}$	Culvert 30 inches diameter, 12 yards long, with conduit mouths for stream to pass under embankment	1, 2.
9	1 $\frac{1}{2}$	Overflow and drain tank, and 22 yards of 2-feet barrel-drain, with conduit mouth at stream	1, 2, 4.
9	2 $\frac{1}{2}$	Occupation road to be raised 4 feet	1, 2.
9	2 $\frac{3}{8}$	Embankment with 18 feet of 18 inches diameter cast-iron pipe to convey mill stream under aqueduct to Park Saw Mills	1, 2, 4.
9	2 $\frac{3}{4}$	Culvert 1 foot diameter, 20 yards long, to convey waste water over aqueduct	1, 2.
9	5 $\frac{1}{2}$	Public road to be raised 1 foot, and 22 yards of 18-inch barrel-drain built for side ditch with conduit mouths	1, 2.
9	6 $\frac{1}{4}$	Bed of stream to be raised and paved for 10 yards in length	1, 2, 4.
9	7 $\frac{3}{8}$	Ditto	1, 2, 4.
11	0 $\frac{3}{4}$	Embankment at Drum Mill Stream, with side walls and pitched channel over aqueduct, with a 40-inch cast-iron pipe	1, 2, 7.
11	3 $\frac{1}{4}$	Overflow and drain tank, and 125 yards of 2-feet barrel-drain and conduit mouth at stream	1, 2, 4.
11	6 $\frac{1}{2}$ „ 11 7 $\frac{1}{2}$	Beds of three ditches to be raised and paved across aqueduct	1, 2, 4.
12	0 „ 12 4	Embankment and dry rubble hearting	1, 2, 4.
12	1	Culvert 30 inches diameter, 19 yards long, with conduit mouths	1, 2, 4.
12	2 $\frac{3}{4}$	Public road to be raised 13 feet	1, 2.
12	4 „ 12 4 $\frac{3}{4}$	Turnpike road to be raised 2 $\frac{1}{2}$ to 3 feet	1, 2.
13	4	Two embankments, with dry rubble heartings, to support aqueduct, and farm road to be raised 7 feet 6 inches, and 18-inch and 12-inch drains under aqueduct	1, 2, 4.
13	5 $\frac{1}{4}$	Overflow and drain tank, and 84 yards of 24-inch barrel-drain, with conduit mouth	1, 2, 4.
13	5 $\frac{1}{2}$ „ 13 6 $\frac{3}{8}$	Cast-iron pipes 36 inches diameter, through valley of Culter Burn, with abutments, embankments, &c.	1, 2, 4, 9.
15	1 $\frac{1}{2}$	Embankment, and paved channel for stream to pass over aqueduct	1, 2, 4.
15	6	Embankment, with 12 yards culvert, 2-feet diameter, under aqueduct, with conduit mouth and one 40-inch cast-iron pipe	1, 2.
16	1 $\frac{1}{2}$	Overflow and drain tank, and 31 yards of 24-inch barrel-drain, with conduit mouths at stream	1, 2, 4.
16	1 $\frac{1}{2}$	Embankment, with dry rubble hearting to carry aqueduct across Den of Murtle, culvert 4 feet diameter, 24 yards long, for stream, with conduit mouths	1, 2, 4.
16	1 $\frac{7}{8}$	Embankment, with dry rubble hearting, and road to be raised 1 foot	1, 2, 4.
16	5 $\frac{3}{4}$	Embankment, with dry rubble hearting, and culvert 3 feet diameter, 12 yards long, with conduit mouths for stream under aqueduct	1, 2, 4.
16	6 $\frac{1}{4}$	Paved channel for stream to cross over aqueduct	1, 2, 4.
17	5 $\frac{1}{4}$ „ 17 6	Portions of turnpike road to be raised. Two lengths of 40-inch cast-iron pipes, respectively 21 yards and 16 yards long, with junction tanks	1, 2, 4.
17	7 $\frac{1}{2}$	Overflow and drain tanks, and 45 yards of 24-inch barrel drain and conduit mouth at Burn of Cutts	1, 2, 4.
17	7 $\frac{3}{4}$	Embankment, with dry rubble hearting, and culvert 5 feet diameter, 20 yards long, with conduit mouths for stream to pass under aqueduct	1, 2, 4.
18	0 $\frac{1}{2}$	Junction tank, &c., for pipe to supply hydraulic engine	1, 2, 13.
18	4 $\frac{1}{2}$	Road to be raised 18 inches	1, 2.
18	5 and 18 5 $\frac{1}{2}$	Two culverts, 18 inches diameter, 12 yards long each, with conduit mouths	1, 2.
18	6 $\frac{1}{2}$ to 19 0	Turnpike road to be raised for a length of about 380 yards, and side wall to be raised.	1, 2.
19	2 „ 19 2 $\frac{3}{4}$	Turnpike road to be raised for a length of about 160 yards	1, 2.
19	3 $\frac{1}{2}$	Junction tank and commencement of 36-inch pipe to Aberdeen	1, 2.
19	4 $\frac{1}{2}$	Low-service reservoir and works connected therewith at Brae of Pitfodels	1, 2, 10.
		High-service reservoir and works connected therewith at Hill of Pitfodels	1, 2, 11.
		Hydraulic engine and pumps, with building complete.	1, 12.

DESCRIPTION OF WORK.

Shown on
Drawings
Nos.

Laying and jointing 540 yards, or thereabouts, of cast-iron pipes, 18 and 15 inches diameter, from aqueduct to hydraulic engine; also 33 yards of 18-inch drain pipe, with tank 4 feet diameter, and 10 yards of 24-inch barrel-drain to river	1, 13.
2,000 yards, or thereabouts, of 10-inch diameter cast-iron pipes from hydraulic engine to high-service reservoir	
1,130 yards, or thereabouts, of 27-inch, and 1,460 yards, or thereabouts, of 24-inch diameter cast-iron pipes from the low-service reservoir to the water-house at Union Place, Union Street, Aberdeen	1, 2.
400 yards, or thereabouts, of 24-inch brick barrel-drain, to drain low-service reservoir	
2,290 yards, or thereabouts, of 10-inch, and 1,840 yards, or thereabouts, of 9-inch diameter cast-iron pipes from the high-service reservoir to Aberdeen	
1,570 yards of pipes 7 inches diameter	
140 " " 6 " "	
32 " " 5 " "	

The above specified pipes are the lengths as measured after laying and jointing, and are exclusive of, and in addition to, those to be laid within the boundary walls of the sites of the service reservoirs.

It must be understood, however, that independently of the above data, the whole of the pipes and apparatus specified hereinafter to be provided are to be laid, jointed, and fixed in the lines and places shown, or as will be directed.

BORINGS.

4. Whereas certain borings were made in the months of April and May 1863, on the sites of the Invercarnie Reservoir, along the line of aqueduct, and on the sites of the high and low service reservoirs, and of which borings a list is herewith annexed and signed by the parties of even date herewith, as relative hereto, it is hereby declared that the said borings were given as a general indication of the nature of the ground in which the works are to be constructed, in order to assist the contractor in estimating the value thereof to be performed under the contract; but it is expressly and distinctly understood that the commissioners do not bind themselves to the absolute correctness of the description of the nature of the sub-strata in every boring, or of the depth at which water may or may not be found; nor shall they be held liable for any difference or variation therefrom that may be hereafter discovered—the intention having been and being that the contractor should and shall investigate the soil on the sites of the several works, and make himself thoroughly acquainted with the nature and description thereof; and also to take upon himself the risks and bear all the costs of the complete construction of the whole of the works, according to the terms of the contract, whatever might or may turn out ultimately to be the nature or condition of the excavations, or the foundations for the several parts of the works.

EXCAVATIONS
GENERALLY.

5. The earth, gravel, rock, and all other materials are to be excavated in the several places and to the several depths and dimensions necessary for the construction of the aqueduct shafts, tunnel, or driftway, reservoirs, filters, and other works, and for laying down the lines of pipes and drains in accordance with the said drawings, signed as relative hereto, and provisions of the specification, and the conditions of the contract hereinafter written.

The excavations for the foundations are to be as nearly as possible of the forms of the works to be built therein; but, when such excavations are made, should any loose, faulty, or unsound places appear, they are to be cut out, and the spaces thus left, as well as all superfluous excavations of any kind, are to be filled in with hard, dry material, as will be directed.

As the foundation works are executed, the walls built, and the drain pipes and other things laid and completed, the excavations are to be filled in with suitable and proper materials, of a hard, dry character, in horizontal layers of such thickness as will be approved, each and every course being well beaten, rammed, or otherwise consolidated, and the surfaces restored as hereinafter specified.

Where the tunnel or driftway at Invercarnie runs through rock, it is to be quarried and excavated as nearly as possible of the form and dimensions shown on No. 4 of the said drawings signed as relative hereto, and the rock worked to a fair surface up to a height of four feet above the invert. All fissures, or loose and faulty places, up to the said level in the rock, are to be cut out and removed, and the spaces filled in with masonry, set solid in cement, as directed.

Should the rock in any part or parts prove to be so loose and fractured as to necessitate the tunnel being lined for certain lengths, the excavation is to be increased, so as to admit of the lining being built and finished according to the alternative cross-section on the said drawing No. 4 without the clay puddle.

The positions of two shafts are indicated on the general section. The contractor, however, will not be confined expressly to these places, nor to this number of shafts, but will be permitted, with the sanction of the engineer, in writing, to vary the positions and increase the number of shafts (the increased number being at his own cost and charge), to facilitate and expedite the execution of the tunnel or driftway.

The shafts are to be six feet internal diameter in the clear, and the upper portions thereof above the solid rock are to be lined with brickwork or masonry, not less than nine inches in thickness carried up to the ground surface. The shafts are to be covered with stone landings six inches thick, fair worked on top, and a cast-iron grating or air escape is to be fixed as directed on top of each.

Previously to commencing the excavations for the reservoirs, aqueducts, or other works, the turf and vegetable mould are to be removed from the ground surfaces generally, as well as from under the seats of the embankment, and preserved for recovering the trenches, slopes, and top of embankments and other parts, as hereinafter specified, or as will be directed during the execution of the works.

The contractor will be bound, at his own cost and charge, to procure the necessary licenses from, to make every arrangement with, and to conform to all the rules and regulations of, the road trustees and their surveyors, as well as other authorities, for breaking up, restoring, or otherwise interfering with any streets, roads, footpaths, bridges, buildings, sewers, culverts, drains, water channels, trees, walls, fences, and all other things along and contiguous to the lines of works.

Where the excavations and other operations of this contract are carried on in any streets, roads, footpaths, or other places open to the public, all obstructions to the traffic are to be avoided, as far as practicable, temporary roads and footways are to be formed where requisite, for the convenience of the public, temporary fencing and boarding erected, lights fixed and maintained at night, and a sufficient number of watchmen provided and stationed as will be directed. The excavated earth and materials are to be carefully trimmed as often as necessary, the surplus removed daily, and all possible further precautions taken for the protection of the public from accident during the progress and until the entire completion of the works of the contract.

All excavations are to be especially subject to the control of the resident engineer and the superintendents acting under him, with reference to the extent of ground open at one time in public roads and places, the excavations being made to such lengths only as will suit the quantity of pipes or other works ready to be laid therein, so that as little delay as possible may occur between opening and filling in the ground.

EMBANKMENTS.

6. Embankments are to be formed round the high and low service reservoirs, in various parts along the line of aqueduct, round the Invercarnie Reservoir, for raising sundry roads, and in other places, to the heights, breadths, and slopes shown on the said drawings, signed as relative hereto. All the embankments formed on the lands coloured purple on the general plan No. 1 of the said drawings are to be fenced in as hereinafter specified; they are to be formed in regular horizontal courses, not exceeding six inches each in thickness, and

each and every course is to be well pounded or carted over, or otherwise consolidated, the whole being, if required, well watered as the works proceed, and the slopes are to be finished 2 horizontal to 1 vertical. The embankments formed on the lands coloured green on the said drawing No. 1 are to be formed with slopes of not less than 6 horizontal to 1 vertical, and are arranged with the view of affording convenient places of deposit for the surplus earth and other materials from the excavations; they are not to be fenced round, it being intended to give up the raised surfaces to the adjoining owners and occupiers of the lands on the completion of the works. These embankments are only required to be raised to the height of 2 feet 6 inches above the crown of the aqueduct on the land coloured purple, and four feet above the crown on the land coloured green; but if the contractor should find it convenient to increase the heights thereof at any part, so as to deposit a further amount of material, he is to be at liberty to do so, upon the understanding that the embankments are not to exceed the limits of the coloured spaces on the plan, the slopes being not less than 6 to 1, as above stated, and that all extra drainage works rendered necessary by such increase are to be performed at his own cost and charge.

All the slopes are to be trimmed and formed with regular and uniform inclinations, or otherwise as shown on the said drawings, or as directed; due allowances are to be made in raising the embankments for the settlement and consolidation of the materials, and those with the 2 to 1 slopes will have to be left at the required dimensions and inclinations on the completion of the contract.

All embankments and parts thereof in which the top of the invert of the aqueduct is more than one foot above the original ground surface are to have dry packed rubble stone heartings in them, to support the aqueduct, founded 6 inches below the surface, and carried up to underneath the bed puddle, as shown on No. 4 of the said drawings; the heartings to be of packed stone, the larger interstices being filled in with small stone, the whole being grouted with the clayey subsoil from the excavation, to render it firm and compact.

SOILING SLOPES
AND GROUND
SURFACES.

7. The tops and slopes of all embankments (where not specified to be otherwise finished), and of all the surfaces of the trenches, and other parts, in gardens, fields and private lands, where cut up for the works or injured during their progress, are to be covered with vegetable mould. The embankments of the reservoir, &c., and those raised on the lands coloured purple on the general plan, are to have 6 inches of thickness of mould; and all other land surfaces over the aqueduct, including the embankments of deposit, are to be covered with 9 inches of mould; and the whole of the permanent embankments and surfaces, viz. those specified to have 6 inches in thickness, are to be sown with good grass seed, and well watered, if necessary, and attended to as required during the carrying out of the contract.

Should the mould removed previously to commencing the excavations prove insufficient to cover the slopes of the embankment and ground surfaces generally, as specified, the contractor will have to procure the additional mould for this purpose.

SURPLUS EARTH.

8. The surplus earth and materials (if any) from the excavations, over and above the quantities disposed of in the embankments and other parts, as above described, are (with the exception of any portions of the same which the resident engineer may direct to be retained for the use of the commissioners) to be removed and deposited by the contractor, who is to find places of deposit for the same, at his own cost and charge.

MASONRY
GENERALLY.

9. The whole of the masonry (except where any other particular mode of building is specially specified) is to be laid solid in mortar, made as hereinafter described. The joints are to be as thin as possible, consistent with sound and good workmanship, and grouting is only to be resorted to where specially directed or permitted.

The granite excavated from the different parts of the work may be used when fit for the purpose; but, in addition to this, the whole of the stone is to be provided of a proper description for the various works.

The reservoir, abutment, wing retaining and tank walls, where of stone, are to be faced with coursed granite masonry, the stones being fair worked on the bed and side joints, and rough dressed on the faces, and backed up behind to the finished thickness with rough rubble. The stones for the coursed masonry are not to be less than 12 inches thick, and of such lengths and breadths as will effect proper and approved bond throughout the whole of the work.

All landings and copings are to be fair-dressed and square-jointed, and no coping stone is to be less than three feet long.

The walls of the building for the hydraulic engine and pumps are to be fair-dressed, square-jointed, coursed granite masonry, with plinth, strings, and ornamental parts worked in the most approved manner.

Wherever pipes or other ironwork pass through walls of masonry the stones are to be cut and worked to fit the curves of the same, or otherwise as required to joint and fit them neatly in the walls.

BRICKWORK
GENERALLY.

10. All brickwork (except where any other particular mode of laying is specially described) is to be laid in mortar, the joints to be as thin as possible consistently with making sound work, and every course is to be pushed up solid.

No grouting is to be used, unless specially directed, and no bats or broken bricks will be permitted in the work, excepting where required for proper bond. All face work is to be built with selected and suitable bricks, and the exterior joints are to be neatly pointed, flatted, and struck throughout.

Where pipes or ironwork pass through brick walls, the bricks are to be cut to suit the shape thereof, and the work laid in cement to the extent of 18 inches round the iron. All brick on edge copings are to be set in Roman cement.

The aqueduct is to be built with wedge-shaped or radiated bricks, specially manufactured to suit the curves of the work, as shown by the cross-section (drawing No. 4); the whole to be laid solid in mortar; and after the centering moulds and other appliances are removed, the joints are to be pointed and the whole flatted and drawn flush with the brickwork, and left in a clear, clean, and sound condition. Due and proper allowances are to be made in building the invert sides and arches of the aqueduct for the consolidation of the work, as it will be required to remain at the full specified dimensions at the final completion of the contract.

In case it shall be found necessary in any part of the aqueduct, the invert is to be blocked, and the aqueduct to be built in Portland or Roman cement, and where rock is met with sufficiently solid, Portland or Roman cement may be applied and used to render the aqueduct watertight, the clay puddling being in such case omitted.

INLET AND GAUGE
TANK AT THE RIVER
DEE, AT CAIRNTON.

11. An inlet tank, with gratings, gauge, and other works, is to be built of masonry, to admit water from the river Dee, at Cairnton, and to measure the same into the aqueduct, the whole being constructed in the manner and of the forms and dimensions shown on No. 3 of the said drawings, signed as relative thereto.

The wing and side walls of the tank are to be built, as shown on the drawing, to a height of 11 feet 6 inches above 'summer water level.' The mouth of the tank is to be 7 feet wide, gradually diminishing to 5 feet, and vertical grooves are to be formed to hold the outer frame and gratings, as well as for inserting wire gauze screens—the outer grooves to be 6 inches wide and 6 inches deep, and the inner grooves 4 inches wide and 4 inches deep.

The internal or gauge chamber is to be 9 feet wide, having projecting walls built as shown, to break the velocity of the current of water before reaching the gauge.

The gauge is to be made of cast iron 7 feet wide, fixed on a cross wall, as shown. The inner chamber is to be arched over, excepting a portion over the gauge, which is to have side walls carried up to a height of 6 feet above the finished ground surface, and covered with bevelled stone landings to form an entrance to the gauge tank. This tank is to be furnished with a stout oak entrance door and plate-glass window, both in oak frames, the door being fitted with a strong lock and two keys. The wing walls are to be finished with rough-dressed, square-jointed copings, and rebated copings are to be fixed round the top of the walls of the sluice tank to receive the covering plates; two 15-inch inlet sluices are to be fixed, with pipes, spindles, &c., to admit water to the gauge chamber.

The ground is to be embanked over the chamber, and behind the wing and side walls, up to the level of the top of the copings, and run out level from the river to meet the slope of the present surface, and the whole finished with side slopes, as shown on the drawing or as will be directed at the time by the resident engineer.

AQUEDUCT.

The bed and bank of the river is to be excavated to form a channel 11 feet wide in the bottom down to the level of the invert of the grating tank, to admit the water freely at that level.

12. The brick aqueduct from the inlet tank above specified to the tunnel or driftway, and from the opposite end thereof to the Invercannie reservoir, is to be 4½ feet high by 3½ wide; and from junction tank, for the by-pass pipe and aqueduct from the said reservoir to the low service reservoir, at the Brae of Pitfodels, is to be 3 feet 9 inches high, and 3 feet 2 inches wide, finished dimensions inside; the portion from the filtered well to the said junction tank at Invercannie reservoir being 4 feet high, by 3 feet wide, as shown on No. 6 of the said drawings. The aqueduct is to be built 6 inches thick throughout, as shown by the cross section on No. 4 of the said drawings, and surrounded by clay puddle in such parts and places, and to such extent along the line of works, as is marked on the general section. The clay under the aqueduct is to be worked as stiff as possible, and laid in layers, each layer being well kneaded and pounded in its place to sustain the weight of the structure; the side puddle is to be cut, tempered, and worked with a proper quantity of water, and every means used to render the whole watertight.

The gradients or inclinations of the aqueduct are to be strictly maintained, as shown on the said drawings, and hereinbefore specified, and they are to be perfectly uniform throughout.

INVERCANNIE
RESERVOIR AND
FILTERS.

13. A circular reservoir and two filters with filtered water and other tanks, pipes, drains, and appurtenances are to be constructed at Invercannie, in the manner and of the several forms and dimensions shown on Nos. 1, 5, and 6 of the said drawings.

They are to be formed partly by excavating and partly by embanking, and rendered perfectly watertight with clay puddle. The bottoms and internal slopes are to be lined with layers of concrete and the entire side slopes of the reservoir and those of the filters to the extent of 10 feet from the top are to be pitched with random rubble granite pitching of the thickness marked on the drawings. The invert and apron over which the water will flow from the aqueduct are to be pitched with squared granite stones of the thicknesses marked on the drawing, the whole to be laid in mortar in regular courses.

Glazed earthenware drain pipes 18 inches in diameter are to be laid and jointed in cement from the centre tank to the foot of the slope and from thence 18 inch cast-iron pipes are to be laid through the drain tank to the Burn of Cannie and there finished in a conduit, mouth built as directed.

Footpaths 6 feet wide are to be formed round the reservoir and 5 feet wide round the filters with 3 inches of strong gravel laid on under beds of broken stone or coarse gravel 4 inches thick, the whole to be formed to fair and even surfaces to drain towards the outer slopes and well beaten or rolled.

An overflow tank is to be built in the aqueduct in the position and of the form and dimensions, shown on Nos. 1, 5, and 6 of the said drawings, and an open channel, 290 yards or thereabouts in length, is to be cut from thence to the Burn of Cannie, of the dimensions shown and with such regular inclinations as will be directed, a length of 10 yards at the commencement next the overflow tank being pitched with granite stones laid in mortar. The land-drain at present crossing the site of the reservoir and filters is to be diverted into the new channel.

An alternative tank is to be built near the inlet to the reservoir and from thence a line of cast-iron by-pass pipes 18 inches in diameter and 184 yards or thereabouts in length is to be laid and jointed to the junction tank for the filtered water aqueduct as shown on No. 5 of the said drawings.

The filtered water tank is to be 10 feet internal diameter, the walls being finished on top with a rebated coping, and the tank covered with cast-iron plates.

An open jointed brick conduit is to be built in each filter bed with side and end walls and arches. The lower portions of the side walls are to be built in cement and the arches are to be turned with 6-inch radiated bricks like those for the aqueduct laid in cement. A layer of neat cement is then to be rendered over this arch on which 3-inch stone landings are to be bedded and built into the side walls as shown, all possible care being taken to render the work watertight, and prevent the passage of unfiltered water from the top to the bottom.

Glazed perforated stoneware pipes 12, 9, and 6 inches diameter are to be laid in the lower filtering stratum to convey water to the centre drain as shown on No. 5 of the said drawings, and 3-inch cast-iron air escape pipes are to be connected with the ends of the 6-inch drains and centre drains and laid up the filter slopes and terminated with grating heads.

The filtering medium in each filter is to consist of a bed of gravel laid on the bottom concrete, finished with a top layer of sand 2 feet in thickness, of approved qualities and varying from 5 feet thick at the centre to 4½ feet at the sides of the filter beds. These materials are to be thoroughly washed and cleansed, and are to be screened, assorted, and put in place, so that the coarsest of the gravel may be at the bottom and the finest of the sand at the top, which is to slope as shown, to drain towards the centre tank.

The culvert from the filtered water well, together with the supply, overflow, drain, and other tanks, the steps and all other appurtenances are to be built of brickwork with stone bases, treads, coverings, copings, and other parts as shown on the said drawings; and all the pipes, cocks, sluices, ladders, girders, spindles, guides, covering plates, and other iron apparatus are to be provided, laid, and fixed in the positions shown on the said drawings, and jointed as hereafter specified.

AQUEDUCT AND
BRIDGE OVER BURN
OF CANNIE.

14. A 3-foot diameter cast-iron aqueduct is to be constructed across the Burn of Cannie with abutments of masonry, which are also to carry the girders and roadway of a bridge across the same in line of approach road to the reservoir, the whole to be constructed in the manner and of the form and dimensions shown on Nos. 1, 2, and 8 of the said drawings.

The bridge is to be formed with two wrought-iron girders bedded in and built into the abutments, and a platform of planking 4 inches thick, laid on cross sleepers 9 inches by 4 inches, fixed over the tops of the girders. The planking to be shot at the edges, and laid close and even, and covered with a layer of hot pitch, at least half an inch thick, before the ballast and road material is laid on.

The road is to extend from the turnpike road near Invercannie toll-bar to and by the side of the reservoir and to terminate at the road to Cairnton College, as shown on the general plan.

The roadway over the bridge is to be 12 feet wide in the clear, and a wrought post and rail fence is to be fixed by the sides of the bridge in the manner shown on the drawing and extended 3 feet each way therefrom. Elm earth-boards 3 inches thick and 9 inches high are to be fixed by the sides of the bridge to retain the road material, and the railing is to be fixed with back stays to the posts which are to be mortised into the cross sleepers, and secured with strong wrought-iron angle brackets screwed to the flooring. The remainder of the road throughout on both sides up to the site of the reservoir and filters is to have a post and rail fence, with gates, as hereinafter specified.

The road is to be metalled throughout to a breadth of 12 feet, consisting of a top layer of stone or gravel 6 inches thick laid on an under-bed of rough stone 9 inches thick, the whole to be formed 6 inches higher in the centre than the sides to effect drainage.

CROSSING VALLEY
OF CRATHES BURN.

15. A length of 105 yards, or thereabouts, of 3 feet diameter cast-iron pipes is to be laid and jointed through the valley of Crathes Burn, with junction and overflow and drain tanks, as shown on No. 9 of the said drawings.

The overflow and drain tank is to be in connection with the western junction tank and a length of 41 yards of 24-inch brick barrel drain constructed therefrom to the stream. The brick ring is to be 6 inches thick and laid with the inclination shown, and finished at the stream with side and head walls, and apron protected in front with 3-inch sheet piling 5 feet deep, fixed with 3-inch top walling as shown, secured with bolts and nuts as directed.

AQUEDUCT OVER
CULTER BURN.

16. A cast-iron aqueduct 3 feet in diameter with two abutments and two piers, also with junction and overflow and drain tanks, drain retaining walls and other things, is to be laid, jointed, and constructed over the Culter Burn in the manner and of the forms and dimensions shown on the said drawing No. 9.

The piers and abutments are to be of granite masonry, carried up to the heights and finished in the manner shown on the drawing, the piers having caps in single stones to receive the cast iron saddles for sustaining the pipes.

The junction tanks are to have retaining walls to support the embankments as shown, and the western junction is to be also an

LOW SERVICE
RESERVOIR.

overflow and drain tank with 84 yards or thereabouts of 24-inch brick barrel drain to connect the same with Culter Burn, constructed and finished as above described for Crathes Burn.

17. A circular reservoir 270 feet in diameter with tanks, pipes, drains, and other works, is to be constructed at the Brae of Pitfodels in the position marked on the general plan and of the form and dimensions shown on No. 10 of the said drawings.

The bottom is to be formed with a uniform fall of one foot to the side where the overflow and drain tank is placed and is to be covered with a layer of clay puddle one foot thick which is also to be carried under the side walling, being worked at this part as dry and stiff as possible, and with a mixture of broken stone in order to render it sufficiently firm to sustain the weight of the walls. The walls are to be built of granite random rubble work (excepting the top 4 feet which is to be of coursed rubble work) of the thicknesses shown on the drawing, and battered on the face $\frac{3}{4}$ ths of an inch to the foot and finished on the top with a rough dressed coping 2 feet wide and 6 inches thick. The bottom puddle is to be covered over with a 6-inch layer of concrete made smooth and even on top, to drain as above described. Vertical puddle is to be connected with the floor puddle and carried up one foot thick behind the walls and the whole backed up with an embankment finished with 2 to 1 slopes as shown on the drawing. Footpaths are to be formed round the top of the bank with under-beds of broken stone 4 inches thick finished on top with a layer of gravel 3 inches thick laid to drain, and well beaten and rolled.

The supply, overflow, and drain tanks are to be constructed as shown, and all the pipes, cocks, sluices, gratings, spindles, guides, covering-plates, and other apparatus, are to be provided, laid, and fixed in the positions shown on the drawings, and jointed as herein-after specified.

A rubble stone boundary wall, 7 feet 6 inches in height above the ground line, is to be built round the site of the reservoir, and finished with a hammer-dressed coping, as shown on Drawing No. 11; the masonry of this wall is to be laid in mortar, and the stones of the present boundary walls to be taken down and applied in building it, so far as the same are sufficient for the purpose.

Coursed ashlar hammer-dressed piers, 2 feet 6 inches square, are to be built at the angles and for supporting the gates, and double-hung carriage and foot gates are to be provided and hung to enter from the turnpike road, as shown in the said Drawing No. 11.

The carriage gates are to be hung on 12-inch square oak posts, and the foot gate on similar posts 8 inches square, the whole to be left rough at the bottoms and fixed in beds of concrete, and secured to the piers with wrought-iron cramp bolts and nuts.

The gates are to be framed of 2-inch yellow deal, and filled in flush on the face with 1-inch bead butt boarding, and finished on top with oak capping and spikes; the whole to be wrought, framed, finished, and fixed in most approved manner, on strong wrought-iron bar hinges with hinge hooks passing through the posts, and provided with a long bolt fastening with hooks and padlock for the double gates and with good 8-inch mortise lock and proper fittings for the foot gate, each lock to have 3 keys. A granite check post is to be fixed in the centre of the gateway to stop and sustain the double gates, the bolt passing into it; and two oak check posts 3 feet high and 6 inches square with hooks, &c., are to be provided and fixed substantially in the ground within the gates to hold them when open.

HIGH SERVICE
RESERVOIR.

18. A circular reservoir 80 feet in diameter is to be constructed at the hill head of Pitfodels in the position marked on the general plan, with clay puddle concrete rubble walling and embankments with tanks, pipes, and other things corresponding in every respect with the works already specified for the low service reservoir, and of the several forms and dimensions shown on the said drawing No. 11.

A length of about 50 yards of 12-inch glazed stoneware drain pipes is to be laid and jointed in cement from the small tank within the gates to the existing drain near the side of the road, and there terminated in a conduit as shown on the said Drawing No. 11.

A rubble-stone boundary wall 7 feet 6 inches in height is to be built all round the site of the high service reservoir, with stone piers and double gates and appurtenances in all respects to correspond with those before specified for the low service reservoir.

OVERFLOW AND
DRAIN TANKS AND
DRAINS.

19. Overflow and drain tanks and drains are to be constructed in various places along the line of aqueduct as hereinbefore specified, and as shown on the general plan and section in the manner and of the form and dimensions shown on the said drawing No. 4. They are to be built of brickwork founded on concrete and enveloped in clay puddle, and provided with cast-iron overflow pipes, ladder, bars, and iron covers; a 15-inch sluice with pipe, spindle, and girder, is to be fixed to drain the aqueduct, and brick barrel drains are to be built from the tanks to the outfalls of the dimensions and lengths hereinbefore specified in the detailed list of works, and with such positions and inclinations as will be directed, and finished at the terminations with conduit mouths consisting of side and head walls, inverts, and copings, and protected with sheet piling in front where required; the whole arranged to suit each particular outfall.

The drains, which are 18, 24, and 30 inches only in diameter, are to have 6-inch brick rings, and all larger drains are to have 9-inch brick rings all round.

All drains crossing under or through the embankments carrying the aqueduct are to be of the length and size hereinbefore specified in the general list of works, and of the description and character shown on No. 7 of the said drawings, for the 5-feet culvert, for the Burn of Bennie, with head walls, inverts, and side walls formed to the slopes of the embankments and finished with copings.

LAND AND OTHER
DRAINAGE.

20. The present contract is to include the restoration and making good of all land, and other drainages, and underground arrangements, which may be interfered with or cut off during the construction of the aqueduct, and works connected therewith; and it is likewise to include all new ditches, pipes, leader and other drains requisite and necessary for collecting and conveying away the water from the lands, roads, and other places affected by the operations under the contract.

All drains for conveying streams under the aqueduct to be of brickwork, in the body of the culvert, with head and wing walls of stone finished with stone copings, all the drains being laid with proper and sufficient falls to suit their positions, as will be directed. The Drum Mill Stream is to be passed over the aqueduct with paved channel and side wall, as shown on the said Drawing No. 7.

MANHOLES AND SIDE
ENTRANCES.

21. A sufficient number of manholes and side entrances are to be constructed for the purpose of affording access to the aqueduct at such points and places as will be directed during the progress of the undertaking; and whereas a sum of five hundred pounds (£500) is to be included in the contract-price hereinafter specified for defraying the cost of these works, to be estimated according to the schedule of prices annexed to this contract, the said sum of five hundred pounds, or any part thereof not expended on such works, shall be subject to deduction on the completion of the contract, the same as for contract work not executed in the manner provided in the general conditions hereinafter written.

COTTAGE FOR
RESERVOIR AND
SLUICE KEEPER.

22. The present contract is to include the erection and completion of a cottage for the reservoir and sluice keeper, at Cairnton-on-Invercarnie, of the value of two hundred and fifty pounds (£250), the drawings for which are to be furnished by the contractor and submitted to the engineer for approval previous to commencing the work.

POST AND RAIL
FENCING, &c.

23. The portions of land, coloured purple on the said general plan, No. 1 of the said drawings, on which permanent embankments and other things are to be constructed, also the sides of the approach-roads to the Invercarnie reservoir, excepting the portion over the Bridge and Burn of Cannie as hereinafter specified, are to be fenced round with post and rail fencing.

The fencing is to be finished 4 feet 6 inches in height above the finished ground-lines, and is to be constructed with large posts and rails in the manner and to the scantling shown on the said drawing No. 7. The posts are to be 8 feet long, sawn for a length of 5 feet to a scantling of 6 inches by 5 inches; the bottoms are to be charred and the posts fixed 9 feet apart from centre to centre. The top of each post is to be strongly bound round with hoop iron; five horizontal larch rails, 4 inches by 1½ inches, are to be fixed in each bay, the ends being bevelled so as to fold together and wedge up tight through the mortise-holes of the posts. Additional oak posts 4 inches by 2 inches, properly pointed and charred, are to be driven into the ground at a depth of at least 1 foot 6 inches in the centre of each bay and securely spiked to the horizontal rails with 2 spikes to each rail.

Two good and substantial five-barred field-gates, 5 feet high and 9 feet wide, are to be fixed as directed at each end of every

separate piece of land specified to be fenced round, and one of such gates at the end of the western approach road to the Invercannie reservoir on leaving the public road. The gates are to be constructed of larch timber, wrought and planed, and strongly framed to uprights, and strengthened with diagonal bracing, the whole corresponding in dimensions with the post and rail fencing.

The gates are each to be supported on two oak posts, 9 feet long, sunk 4 feet into the ground, and sawn 6 inches square for 5 feet of their length fixed into the ground, as already described, the gates being each hung on two substantial wrought-iron hinges, 3 feet 6 inches long, and wrought-iron crooks, with screws and nuts to pass through the posts. Each gate to have an approved spring-fastening and catch fixed complete.

The Invercannie reservoir is to be fenced round with post and rail fencing of larch timber 5 feet 6 inches high, finished with upright pales, and constructed as shown on the said Drawing No. 7. The posts are to be as above described for the road fencing, and fixed 5 feet apart and the pales to be half round (two cut out of each tree) $3\frac{1}{2}$ inches at bottom and tapering upwards, pointed at top and spiked 2 inches apart to the rails. Three gates, each 10 feet wide, are to be constructed to correspond with the fencing and hung on oak posts, as specified for the other gates, one to be fixed across the entrance to the new road to the reservoir site, where it leaves the turnpike, and the others in the fencing near the reservoir, each gate being furnished with an improved 6-inch mortislock and fittings, and four keys.

HYDRAULIC
ENGINE, PUMPS,
AND BUILDINGS.

24. An hydraulic engine, with pumps, air-vessels, valves, pipes, and other appurtenances, together with the well foundations, engine-house, and other works, are to be provided, manufactured, fixed, completed, and set to work on the site marked on the said general plan, No. 1 of the said drawings, and in accordance with the several forms and dimensions shown on No. 12 of the said drawings.

DUTY OF ENGINE.

25. The said hydraulic engine is to be worked by the pressure of the water flowing from the aqueduct at Cults, through an 18 and 15-inch pipe 540 yards, or thereabouts, in length, the height of the water in the aqueduct at the said point being about 135 feet above the engine-house floor, and about 150 feet above the ordinary level of the river Dee at the point where the waste pipe from the engine will enter it.

The quantity of water available for motive power will be 1,000,000 gallons per day; and the engine, pumps, and appurtenances are to be capable of raising 300,000 gallons of the above-named quantity of water in 12 hours, and delivering the same into the high service reservoir, the elevation of which is about 371 feet above the engine-house floor, through a pipe 10 inches in diameter, and 2,000 yards, or thereabouts, in length; and every part of the work is to be of sufficient size and strength to perform this duty with perfect steadiness and regularity.

The engine is to be horizontal, with a single cylinder, fitted with a metallic piston and steel rod, and provided with a fly-wheel to regulate the motion, and all inlet and outlet-valves, with proper stop-valves and starting-gear; regulating-valves, with regulator and governor; also all pipes, passages, stuffing-boxes, wrought-iron crank-shaft, and connecting-rods, plummer-blocks, and all other things complete, are to be furnished and erected on a cast-iron bed-plate, to be fixed on a foundation of masonry, and held down by proper hold-down bolts, nuts, and plates complete.

A double-acting pump, of the bucket and plunger description, is to be provided and fixed to work direct from the piston-rod of the engine, with suction and stop-back valves, plunger bucket, stuffing-box, suction and delivery pipes, and all other parts complete. The pump is to draw water direct from the 15-inch supply-pipe to the engine, and will be required to work with the differential pressure of the columns of supply and delivery water only.

Two cast-iron air-vessels, each being of ten times the capacity of the working barrel of the pumps, are to be provided, and fixed on masonry foundations, with proper holding-down bolts—one on the supply, and the other on the delivery main, to equalise the flow of water. They are to be provided with small air-pumps, pipes, &c., complete, working from the engine to charge them with air; and also with shift or relief valves, to regulate the quantity.

The contractor will be required, at his own cost and charge, to furnish, on or before the 1st day of June 1864, a detailed drawing of the hydraulic engine, pump, &c., in accordance with the above description, for approval, and to make such alterations in the arrangement, strength, or detail of the design as may be considered necessary, the understanding being that the engine, pumps, and appurtenances are to be provided and fixed complete and perfect in all their parts, and fully capable of performing the duties above stated to the satisfaction of the engineer, at the entire cost and charge of the contractor.

The engine, pumps, and works are to be of first-class manufacture in every respect, and finished in the manner of what are termed 'bright engines'—that is, the whole of the wrought iron, steel, gun-metal, and brasswork in sight are to be finished dead bright; as are likewise the covers of the cylinders and valve-casings, the shafts, rods, and other parts, in accordance with the design finally approved of.

The engine is to be started and worked for one month when the waterworks are finished and in regular operation, at the entire cost and charge of the contractor.

A strong deal chest is to be provided, and furnished with all necessary tools; spanners, to fit all nuts; hammers, chisels, and other things necessary to perform all ordinary repairs and work requisite to keep the engine, pumps, and appurtenances in good working condition.

ENGINE-HOUSE.

26. The engine-house, pumps, well, &c., are to be erected on the site shown on Nos. 1 and 13 of the said drawings, and in accordance with the form and dimensions shown on the said Drawing No. 12. They are to be of granite-coursed masonry, worked as before specified; fire-places, with chimneys, being arranged as shown on the drawing, and provided with approved fire-grates.

The form and dimensions of the foundation works must be carried out in accordance with the requirements of the design for the engine, &c.

The engine-house is to have a wrought-iron roof, with cast-iron wall-plates, fastened to the walls with 1-inch holding-down bolts, and provided with sockets to receive the ends of the principals. The roof is to consist of T-iron principals, with struts, ties, bolts, and nuts, and other parts, as shown on the drawing; and intermediate T-iron rafters are to be fixed 31 inches apart, the whole being rivetted together and fastened in an approved manner.

The roof is to be entirely boarded over with 1-inch yellow deal boarding, shot at the edges, and laid close and smooth, and then covered with duchess slates, laid with $2\frac{1}{2}$ -inch overlap, and fastened with copper nails. The ridge is to be covered with milled sheet-lead, laid on proper roll and lead-gutters, with 1-inch fir gutter-boards; and bearers are to be laid all round the roof, and arranged to drain to two 4-inch cast-iron down-pipes, provided with approved heads, and fixed as directed.

The doors are to be framed with $2\frac{1}{2}$ -inch deal flush-panels, moulded outside, and double hung each with 3-inch iron butt hinges in a stout deal rebated door-frame, substantially fixed to the masonry.

The windows are to be of 2-inch yellow deal, double hung in strong deal frames, with oak sunk sills and pulley-pieces, and provided with brass pulleys, patent lines, weights, and brass spring fastenings, the whole substantially fixed to the walls, and properly glazed with strong reeded glass, weighing 26 ounces to the foot.

The engine-house walls are to be rendered inside with hair-lime and set with fine mortar, a cement skirting, 10 inches deep and with 1-inch projection, being run round the walls.

RAISING SITE OF
ENGINE-HOUSE, &c.

27. The site of the said engine-house and works is to be raised to the height and extent shown on the said Drawing No. 13. The earth is to be embanked as hereinbefore specified, and formed smooth and level at the surface, and with such inclinations as will be directed to effect proper drainage. Stone boundary walls are to be erected round the site, with carriage and foot entrance gates and appurtenances corresponding exactly with those specified for the low service reservoir and works; and a roadway, 20 feet wide, is to be formed from the gates to the front of the engine-house, and 7 feet wide round the same, with a top layer of broken granite stone 6 inches thick, laid on an underbed of broken stone 9 inches thick, the whole formed with an upper curve of 6 inches in the centre of

- the road; 100 yards of 12-inch glazed stoneware drain-pipes are to be provided, laid, and jointed as will be directed, to drain the engine-house and site thereof to existing drains.
- FORMATION OF ROAD SURFACES.** 28. All existing roads, footpaths, and places hereinbefore specified, to be raised, as well as all roads opened, for constructing the aqueduct and works—and which are to be restored at the existing levels—are to be finished on the surfaces with 6 inches thick of new stone (similar to that at present used at those places), laid on under beds of rough broken stone, 9 inches thick, to the breadths and extents of the old road surfaces which became superseded, and formed to drain and otherwise, as will be directed. Footpaths similar to existing footpaths are also to be formed, and all boundary walls are to be raised to corresponding heights with the roads, and with similar materials to the present walls, so as to form the same heights and description of boundary walls as at present exist.
- The contractor will also have to take upon himself the arrangement and cost of raising and making good all gullies, gratings, drains, walls, piers, grates, curbs, steps, pavements, and other things that may require alteration in consequence of the roads being raised, and perform all the works connected therewith according to the requirements of each case as directed, the same as if such works had been particularised therein.
- PIPE-LAYING.** 29. All the cast-iron pipes included in the present contract are to be properly prepared and coated with Dr. Smith's preparations of asphalt in the most approved manner.
- The pipes are to be laid in regular and uniform lines with proper gradients, as shown on the drawings, or as will be directed at the time, all abrupt curves, undulations, or air-locks being carefully avoided. Where specific depths are not shown on the sections, the pipes must be laid so deep that the covering over the highest parts of the sockets shall in no case be less than 30 inches, the depth being so much greater in other parts as will fulfil the conditions above specified.
- JOINTING PIPES, &c.** 30. The joints of the pipes are to be made with white yarn and blue lead. The yarn is to be tallowed and well caulked into the sockets, and the lead is in no case to be less than 2½ inches deep, run entirely around the pipe, and every joint is to be set up when cool ¼th of an inch within the socket.
- All flange joints are to be properly made with lead-lapped rings secured with bolts and nuts, and afterwards, if necessary, run with lead. All branches, bends, reducing pipes and collars, cocks and cock-boxes, sluices and other irregular pipes and apparatus are to be laid, jointed, and fixed in the manner shown and the position shown on the drawings, or as will be directed during the execution of the works.
- All sewers, drains, culverts, cesspools, pipes, walls, foundations, and other things that may obstruct or interfere with the intended line of pipes are to be altered and made good again, as found necessary, or, if damaged, are to be properly restored by the contractor; and in case the resident engineer should consider it desirable to make any deviation from, or alteration of, the intended line of pipes in consequence of such obstructions, these alterations are to be considered as included in the present contract, and no extra charge will be allowed for the same.
- The surfaces of all streets, roads, footpaths, and grounds opened for the laying of pipes, as well as for the aqueduct and works generally, are to be restored and made good with similar materials and in the same manner as existing at the time of executing the works, and are to be repaired from time to time as occasion may require during the progress of the works and for a period of twelve calendar months after the completion of the same.
- PAINTING.** 31. The whole of the exposed iron in and about the entire building, including pipes, cocks, sluices, ladder, bars, girders, aqueduct pipes, and all other ironwork, is to be properly cleaned and painted four times in oil, twice before fixing and twice afterwards, the whole being finished in approved plain colours. The aqueduct pipes and the girders of the bridge over Cannie Burn are to be finished light stone colour.
- The entrance gates to the reservoir and works, also the doors and windows of the engine-house, and all woodwork specified to be wrought and planed, is to be knotted, primed, and painted four times in oil, the gates and doors to be grained oak, and to have two coats of varnish.
- CATTLE PONDS, &c.** 32. Whereas there has been included in the contract price hereinafter specified the sum of two hundred pounds for cattle ponds or any local water supplies which may be found necessary, as well as for any other minor works not at present contemplated or included in the specification or shown on the drawings, it is declared that the said sum of two hundred pounds, or any part thereof not expended, shall be subject to deduction on the completion of the contract, the same as for contract works not executed in the manner provided in the general conditions hereinafter contained.
- CONTRACTOR TO REMOVE SURPLUS MATERIALS, &c.** 33. As the several portions of the works are completed from time to time, the contractor is to collect and take away all tools, implements, timber, scaffolding, and other things brought on the site thereof for use during the construction and execution of the works and adjoining lands all rubbish and waste material whatsoever. He is also to remove all coffer dams, timber, framing, and other works of the kind which may have been made use of at the rivers, streams, and other parts in carrying out the works; all piling being cut off at the river beds if required. He is to restore all buildings, walls, hedges, fences, land surfaces, drains, roads, footpaths, and other things which may have been injured, disturbed, or destroyed during the execution of the works of the contract, and to leave the entire line of waterworks, with all the premises belonging thereto, in a clear and proper state.
- QUALITY OF MATERIALS.**
- STONE.** 34. All the stone throughout the works is to be the best Aberdeen granite, free from cracks, flaws, and all other imperfections. The landings to be of granite or other stone of approved qualities.
- BRICKS.** 35. The bricks are to be of the best description, new, hard burnt, well shaped, and sound and fit for waterwork. All face bricks are to be selected of the most suitable description and of uniform colour. The bricks for the aqueduct are to be 6 inches broad, and of corresponding length and thickness; they are to be wedge-shaped, or radiated to suit the curves of the work, and specially manufactured for the purpose. The bricks for the drains are also to be wedge-shaped, or radiated to suit the diameters thereof.
- MORTAR.** 36. The mortar is to be composed of good fresh burnt hydraulic lime of approved qualities, and clean sharp-grit fresh-water sand, free from loamy, clayey, or other extraneous matters; it is to be gauged and mixed in the proportions of one part of lime, measured before slaking, to three parts of sand, or in other approved proportions, according to the nature of the work. The whole to be well mixed together, worked in pug mills, and properly incorporated. Samples of the lime and mortar proposed to be used are to be provided, mixed, and tested at the cost of the contractor previously to the commencement of the masonry and brickwork, in order to the adoption of the most approved mortar for the works.
- CEMENT.** 37. The cement is to be of the best qualities obtained from the manufacturers, approved by the resident engineer, and used fresh from the kiln, being mixed in proportions of two parts of cement to one part of clean sharp sand, or in such other proportions as will be directed at the time.
- CONCRETE.** 38. The concrete is to be composed of three parts of gravel, two parts sand, and one part lime, the sand and gravel are to be clean and sharp, and free from clay, loam, and all other extraneous matters; the lime is to be fresh burnt hydraulic lime of the most approved quality for waterwork purposes.
- GRAVEL AND SAND.** 39. The gravel and sand for the filters and other parts of the works are to be of a proper description and of approved qualities, and free from loamy, clayey, or other extraneous matters. The filtering materials are all to be thoroughly washed and screened before being put in place, and selected and laid in layers as before specified.
- CLAY PUDDLE.** 40. The clay for the puddling and ponding is to be of a good tenacious quality, and, when directed, is to be mixed in the proportion of six parts of clay to one of broken stone, passed through screens of 1½ inch mesh, the whole to be properly mixed and well cut, tempered, and worked, with a sufficient quantity of water to render it fit for the different parts of the work.

TIMBER.

41. All the timber used throughout the works is to be of the best Memel or Dantzic fir, larch, or oak, as required or specified for the various parts of the works, the whole to be well seasoned and free from sap shakes, dead knots, and all other imperfections.

LEAD.

42. The lead for the joints of the pipes is to be the best blue, soft, pig lead.

PAINT.

43. The paint is to be composed of the best white lead, linseed oil, and turpentine, coloured as directed.

YARN.

44. The yarn is to be of the best new white spun yarn, of uniform size and even texture.

OTHER MATERIALS.

45. All other materials whatsoever made use of in the work are to be of the best description of their respective kinds, and to be subject to the approval of the resident engineer.

CAST-IRON PIPES AND OTHER IRONWORK.

NUMBER, DISCRIPTION, AND DIMENSIONS OF PIPES REQUIRED.

46. The following is a statement of the cast-iron pipes and other ironwork and apparatus required to be provided, the whole of which are to be laid and fixed as hereinbefore specified :—

Drawing No.	Number required	Description	Internal diameter	Extreme length of each Pipe	Weight of each Pipe to be not less than
			Inches	Feet	Cwt. qrs. lbs.
	40	Cast-iron socket pipes	40	12	35 0 0
14	160	Ditto	36	12	35 0 0
15	14	Ditto	30	12	31 0 0
14	300	Ditto	27	12	25 0 0
14	385	Ditto	24	12	22 0 0
14	145	Ditto	18	12	16 0 0
15	110	Ditto	15	9	9 0 0
14	25	Ditto	12	9	7 0 0
14	550	Ditto	10	9	6 2 0
14	950	Ditto	10	9	5 2 0
14	650	Ditto	9	9	5 0 0
15	550	Ditto	7	9	3 0 0
15	50	Ditto	6	9	2 2 0
15	12	Ditto	3	9	1 0 0
17	1	Branch pipe 24-in. off 36-in.	...	...	...
17	1	Double socket branch pipe 27-in. off 27-in.	...	...	...
16	1	Branch pipe 15-in. off 24-in. $\frac{1}{4}$ bend	...	...	...
16		Ditto $\frac{1}{2}$ -in. bend	...	...	...
19	2	Ditto 6 " off 27-in.	...	...	...
19	1	Ditto 5 " off 27 "	...	...	...
15	1	Ditto 10 " off 10 "	...	...	...
19	1	Ditto 6 " off 10 "	...	...	...
19	1	Ditto 5 " off 9 "	...	...	...
19	1	Ditto 5 " off 7 "	...	...	...
19	1	Ditto 4 " off 6 "	...	...	...
19	1	Ditto 3 " off 6 "	...	...	...
16	2	Flange and spigot pipes with 6-in. branch	15	...	...
15	2	Flanged outlet pipes 9-in. off 36-in.	...	...	...
16	1	Flange and socket pipe	27	...	...
16	2	Ditto	18	...	...
16	3	Ditto	15	...	...
17	2	Ditto	10	...	...
16	2	Ditto	6	...	...
19	2	Flange and spigot pipes	36	11	...
16	2	Ditto	18	...	...
17	2	Ditto	15	...	...
17	10	Ditto	15	...	...
18	1	Flanged seat pipe	18	...	...
17	9	Flanged seat pipes	15	...	...
17	1	Ditto	10	...	...
17	10	Flanged bellmouth pipes	12	...	...
17	1	Ditto	10	...	...
17	2	Double flange pipes	12	...	...
17	2	Ditto	10	...	...
19	1	Ditto	36	11	...
16	1	$\frac{1}{4}$ th bend pipe	24	...	...
16	2	Ditto	15	...	...
15	1	Ditto	10	...	...
16	6	Bend pipes	3	...	...
16	6	Ditto with helmet heads	3	...	...
15	10	Canted socket pipes	36	...	...
19	4	Ditto	24	...	...
19	12	Ditto	10	...	...
19	9	Ditto	9	...	...
19	9	Ditto	7	...	...
16	9	Reducing pipe	36 to 27	...	...
15	1	Ditto	36 to 30	...	...
15	1	Ditto	30 to 27	...	...
16	1	Ditto	27 to 24	...	...
18	1	Ditto	18 to 15	...	...
19	1	Ditto	10 to 9	...	...
19	1	Ditto	9 to 7	...	...
19	1	Ditto	7 to 6	...	...
19	1	Ditto	6 to 5	...	...

Drawing No.	Number required	Description
		For Inlet and Gauge Tank, River Dee, the following articles :—
17	3	Wrought-iron gratings with wood frames
17	8	Copper gauge screens
17	2	Covering plates over screens
17	1	Gauge plate
19	1	Gauge pipe with float, &c.
		For Invercarnie Reservoir, Filter, &c., the following articles :—
16	1	Wrought-iron double floating pipe, 30 in. to 27 in. diameter
15	1	Set of covering plates, 10 ft. 4 in. diameter
15	1	Cast-iron girder, 11 ft. 6 in. long for ditto
		For line of works, the following articles :—
17	9	Sets of covering plates for overflow and drain tanks
18	2	Saddles for 36-in. pipes at culter, with bolts, plates, &c.
18	10	Circular chequered manhole plates, 22 in. diameter and $\frac{3}{8}$ -in. thick, with bolts and keys
18	30	Air escapes for aqueduct
18	8	14-in. holding-down belts, &c., for ditto
		For Low Service Reservoir the following articles :—
16	1	Grating box for 27-in. pipe
15	1	Spindle and overflow guide
18	6	Collars for 36-in. pipes
18	4	Ditto „ 27 „
18	4	Ditto „ 24 „
18	4	Ditto „ 18 „
18	4	Ditto „ 15 „
18	6	Ditto „ 10 „
18	6	Ditto „ 10 „
18	6	Ditto „ 7 „
		For High Service Reservoir, the following articles :—
15	1	Grating box for 10-inch pipes
15	1	Spindle and overflow guide
		For works generally, the following articles :—
16	18	Spindle guides
18		Wrought-iron spindles, containing about 210 feet of 1-in. round iron
16	260	Wrought-iron ladder bars
18	10	Wrought-iron T spindle keys
18	10	Ditto lifting keys
		And the following cocks and sluices :—
	2	27-in. screw cocks
	2	24-in. ditto
	1	18-in. ditto
	2	15-in. ditto
	2	10-in. ditto
	2	9-in. ditto
	1	6-in. ditto
	5	18-in. sluices
	13	15-in. ditto
	1	10-in. ditto
	2	6-in. ditto

THICKNESS OF METAL.

47. The thickness of metal in the bodies of the straight pipes is to be such as will give the weights specified, the sockets being made as shown on the drawings. The thickness of metal in all other cases is to be as marked on the drawings.

WEIGHT OF PIPES.

48. The weight of each pipe is to be marked on the socket with white paint. In case any of the straight pipes, when delivered, are found to be of less than the specified weights, the Commissioners are to have the option of either rejecting them or making a deduction from the contract sum for the deficiency in weight, as may be determined by the engineer.

QUALITY OF IRON AND OTHER MATERIALS.

49. The iron throughout the whole of the castings is to be remelted from the cupola, and to be of a good tough quality, not inferior to No. 2 cold blast pig-iron. The wrought iron is to be the best scrap iron, and not inferior to $\frac{1}{2}$ C bars. The gun-metal, brass, copper, lead and other materials used are to be of the best quality, and such as the Commissioners' engineer shall approve.

MOULDS.

50. The straight pipes are to be cast in dry sand moulds set vertically. All other castings are to be moulded in close boxes in the usual way. No open sand castings will be received.

CASTINGS TO BE SOUND, &C. PIPES TO BE PERFECT IN FORM, &C.

51. The whole of the pipes and other castings must be sound, free from porous places, sand and air-holes and all other imperfections. The surfaces, both external and internal, must be clean, smooth and even, and the sand properly removed therefrom.

52. Every pipe must be perfect in form and shape; the bore must be circular and of the full specified diameter throughout, and the thickness of metal equable, even, and uniform, except where shown on the drawings to be otherwise.

PIPES, &C., TO BE PROVED.

53. The whole of the pipes, as well as the slide-cocks and sluices, must be properly proved with hydrostatic pressure, by and at the expense of the contractor. They are intended to sustain, and must withstand, when in work, a pressure equal to that of a column of water 400 feet high; and the 10-inch diameter pipes, weighing $6\frac{1}{2}$ cwt. each, are to be proved to 600 feet pressure under the same circumstances.

SLIDE-COCKS AND SLUICES.

54. The slide-cocks and sluices are to be of the most approved construction, fitted up with planed joints, brass faces, gun-metal square thread, left-handed screw, spindles and nuts, and wrought-iron bolts and nuts complete. The slide-cocks are each to have a spigot and faucet pieces jointed, with lead-lapped rings and bolts and nuts.

The sluices are each to have wrought-iron false spindles, with set screws and guides, and the T handled keys are to be provided to fit the whole. The flanges of the sluices are to be cast plain to admit of the holes being drilled at the time of fixing, to correspond with those in the flanges of the pipes to which they are to be attached.

CARRIAGE OF IRONWORK, &C.

55. The greatest care is to be taken by the contractor in the removal and transit of all ironwork and machinery, and the contract is to include the cost and risk of the carriage and delivery of the same, as arranged in the general conditions afterwritten. And it is hereby contracted and agreed that the following

GENERAL CONDITIONS OF CONTRACT

are and shall be binding on the parties hereto, viz. :—

WHAT THE CONTRACT INCLUDES.

1. The present contract is to include the execution of the whole of the works shown on the said drawings, as of all works temporary or permanent, compensatory, or otherwise described or directed to be done in the foregoing specification. And as there may be additional operations and matters necessary for the proper execution and completion of the various works, but which are neither shown on the said drawings, nor particularly mentioned in the said specification, nor provided for by either, the contract is to extend to, and comprise, all such operations and matters, whether alterations in the extent or quality of the work, or materials or otherwise, as if they had been expressly shown and described; the intention being that the contractor is to execute, as a part of this contract,

and without extra charge by him, everything requisite for the full and perfect completion of the whole of the works comprised therein and essential to their water-tightness, and to their stability and completeness for the purposes intended by them, whether the drawings and specifications are sufficient or not. And it is declared that the foregoing clauses of the present first article of these general conditions shall be read and construed along with article fifteen thereof, hereinafter written; and it is also declared, without prejudice to either article, and for more clearly explaining the true meaning of the parties hereto, as intended to be conveyed by these two articles, that, in the event of the engineer, for the greater stability and completeness of the works, increasing the thickness of the stone or brickwork of the aqueduct, or for the reservoirs, or increasing the strength of the walls of the reservoirs, all beyond what is shown and described in the drawings and specification, such increase, on being executed in any of these cases under the authority of written orders, sanctioned by the commissioners and signed by their clerk, and countersigned by the engineer, as is hereinafter prescribed, in respect to additional or extra work by the said fifteenth article, shall be deemed to be additional or extra work, and be paid for accordingly, in manner hereinafter provided by the said fifteenth article.

It is also declared that the contractor is bound to provide, as part of the contract, the whole of the materials required for the works comprehended therein, as well as all labour and carriage of every kind necessary for the due and proper execution thereof.

He is also bound to furnish, free of any charge for use, deterioration, or damage, all tools, implements, tackle, and power, as well as other apparatus, provisions, matters, and things which may be necessary for properly, expeditiously, and safely carrying on the works, or which the engineer, resident engineer, or superintendent may, at any time, direct to be used.

2. Wherever the dimensions are marked on the said drawings, or stated in the foregoing specification, such dimensions are to be worked to, even though they may not exactly correspond with the measurements by the scales, which are to be referred to only when the dimensions are not so marked or stated. Drawings to enlarged scales, showing particular parts of the work, are to be adhered to in preference to those of a more general nature. Any working or detailed drawings that may be furnished by the engineer, resident engineer, or superintendent, from time to time during the progress of the works, are also to be strictly adhered to.

In case any discrepancy should accidentally exist between the said drawings and specification, or between different portions of the said drawings themselves, or if any doubts should arise as to the intent or meaning of any part or parts of the said drawings or specification, reference must be made to the arbiter hereinafter named, whose decision thereon shall be conclusive. The contractor will be held responsible for, and must rectify, without extra charge, any error in the execution of the works resulting from such doubt or discrepancy.

The said drawings are signed by the contractor as aforesaid, in evidence of his adoption of the same, and of his acknowledgment of their sufficiency, and they are to remain in custody of the engineer during the progress of the works. No copies of the said drawings will be furnished to the contractor, but he will be allowed access to them at reasonable times, and may take copies of the whole or any portions he may require.

3. The contractor is to have satisfied himself as to the dimensions, levels, character, and nature of all existing works, buildings, roads, lands, strata, subsoils, and other things, as regards any connection they may have with the works of the contract; and he is also held generally to have obtained his own information on all matters which could in any way influence his said tender, which tender shall be held to have been in no wise made on the faith of any representation on the part of the commissioners, or of those acting for them. No charges for extra work, or otherwise, will be allowed, in consequence of any misunderstanding, error, or incorrect information on those points, or of any inaccuracies in reference thereto, which may appear in the said drawings or specification, nor shall the present contract be nullified in consequence of any such misunderstanding, error, incorrect information, or inaccuracies.

4. The whole of the works are to be executed with due diligence and expedition, and are to be performed and completed both as regards quality of materials and mode of execution in the most approved, substantial, and workmanlike manner, in perfect conformity to the said drawings and specification, and to the entire satisfaction of the engineer.

5. The execution of the works is to be carried on under the entire control and supervision, and according to the direction, of the engineer, resident engineer, and superintendents, and the contractor must attend to, and execute without delay, all orders and directions in reference to the execution of the contract given him from time to time by the said engineer, resident engineer, or superintendents. It is, however, to be understood that the contractor is bound to set out the whole of the works, and he shall be held responsible for their correctness in all respects, and he will not be allowed to plead any acts, orders, or directions of the engineer, or any person acting on his behalf, in justification of any departure from the requirements of his contract, unless he can produce special and positive written instructions to such effect signed by the engineer.

In case of any portions of the work being manufactured or prepared in any other place than on the site of the works, the engineer, resident engineer, and superintendents are to have full power and liberty to inspect the entire process of such manufacture or preparations at all times, and if the liberty of such inspection be refused the work is to be deemed imperfect and not in accordance with the terms of the contract.

6. The contractor shall carefully cut and take down all trees and buildings on the site of the works, and shall lay them aside for the use of the commissioners or of the proprietors of the ground, as the case may be.

The earth, stone, gravel, clay, turf, sand, and all other materials and things excavated from the works or existing on the site thereof, are not to become the property of the contractor, but with the exception above mentioned are to be at his disposal so far as use can be made of the same for the purposes of this contract, and as the commissioners may be entitled thereto, and in accordance with the terms of the foregoing specification.

7. All materials, tools, implements, and other matters and things brought on the site of the works or upon lands adjoining, for the purposes of this contract, shall thereupon become and shall continue to be, the absolute property of the commissioners, and be considered as in their possession, the contractor having only the right of using the same for the purposes of this contract. But after the contract shall have been duly completed and all obligations incumbent on the contractor duly fulfilled, the commissioners will be bound to return to the contractor the tools, implements, and surplus or waste materials then remaining on the ground to be by him removed and cleared away according to the terms of the foregoing specification. And it is provided that the commissioners shall not at any time be liable for the loss or injury of any of the said materials, tools, implements, or other matters and things, but that the whole of this liability shall fall on the contractor the same as if they had remained in his own possession.

8. If at any time during the progress of the work the engineer, resident engineer, or superintendents shall disapprove of any of the materials employed, the contractor shall be bound forthwith to take away such objectionable materials from the ground, and to substitute for them others of an approved quality. And in case any portion of the work executed shall, in the judgment of the engineer, resident engineer, or superintendents, be considered imperfect or defective, or not in accordance with the terms of the contract, such portions shall forthwith be removed and the work re-executed in an improved manner.

9. The contractor shall employ not only a sufficient number of workmen, but also competent foremen constantly on the works to ensure proper management and efficient control. No person is to be employed or allowed to remain on the works who shall be objected to by the engineer, resident engineer, or superintendents, whether such person has been employed by the contractor or any sub-contractor; and no unskilful workmen are to be retained or employed in the execution of the works under the contract.

10. Whereas by the 'Aberdeen Police and Water Works Act, 1862,' and the general Acts therewith incorporated, the commissioners are bound in regard to the construction of the said waterworks, and the taking possession, either permanently or for temporary uses, of lands therefore and in regard to other matters by certain prohibitions, restrictions, and conditions contained in the said Acts of Parliament; the contractor shall be bound not only not to exceed in any degree the powers conferred upon the commissioners for the construction of the said waterworks, but to observe and abide by the several prohibitions, restrictions, and conditions contained in the said Acts of Parliament, in so far as the same or any of them may touch or be applicable to the said

DRAWINGS AND SPECIFICATION.

CONTRACTOR HELD TO HAVE SATISFIED HIMSELF ON ALL POINTS.

WORKS TO BE EXECUTED IN APPROVED MANNER.

ENGINEER'S SUPERINTENDENCE AND DIRECTION.

MATERIALS EXISTING ON SITE OF WORKS.

MATERIAL, &c., BROUGHT ON WORKS TO BECOME THE PROPERTY OF THE COMMISSIONERS.

OBJECTIONABLE MATERIALS OR WORKMANSHIP TO BE REMOVED.

FOREMEN AND WORKMEN.

WORKS TO BE EXECUTED ACCORDING TO SPECIAL AND GENERAL ACTS.

FOR THE PROTECTION OF TURNPIKE AND STATUTE LABOUR ROADS.

PRECAUTION AGAINST INJURY TO ADJACENT FENCES, PROPERTY, &c.

PROVISION IN CASE OF CONTRACTOR'S NEGLIGENCE.

SUB-LETTING.

ADDITIONAL WORKS AND ALTERATIONS.

MONTHLY BILLS OF ADDITIONAL WORKS.

WAGES TO BE PAID IN CASH, THE TRUCK SYSTEM NOT ALLOWED.

TIME OF COMPLETION.

waterworks or works hereby contracted for or any part thereof; and to free and relieve the commissioners from all claims for compensation or damage, or otherwise, consequent upon the non-observance by the contractor of the whole or any of the aforesaid prohibitions, restrictions, and conditions imposed upon the commissioners in the construction of the said waterworks by the said Acts of Parliament, or any of the clauses therein contained, which Acts are herein specially referred to; and the clauses thereof applicable to the construction of works, the occupation and use of lands, roads, quarries, and others, or otherwise applicable to or touching the execution of the work hereby contracted for are held as engrossed herein as relative to the present contract.

11. And specially without prejudice to the foregoing general conditions the contractor shall be bound to fulfil the obligations incumbent on the commissioners by virtue of section 408 of 'The Aberdeen Police and Waterworks Act, 1862,' in relation to the operations under this contract, affecting any turnpike or statute labour road, and to free and relieve the commissioners of all such obligations and liabilities, damages, and expenses that may be incurred, and generally of the whole consequences that may result from the failure to implement such obligations.

12. The contractor shall take special care, by the erection of temporary fences, and by every other means which circumstances may render necessary, to prevent all injury or damage to, or trespass upon the lands, roads, fences, and other property adjacent to the site of the works, and he shall confine the passage of his workmen to existing roads and footpaths so far as such roads and footpaths are open to the public. He shall likewise be bound to pay and satisfy all claims whatsoever, and from whomsoever, for temporary occupation, way, leaves, damages, trespass, or otherwise, in reference to the said adjacent lands, &c., and to bear the commissioners entirely harmless therefrom, and free and relieve them thereof; and, further, the contractor shall restore, join, and make good all walls, fences, and hedges cut through or injured by his operations on, or adjacent to, the line of works.

13. In case of the contractor not proceeding, in the opinion of the commissioners, with due diligence and expedition in the execution of the works, or of refusing or neglecting to comply with any orders or directions given him by the engineer, resident engineer, or superintendents, or of his failing to do any other matter or thing stipulated for by the terms of this contract within seven days after a written notice requiring the same has been served on him (the delivery of such notice at any of his usual places of business, or residence, or to his foreman, being deemed sufficient service), the commissioners shall be entitled to apply to the arbiter hereinafter named for authority, and such arbiter shall be entitled to authorise and empower the commissioners, without any judicial procedure whatever, either to employ their own workmen, and forthwith to perform such works as the contractor may have neglected or refused to do, or such other works as the engineer shall direct agreeably with the terms of this contract; or if the said commissioners shall think fit to take the works wholly, or in part, out of the hands of the contractor, and to contract with any other person or persons, or to provide any additional workmen, materials, tools, or implements, for the purpose of completing the said works, or any part thereof; and the commissioners shall have liberty to use, free of cost and charge, all or any materials, tools, implements, or other matters and things which may be on the works or in use at the time, to the exclusion of any right of the contractor over the same. And the contractor shall, on demand, reimburse and pay to the said commissioners all expense, cost, and charges which may be incurred in the performance or completion of such works as aforesaid.

14. The contractor shall not make any sub-contract for executing the whole or any portion of the brick or stone work of the reservoirs and aqueducts, or the puddling thereof (except as to the supply of materials), without the express written consent of the engineer. Nor shall he be entitled to assign this contract, or any part thereof, without a special agreement to that effect with the commissioners.

15. In case the engineer should consider it desirable to order additional works, or to increase or diminish the quantities, or alter the dimensions or character of any of the works included in this contract, such additions, diminutions, or alterations shall not in anywise vitiate the said contract, but shall be performed by the contractor under all the conditions, stipulations, and responsibilities herein contained, the same as if they had been expressly described and included in this contract. Save and except that the value of such additions, diminutions, or alterations shall be estimated according to the schedule of prices annexed to this contract, and signed by the parties of even date as relative hereto, and the amount shall be added to or deducted from the contract sum or price hereinafter specified, as the case may require, except in the case where such additions or alterations are comprehended or included under the obligation of the contractor to make the works contracted for complete and watertight without extra charge by him; in which case no addition shall be made to the contract sum or price.

And it is hereby declared that the prices inserted in the said schedule are to include and cover all the contingent works and operations specified for, or belonging to, the different classes of work for which the prices are given, and that no charges will be allowed for such contingent works, other than under the heads and prices in the said schedule. For instance, the prices for 'excavating and wheeling, &c.,' are to include all the contingent works of timbering, shoring, pumping, &c., &c., and the price for 'brickwork' or 'masonry' is to include all the contingent works of scaffolding, centering, ladders, and other necessary implements, and costs.

No additional or extra work of any kind or description whatever will be paid for unless it has been executed expressly as additional or extra work to be paid for, under the authority of written orders, sanctioned by the commissioners, signed by the clerk to the commissioners, and countersigned by the engineer, which orders the contractor must produce as vouchers for the charge.

In estimating the value of extra or additional work, the measurements shall be the net contents of the work as executed, provided, however, that no excess above the dimensions ordered shall be included in such measurements.

No allowance will be made for circular work, face work, or any incidental circumstances, notwithstanding any custom to the contrary.

16. When any additional or extra work is in course of execution, the contractor must, at the end of each calendar month, deliver to the engineer, resident engineer, or superintendent, a priced bill or account for the quantity of such work executed during the month. The non-delivery of such bill or account at the proper and stated time will be considered as an abandonment of any claim for the value of such work, and as exonerating the commissioners from all liability relative thereto.

17. The contractor shall cause all men employed directly or indirectly under him to be paid regularly and in cash, and on no account shall the whole or any portion of the wages be paid, or any advance made to men by tickets or orders made upon victuallers, or in any way whatever except money. The introduction of the truck system will in no wise be allowed, and to this effect the contractor shall not, by himself or agents, directly or indirectly, permit the sale of provisions, or any other articles, to the workmen, by parties exclusively privileged, in payment of wages, or for any other consideration than money, and in like manner he shall prevent any control or inducement being exercised over the men with reference to their choice of market or of prices or of the mode of payment.

18. The works between the crossing of the public road leading to North Leys, and the entrance out of the plantation field marked 219 on sheet No. 4 of the plan signed by Sir James Horn Burnett and the Lord Provost of Aberdeen, on behalf of the promoters of the 'Aberdeen Police and Water Works Act, 1862,' in reference to their agreement of 21st March, 1862, shall be completed within six months' time of the contractor breaking ground, and the whole of the works comprised in the contract are to be completed within two and one-half years after the date of the engineer's order to commence the work, under forfeiture of £500 per week, to be paid to or retained by, the commissioners, as ascertained and liquidated damages, and not by way of penalty, for each and every week the work shall remain unfinished after the expiration of the period above named.

The Commissioners are taking, or are about to take, the requisite means for acquiring possession of the land for the execution of the works; but they shall not be responsible to the contractor for any delay in acquiring possession, or for any loss or damage which may be occasioned to him by such delay, nor shall such delay be held in any way to vitiate the contract.

The engineer is to have power, without vitiating the contract, and without the contractor being entitled to claim any damage from the commissioners, to delay the commencement or progress of the works, in case of frost, wet, or inclement weather, or other cause not imputable to the contractor; and the engineer is also to have power to grant such extension of time for completing the whole as

he may deem proper and sufficient in consideration of any such delay, or of any delay occasioned by the Commissioners not acquiring possession of the ground, or of any additions or alterations made to the works which may render an extended time necessary for their due execution. And the contractor shall be bound to complete the works by the expiration of this extended period, under the same condition of forfeiture as hereinbefore mentioned.

The contractor is to give written notice to the engineer of his having finished the whole of the works according to the terms of the above-written specification; but the contract is not to be considered as completed until the perfect and satisfactory completion of the same shall have been certified in writing by the engineer.

ACCIDENTS AND
DAMAGES.

19. The contractor hereby takes upon himself the risk of—and it is declared that he shall be answerable for—all accidents and damages of any kind, or to the detriment of any person or persons whatever which may occur during the performance of this contract, and which, in the opinion of the engineer, are consequent upon, or in any way attributable to, the execution of the works.

In case of damage to the works, the contractor shall be bound to repair and make good the same as soon as possible, at his own cost and charge; and, in respect of any other kind of accident or damage, he shall be bound forthwith to reimburse and compensate the commissioners or other injured parties, as the case may require, for all expenses, losses and injuries which they, in consequence of any such accident or damage, may have sustained or become liable for.

In the event of the contractor failing to meet, reimburse, defray, and pay all claims, costs and charges in respect of such accidents or damages, or in respect of the restoration of any streets, roads, footpaths, and land surfaces, buildings, walls, fences and hedges, sewers, drains, and other things which may have been injured or disturbed during the execution of the works, or the maintenance thereof subsequently, or in respect of any compensation or satisfaction for temporary occupation, way-leaves, damages, trespass, or otherwise, in reference to the said adjacent lands, or in respect of any compensation or damage, or penalty upon the non-observance by the contractor or any of the said Acts of Parliament, the Commissioners are to be at liberty to adjust, pay, and discharge the same, and for that purpose to retain and deduct such sum or sums so paid, and all expenses incurred relative to the adjustment or settlement thereof, from and out of any monies due or becoming due under this contract, the true intent and meaning being that the contractor shall be bound to reimburse and compensate the Commissioners for all such payments and expenses so defrayed by them; and, in case such monies shall be insufficient to cover the amount of such payments and expenses, the contractor shall be bound to pay the deficiency to the Commissioners on demand.

CONTRACTOR TO
UPHOLD WORKS FOR
ONE YEAR.

20. The contractor shall be bound to maintain, uphold, and guarantee the stability of the works, and to keep them watertight and in good and perfect repair and condition for one year after the completion of the whole works shall have been certified by the engineer as aforesaid; and if at any time during this term any defects shall appear, such defects shall forthwith be made good by the contractor, at his own cost and charge, to the satisfaction of the engineer, so that the whole of the works may be delivered up at the end of the period above named properly and completely finished, and perfect in all their parts, in conformity in every respect with the terms of this contract.

The contractor also hereby takes the risk of, and it is declared that he shall be answerable for, any accidents or damage of whatsoever kind that may arise during this term in consequence of such defects, the same as if they had occurred during the progress of the works as hereinbefore provided.

EXPENSE OF
CONTRACT DEED.

21. The contractor shall be bound to pay the solicitor's charges for the preparation of this contract deed, and recording and extracting the same, and other legal provisions usual in such cases.

And the said Easton Gibb, as principal, and (the persons bound with him) as cautioners, sureties, and full-debtors for and with him, hereby bind themselves, jointly and severally, and their forebears, to implement and fulfil the whole obligations incumbent on the contractor contained in the foregoing specification and general conditions.

For which causes, and on the other part, the Commissioners bind and oblige themselves and their successors in office to make payment to the contractor of the sum of one hundred and three thousand nine hundred and ninety-nine pounds sterling for the execution of the whole of the works comprised in this contract agreeably with the said drawings and the foregoing specification and general conditions, and that in manner following:—

MODE OF PAYMENT.

Advances of money on account will be made every calendar month, upon the engineer's recommendation, as the works proceed, of a sum equal to the value of the work which shall have been executed in the preceding period, calculated according to the said schedule of prices hereunto annexed, under deduction of ten per cent.; and in fixing the said sum due, regard shall be had to the value of the materials laid down, and of any extra works which may have been executed, beginning the first payment at the end of one calendar month from the commencement of the said works; but such advances are in no way to affect any question in the ultimate settlement of the accounts, or to be considered as proof or admission of any particular work or amount of work having been executed. The final balance, including the price of any extra works under deduction of percentage after mentioned, will be paid three calendar months after the completion of the contract, provided that within one month from the date of such completion the contractor shall have delivered to the engineer a full account in detail of all claims he has on the Commissioners, and that the engineer shall give a certificate in writing of the correctness of such claims. From the final balance there shall be retained by the Commissioners, if they see fit, for the period of twelve calendar months after the completion of the whole works, a sum equal to ten per cent. of the contract price, as a security for the sufficiency and stability of the works.

DISPUTES TO BE
SETTLED BY
ARBITER.

And it is hereby provided and declared that if at any time before the commencement, or during the progress, or after the completion of the contract, there shall arise any disputes or differences between the Commissioners, and all or any one or more of the said parties hereto of the second part, as to the true intent, construction, or meaning of these presents, or as to the manner of executing or maintaining the works hereby contracted for, or as to what is due diligence and expedition used in the execution of the said works, or as to the quality of the materials employed, or proposed to be employed therein, or as to the amount of any monthly advances to be made to the contractor, or as to any claims for additional or extra works, or as to any claims of deduction for or in respect of alterations or diminutions on the works, or as to any charge, account, costs, expenses, or damages made or claimed by the Commissioners against or from all or any one or more of the said parties hereto of the second part, or made or claimed by all or any one or more of the said parties hereto of the second part against or from the Commissioners, arising out of or incurred or suffered by or for or in respect of the execution or the failure in the execution of the works or any part thereof, or arising out of or incurred or suffered by, or for or in respect of the performance, or the failure of the performance, of any of the obligations undertaken by the parties, or payable under or by reason of such obligations, or as to the performance, or failure in the performance, of any of the obligations undertaken by the parties; and generally as to any matter or thing whether of the nature above specified or of any other kind, as well non-executorial as executorial, arising out of or in any way connected with this contract: then all the said disputes and differences are hereby submitted and referred to the decision, final sentence, and decret arbitral of William Leslie, Esquire, Civil Engineer and Architect, in Aberdeen, whom failing of, James Simpson, Esquire, Civil Engineer, in London, whom failing of, Thomas Hawkesley, Esquire, Civil Engineer, in London, and whatever the said arbiters shall determine on the premises, in whole or in part, by award or awards, decret or decreets arbitral, whether interim or final, to be pronounced by them respectively, the Commissioners, and the said parties hereto of the second part shall be bound to acquiesce in, implement, and fulfil to each other under the penalty of £10,000; which submission shall not fall by the lapse of year and day, or by the death or change of any of the Commissioners, or by the death of all or any one or more of the said parties hereto of the second part, or of their respective successors; and the arbiter for the time shall not be disqualified by his being or becoming the engineer of the Commissioners; and it is especially declared that the said arbiters respectively shall have full power under said submission not only to determine the liability of any of the parties to the other for or in respect of the claims, charges, accounts, costs, expenses, or damages, as to which any dispute or difference is referred to the arbiters as aforesaid; but also conclusively to assess and fix the amount of such claims, charges, accounts, costs, expenses, or damages, in so far as the same are not expressly liquidated, assessed or fixed in these presents. And the

said arbiters respectively shall also have power to award the costs either in whole or in part, which may be incurred under the said submission, and of making out and recording the award or awards, decree or decreets arbitral to follow thereon, against such of the parties as he shall think fit.

And the Commissioners on the one part and the contractor as principal, and the [persons bound with him] as cautioners, sureties, and full debtors, for and with him, and all jointly and severally on the other part, bind and oblige themselves and their foresaids to fulfil this contract to each other in the whole heads, articles, and clauses thereof, under the penalty of ten thousand pounds sterling to be paid by the party failing to the party observing and fulfilling, or willing and ready to observe and fulfil, the same over and above performance.

CANTERBURY WATERWORKS.

SPECIFICATION

To be observed by the contractor or contractors for making, supplying, and delivering—

1,450	socket pipes	12 inches	internal diameter
150	do.	do.	7 " do. do.
720	do.	do.	6 " do. do.
660	do.	do.	5 " do. do.
3,380	do.	do.	3 " do. do.

of cast iron required by the Chairman and Directors of the Canterbury Gas and Water Company in accordance with this Specification and the further instructions to Mr. S. C. Homersham, Civil Engineer, the Engineer of the Company.

PIPES TO BE MADE
TO SPECIFICATION
AND DRAWINGS.

The straight pipes shall be of the kind or description known as 'socket pipes,' to be made in strict conformity with this specification and with the drawings and schedule hereunto annexed.

The branches, curved, and other special pipe castings shall also be made as directed in this specification, and according to such drawings and instructions as may be given by the company, or the engineer of the said waterworks, from time to time, and at any time during the continuance of the said contract entered into by the said contractor.

QUALITY AND
STRENGTH OF METAL.

All the pipes and special castings shall be of cast metal, remelted either in the cupola or air furnace, without an admixture of cinder iron or other inferior material, so that when cast it shall be strong, tough, and close-grained, and of such strength that a bar 1 inch square 3 feet 2 inches long when placed on two supports 3 feet apart and loaded in the middle shall sustain a weight of not less than $6\frac{1}{2}$ cwt. Such metal shall be cast as hard as can be conveniently drilled and tapped, but not so as to present when broken a white and vitreous surface of fracture.

The contractor shall make and provide from time to time or as often as may be required by the engineer, or some person appointed on his behalf, six test bars as before described, cast from each, and the same runnings as the pipes are cast from, and the contractor shall provide suitable and proper machinery for testing the bars, and shall have the same tested whenever required in the presence of, and to the satisfaction of the engineer or some person appointed on his behalf.

PIPES TO BE CAST
VERTICALLY.

The straight pipes of a greater diameter than 5 inches shall be cast vertically in dry sand moulds without the use of core nails, chaplets, thickness pieces, or any substitute therefor.

The special castings shall be cast in either loam or dry sand at the option of the contractor.

All smaller pipes may either be cast vertically in dry sand (which will be preferred) or in green sand at an angle of not less than 30 degrees.

The patterns used shall be made of iron truly turned of the proper form and dimensions for each size of pipe and in all cases where the boxes require to be separated for taking out the patterns, the contractor shall use or cause to be used boxes that are so fitted, that the separate portions of the boxes can only occupy the same relative position one part to the other, when rejoined as they occupied one to the other when the boxes were rammed up with the patterns in them.

PIPES TO BE CAST
PERFECT.

The whole of the pipes, including the curved pipes and special castings, shall have smooth and perfect surfaces, and to be thoroughly well dressed, inside and outside, so as to remove all sand or loam or other extraneous matter, they shall be free from scoriae, air bubbles, cold shuts, scabs, laps, washes, or other imperfections of casting, the pipes (as distinguished from the special castings) shall be straight, and truly cylindrical in the bore, to which the outside of the pipe shall also be concentric. The special castings of all descriptions shall be truly circular in the bore and of uniform thickness, this being a most important condition applying equally to both pipes and special castings.

Also in all cases the internal diameters shall be the full size specified, otherwise they will be rejected.

In cutting off the gates or runners great care must be taken to preserve a square angle on the inner edge of the sockets against which the lead joints have to be made; and it being of the greatest importance that the spigots will in all cases enter to the bottom of the sockets and that the sockets will in all cases receive the spigots, therefore to insure the fulfilment of this condition, a pair of gauges shall be made for each size of pipes, namely 2 rings of wrought or cast iron, one for the spigots, to be bored out in the inside in the lathe to the required internal diameter into which all the spigots shall be made to enter, and the other, to be turned outside, of the requisite outside diameter and which all the sockets shall be made to fit, but so as to admit the gauge to the bottom.

Great care must be taken that the spaces for lead joints are kept in all respects of the same size as shown in the drawings, as otherwise the expense of jointing will be unnecessarily augmented.

CURVED PIPES AND
SPECIAL CASTINGS.

The curved pipes and other special castings shall be made of the exact form and dimensions given in the drawings, they must not be made of greater thickness than the straight pipes of the same internal diameter, unless so specially provided, and figured on the drawings or otherwise especially directed, and pains must be taken to ensure that these pipes or other special castings shall properly joint with the straight pipes and other castings with which they may be intended to connect by actually placing such pipes in proper connection with standard straight pipes and other castings of a like diameter with which they may be intended to connect.

EXAMINATION AND
PROOF.

Whenever the pipes and special castings shall have been duly and properly cleaned and dressed as before specified they shall then, without delay, and if practicable before getting wetted, be proved by hydraulic pressure, in a suitable proving machine by competent and experienced workmen to a pressure equal to that of a column of water 600 feet high, this pressure to be kept up for 3 minutes, and to be indicated by a mercurial or other approved pressure gauge, connected with the proving machine, and during the time this pressure is maintained the pipe or special casting undergoing proof shall be repeatedly struck in various parts of its length and circumference with a hammer of a weight proportioned to the thickness of the pipe, this process of proof is to be performed in the presence of, and to the satisfaction of such person or persons as Mr. S. C. Homersham may appoint for the purpose.

In case the pipes or special castings have been unavoidably wetted between the time of dressing and the time of proving them, they shall nevertheless in all cases be perfectly dry outside when they are proved.

PIPES AND ALL
CASTINGS TO BE
COATED BY DR.
ANGUS SMITH'S
PROCESS.

LENGTH AND
WEIGHT.

The founder or contractor for the pipes shall find and provide all the necessary labour and machinery, &c., for the testing and proving of the pipes and special castings, as aforesaid. Should any pipe or pipes upon examination or when undergoing such test be found defective or appear to the person appointed on behalf of Mr. S. C. Homersham to inspect such pipes to be in any way inferior to the description of water pipes required and described in this specification, they will be rejected and shall be replaced by the contractor at his or their own expense by such other pipes as may be found upon examination and the aforesaid test and examination to fulfil all the conditions of this specification.

When the pipes and special castings shall have been proved as before specified and have been found on examination to be in all respects in accordance with this specification they shall at once (and before there is time for them to become rusted) be coated with pitch according to Dr. Angus Smith's process. The pipes and special castings shall be first equally heated all over in a pit or stove specially adapted for the purpose, to a temperature of 20° above that of the boiling pitch, and then at that heat shall be immersed in a bath or pan containing a proper mixture of pitch and linseed oil, maintained at a boiling heat by heating flues surrounding the bath or pan containing the mixture, this temperature is necessary to insure the coating being thin, uniform in thickness, and quite hard when cold so that it shall not stick to anything it may come in contact with.

When the pipes and castings have remained a sufficient time in the bath they are then to be withdrawn very slowly, the straight pipes in a vertical position, and to remain suspended in that position until the surface be sufficiently hard to resist injury in being rolled aside.

The surface of the coating of the pitch shall be quite black, shall resemble japanned work and retain a smooth glossy appearance, and adhere firmly to the pipes all over and be incapable of being mechanically separated from it. Pitch of the proper quality to be obtained from Mr. McDougal, of the Irk Vale Chemical Works, Chadderton, near Manchester, or of some other firm supplying pitch similar in quality.

Every straight pipe shall measure 9 feet long when in work, that is to say exclusive of the inner depth of the socket, and no pipe shall deviate from the mean weight respectively assigned in No. 4 column in the annexed schedule to a greater extent than is given in No. 5 column, beyond which in case of addition or over weight no payment will be made for such over weight.

The following schedule gives the number of each kind of straight pipe that is referred to in this specification, the length, thickness, and internal diameter, estimated weight, &c. &c.

1	2	3	4	5	6
Internal Diameter of Pipe	Thickness of the metal of each Pipe	No. of each kind of Pipe required	Mean Weight of each Pipe	Permitted deviation from the prescribed Mean Weight	Length of each Pipe in work
			Cwt. qrs. lbs.		
3	.360	3,380	1 0 0	3 lbs.	9 feet.
5	.420	660	2 0 0	5 "	"
6	.435	720	2 2 0	6 "	"
7	.440	150	3 0 0	7 "	"
12	.600	1,450	6 0 0	12 "	"

NOTICE WHEN PIPES
ARE PROVED.

FOUNDRY WORKS
MAY BE INSPECTED.

TIME, PLACE, AND
RATE OF DELIVERY.

PIPES TO BE NUM-
BERED AND HAVE
THEIR LOTS PAINTED
ON THEM.

TERMS OF PAYMENT.

QUANTITIES TO BE
ALTERED.

TENDER: HOW TO
BE MADE.

At least 6 days' notice in writing of the time when the pipes are to be proved shall be given to Mr. S. C. Homersham, the engineer appointed to examine the pipes, in order that he or a person on his behalf may attend to examine the pipes and see them proved.

The engineer shall be at liberty, if he so thinks fit, to send an inspector or inspectors to examine the metal, the melting, moulding and casting processes, &c., as well as to be present from time to time as aforesaid at the proving, weighing, measuring, and otherwise examining and making the said pipes, and the said contractor shall afford such inspector or inspectors every facility and assistance and such tools and materials as he or they may need for the due performance of his or their duty.

The pipes shall be delivered in parcels of not less than 50 tons at a time (unless specially ordered in smaller parcels) at the station of the South Eastern Railway Company, St. Dunstan's, Canterbury, Kent, as may be from time to time directed as follows, namely,—not less than 100 tons in weight in one month from the date of order, and 200 tons in weight shall continue to be delivered as before mentioned during every month after the expiration of the first month till the whole of the pipes named in this contract be made and delivered as aforesaid: such deliveries shall consist of pipes of such several sizes as the company or their engineer shall from time to time direct. All branch pipes, curved pipes, hydrant pipes, and other special castings shall be made and delivered as soon as possible after the receipt of the order therefor, and unless directed to the contrary shall have precedence over all other work; and in case the directors of the company or Mr. S. C. Homersham, civil engineer, shall be of opinion that the contractor has not used due diligence in making and delivering such pipes and special castings or any of them it shall be in their or his discretion to order and purchase the same or any substitute therefor and to deduct or cause to be deducted any extra costs or charges thereby incurred from any sums of money which may then be or may afterwards become due or owing to the said contractor, and any pipes so ordered or purchased shall be considered to form part of the number to be supplied by the said contractor.

The said pipes and special castings shall be delivered at the aforesaid in a sound and perfect state, and should the company see fit, the pipes and special castings shall be proved again to the pressure hereinbefore stated, and should any pipe or special casting upon examination or such further test and examination as aforesaid be found defective or appear so to the person appointed on behalf of the engineer to reinspect or reprove such pipes or castings, they will be rejected, and shall be replaced by the contractor at his or their own expense, by such other pipes as may be found upon examination, and the aforesaid test and examination, to fulfil all the conditions of this specification.

As soon as any pipes shall have been measured, examined, and have undergone proof, and have been coated as aforesaid to the satisfaction of the person appointed to inspect the pipes on behalf of the engineer, such pipe if of the proper weight and regular size and thickness within the prescribed limits shall be weighed; the 3 in. pipes in batches of 25 in number, the 5 in. pipes in batches of 12 in number, the 6 and 7 in. pipes in batches of 10 in number, and the 12 in. pipes each separately; and each pipe of every batch, or pipe weighed separately, shall be legibly marked in white oil paint on the outside or inside of the socket thereof with distinctive marks and figures at least 1½ in. long to indicate such batch, and of every batch shall also be marked in like manner with a consecutive number, and one pipe of each batch with the weight of the batch or pipe to which the bill of lading and invoice shall have reference.

The contractor shall be entitled to payment in the manner following, that is to say, to an instalment amounting to three fourths of the value of the pipes and castings so delivered proved and accepted at the expiration of one month from the delivery and acceptance thereof, and to the balance at the expiration of four months from the due and complete fulfilment of such contract, provided always that such instalment or balance, or any portion thereof respectively shall not be considered as due and owing to the said contractor unless and until the said engineer shall have given his certificate that the said contractor is reasonably entitled thereto.

The quantities, weights, and dimensions of the pipes already mentioned are believed to be the quantities, weights, and dimensions which will be actually required, but the engineer shall however have full power and authority to extend or diminish the quantities, lots, and dimensions within reasonable limit.

The tender shall be according to the following form, and after being duly filled up and signed by the contractor, must be delivered at the office of the company, enclosed in a sealed envelope and addressed, James Burch, Esq., Secretary to the Gas and Water Company, Wincheap, Canterbury, Kent, and endorsed 'Tender for Water Pipes,' on or before 12 o'clock in the forenoon of March 3rd, 1868, next, and the same will be considered, and the determination of the company will be announced under the hand of the engineer within seven days from that date; but the said company do not bind themselves to accept the lowest or other tender.

19 Buckingham Street, Adelphi, London, February 18th, 1868.

FORM OF TENDER.

THE CANTERBURY GAS AND WATER COMPANY.—WATER PIPES.

CONTRACT No. 9.

To the Chairman and Directors of the Canterbury Gas and Water Company.

GENTLEMEN,— will undertake to make, deliver, and supply you with pipes and other castings, in conformity with the terms and conditions contained in the specification marked, 'The Canterbury Gas and Water Company,' 'Water Pipes,' 'Contract No. 3,' and signed by your engineer, Mr. S. C. Homersham, for the following sums:—

	£.	s.	d.
Price for straight pipes 9 inches internal diameter, per ton.	.	.	.
" " " 8 " " " "	.	.	.
" " " 7 " " " "	.	.	.
" " " 6 " " " "	.	.	.
" " " 5 " " " "	.	.	.
" " " 4 " " " "	.	.	.
" " " 3 " " " "	.	.	.
Branches, bends, flange pipes, and other special castings to connect with above pipes; at per ton extra, on above prices	.	.	.

Gentlemen, your obedient Servant,

*Name**Address**Date**Note.*—Tender to be sent without being detached from the Specification.

HALIFAX CORPORATION WATERWORKS.

SPECIFICATION

To be observed in the construction of the Work.

This Contract includes—

EXTENT OF
CONTRACT.

- 1st. The construction of a flood and waste watercourse, commencing in the Luddenden Brook course, a short distance above the existing Dean Head Reservoir, and terminating at the junction of the Fulshaw and Luddenden streams, including the weir and sluices at the head of the flood watercourse, and the waste weirs of the Dean Head Reservoirs and the Castle Carr Reservoir;
- 2ndly. The formation of two reservoirs, to be called the 'Dean Head Upper Reservoir' and the 'Dean Head Reservoir,' with the embankments, puddling, and pitching; the sinking of shafts and driving of tunnels for discharging the water; and all the masonry connected therewith;
- 3rdly. The formation of various roads in connection with the reservoir embankments, and the fencing round the reservoirs;
- 4thly. The construction of the 'Castle Carr Reservoir,' with the embanking, puddling, and pitching, and the masonry connected with the discharge pipes;
- 5thly. The construction of the 'Compensation Basin,' with the excavation, the embanking, puddling, and masonry;
- 6thly. The intercepting and diversion of the Fulshaw stream, with the masonry and piping connected therewith;
- 7thly. The continuation of the compensation watercourse from the end of the No. 1, or Warley Moor Contract at the Fulshaw stream, to the Compensation Basin, with all the masonry and piping connected therewith;
- 8thly. The laying of a line of pipes from the Discharge Basin of the Castle Carr Reservoir, round the north and east sides of the Compensation Basin, to join the covered conduit at the commencement of the No. 3, or Saltonstall Contract, and the construction of a covered well at the point of junction; and,
- 9thly. The construction of three small weirs or falls on the Luddenden stream below the Compensation Basin.

REFERENCE TO
PLANS AND SECTIONS.

The situation of the various works are shown upon the general plan, marked No. 1, and their forms, dimensions, and details are more particularly described in the accompanying drawings, marked Nos. 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17. All these drawings are referred to in this specification, and together with the general plan and the schedule attached to the specification, are to be taken as part of the specification.

I.—THE FLOOD AND WASTE WATERCOURSES, INCLUDING THE WEIR AND SLUICES ON THE LUDDENDEN STREAM, THE WASTE WEIRS OF THE DEAN HEAD AND CASTLE CARR RESERVOIRS, AND THE STEPPED FALL INTO THE COMPENSATION BASIN.

WEIR AND SLUICES AT THE HEAD OF THE FLOOD WATERCOURSE.—DRAWING No. 3.

WEIR.

A weir to be built across the Luddenden stream at the point marked on the plan for the purpose of turning the water into a flood watercourse, to be made on the east side of the Dean Head Upper Reservoir, and so into the waste watercourse from these reservoirs, and into the Luddenden stream again at its junction with the Fulshaw stream. The works under this head must be first executed, so as to divert the flood water and facilitate the construction of the embankments.

DESCRIPTION OF
THE WEIR.

The weir to be built of stone, to have a flag apron or fall, and an ashlar sill; the weir to be 50 feet 6 inches in length along the face between the side walls, and be divided into eight openings, of 5 feet each, by seven ashlar piers, into the sides of which grooves must be cut for the reception of stop planks, and upon which flags to form a footway must be placed.

EXCAVATION.

The ground to be neatly excavated to the required depth and form, so that the masonry may be well bedded on the bottom, and securely built in against the sides, the excavated material going into the embankment of the flood watercourse.

BREAST-WALL OF WEIR.

The breast wall, on which the sill is to be placed, to be founded upon rag flags 6 inches in thickness; the lower part of the wall for the full length of the weir, and for a short distance under the side walls, to be of rubble and to be coped with two courses of flags 4 inches in thickness, for the full width of the wall under the sill, but for only 2 feet 6 inches in width under the wing wall at the west end; the lower course to be bedded in mortar, the upper course to be bedded in asphalte, which must also fill the joints of both courses. The 4-inch flags to serve as the foundation for the upper part of the wall, which must be of two breadths of parpoints 8 or 9 inches in width, leaving a vacancy of 1 inch between the courses to be filled with asphalte. The face of the parpoint wall to be set 18 inches back from the face of the rubble wall below. The parpoint wall to be coped with ashlar of the same width as the wall, to be bedded in asphalte, and made watertight. A course of flags 6 inches thick, on edge, to be placed on the 4-inch flags, immediately behind the parpoint wall; the top of the flags to be level with the top of the ashlar coping, to be made watertight, and the joint between the flags and parpoint wall to be filled with asphalte.

RUBBLE-HEARTING AND RUBBLE-WALL AT FOOT OF APRON.

The breast wall to be backed up and supported by a mass of dry rubble; and a rubble wall set in mortar, to extend the full width of the weir at the foot of the flag apron or fall; this wall, together with the dry rubble, to form the foundation for the flag apron, and for a portion of the side walls of the weir; the rubble in mortar to be founded upon rag flags 6 inches thick, and to be faced with hammer-dressed wall stone.

FLAG-APRON.

The apron of the weir to be of sound flags 6 inches in thickness; each step in each bay to be of one stone, which must be sufficiently long on the face to extend 3 inches under the division or side walls at each end. The space between the ends of the steps in the same course, and between the ends of the steps under the side walls and the solid ground, to be built in with good flat-bedded rubble stones on edge set dry; these pinnings under the division walls to be covered with flags 6 inches thick, upon which the ashlar division walls are to rest. The face of the flags forming the apron to be neatly pitched off and left rough.

DIVISION OR SPUR WALLS.

The division walls to be of ashlar set on edge; to be founded upon the flag apron, and, in front of the apron, upon rubble walls built on rag flags 6 inches thick; the lower ends to abut against the solid ground, and the upper end against the ashlar piers. The exposed surfaces of the stone to have the edges neatly pitched off and left rough.

SIDE WALLS.

The side walls to be founded upon the flag apron and dry rubble hearting, and, in front of the apron, upon rag flags 6 inches in thickness; to be faced with small blocking, or parpoints, backed with rubble. Adjoining the sill the side walls must be wholly of ashlar made watertight. The face of the ashlar to be dressed to suit the dressing on the division walls, except for the width of the sill, which portion must be dressed to suit the upper surface of the sill to be hereafter described.

COPING TO SIDE WALLS.

The side walls to be coped with ashlar in the manner shown.

ASHLAR SILL.

The ashlar sill to stretch across each opening in one stone, and be let into the piers for the depth of one inch at each end; to be founded partly upon the ashlar coping of the parpoint wall, into which it must be let for the depth of one inch, partly upon the row of upright flags, and partly upon the top step of the flag apron. The upper surface to be dressed off with a diamond-pointed hammer or pick point, and to have a chisel draft $1\frac{1}{2}$ inch in width round the edges. The exposed faces to be left rough.

ASHLAR PIERS.

The ashlar piers to be founded partly upon the ashlar coping of the breast wall, and partly upon the flag apron, the lowest course being further supported by abutting against the division walls on the apron. The sides of the stones for the width of the sill to be dressed off in a similar manner to the upper surface of the sill, the remainder to be left rough, neatly pitched off at the edges.

GROOVES FOR STOP PLANKS.

Grooves, 3 inches wide and 3 inches deep, to be cut into the piers and side walls for the admission of stop planks.

STOP PLANKS.

The stop planks to be of pitch pine 10 inches deep and 3 inches thick, and to have planed surfaces.

FLAG FOOTWAY.

The footway over the weir to consist of 6-inch landings stretching in single stones across each opening; the upper and under surfaces to be neatly boasted over, the edges neatly pitched off and left rough.

SLUICES.

Three sluices to be constructed at the east end of the weir to regulate the flow of water down the watercourse; the width of the sluices to be the same as the openings in the weir.

FLAG FOUNDATION UNDER SILL.

The 4-inch flags, forming the coping to the rubble-walling in the breast wall, to be continued as the footings for a course of ashlar forming the foundation for the ashlar sill; the flags and ashlar course to be extended for a short way under the side and wing walls of the sluices, and treated in all respects similar to those already described for the breast wall of the weir.

SILL PIERS, ASHLAR IN SIDE WALLS AND FLAG FOOTWAY. BUTTRESS WALLS.

The sill, piers, ashlar portion of the side walls, and flagged footway, to be treated similarly to corresponding work in the weir.

The piers to be supported by buttress walls faced with small blocking; to be 18 inches thick, and founded upon rag flags 4 inches thick, and to be coped with ashlar, worked and dressed in a similar manner to the ashlar division walls on the flag apron.

SIDE WALLS.

The side walls, where not ashlar, to be of small blocking backed with rubble; to be founded upon rag footings 6 inches thick and coped with ashlar; the upper surface of the coping to be neatly boasted over, and the exposed face left rough.

SILL ACROSS WATER-COURSE.

An ashlar sill, similar in all respects to that forming the sill of the weir, to be placed across the watercourse at the end of the side walls of the sluices, for the purpose of forming pools below the sluices; the sill to be founded upon flags 6 inches thick.

PAVING.

The pools to be paved with hammer-squared stones closely set, and run in with asphalte; adjoining the sluices, the stones to be 12 inches deep, the remainder to be 9 inches deep.

WING WALLS.

The side walls of the weir and sluices to be returned in line with the weir and sluices as wing walls. Flags, 6 inches thick, stepped one above the other, to be built into the walls, the lowest step resting upon the ashlar coping on the parpoint wall, and projecting 18 inches in front of the upper part of the wing walls; the flags to be supported by rubble masonry. Above the flags, the walls to be faced with parpoints in two widths, and asphalted in a similar manner to the parpoints in the breast wall; the wall to be coped with ashlar.

COPING OF SIDE AND WING WALLS. SIDE WALLS BETWEEN THE WEIR AND SLUICES. PUDDLE TRENCH.

The coping of the side and wing walls of both weir and sluices to be neatly boasted over on the upper surface, and the faces left rough.

Between the weir and the sluices the side walls at the point of meeting to be solid ashlar, as shown, made watertight; the ashlar to extend for a mean length of 6 feet along each wall.

A puddle trench to be sunk along the face of the weir and sluices sufficiently deep to meet retentive ground, and to extend as far as needful into the hill sides at each end. The puddle to be brought up along the face of the masonry and wrapped over the exposed portion of the two courses of 4-inch flags under the sills of the weir and sluices, and over the 6-inch steps in the wing walls. The quantity of puddling given in the schedule includes only so much as is shown on the drawings; additions or deductions to be made as the case may be, and to be allowed for at the price stated in the schedule.

A layer of gravel or broken stone to be laid over the puddle in front of the weir; and in front of the sluices a certain width is to be paved with rubble stones 9 inches deep.

The sides of the basin above the weir to be dressed off to a slope of 1 to 1 for a distance of 10 yards from the wing walls, and the slopes to be pitched with a dry rubble pitching 12 inches thick.

A level bench, $1\frac{1}{2}$ yard in width, covered with gravel or broken stone 6 inches thick, to be formed along the top of the rubble pitching.

FLOOD WATERCOURSE—DRAWINGS Nos. 1, 2 AND 3.

The flood watercourse to commence at the sluices and terminate at the Waste Weir of the Dean Head Upper Reservoir.

The upper length of the watercourse to be open; a short length at the lower end adjoining the weir to be covered.

OPEN WATERCOURSE.

The open watercourse to be 17 feet wide at the top, 6 feet wide at the bottom, and 5 feet 6 inches deep. The slopes to be 1 horizontal to 1 vertical; to be pitched, to the height of top bank level, with flat bedded rubble pitching 12 inches thick. The upper slope of the cutting of the watercourse above the pitching to be covered with sods or soil 9 inches in thickness. The width of bank

	on the lower side of the watercourse to be 4 feet 6 inches ; to be covered with gravel or broken stone, 6 inches in thickness, and form a footway, which must be continued as far as the waste weir of the reservoir. The slope of the embankment facing the reservoir to be dressed off to a slope of $2\frac{1}{2}$ to 1 for the greater part of the length, gradually increasing towards the weir to $1\frac{1}{2}$ to 1; the slope to be covered with soil 9 inches in thickness down to the top bank level of the reservoir.
SPLAYED WALLS NEAR SLUICES.	Adjoining the sluices, the battering slopes of the watercourse to be brought to the perpendicular side walls of the sluices by splayed dry rubble walls ; these walls to be coped with ashlar 8 inches in thickness, dressed to suit the coping of the side walls of the sluices.
PUDDLE TRENCH.	A puddle trench to be sunk parallel with the watercourse, on the lower side, in the manner shown on the drawings ; to be refilled with puddle which must be carried up to the level of the underside of the footway.
COVERED WATER- COURSE.	The covered portion of the flood watercourse to be 9 feet wide at the level of the springing of the arch and 6 feet high. The invert and crown of the arch to be of parpoints 9 inches deep, dressed to the radius, the remaining portion of the arch to be of ashlar, 12 inches thick ; the arch to spring from ashlar stones dressed to the radius of the invert and side walls, and to be backed with rubble in mortar. The spandrels and walling at the northerly end of the covered conduit to be faced with small blocking and backed with rubble ; where not resting upon the arch to be founded upon rag flags 6 inches thick. A fence wall to be built on the top of the wall ; to be faced on both sides with parpoints, and coped with ashlar in the manner shown. The coping to be tooled.
EXCAVATION.	The excavation for both open and covered portions to be neatly made to a template. Any hollows or vacancies in the open course to be filled in with dry rubble, and in the covered course with rubble in mortar. In the quantity of excavation given in the schedule for this portion of the work, the whole of that shown on the sections for the open watercourse is included, but only so much of that for the covered conduit as is absolutely necessary for the construction of the conduit. A large proportion of the excavated material will be required for the embankments of the open watercourse, and the remainder will have to be run out to spoil until the reservoir embankment is sufficiently advanced to receive it, when it can be taken to the embankment along with the remainder of the material above the covered conduit, and be paid for under the head of embankment.
DRESSING AND SOILING SLOPES AND BENCHES.	The slopes of the cutting above and below, and the level bench over the covered conduit, to be neatly trimmed off and covered with soil 9 inches deep.
THE WASTE WEIRS OF THE DEAN HEAD UPPER, DEAN HEAD, AND CASTLE CARR RESERVOIRS.—DRAWINGS NOS. 1, 4, AND 5.	
EXCAVATION.	The ground to be neatly excavated to the required depth, and the excavated material to be taken at once into the respective reservoir embankments.
SILL AND STEPS OR APRON.	The sill and steps of each weir to be of ashlar, each step being notched out 3 inches to receive the step above it. The ends of the sill and steps to be built in with the ashlar side walls. The sill to be supported upon three courses of ashlar, founded upon two courses of 6-inch flags, which project 12 inches beyond the face of the wall, except at the Dean Head Reservoir, where the ashlar supporting the sill must be founded upon rubble in mortar, bedded on the solid ground or rock. All to be made watertight. The steps, where not resting on the solid ground, to be founded upon rubble in mortar.
SIDE WALLS.	The side walls of the weirs to be of ashlar for three feet above the level of the sill, made watertight, and founded upon two courses of 6-inch flags, which must project 12 inches beyond the faces of the walls, except on the portion adjoining the sill and steps, under which the projection need only be 3 inches. Above the ashlar the side walls to be of small blocking, backed with rubble.
WATERWAY OPPOSITE WEIR.	The waterway below the steps to be wholly of ashlar, founded upon a course of flags 4 inches in thickness, extending under the whole area ; and to consist of a series of level benches, one above the other, bounded by curved steps of ashlar, dressed to the radius. The spaces between the steps to be filled in with ashlar stones, 12 inches deep and 9 inches wide—stones of greater breadth to be placed under the foot of the steps forming the apron of the weir, under the curved steps just mentioned, and under the ashlar walling of the retaining wall opposite the weir. The paving and curved steps to be set dry upon the flag foundation, and the interstices filled with asphalt.
FLAGGING UNDER PAVING.	The flags to be well bedded in mortar on the solid ground, the joints being left open and filled with asphalt.
RETAINING WALL OPPOSITE WEIR. SPANDRELS.	The retaining walls to be founded upon flag footings 6 inches thick ; to be faced with ashlar, backed with rubble to the level of top water, and, above that level, with small blocking, backed with rubble.
FACE OF ARCHES.	The spandrels over the arches of the flood and waste watercourses to be of a similar character of work to the upper part of retaining wall. The face of the arches to be 9-inch parpoints of ashlar, corresponding with the character of the work in the culverts. A ring of stone 3 inches thick, projecting 3 inches beyond the face of the wall, to be placed over each arch.
FENCE WALLS.	A fence wall 18 inches thick, to be built upon the side walls, spandrels, and retaining walls ; to be faced with parpoints on each side, and coped with tooled ashlar in the manner shown. For slight differences see the drawings. The exposed surfaces of all the ashlar, except the coping, to be dressed off with a pick or diamond point and have drafted margins.

THE WASTE WATERCOURSE FROM THE DEAN HEAD UPPER RESERVOIR TO THE HEAD OF THE STEPPED FALL TO THE COMPENSATION BASIN.—DRAWINGS NOS. 4 AND 5.

	The watercourse to be covered for its whole length, with the exception of a short length at the lower end adjoining the stepped fall, which will be open ; and to be of the several dimensions shown on the drawings.
DESCRIPTION OF MASONRY IN CONDUIT.	The invert springers and side walls to be of ashlar, worked to the forms shown upon the drawing. The invert to be founded upon flags, which must be firmly bedded upon the solid ground ; to be bedded in mortar, but the joints filled with asphalt ; the side stones must be bedded and jointed in mortar, and made as watertight as possible ; the arch to be of parpoints 9 inches deep, set in mortar. The conduit, where double to have two archways side by side, each 9 feet span and 7 feet high. The arches to spring from a middle pier of ashlar, running the full length of the conduit, and from ashlar side walls, both side walls and middle pier to be founded upon rag flags 6 inches in thickness. The side walls to be made watertight, and all the exposed faces of the ashlar to be neatly boasted over. The arches to be of parpoints 9 inches deep, backed with rubble in mortar. The bottom to be pitched with squared stones 9 inches deep, bedded upon a course of flags 3 inches thick. The flags to be bedded upon the solid ground in mortar, but the joints of the flags and the joints of the pitching to be filled with asphalt. The face of the arches and the spandrels at the south end of the covered conduit to be finished in a similar manner to those on the north face, but, instead of a fence wall being built on the spandrels, they must be coped with a projecting string course 6 inches thick, surmounted by an ashlar parapet 2 feet in height. The coping or string course and the parapet to be dressed to the required form and tooled.
OPEN WATERCOURSE.	A short length of open watercourse to be constructed between the end of the covered conduit and the stepped fall ; to be 20 feet wide and 7 feet from the top of the string course to the top of the paving. The side walls to be of parpoints in two widths ; to be asphalted and backed with rubble, and founded upon a course of sound 6-inch flags ; and to be surmounted by a string course and parapet similar to that over the end of the covered conduit already described. The bottom of the waterway to be similar, in all respects, to that for the covered conduit already described. A footway to be formed level with the string course, on each side of the open watercourse. A flight of tooled ashlar steps to be placed on each side adjoining the end of the covered conduit, and a footway 6 feet wide to be continued over the arching to the end of the embankment of the Castle Carr Reservoir. The footway to be of gravel or broken stone 6 inches thick.

EXCAVATION.	The excavation to be neatly made to a template, any hollow or faulty places being filled up with rubble in mortar. The quantity of excavation given in the schedule is only that necessary for the construction of the conduit, almost the whole of which will be required in the formation of the embankment over the line of conduit. The remainder of the excavated material to be run out and left on the line of conduit until such time as the reservoir embankments are in a sufficiently advanced state to receive it, when it must, together with that afforded by the cuttings required to bring the ground on the sides of the conduit to the form shown upon the cross sections, go into the reservoir embankments, and will be paid for under the head of embankment.
SOILING BEYOND THE LINE OF CONDUIT.	Where it is necessary to extend the slope of the embankment beyond the line of the conduit, the soil below must be first stripped off and laid aside, and then carefully replaced over the embanked material when all is finished.
SOILING.	The level bench over the conduit, and the slope from thence to the top bank level of the Dean Head Reservoir, to be neatly dressed off, and covered with soil 9 inches thick. All the excavations and refillings to be covered over, when properly trimmed off, with soil 9 inches thick. The small stream crossed near peg No. 19 to be admitted into the conduit.

STEPPED FALL AT THE END OF THE WASTE WATERCOURSE.—DRAWINGS NOS. 4, 15, AND 16.

SILL.	The water to fall into the Compensation Basin through a succession of pools or basins. An ashlar sill, 2 feet 6 inches deep, 1 foot 6 inches thick, and standing 1 foot 6 inches above the bottom of the waste watercourse last described, to be built across the south end of the open portion of the course. This sill to rest upon a course of ashlar extending 18 inches under the paving forming the bottom of the waterway, and to be made watertight with asphalt. The course of ashlar, as well as the sill, to extend from 9 inches to a foot into each side wall.
WALLS UNDER SILLS.	The course of ashlar just described to form the coping to a wall built with a facing of double parpoints asphalted, and a backing of rubble founded upon a course of 6-inch flags, well bedded in mortar on the solid ground.
POOLS.	A pool to be formed at the foot of this drop by a wall having an ashlar coping and sill exactly like that already described, and below this again three other similar pools are to be formed, but the walling under the lowest sill will differ from that already described, by being higher and heavier, and the coping and sill will be longer, owing to the side walls leaving the straight and curving away from the fall. The lowest wall, which will form a part of the side wall of the Compensation Basin, to be founded upon a course of 6-inch flags, and to be faced with small blocking, backed with rubble. A pool or basin to be formed at the foot of this wall also, by an ashlar sill, resting upon a course of 6-inch flags bedded in the solid ground.
DRESSING OF STONES.	The exposed surfaces of the ashlar to be finished off with a pick-point or diamond-hammer, chisel-drafts, 1½ inch in width, being run round each aris.
PAVING.	The bottoms of all the pools to be paved with hammer-squared stones, 12 inches deep, set dry, and the interstices filled with asphalt.
SIDE WALLS AND STEPS.	The side walls to be similar in quality to the walls supporting the sills of the falls, and to be coped with a flight of tooled ashlar steps extending from the top to the bottom of the fall; the ends of the steps to project 1 inch over the face of the side walls.
PARAPET.	An ashlar parapet, similar in all respects to that already described, for the open watercourse at the head of the fall, to be placed upon the steps. A low retaining wall to be built at the foot of each flight of steps; to be of coursed rubble, founded upon rag flags 4 inches thick, and coped with ashlar 18 inches wide and 9 inches thick.
EXCAVATION.	The excavation for this portion of the work must be very carefully made; no separate quantity is given, it being included in that for the Compensation Basin.

II.—THE DEAN HEAD RESERVOIRS.

DRAWINGS NOS. 1, 2, 3, 4, 5, 6, 7, 8, AND 9.

As the embankment of the Upper Reservoir is placed immediately below the embankment of the present Millowners' Reservoir, the work connected with the sinking of the puddle trench, and the raising of the embankment to the height of the present one, may be proceeded with at once, but provision must be made for passing away the compensation water daily delivered from this reservoir. The work at both reservoirs to be commenced first must be the sinking of the shafts, and the driving of the necessary tunnels for discharging the water.

DISCHARGE SHAFTS AND TUNNELS, AND THE FOREBAYS, WATER-TIGHT MASONRY, TAILBAYS, TOWERS, AND FOOT-BRIDGES CONNECTED THEREWITH.—DRAWINGS NOS. 8 AND 9.

SHAFTS.	Shafts to be sunk at the points marked on the general plan, and to the depths shown upon the sections and drawings, the ground being first excavated down to the level of the foundations of the masonry towers. The shafts to be properly timbered, if required, until the iron standpipes have been carried up sufficiently high to admit of the concrete being filled in round them.
LINING SHAFTS.	A course of ashlar, 21 inches in width, to be placed for the foundation of the lining, founded partly upon the solid ground, and partly on the concrete, and the lining 12 inches thick, carried up in regular courses. All hollows or faulty places to be filled in solid with rubble in mortar as the work proceeds. A ring of flag-stones, 6 inches thick, projecting about 2 inches into the shaft, to be introduced near the top, to serve as a support for the cast-iron flooring to be placed at this level.
JUNCTION WITH INLET TUNNELS.	Near the bottom of the masonry shafts, the lining to be built in with the side walls and arch of the lower inlet tunnels, and, above the projecting ring just described, the lining to be built in with the masonry of the barrel culverts forming the upper inlet tunnels.
LOWER INLET TUNNEL.	The lower inlet tunnel of the Upper Reservoir to be 4 feet diameter and circular in section; and to be lined with parpoints 6 inches thick. That of the Dean Head Reservoir to be 6 feet high and 6 feet wide; to be of the same section as the outlet tunnels hereafter described; and to be lined with parpoints 9 inches thick. The ends adjoining the shafts to be stepped down in the manner shown, by two steps of 12 inches each; the steps to be of ashlar, and each step must be let into the one below; the flooring between the bottom step and the shaft to be of ashlar, and the side walls to be of ashlar up to the level of the springing of the arch, which at this point must be increased to 9 inches in thickness.
FOREBAYS.	The inner ends of the tunnels to terminate in small masonry forebays. The side-walls of the forebays to be of coursed rubble, founded upon rag flags 6 inches thick, and coped with ashlar. A course of ashlar to be placed across the foot of the forebay, against which the coping on the side walls must abut. The spandrels forming the back wall to be of similar work to the side walls; to be coped with ashlar projecting over the face of the culvert or tunnel in the manner shown, and upon this coping a heavy course of ashlar must be placed. The exposed surfaces of the ashlar to be left rough. The bottoms of the forebays to be paved with hammer-squared stones, set in mortar, of the dimensions shown on the drawing.
UPPER INLET CULVERTS.	The upper culverts or inlet tunnels to be built in open cutting, which must be refilled after the culverts have been finished; to be circular throughout their whole length, and built of parpoints 6 inches deep, except under the wall of the tower, where they must be 9 inches deep. Small forebays, similar in all respects to the one just described, to be placed at the inner end of the culvert.

GRATINGS TO
FOREBAYS.

The forebays to be covered with gratings formed of cast-iron bars 4 inches deep, supported in notches cast in iron beams built into the side walls.

OUTER TUNNEL.

A tunnel to be driven from the bottom of each shaft, as shown upon the drawings, and to terminate in a tailbay at the outer end. The tunnels, when finished and lined, to be 6 feet high and 6 feet wide, and to be lined with masonry in the manner shown on drawing No. 8. For a short distance adjoining the shaft, and again adjoining the tailbay, the lining to be of ashlar 12 inches thick; the length between these sections to be lined with parpoints 9 inches deep, with springers of ashlar. The end adjoining the shaft to be widened out, in the manner shown, to receive the masonry for resisting the pressure of the water. The shale or rock to be neatly dressed out to the required form, and the masonry built firmly against it.

WATER-TIGHT
MASONRY.

The watertight masonry to be of parpoints or blue bricks, set in cement, tightly driven home and keyed up. The discharge-pipe to be passed through the middle of this masonry. For this purpose, the pipe must be bedded in a frame of cast iron, built in with the masonry, the bottom of the frame being flat, and the vertical ends solid, radiated, and checked, the better to bond with the masonry. The frame will consist of a number of curved ribs, placed a few inches apart, and connected together by radiating ribs, thus forming a number of cells which must be filled in with brick or stone in cement, flush with the top of the ribs which are hollowed out to suit the convexity of the pipe. Flanges, about $2\frac{1}{2}$ inches in width, cast upon the outer ribs parallel with the concave edges, and about $\frac{3}{8}$ of an inch below it, will form a hollow ring round the pipe, which must, after all the other work is done, be run full with lead and caulked up. After this frame has been solidly filled, and the masonry has been brought up level with the top of it, the pipe must be bedded in it in cement, and another frame, similar in all respects to that just described, be placed on the top of the pipe; this frame must also be filled in with brick or stone in cement, after it has first been built in with the masonry. After the frame has been filled, the masonry may be continued up to the roof, against which it must be firmly keyed.

RUBBLE MASONRY.

The watertight masonry to be further strengthened by a wall of rubble masonry built on the lower side, against which the lining of the tunnel will abut.

EXCAVATION.

The excavation for the tunnels to be carefully and accurately made to a template, great care being taken that it shall be no larger than sufficient for the reception of the masonry lining. All hollows or faulty places, whether in bottom, sides, or roof, to be securely packed with stone and mortar.

TUNNEL LINING.

The lining of the tunnels to be of good sound stone, all the joints dressed through to the radius; the side walls to be founded upon ashlar springers dressed to the radii of the invert and side walls—no springer to be less than 3 feet in length.

TAILBAYS.

The tailbays to be built in the form shown upon the drawings. The side walls to be of blocking backed with rubble, founded upon rag flags 6 inches in thickness, and coped with ashlar. The spandrels over the arch to be of similar work and coped with a string course of ashlar, upon which a heavy course of ashlar or cap course must be placed. The invert of the tunnels must be deepened at the outlet as shown, and be founded upon a course of 6-inch rag flags. An ashlar sill to be built across each tailbay between the side walls as shown, for the purpose of throwing the ends of the tunnels into dead water; the sill to be bedded upon a rubble wall, founded upon rag flags 6 inches thick. All the exposed faces of the ashlar to be left rough with the exception of the top of the sill, which must be neatly boasted over. The bottoms of the tailbays to be paved with good heavy squared stones, 12 inches deep, dressed with the pick or punch, set dry, and the joints filled with asphalt. The space between the side walls below the sills to be paved with heavy rubble stones, the space between the stones being well filled with gravel. Cast-iron pipes 9 inches diameter, to be laid at the level shown on the drawing, for the purpose of draining off the water from the tailbays. This piping to be found and fixed by the contractor.

PAVING.

DRAIN-PIPE.

A good and sufficient channel to be made to conduct the water from the tailbay to the brook course below, and the sides of the cutting about the tailbay to be neatly sloped off.

THE MASONRY TOWERS.

The towers to be octagonal in form and of the dimensions shown; to be founded partly upon the solid ground, and partly upon the lining of the shaft, upon two courses of rag flags 6 inches thick. That portion of the side walls near the upper inlet tunnel to be carried down below the level of the foundation of the remaining portion as shown on the drawing, and there founded upon a course of ashlar 12 inches thick.

WALLS.

The walls to be faced with hammer-dressed wall stone on the outside, and coursed rubble on the inside; to be 3 feet thick at the bottom and 20 inches at the top; to be narrowed by 3 set-offs on the outside, each 3 inches in width, and 2 set-offs on the inside, the lower one 3 inches, and the upper one 4 inches in width; at each set-off the walls to be coped with a belt course of ashlar, facing both inside and outside, the upper edge of the ashlar on the outside being bevelled off as shown. Three courses of 6-inch flags to be built in the walls at different heights, to project beyond the inside face of the wall 2 inches, to support floorings of cast-iron plates.

OPENINGS FOR THE
ADMISSION OF
WATER.

Openings for the admission of water to be made through the walls of the tower at three different levels, four openings at each level; the belt courses, already described, to form the bottom of the openings, and the covers to be also of ashlar extending through the walls. A cast-iron grating, of the pattern shown, to be placed at the mouth of each opening, and securely fixed by being let into the masonry.

COPING OR CORNICE.
PARAPET.

The walls to be coped with three courses of ashlar, dressed, as shown upon the drawings. A parapet wall to be built on the top of the coping in the manner shown; to be of hammer-dressed wall stone, and coped with an ashlar coping $6\frac{1}{4}$ inches thick, the upper surface being bevelled off on both sides.

DRESSING OF THE
ASHLAR.

The outer surfaces of all the ashlar to be neatly tooled, the faces in the inside of the tower to be dressed off with a pick point or diamond hammer.

IRONWORK CON-
NECTED WITH THE
CONTRACT.

The only ironwork, connected with the shafts, the towers, and the tunnels, included in this contract will be the cast-iron gratings over the forebays and in the openings for the admission of water in the towers—all the rest will belong to another contract. The 42-inch pipes, and the saddles or chair for the watertight masonry, will be found and lowered to the bottom of the shaft for the contractor, but they must be fixed in their places by him; the fixing of the stand pipes, and ironwork connected with them, will be done by the contractor for the stand pipes.

FOOTBRIDGES, PIERS, AND ABUTMENTS.

Access to be gained to the masonry towers by means of wrought-iron lattice bridges, supported at one end upon the towers, at the other upon abutments of masonry, and in the middle by masonry piers.

ABUTMENTS AND
PIERS.

The abutments and piers to be built to the form and dimensions shown on the drawing. The walling to be founded upon rag flags 6 inches in thickness, the footings under the piers being in two courses; to be faced with hammer-dressed wall stone, coped with ashlar, and finished with a parapet in all respects similar to the work already described for the towers.

IRON WORK OF
BRIDGE.

The flanges of the lattice girders to be formed of angle iron, the upper one being further stiffened by a cast-iron hand rail rivetted on the top, cast in lengths of about 6 feet each. The flange of the rail to be cast solid, but the upper part to be cast hollow, and to be turned out for a depth of 3 inches at each end, so that a closely fitting pin, 6 inches in length, may be inserted at the joints, which will assist in connecting the castings together. The diagonals to be of bar iron. The girders to be stiffened at the points of support by vertical angle irons, to which sheets of plate iron of the requisite form have been riveted. Sheets of plate iron to be riveted to the underside of the lower flanges at the points of support, to increase the bearing area; the girders to be connected together by

diagonal bracing of bar iron and tie beams of double angle iron. The flooring to consist of bar iron placed at right angles to the girders, and resting on the bottom flanges—the distance between the bars to be preserved by the insertion of hollow cast-iron rings—and the whole must be tied together by round rods, passed through holes punched in the bars and through the cast-iron rings, and bolted through the flanges of the double angle iron ties.

For the dimensions and particulars of the various parts of the work, see the drawings. The whole of the work must be of the best description, and carried on in the most approved manner. The iron to be of good quality, and free from flaws and defects of all kinds. The punching must be very carefully and accurately done, so that no widening out need be required. The girders to be bolted down to the masonry of the middle pier.

THE EMBANKMENTS.—DRAWINGS Nos. 1, 6, AND 7.

BASE OF BANK.	The base of each bank to be prepared for the reception of the earthwork by the removal of all peat and soft material. The whole of the remaining surface to be turned over for a depth of 9 inches, and springs and swampy places to be drained off as may be directed by the engineer.
MODE OF FORMING EMBANKMENTS.	The embankments to be formed in concave layers, not exceeding 2 feet in thickness on each side of and adjoining the puddle wall, and 4 feet in thickness for the remainder of the banks. The most clayey and adhesive material to be employed close adjoining the puddle, and the remainder of the embankments to be made up of sand, gravel, stone, or shale, reserving the greater portion of stone for the toe of the outside slope.
PUDDLE TRENCH.	A puddle trench to be sunk along the centre of each bank, to the depth shown upon the longitudinal section, and of the form and dimensions shown upon the transverse sections, or to any greater depth that may be required by the engineer, such additional depth to be paid for as extra work, according to the price fixed in the schedule. Should it appear to the engineer that a secure foundation could be made without going to the depth shown upon the section, a corresponding deduction to be made from the amount of the contract for such diminished work. Whilst sinking the puddle trench, the rock forming the sides must be examined, and all open fissures found in it must be cleared out and carefully refilled, either with stone and cement or cotton waste tightly driven in.
ARM PUDDLE.	At the westerly end of the embankments, the puddle trenches to be carried into the side of the hill until secure ground has been reached. At the easterly end of the Upper Reservoir, an arm puddle trench to be cut along the face of the waste weir, and the puddle trench ended in the solid ground immediately on the north of the side wall of the weir. At the Dean Head Reservoir, the arm puddle trench must be continued under the waste watercourse and carried into the solid ground above until good ground has been reached. Under the waste watercourse the trench to be filled with parpoints in cement or asphalt, the rock or other material forming the side of the trench being neatly dressed down, and the masonry firmly built up against it, the ends of the pillar against which the puddle will abut to be built to an even batter as shown in the drawing. The space between this pillar and the end of the weir to be built solid with rubble in mortar, upon which the culvert and side wall of the weir are to be founded. The parpoint walling and the rubble work to be carried up on the sides of the culvert as shown on the drawing. The whole of the trench to be refilled with the clay puddle, and great care must be taken that the trench is clean and free from loose stones and sand before any puddle is placed into it; the trench to be kept as free from water as possible during the operation.
PUDDLE WALL.	The centre puddle to be continued as a puddle wall from the trench just described to within 9 inches of the top bank level; to be 12 feet thick at the top; and to increase towards the base at the rate of 2 inches per foot in depth. The puddle to be wrapped over the ground between the arm trench and the waste weir, and abut against the sill and side walls: to be carried round the end of the side wall at the north end of the weir, and fill the space between the side wall and the culvert. At the south side a puddle wall 3 feet thick to be carried round the back of the side wall as far as the waste watercourse. At the Dean Head Reservoir, the side of the cutting on the low side, and round the ends of the puddle, must be lined with fibrous peat sods, in the manner shown upon the cross sections; this sod lining to be continued round the arm puddle trench also.
CLAY FOR PUDDLE.	The puddling to be composed of good clay, to be carefully selected from any place that may be pointed out by the engineer; and to be done by soaking each course 12 hours in water, and then cutting it lengthways and crossways and treading it; each course to be cut and worked into the one immediately below it, and to be carried out to its full extent and worked before another course is laid upon it.
PUDDLING.	The price given in the schedule for puddling to be that for which it can be done, supposing it to be procured within 750 yards of the centre of the embankment, and an additional price to be stated for every additional hundred yards it has to be carried.
INSIDE SLOPES.	The inside slopes to be 3 horizontal to 1 vertical, and abut against the embankment of the existing reservoir at the Upper Reservoir, on the top of which the slope must commence. The slopes to be covered with a stone facing 2 feet thick, formed of stones closely pitched on edge at right angles to the face, from 12 to 18 inches deep, upon a rubble or broken stone foundation from 6 to 12 inches in thickness. When finished, the pitching must be covered with a coating of small gravel, which must be scraped into and be sufficient to fill the interstices of the stones. The stones used for the pitching to be good flat bedded rubble.
OUTSIDE SLOPES.	The outside slopes to be 2 horizontal to 1 vertical. The lower part of the slope of the Upper Reservoir, being below the water level of the Dean Head Reservoir, will require pitching in a similar manner to the inside slope for a height of 4 feet above the level of the water in the Dean Head Reservoir. The remainder of the slope to be covered when finished with soil 9 inches thick. The outside slope of the Dean Head Reservoir must be soiled over 9 inches thick.
TOP OF EMBANKMENTS.	The top of the embankment of the Upper Reservoir to be 15 feet wide, 4 feet above the top water level when finished and consolidated, and to be covered with soil for a depth of 9 inches; that of the Dean Head Reservoir to be formed into a road, as hereinafter described.

SLOPES.

The slope of the hill on the east side of the Upper Reservoir between the embankment and weir at the head of the Flood Watercourse and below the watercourse, to be dressed to a regular slope and pitched with a rubble pitching 18 inches in thickness, the upper part of which must be curved as shown on the section.

Immediately in front of the sill of the weirs the puddle to be covered with a squared pitching 15 inches deep for a width of 4 feet, and the space between this squared pitching and the edge of the slope to be pitched with rubble 15 inches thick. The material afforded by the excavation for this slope to go into the embankments.

Between the Dean Head Reservoir Embankment and the Horse Pasture Stream, the side of the hill to be dressed off to a slope of 2 horizontal to 1 vertical for a depth of 18 feet below top-water level, the excavated material going into the embankment. The slope to be pitched with rubble stone 18 inches thick. A footway to be formed on the upper margin of the pitching 6 feet in width.

Between the embankment of the Dean Head Reservoir and the outside slope of the embankment of the Upper Reservoir, the face of the hill on the east side to be dressed down to a slope of 4 horizontal to 1 vertical, leaving a margin of 7 feet at the foot of the soiled slope below the waste watercourse, and covered with small or broken stones 12 inches in thickness, so as to form a stone beaching against the action of the water in windy weather. This slope to terminate against a pitched slope of 2 horizontal to 1 vertical, pitched with stone, 24 inches thick, excavated in a parallel line with the outer slope of the Upper Reservoir, a bench 20 feet in width intervening between the margin of the pitching and the foot of the outer slope; the return slope between the pitching just described and the pitching on the outside slope of the Upper Reservoir to be dressed down to a batter of 4 to 1, and covered with a beaching of broken stone 12 inches thick. A footway to be formed on the 7-foot bench along the margin of the beaching, to be covered with gravel or broken stone 6 inches in thickness.

The 20-foot bench at the foot of the soiled slope of the upper embankment to be covered with soil 9 inches in thickness.
 The embankment of the present small reservoir must not be interfered with in any way, and the efficiency of the waste watercourse from that reservoir must be undisturbed until the new embankment for the upper reservoir has been raised 10 or 12 feet above the level of the waste watercourse, when it may be filled up.

MATERIAL FOR EMBANKMENTS.

All the material required for the embankments of the Dean Head Reservoirs, except so much as may be furnished by the cuttings for the various slopes already described, by the excavations afforded by the puddle trenches, waste weirs, and surplus from the watercourses, and from the excavations from the roads to be hereafter described, to be obtained within the sites of the reservoirs and below the level of top water. No excavation must be made or come within 20 feet of the foot of any embankment, and the excavations must be made, carried out, and left to the satisfaction of the engineer.

SOIL.

The soil within the boundary of the land belonging to the Corporation must be carefully laid aside for soiling slopes.

III.—FORMATION OF ROADS AND FENCING.

DRAWINGS Nos. 10, 11, AND 12.

DESCRIPTION OF SECTIONS.

The black line on the sections of the roads represents the natural surface of the ground, the red line the proposed finished surface or formation level on which the road materials are to be laid, and the blue line the surface of the road materials at the centre of the road when the road is finished. The depths of cutting and filling are given to the surface of the formation level.

ROAD MATERIALS.

The surface of the bed for the road materials to be formed level from side to side. On this the road materials are to be laid 12 feet in width on the road over the embankment of the Dean Head Reservoir and from thence to Castle Carr and Deep Clough, and 9 feet in width on the narrower roads. The stoning to consist of two layers—the bottom layer to be formed of hard sandstone, no stone to exceed 4 lbs. in weight, and to be 7 inches thick in the centre of the road and 5 inches at the sides; the top layer to be formed of broken sandstone, the hardest that can be selected, broken so as to pass through a 2½-inch ring, and to be spread regularly over the road, 5 inches thick at the centre, and 4 inches at the sides. All the stones to be broken off the road. The sides to be trimmed to the full width of the road with gravel or quarry rubbish.

The roads to be made in exact accordance with the longitudinal and transverse sections.

OCCUPATION ROAD ON THE WEST SIDE OF THE UPPER RESERVOIR.

The occupation or bridle road on the west side of this reservoir to be diverted as shown on the general plan. The road to be formed along the margin of the reservoir for a considerable portion of its length; a level bench to be driven into the hill side, about 5 feet below top water level, and a dry rubble wall built upon this bench to support the road. The slope of the cutting on the upper side of the road, which need not be soiled over, to be left as steep as it will stand, the material going into the embankment. On the lower side of the reservoir embankment the road will require embanking: the width of the bank at the formation level to be 18 feet; the sides to be dressed to a slope of 2 to 1, and soiled over 9 inches deep.

ARCH OR CULVERT AT BARE CLOUGH. CHANNELS CONNECTED WITH CULVERT.

The road to be passed over the Bare Clough Stream by a culvert or archway of 9 feet span. The abutments and wing walls to be founded upon 6-inch rag flags, and, as well as the spandrels, to be of rubble. The arch to be of parpoints 9 inches deep.

A good paved channel, 9 feet wide, to be made for the stream above the culvert, and below the culvert the channel to be widened out as shown on the general plan. The paving to be of heavy stones, 12 inches deep, closely pitched and hammer-dressed, the paving under the arch to be of a rather better description of work. The side of the channel above the culvert to be pitched with rubble 24 inches thick, and the foundation of the wing walls of the culvert to be protected, on the lower side, by a rubble pitching 18 inches thick, in the manner shown on the plan.

The width of the roadway when finished to be 10 feet.

ROAD FROM THE DEAN HEAD EMBANKMENT TO THE UPPER EMBANKMENT.

A road 9 feet in width, to be formed from the east end of the Dean Head Reservoir embankment to the north end of the waste weir of the Upper Reservoir, between the waste watercourse and the boundary of the land belonging to the Corporation. A portion of this road will serve as a public bridle road, and for so much of it, a fence wall 3 feet 9 inches high, similar to the fence wall round the reservoir, will have to be built between the road and the reservoir.

STEPS.

Two flights of steps to be built, to connect this road and the footways formed alongside the reservoir. The steps to be of tooled ashlar, 6 feet long, 15 inches wide, and 6 inches deep.

ROAD FROM THE WEST END OF THE EMBANKMENT OF THE DEAN HEAD RESERVOIR TO HORSE PASTURE CLOUGH.

This road to be 9 feet in width, and to have a regular inclination from one end to the other. The ground between the road and the footway, along the margin of the side pitching of the reservoir, to be dressed off to a slope of 2 to 1, and soiled over 9 inches thick; the material going into the embankment of the reservoir.

ROAD FROM DEEP CLOUGH TO CASTLE CARR.

A road, 18 feet in width, to be formed from the farm road, a few yards south of the Deep Clough Farm, to the embankment of the Dean Head Reservoir, over that embankment, and then on to Castle Carr. The embankments, where necessary, to be 28 feet wide at the formation level, with slopes of 2 horizontal to 1 vertical. Where the slopes of embankments are on very sloping ground, the ground under the slope to be cut in benches as shown in the cross sections.

SLOPES OF CUTTINGS.

The slopes of the cuttings on the east side of the valley to be 1½ horizontal to 1 vertical, except for a short length of cutting adjoining the Fulshaw stream, where they are to be 1 to 1. Between the reservoir embankment and Castle Carr, where the cutting will be deep, the cuttings to be dressed to a slope of 2 to 1, but a series of level benches 9 feet in width must be cut into the sides, in order to break the continuous slope in the manner shown upon the transverse sections.

SOILING.

All the slopes both of cuttings and embankings to be soiled over for a depth of 9 inches.

- SURPLUS MATERIAL.** All the surplus material, after the necessary embankments have been made, to go into the reservoir embankments, and be paid for under that head.
- SURFACE WATER.** The surface water of the road between Deep Clough and the Reservoir Embankment to be turned, partly into the Fulshaw stream and partly into the small stream crossing the road near the embankment. A cast-iron grid to be placed at the easterly end of the reservoir embankment, and any water that may collect there passed through the grid into the waste watercourse. Another grid must be placed at the westerly end of the embankment, to carry off the water from the Castle Carr Road and the occupation road, into the Dean Head Reservoir by means of stoneware pipes 9 inches diameter.
- FENCING ALONG ROAD.** Fence walls, 4 feet 9 inches high, to be erected on each side of the Deep Clough road and of the road over the embankment. The wall to be founded upon the formation level, 1 foot below the level of the road; to be 18 inches thick at the level of the road, and gradually diminish to 12 inches thick when 3 feet above the level of the road, at which level the coping, 9 inches deep, must be put on; the wall to be of dry flat bedded rubble; the coping to be set on edge, hammer dressed, and set in mortar.

FENCING ROUND THE RESERVOIRS.

- The fencing round the reservoirs to be similar, with only a short exception, to that already described for the roads; to be 4 feet 9 inches high, and stand 3 feet 9 inches above the ground.
- FENCE WALL ON THE EAST SIDE OF THE DEAN HEAD RESERVOIR.** The fence wall on the east side of the Dean Head Reservoir, and between the embankment of that reservoir and to within a few yards of the upper embankment, to be a retaining wall, 7 feet high to the top of the coping, and standing 6 feet above the level of the road alongside it; to be 2 feet thick at the bottom and road level, and 18 inches thick on the top of the coping, the back of the wall to be plumb; the wall to be of dry rubble, and the coping to be set on edge in mortar.
- RETAINING WALL AT THE EAST END OF THE UPPER EMBANKMENT.** From the point at which the wall just described terminates, past the end of the embankment of the Upper Reservoir, and alongside the waste weir and covered portion of the flood watercourse, the ordinary form of fence wall is to be used; but, instead of being placed upon the ground, it must be founded on a course of 4-inch flags, which will form the coping to a heavy rubble wall built below it; this heavy wall to be founded upon rag flags 6 inches in thickness; to be 2 feet thick at the top, and to have a batter on the face of $1\frac{1}{2}$ inch per foot; the back to be plumb. The top of the coping of the fence wall to be 3 feet 9 inches above the 4-inch flag coping. (See drawing No. 4.)
- A short length of fence wall must be built immediately over the archway at Bare Clough, on the west side of the road.
- Openings to be left in the fence wall, at the points indicated on the plan, in which gates are to be placed. The gates to be of wrought iron, of a pattern to be hereafter agreed upon, and the cost price not to exceed that stated in the schedule. The gate-posts to be good sound stones, not less than 7 feet long, the upper part being shaped to the section of the fence wall, and the surfaces to be tooled.

IV.—THE CASTLE CARR RESERVOIR.

DRAWINGS NOS. 1, 13, 14, 16, AND 17.

THE DISCHARGE PIPES AND MASONRY CONNECTED WITH THEM.

- CARTING.** The 24-inch pipes and valves for discharging the water from the reservoir will be found by the Corporation, and delivered to the contractor in Halifax, from whence they must be carted to the ground, and laid and fixed by the contractor, who will be responsible for all accidents that may happen to them after they have been delivered into his hands.
- PIPE TRENCH.** The trench, in which the pipes are to be laid, to be cut in the line and to the levels shown upon the plan and section, and to be 4 feet wide at the bottom, except where the sockets of the pipes will come, where the excavation must be widened out sufficiently to allow of the free use of the tools in caulking up the joints. The bottom of the trench will in all probability be rock, which must be neatly levelled, so as to give a solid bed for three-fourths of the length of each pipe. When the pipes are laid and jointed, the trench on the upper side of the puddle trench must be refilled for a height of 4 feet above the pipes with good stiff clay, mixed with gravel, and well consolidated about the pipes; and, on the lower side of the puddle trench, the pipes to be surrounded with concrete, as shown.
- LAYING AND JOINTING PIPES, AND FIXING VALVES.** The pipes must be carefully laid in the trench and firmly bedded on the bottom, in a straight line. Before being put into the trench they must be carefully brushed out, to remove any soil or other matter that may have entered, the inside of the socket and outside of the spigot end being carefully looked to; they must then be placed singly in the trench and carefully driven home. The joint must be made first, by so much spun yarn, tightly driven, as will leave 3 inches in depth to be occupied by the lead, and then completed by being run full of good new lead, melted from the pig. The lead to be run flush to the outside of the joint, and well caulked or driven up with proper caulking tools and four-pound hammers. Sufficient time must be allowed for the lead to cool before the joint is caulked up. The thickness of lead in the joints will be about $\frac{3}{8}$ inch. Each valve will have to be fixed to the pipes on each side of it by 24 wrought-iron bolts, 1 inch in diameter. Gutta-percha rings, $1\frac{1}{4}$ inch in width and $\frac{1}{4}$ inch thick, to be used to make the joint. The joints should be slightly warmed before the ring is put in. The bolts and rings to be found by the contractor.
- FOREBAY.** The pipes to commence in a small well or forebay. The well to be founded upon a course of flags, 6 inches in thickness, which must extend over and form the bottom of the well. The side walls to be coursed rubble, and to be prolonged in the shape of wing walls past the lower end of the well until they meet the bottom of the reservoir. The space between the walls to be paved with rubble stones, set dry on edge. An opening to be left through the end wall opposite the pipes, to be covered by a cast-iron plate sliding in vertical grooves cut into the sides of the opening—the sides, top and bottom of the opening to be lined with ashlar. The walls to be coped with ashlar, the face of the ashlar to be left rough, neatly pitched off; the upper surface to be neatly boasted over. The well to be covered with a cast-iron grating formed of straight bars about 4 inches deep, 1 inch thick at the upper edge, and $\frac{3}{4}$ inch thick on the lower. The ends of the bars to be sunk into the ashlar coping of the end walls, until the top of the bars is flush with the top of the coping of the side walls.
- MASONRY SUPPORT IN PUDDLE TRENCH.** The pipes to be supported across the puddle trench on a solid pier of parpoint masonry, of the form and dimensions shown on the drawing. The bottom course of stones to rest for its full extent on the rock, without packing; the ends of the courses must all abut against the sides of the trench in the most solid manner, and the sides of the trench must be dressed down to receive the masonry. The ends of the courses, where abutting against the rock, to be grouted with cement. The stones must be laid lengthways across the pier, and break joint, so that there may be no continuous vertical joints running lengthways through the pier. The masonry to extend half-way up the side of the pipe. All the masonry in the pier to be set flush in cement. A sheet of wrought iron, $\frac{1}{2}$ inch in thickness, to be brought up in the centre of the pier, to commence at the bottom and rise about 18 inches above the pipe; the sides of the sheet to extend 12 inches beyond the faces of the masonry. The masonry must abut firmly against the iron plate, and the joint between the plate and masonry must be filled with cement. The pipes must pass through this wrought-iron sheet, the sheet being further stiffened at this point by having two cast-iron collars bolted to it, one on each side of the plate; these collars to be bolted together through the plate by eight wrought-iron bolts, 1 inch diameter, the bolt holes being drilled and the bolts turned to fit

accurately. The collars may be made in one or two castings; if in two, the castings must be bolted together, top and bottom, by one 1-inch bolt. The collars to be $1\frac{1}{4}$ inch thick throughout, and $4\frac{3}{4}$ inches deep. The joint between the collars and pipe to be made with lead run in and caulked like the ordinary socket joints, but without spun yarn. The plates forming the sheet to be jointed horizontally and not vertically; the length of the plate extending across the sheet to be lap-jointed with a double row of rivets.

THE VALVE HOUSE AND VALVE WELL.

VALVE HOUSE AND VALVE WELL.	A valve house to be built over the valves, of the form and dimensions shown on the drawing, and founded upon the side walls of the valve well.
VALVE WELL.	The side walls of the valve well to rest upon rag footings, 6 inches thick, bedded on the solid ground, which must be neatly dressed out to receive them. The walls to be of good rubble laid flat. The pipes, besides resting on the walls of the valve well, to be further supported by three blocks of ashlar. The well to be covered by 6-inch flags, resting partly upon the side walls of the well and partly upon cast-iron beams, supported on the walls of the well. These flags to be neatly dressed, jointed, and finished, to form the flooring of the valve house. The cast-iron beams to be clean, sound castings of the dimensions shown—the cross or short beam to have an aperture cast in it, through which the valve spindle must pass.
DRAIN PIPE.	A cast-iron pipe, 4 inches diameter, to form a drain from the well, communicating with the culvert for carrying off the water from the discharge basin, to be found and laid by the contractor.
VALVE HOUSE.	The valve house to have a base course of ashlar, with tooled faces both inside and outside. The quoins of the windows and doorway, and the window sills, door head, and window heads, to be also of tooled ashlar, and so also the string course and coping or cornice, all of which are to be worked in strict accordance with the dimensions and mouldings shown on the drawing. The walls of the house to be of parpoints, in courses not exceeding $3\frac{1}{2}$ inches in thickness—the faces on the outside to be left rough, and on the inside to be neatly boasted over.
ROOF.	The roof to be formed of flags, 4 inches in thickness, in three tiers, besides the capstone. The flags to be supported by oak rafters, resting at one end on corbel stones placed in the angles of the octagon, and at the other end by a Baltic timber upright standing upon a beam of Baltic timber, supported on the side walls of the house; the oak rafters to be mortised into the upright timber. The lowest tier of flags to rest upon the cornice, which must be properly checked to receive it; the second course to rest upon the first, likewise properly checked. The upper side of the roof flags to be tooled, and the under side boasted. The joints of the flags to be covered by stones, 4 inches wide and $2\frac{1}{4}$ inches deep, and the apex to be covered with an octagonal stone, resting upon the timber upright, already mentioned, and upon the upper edge of the third course of flags. All the work to be jointed with cement.
DOOR, &c.	A good flag, having tooled surfaces, to be placed at the door of the valve house. The door to be a 2-inch framed door, bead and butt, of the best pitch pine; to be hung with band and gudgeon hinges, and secured by an 8-inch iron-rimmed lock. The door, and the timber beam and upright supporting the roof and the oak rafters, to have three coats of varnish, the whole of the woodwork having been planed and properly prepared for receiving it. The outside and inside of the valve house to be neatly pointed with good lime mortar, but only to such an extent as to cover the joint, care being taken in the course of building to keep the joints as close as possible.
SPOUTING.	The rain-water falling upon the roof to be intercepted by a channel cut in the top of the cornice, and passed by means of a short length of lead pipe into a cast-iron down spout, $2\frac{1}{2}$ inches diameter, placed inside the valve house and terminating in the 4-inch drain pipe already mentioned. A wing wall to be built on each side of the valve house in the position shown on the drawing; to be of coursed rubble, founded upon rag flags 6 inches thick, and coped with ashlar 18 inches wide and 9 inches thick.

DISCHARGE BASIN.

DISCHARGE BASIN. SIDE WALLS.	The pipes to terminate in a circular well or basin, 30 feet in diameter, to be called the discharge basin. The walls to be founded upon rag footings 6 inches thick; to be of double parpoints asphalted and backed with rubble in mortar; to be coped with a 6-inch string course, and have a parapet of ashlar round it 2 feet in height; the face of the walling to be rough; the string course and parapet to be tooled.
PUDDLING AND PAVING.	The inside of the basin to be excavated to the level of the footings, and the bottom filled in with clay puddle, upon which a squared rubble pitching must be laid.
18-INCH SUPPLY PIPE.	An 18-inch pipe to convey the water to the conduit for the conveyance of pure water, to be built into the side wall at the point and level shown, and a cast-iron shuttle, 16 inches square, must be attached to the end of it. (See Drawing No. 17.)
CAST-IRON WASTE SHAFT.	A cast-iron waste shaft to be erected in the centre of the well, from which a line of pipes, 24 inches diameter, must be taken through the side walls of the basin, and terminate in a masonry culvert communicating with the Compensation Basin, to be hereafter described.
DISCHARGE PIPES FROM RESERVOIR.	The discharge pipes from the reservoir to be carried under the paving of the basin, and brought up the centre of the cast-iron shaft, terminating in a conical outlet piece, from which the water will issue in a jet or fountain. To prevent the water falling back into the waste shaft, a cast-iron cover must be placed over the shaft in the manner shown on the drawing; the cover to be supported by cast-iron footings forming part of flanges cast on its under side, resting in pockets cast on the sides of the waste shaft. All the joints of the pipes in the shaft, and between the shaft and the pipes, to be flange-joints, similar to those between the pipes and the valves. A branch line of pipes, 24 inches diameter, to leave the discharge pipes from the reservoir in the valve-house and terminate in the waste culvert just mentioned; these pipes to be commanded by a valve placed in the house.
CAST-IRON WORK.	The cast-iron shaft to be formed of three rings of castings, each ring being 3 feet in height, and composed of 4 separate castings, all the castings composing the rings, and the rings themselves, to be firmly bolted together, the faces of the castings being properly planed and faced, to secure a good watertight joint. The shaft to rest upon, and be bolted to, a cast-iron plate, 1 inch in thickness, well founded upon the solid ground. The top of the shaft to be level with the top water-line of the basin.
WASTE CULVERT.	The waste culvert, communicating with the Compensation Basin, to be 8 feet high and 4 feet wide. The side walls to be built with two widths of hammer-dressed wall stone, asphalted and made watertight, and to be founded upon rag flags 4 inches thick. The bottom to be paved with hammer-dressed stones, 12 inches deep, set dry, and then run full of asphalt. The culvert to be covered in with a parpoint arch 9 inches in thickness. The side walls to be carried above the springing of the arch with rubble in mortar, to form a backing to the arch. At the end adjoining the Compensation Basin, the bottom to be formed of flags 6 inches thick, built into the side walls, the flags to be placed in steps as shown, and an ashlar stone or sill to be built in across the end of the paving; in place of the arch the culvert to be covered at this end with ashlar stones 9 inches in thickness—a course of ashlar corbels, projecting 6 inches into the culvert, to be placed on the side walls immediately below the covers. The exposed surfaces of the covers, corbels, flags, and sill, to be neatly boasted over.

STEPS AND
FOOTWAY.

A flight of stone steps to be placed over the waste culvert adjoining the Compensation Basin, and a footway 6 feet wide formed from thence over the line of culvert, and round the Discharge Basin.

The upper end of the culvert, through which the cleansing and waste pipes must pass, to be built up in the circular manner shown in the drawing.

EMBANKMENT.

EMBANKING.

For the description of the manner of forming the embankment, including the puddling, pitching, and soiling, see that already given for the Dean Head Reservoirs. In this instance there will, however, be no occasion to set the ashlar side wall at the north end of the weir on rubble masonry, as is described for the Dean Head Reservoir.

Provision must be made for passing the water of the stream, in times of flood, past the embankment during the execution of the work, either by cutting channels in the solid ground at the end of the embankment, or by the construction of wooden troughs or shoots, which can be elevated from time to time as the work proceeds. The channels or troughs to be made to the satisfaction of the engineer.

MATERIAL.

All the material required for the earthwork of the embankment to be obtained either from the inside of the reservoir, or from the cuttings for the watercourse.

PUDDLE, WHERE TO
BE OBTAINED.

The price to be given in the schedule for the puddling to be based upon the supposition that the clay can be obtained within 400 yards of the centre of the embankment, and an additional price to be stated for every additional hundred yards it has to be carried.

EXCAVATION INSIDE
THE RESERVOIR.

The whole basin of the reservoir to be dressed to the form shown upon the plan and sections; the bottom to have an uniform inclination from one end to the other. A sunk channel to be formed along the bottom for the flow of water when the reservoir is empty; to be of roughly squared rubble stones set on edge and closely pitched. The sides of the reservoir to be pitched at a slope of 2 to 1 with rubble pitching, 18 inches deep, the upper part being curved as shown.

STEPPED FALL.

The water to be admitted into the reservoir at the higher end by a stepped fall, formed of flags, 6 inches thick, dressed to the radius, and bedded upon the ground. An ashlar sill on edge to be placed across the top of the fall, to be founded upon the flag apron, and projecting under the side walls. The side walls to be of ashlar on edge, set upon the flags forming the apron. The whole of the ashlar to be dressed with diamond hammers, and to have drafted edges.

SIDE WALLS OF
STREAM ABOVE
CASTLE CARR
RESERVOIR.

The sides of the stream, from the top of the fall to the boundary of the land belonging to the Corporation, to be faced with dry rubble walling having a coping on edge set in mortar. The wall to be 2 feet thick, and the coping 12 inches deep, the top of the coping to stand 4 feet above, and be founded 12 inches below, the bed of the stream.

FOOTWAY.

A footway to be formed along the margin of the pitching on each side of the reservoir, to be covered with 6 inches of broken stone or gravel.

SOILING.

The ground on the higher side of the footway to be neatly sloped, where necessary, and soiled over.

RETAINING WALL
AT EASTERLY END
OF BANK.

A heavy rubble retaining wall to be built opposite the easterly end of the embankment, to maintain the slope of the cutting below the boundary fence; to be about 22 yards in length, the height to vary from 2 feet at the ends to 12 feet in the centre, to be 2 feet thick at the top, and have a batter on the face of $1\frac{1}{2}$ inches per foot, the back to be plumb; to be founded upon rag footings 6 inches thick, and to be coped with flags 4 inches thick.

ROAD DOWN
OUTSIDE SLOPE OF
BANK.

A road, 10 feet in width, to be formed from the northerly end of the waste weir, down the outer slope of the embankment, to the level space below the bank, and covered with road metalling as already described for the other roads.

WIDTH OF TOP
BANK.

The embankment to be 12 feet wide at the top and soiled over 9 inches deep.

FILLING IN
BETWEEN EMBANK-
MENT AND COMPEN-
SATION BASIN.

The space between the foot of the embankment and the Compensation Basin to be filled in with earth, and soiled over 9 inches thick; the top of the soiling, when finished, to be 20 feet below the level of the top of the embankment of the Castle Carr Reservoir, and 3 feet 6 inches above the level of the footway round the Compensation Basin. The slope between this level bench and the footway round the Compensation Basin to be 2 to 1.

V.—THE COMPENSATION BASIN.

DRAWINGS NOS. 1, 15, 16, AND 17.

The Compensation Basin, to a great extent, to be formed by excavation, and the excavated material to be used in filling up such portions of the bottom of the basin as are now below the formation level. In making the necessary embankments, the surplus material to be run on to the low ground on the left bank of the stream below the basin, over the line of pipes conveying water to the pure water conduit, where it must be carefully levelled and sloped down to the sides of the new channel, and be neatly soiled over 9 inches thick.

The work in connection with the Compensation Basin may be divided under the following heads:—

- 1st. The compensation basin, including the weir walls, the abutments to the same, the side walls of the basin, the gauge basin, the overflows, the masonry about the corner fountains, and the admission of the Fulshaw stream.
- 2nd. The test basin and stairs.
- 3rd. The retaining walls, the paving about the foot of the weirs, and round the test basin, and the formation of the new channel for the brook course.

1.—THE COMPENSATION BASIN AND THE WORK CONNECTED THEREWITH.

WEIR WALLS.

Two curved ashlar walls to be erected in the position shown upon the drawings, to serve as overflows or weirs to the compensation basin; to be wholly of ashlar, the lowest course projecting beyond the face of the upper part of the wall 9 inches on each side, and founded upon a course of sound 6-inch flags; the whole to be made watertight.

PIERS OR ABUT-
MENTS TO WEIR
WALLS.

The curved walls to abut against piers of masonry at each end, that in the middle also serving to connect the two walls together. The middle pier to be built of ashlar throughout; the end piers to be ashlar only on the end next the weir walls, the other portion to be faced with blocking, to course with the ashlar and to be backed with rubble. All the piers to be founded upon sound flags 6 inches thick, and to have a projecting course of ashlar at the base similar to the same course under the weir walls, but the projection, except on the upper side of the middle pier, to be 3 inches only in place of 9. The ashlar work must be perfectly watertight.

SIDE WALLS OF
COMPENSATION
BASIN SOUTH OF
POINT O.

The side walls of the Compensation Basin from the weir walls to the point marked O on the Drawing No. 15, except the two short lengths opposite the puddle trench, to be faced with a double row of parpoints, asphalted and made watertight, and backed with flat-bedded rubble in mortar; to be founded upon sound 6-inch flags, the face of the wall having a projecting course of ashlar placed immediately above the flag footings. The wall to be 3 feet thick at top water level, and to batter at the rate of $1\frac{1}{2}$ inch per foot on the face; the back to be plumb.

WATER-TIGHT WALLING IN PUDDLE TRENCH.	The wall opposite the puddle trench to be built wholly of parpoints, either set in cement or grouted with asphalte, in the form of a buttress, as shown on the drawing; to be 6 feet thick at the top and 13 feet 6 inches at the bottom, the face having the same batter as the rest of the side walling, and the back a batter of 3 inches per foot, against which the puddle must abut.
SIDE WALLS FROM COMPENSATION BASIN NORTH OF POINT O.	The character of the side walling north of the point marked O, and up to the walling below the stepped fall, will depend to some extent upon the sufficiency of the puddling to render the basin watertight. In the schedule it is supposed that the puddling will be sufficient, and that the water-tightness of the basin need not depend upon this part of the walling, to be now described. The wall to be faced with hammer-dressed wall stone, backed with rubble, all well flushed in mortar, and founded upon sound flags 4 inches thick, projecting 10½ inches beyond the face of the wall; under the face of the wall the flags to be double. The upper part of the side walls, above the level of the water, to be of a lighter description; to be only 2 feet thick, and faced with hammer-dressed wall stone, backed with rubble. The walls to be coped with a string course 6 inches thick, dressed to the mouldings shown, and to be surmounted by a low parapet of ashlar. The parapet and string course to be tooled.
FOOTWAY.	A gravel footway to be formed round the basin, as shown on the drawing, and an ashlar gutter hollowed out 3 inches deep, placed on the upper side of it; stoneware pipes, to conduct the water from the gutter to the basin, to be placed at intervals.
GAUGE BASIN.	The gauge basin to be built between the weir walls immediately above the middle abutment, which will form one end of the basin. The outer walls to be of ashlar, made watertight; to have a projecting course at the base, similar to that under the weir walls, and to be founded upon a course of sound 6-inch flags. An opening to be left in the northerly end of the basin, 16 inches square, for the admission of water, and to be commanded by a cast-iron shuttle, 16 inches square. Two ashlar walls to be built in the basin, to serve the purpose of buttresses; to be similar in construction and foundation to the outside walls; openings to be left through the walls for the passage of the water in the manner shown.
EXCAVATION.	All the ground within the area of the gauge basin to be excavated down to the level of the flag foundation, and the space filled in for a certain depth with well-tempered clay, upon which the squared paving, forming the flooring of the basin, must be placed in regular courses across the basin; the paving to be set in mortar.
COVERING OF GAUGE BASIN AND PARAPET.	The well to be covered with good 6-inch landings, supported across the basin by two cast-iron beams, of the pattern shown in the drawing. The flags to cover the walls, and project over and serve the purpose of the string course, which, together with the ashlar parapet, must be worked and dressed in a similar manner to those on the side walls of the Compensation Basin.
MUSHROOM VALVE. (See Drawing No. 17.)	A mushroom valve to be placed in the north division of the basin, to communicate with the 24-inch pipes from the waste shaft, passing through the walls of the basin below the paving. An opening, 3 feet high and 3 feet wide, to be left in the middle pier or abutment; the opening to be closed by a cast-iron plate, having an opening left in it for the passage of the water out of the basin; the plate to be well bedded to the masonry. A small sunk well to be placed in the front of the sluice; the bottom to be a good 4-inch flag, upon which the ashlar side walls are to be placed. The top of the ashlar to be neatly boasted over, and the other faces left rough. A wrought-iron manhole door to be placed in the flagging, over the gauge basin, to be properly hung to the flagging, and to be secured by a galvanised iron padlock. A wrought-iron ladder, to reach from the manhole to the bottom of the basin, to be found and fixed by the contractor.
COPING ON PIER OR ABUTMENTS.	The pier or abutments to the wing walls to be coped or covered with good 6-inch landings, which must project over the side of the walls; to be dressed to the moulding of the string course, and surmounted by an ashlar parapet as before described.
DRESSING OF ASHLAR.	The exposed faces of all the ashlar already described for the Compensation Basin to be neatly pitched off and left rough; the upper surface of the weir walls, and the faces of the ashlar inside the openings left through the ashlar walls, to be finished off with pick point and drafted edges.
OVERFLOW IN CENTRE OF BASIN.	A waste well or overflow to be placed in the centre of the basin. The lower part of the well and the foundation course to be of ashlar, 12 inches thick. The upper part to be of cast-iron firmly secured to the top of the ashlar walling. A line of pipes, 24 inches diameter, to take the water from the waste shaft to the up-cast shaft or pipe, to be placed in the centre of the test basin, to be hereafter described.
18-INCH PIPES.	The 18-inch pipes from the compensation conduit to be carried up the waste shaft in a precisely similar manner to that in which the discharge pipes are carried up the waste shaft in the discharge basin of the Castle Carr Reservoir. For the description of the covering plates and the waste shaft see that given for similar work connected with the Castle Carr Reservoir.
OVERFLOWS IN THE CORNERS OF THE BASIN.	Two small waste shafts to be placed in the south-east and south-west corners of the Compensation Basin. These shafts to be altogether of cast-iron, and founded upon blocks of ashlar 12 inches thick. The water to be carried from the waste shafts to the up-cast pipe in the test basin by cast-iron pipes 12 inches diameter.
CORNER FOUNTAINS.	Two fountains to be erected in the north-east and north-west corners of the basin. The water to be supplied through 8-inch cast-iron pipes laid from the 18-inch pipes in the lines shown upon the plan. The vertical portion of the pipes to be surrounded with rubble in mortar faced with ashlar, stepped up in the manner shown on the drawing, and the whole founded upon two courses 4-inch flags. The face of the ashlar lining to be tooled. The corners in which the fountains are placed to be neatly paved with squared pitching set dry, and the joints run full of asphalte.
ADMISSION OF THE FULSHAW STREAM.	At the north-east corner of the basin, the Fulshaw stream must be admitted. As the level of the basin is below the level of the stream at the point of admission, a new channel must be made from the point at which the boundary fence crosses the stream to the upper side of the footway round the basin. The channel to be 4 feet wide and 2 feet 6 inches deep; to be paved with roughly-squared rubble set dry, and the side walls to be of dry rubble coped with rubble stones on edge, also set dry. The foot of this channel to abut against an ashlar sill 12 inches thick and 2 feet deep, set on edge, founded upon a 6-inch flag and built into the side walls—the top of the sill being level with the top water of the basin. The channel below the sill to be composed of 6-inch flags stepped one above the other, and overlapping each other 18 inches, each step to be in one stone, and sufficiently long to enter the side walls. The side walls to be founded upon 6-inch rag flags; to be faced with hammer-dressed wall stone, backed with rubble, and coped with ashlar in the manner shown. The exposed faces of the ashlar coping to be left rough; the upper edge of the sill to be neatly boasted over. The foot of the flags to be founded upon rubble in mortar, resting upon a continuation of the 4-inch flag foundation of the side walling of the basin.
SIDE WALLS.	
FOOTWAY.	The footway to be carried over the channel in a similar manner to that already described at the entrance of the waste culvert from the Castle Carr Reservoir, see p. 34. For the description of the carting of the pipes, the laying and joining of socket and flange pipes, see that for similar work connected with the Castle Carr Reservoir at pp. 29 and 30.
PUDDLE TRENCH.	A puddle trench to be sunk across the basin, between the two buttresses of watertight masonry already described, in the line marked on the plan, and to be continued behind the masonry into the hill sides until a satisfactory foundation is met with. The trench to be refilled with good clay up to the height shown, and laid over the ground between the trench and side walls of the Compensation Basin and the Gauge Basin, and the weir walls, against all of which it must abut, so as to prevent the water passing down the faces of the walls.
PRICE FOR PUDDLING.	The price to be stated in the schedule for the puddling to be based upon the supposition that the clay can be obtained within 400 yards of the centre of the trench, an additional price to be stated for every additional hundred yards of lead.
BOTTOM OF BASIN.	The bottom of the basin to be dressed to a uniform depth of 8 feet all round the side walls, but the bottom to have a fall of 2 feet from the upper end towards the sluices, and the surface between the side walls and the longitudinal centre line must be dressed to suit that inclination. The bottom to be covered with broken stone or gravel for a depth of 6 inches.

All the excavated slopes round the basin to be neatly trimmed off and soiled over.

2.—THE TEST BASIN AND STAIRS.

WEIRS OR OVER-
FLOWS.

The Test Basin to be of the form and dimensions shown in the drawing—to have eight sides, four of them straight and four curved; two of the curved and one of the straight sides to serve as waste weirs to the basin.

The weirs or overflow walls to be of ashlar, made watertight, founded upon a course of 6-inch flags—the first course of ashlar in the two curved weirs to project 9 inches beyond the outside face of the wall. The weirs to abut against piers of solid masonry at each end. The piers, for the width and height of the overflow walls, to be of ashlar; to be faced on the outside with small blocking, backed with rubble, and founded upon a course of rag flags, 6 inches thick.

SIDE WALLS.

The side walls of the basin to be of small blocking, backed with rubble on the outside, and founded upon rag flags 6 inches thick. The outside of the walls to be founded at a lower level than the inside, which must be founded upon the flags forming the bottom of the basin, and, to the height of top water, to be of ashlar, 2 feet in width, made watertight; above the ashlar the walls to be faced with hammer-dressed wall stone. The inside and outside faces to be well bonded together. The walls on the straight sides of the basin to be carried up 2 feet 3 inches higher than the side walls on the curved sides. The top of the side walls and piers to be coped with 6-inch flags, the edges being flush with the face of the side walls—steps to be built in the ends of the higher walls so that a footway may be formed from one side of the basin to the other.

FLAGGED BOTTOM.

The bottom of the basin to be formed of two courses of flags, each 4 inches thick; the lower course to be well bedded in mortar on the solid ground, but the joints to be filled with asphalt; the joints of the upper course to be also filled with asphalt, so as to make all perfectly watertight. The edges of the flags to be let into the face of the overflow walls, and the joint made good with cement or asphalt. The flags to extend under and form the foundation for the inside facing of the wall.

UPCAST PIPE.

A cast-iron pipe, 30 inches diameter, to stand up in the centre of the basin, up which the waste water from the overflows of the Compensation Basin will flow. The end of the 24-inch and 12-inch pipes to be joined to the 30-inch pipe, below the flooring of the basin; the joints to be made with lead. The pipe to rest upon an ashlar block 12 inches thick, and the top of the pipe to be level with the top of the overflows.

BARREL CULVERT
18 INCHES
DIAMETER.

An opening, 12 inches diameter, to be left in the side of the 30-inch pipe, opposite to the entrance of the 24-inch pipe, and an 18-inch barrel culvert, formed of 6-inch parpoints, to be carried from this opening to the outside of the overflow or weir wall, where it terminates.

STAIRS.

Three flights of steps or stairs, 6 feet wide, to form the means of communication between the footways round the Compensation Basin and the Test Basin, and between the Test Basin and the Gauge Basin. The steps to be supported on parapet walls, built on parapet arches springing from the straight sides of the Test Basin to the abutments or piers of the waste weirs of the Compensation Basin. The span of the arches to be 10 feet and the width 18 inches, one arch being placed under each end of the steps. The vertical faces of the parapoints to be left rough, and the underside of the arches to be neatly boasted over.

SUPPORTS TO
STAIRS.

PARAPET.

The steps to be surmounted by an ashlar parapet, similar to that already described for the side walls of the Compensation Basin. The parapet to be continued between the flights of stairs or steps on the outside wall of the Test Basin.

DRESSING OF STEPS.

The faces of the steps to be tooled; the ends to project 1 inch beyond the face of the sustaining walls.

The water to be carried from the Gauge Basin to the Test Basin by a flagged channel supported on arches, similar to those just described for supporting the steps. The spandrels of the arches to be carried up above the level of the flagged channel and coped with ashlar, and form the side walls of the channel. An opening to be left in the flag bottom as shown, in which a wrought-iron movable plate is to be placed.

TUMBLER PLATE.

The plate to be hung upon gun-metal centres fixed in the side walls, and to be worked by a system of wrought-iron levers, fixed on a wrought-iron axle suspended from the arches carrying the steps by cast-iron brackets. This must be found and fixed by the contractor. The upper side of the plate to be curved up to fit into a throating worked on the underside of the channel above the opening—the lower side of the plate resting upon a bevelled flag on the lower side of the opening. The flags on each side of the opening to be further supported by ashlar stones built into the arches and side walls. The coping of the side walls to be tooled.

OPENING IN SIDE
WALL OF TEST
BASIN.

An opening 3 feet wide by 2 feet 3 inches in height to be made through the side wall of the test basin opposite to this channel, to be covered with a parapet arch 9 inches thick.

MUSHROOM VALVE.

A mushroom valve to be placed in the bottom of the basin immediately below the opening just described, to communicate with the 24-inch pipes below the basin.

2.—THE RETAINING WALLS, THE PAVING BETWEEN THE TEST BASIN AND WEIR WALLS OF THE COMPENSATION BASIN, AND THE NEW CHANNEL.

RETAINING WALLS.

Two heavy retaining walls to be built from the ends of the piers or abutments to the overflows of the Compensation Basin to maintain the slope of the embankments; to be curved in the manner shown in the drawing. The top of the wall to rake with the slope of the embankment; to be 4 feet 6 inches thick adjoining the piers, gradually diminishing to 3 feet in thickness at the opposite end; to be of coursed rubble; and to be founded upon rag flags 6 inches thick and coped with ashlar, the faces of which are to be left rough.

ASHLAR SILL.

An ashlar sill to be built across, between the retaining walls just described and the piers at the end of the Test Basin. The sill to be 2 feet 9 inches deep and 18 inches in width; two courses of ashlar in the form of steps to be placed on the lower side of it; the middle step to be let into the face of the sill to a depth of 3 inches, and into the upper surface of the lower step for the same depth. The sill to be founded upon two courses of 4-inch flags; the middle step to be bedded upon rubble in mortar founded upon the same flags as the sill, and the lowest step to be bedded on the solid ground. The sill to be made watertight. The ends of the ashlar to project at least 6 inches into the abutting walls at each end.

PAVING AROUND
TEST BASIN.

The whole of the space between the walls of the Test Basin and the walls of the Compensation Basin to be paved with squared stones set dry and the joints filled with asphalt. The squared asphalted paving to be continued below the weirs, last described, down to the point at which the contracted or 20-foot channel commences.

A portion of the channel opposite the end of the 18-inch culvert to be sunk below the rest, and the slope between the two levels neatly rounded off; the sunk portion to be continued on the level, until it meets the regular bed of the channel.

The side walls between the ends of the retaining wall and the commencement of the contracted channel to be of the same section as the smaller end of the retaining wall just described, and coped with ashlar in a similar manner, but they must be founded on the ground instead of on 6-inch flags.

NEW CHANNEL.

A new channel to be cut from this point until it meets the regular brook course at a point 47 yards below, and paved throughout its entire length with heavy rubble stones set on edge. The side walls and coping on edge to be of rubble set dry, the upper part of the wall to be 2 feet thick for a height of 4 feet, and below that level to be 3 feet thick; to be plumb on the face; to be 4 feet in height above the bed of the channel, at the upper end, and 8 feet at the lower end, and founded 15 inches below the bed of the channel. The coping to be 15 inches deep.

The material excavated out of the new channel to be deposited in the old one, which, when filled up, must be neatly dressed down and soiled over 9 inches deep.

FENCING ROUND THE COMPENSATION BASIN AND CASTLE CARR RESERVOIR.

FENCING.

The land belonging to the Corporation to be fenced off from the adjoining land in the line marked on the plan, by a wrought-iron continuous bar fence. The fence to be 3 feet 9 inches high above ground, and to have 5 horizontal bars; the top bar being round, $\frac{3}{4}$ inch diameter, and the other bars flat, 1 inch by $\frac{1}{4}$ inch, joined in every 5th upright. The uprights to be placed 3 feet apart, and have strong double prongs. The joining uprights to be $1\frac{1}{2}$ inch wide, and $\frac{3}{8}$ inch thick, and the intermediate uprights to be $1\frac{1}{2}$ inch wide by $\frac{5}{16}$ of an inch thick.

VI.—THE INTERCEPTING AND DIVERSION OF THE FULSHAW STREAM.

DRAWINGS NOS. 1 AND 10.

WEIR AND WELLS.

A small weir to be built across the Fulshaw stream immediately above the point at which the new road crosses it, for the purpose of diverting the water into a small well alongside it, from which the water is to be taken in pipes, laid along the new road, to a similar well and weir placed upon the small stream near the embankment of the Dean Head Reservoir; from the latter well the water to be again taken in pipes, and after being passed under the line of waste watercourse, turned into the course of the same stream again, and so into the Castle Carr Reservoir.

The bed of the streams at the points at which the water is to be intercepted to be covered with flags 6 inches thick, upon which the side walls are to be founded. Two courses of 6-inch flags, set on edge, to be placed across the stream between the side walls, and project into them 3 inches at each end. An opening to be left in one side wall, through which the water will pass into the well adjoining. The side walls of the well to be founded upon two 4-inch flags, which must form the bottom of the well, the higher one overlapping the lower about 3 inches, and the joint between the two to be made with cement; the well to be subdivided by a flag, 3 inches thick, set on edge, built into the side walls. The opening communicating between the stream and the well to be surrounded with ashlar in the manner shown. Grooves 2 inches square to be sunk in the sides of the opening for the admission of stop planks; similar grooves to be made in the side walls of the brook-course over the lower course of 6-inch cross flags. The remainder of the walling to be of double parpoints made watertight with asphalt; the walls to be coped with ashlar, and the wells to be covered with flags 4 inches thick resting on the coping, which must be checked out to receive them. The ashlar, the flags, and the coping to be neatly boasted over, and the parpoints to be hammer-dressed.

CULVERTS.

Culverts to be built, 3 feet high and 2 feet 6 inches wide, to pass the water of the streams under the new road when it is not required to be diverted. The culverts to have a flagged channel stepped in the manner shown, the flags resting upon the rag footings forming the foundation of the side walls. The side walls to be 18 inches thick, and overlap the flags forming the channel 3 inches, to be built of flat-bedded rubble in mortar. The culvert to be covered with an arch of 6-inch parpoints set in mortar, and the side walls carried above the springing of the arch to form a backing to it.

OUTLET OF CULVERT.

The culvert to terminate in a rubble wall built across the face; the wall to be founded upon 6-inch rag flags and coped with ashlar, the faces of the ashlar being neatly pitched off and left rough.

TAILBAY.

A tailbay to be constructed below the outlet of each culvert. The bottom to be paved with roughly-squared rubble stones and the battering sides pitched with a rubble pitching.

STONEWARE PIPES.

The water to be conveyed from the wells by stoneware pipes, one end being built into the side wall of the lower division of the well. The pipes to have socket joints, and must be jointed with cement.

VII.—THE CONTINUATION OF THE COMPENSATION WATERCOURSE FROM THE END OF THE No. 1 CONTRACT TO THE COMPENSATION BASIN.

DRAWINGS NOS. 1 AND 17.

WELL.

A covered well to be built in place of the open well or basin formerly intended to be placed at the end of the No. 1 Contract. The descending portion of the conduit included in the No. 1 Contract to terminate or enter at one end of the well, and the masonry conduit included under this contract to commence at the other. A sluice 16 inches square commanded by a shuttle of the same opening to be placed in the end of the well through which the water must pass into the conduit. Two openings to be left in the side wall adjoining the Fulshaw stream to serve as overflows or waste weirs.

The brook-course adjoining the well to be walled in and flagged or paved.

WALLS OF WELL.

The walls of the well to be founded upon two courses of 4-inch flags, the upper course to extend across the bed of the brook-course adjoining and form the foundation of the side wall on the opposite side of the brook; the walls of the well to be built of parpoints $8\frac{1}{2}$ inches on the bed in two rows, leaving a space of an inch between them, up to the level of the top of the openings; the stones to be bedded and jointed in mortar for 6 inches in width; the remainder of the beds and joints, as well as the space left between the courses, and also the joints of the flags forming the bottom of the well, to be run full of asphalt; above the level of the top of the openings in the side walls, the walling to be of hammer-dressed wall-stone both inside and outside. The parpoints to be hammer-dressed on the face. The sluice and overflow openings to be lined with ashlar, as shown in the Drawing No. 17, a flag 6 inches thick, let into the ashlar at each end, to be placed on edge at each opening. The faces of the ashlar to be neatly boasted over. The well to be covered with good 6-inch landings, resting upon and ending flush with the outside of the walls of the well. The top and sides of the flag covers to be neatly boasted over.

SIDE WALLS OF
BROOK COURSE.

The side walls of the brook course to be of coursed rubble, and coped with ashlar, the exposed faces of which are to be left rough.

Two 6-inch flags on edge to be built across the brook course into the side walls, one immediately below the overflows of the well, and the other at the lower end of the side walls of the brook course. The space between the 6-inch flags to be paved with squared rubble.

MASONRY CONDUIT.

The covered conduit, which is $310\frac{1}{2}$ yards in length, 24 inches high and 18 inches wide, must be cut in the line shown on the general plan, and to the levels shown upon the longitudinal section, with an inclination at the rate of 80 inches per mile.

EXCAVATION AND
REFILLING.

The peat covering the line of conduit to be removed and run to spoil in some convenient place adjoining the line of conduit, no more of the peat being required for re-covering the masonry when completed than is sufficient to serve as a soil covering about 6 inches in thickness. The excavation for the masonry must be neatly made to the required size, any faulty places being well packed with rubble in mortar; and great care to be taken in levelling the bottom, so that the flags forming the bottom of the conduit may have a solid bearing. In refilling the trench, the most adhesive material that can be procured, or a covering of clay well pounded together, must be laid over the top of the conduit for a depth of 18 inches, in order to prevent the percolation of water from above. The remainder of the filling may be composed of any hard material that the cuttings afford. The trench to be filled up level with the present surface of the ground, and left sufficiently high or round to allow for settlement. In all cases where the top of the conduit will stand above or be close to the surface of the ground, an embankment must be formed so as to give a cover of not less than

EMBANKMENTS
OVER CONDUITS.