

## Supplementary Materials

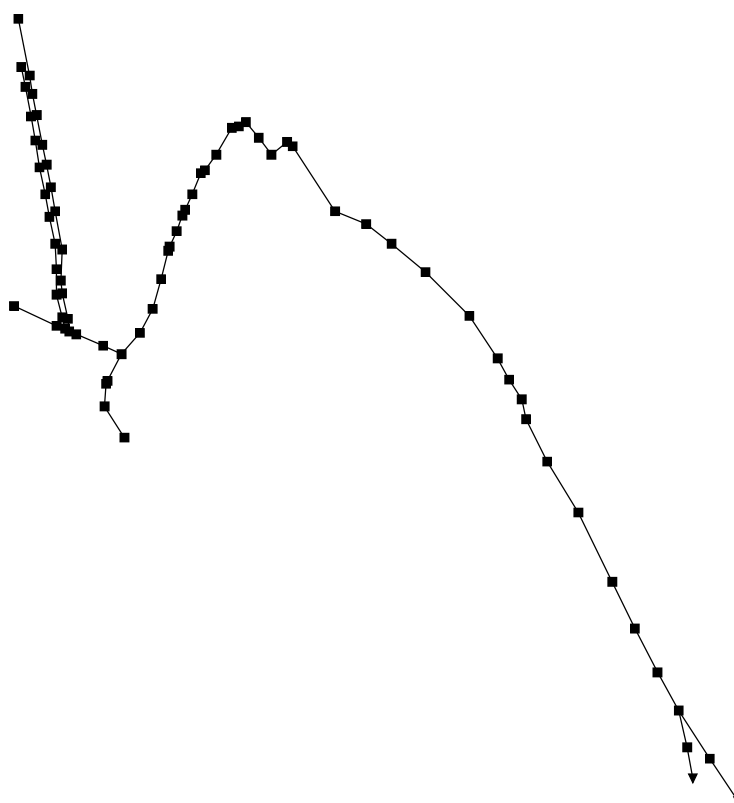
# Economic Analysis of Flood Risk Applied to the Rehabilitation of Drainage Networks

## Supplementary Materials

In the manuscript referred above, two cases study was used to present the validity of the method described. It is the aim of the authors to allow any researcher to be able to reproduce the results obtained. For this reason, the data and the results are included in this supplementary material. Also, information on obtaining flood damage curves based on land use is shown.

### 1. Case Study Data of Balloon Network

Balloon network is presented in the Figure S1 below.



**Figure S1.** Representation of Balloon drainage network.

Table S1. Data for nodes and subcatchments of Balloon network.

Node ID	Invert Elevation (m)	Max. Depth (m)	Flooding Area (m <sup>2</sup> )	Sub-catchment Area (ha)	Impervious Area (%)	Width (m)	Slope (%)
N1	225.914	1.46	86.09	0.08609	85	31.89	86.00
N2	225.395	1.73	67.87	0.06787	85	31.81	75.00
N3	225.017	1.98	10	0	85	0.00	0.00
N4	225.003	1.97	100.7	0.1007	85	32.84	61.00
N5	224.648	2.1	66.84	0.08684	85	31.83	58.00
N6	224.628	2.1	1211	1.30363	85	37.20	265.00
N7	223.493	2.54	136.1	0.1361	85	49.94	257.00
N8	223.328	1.92	145.1	0.1451	85	51.82	224.00
N9	223.202	1.86	10	0	85	0.00	0.00
N10	223.223	1.81	138	0.138	85	44.52	67.00
N11	223.153	1.81	116	0.116	85	34.12	41.00
N12	223.077	1.82	87	0.087	85	23.36	39.00
N13	223.015	1.86	88	0.088	85	21.46	44.00
N14	223.081	1.94	121	0.121	85	40.33	122.00
N15	222.934	2.52	10	0	85	0.00	0.00
N16	222.844	2.58	20,659.8	22.2588	85	195.79	185.00
N17	222.833	2.7	48	0.048	85	29.54	73.00
N18	222.895	3.4	40	0.04	85	24.24	218.00
N19	222.778	3.63	23	0.023	85	12.96	226.00
N20	222.751	3.53	1060	1.398	85	94.43	295.00
N21	222.94	3.53	70	0.07	85	33.73	0.36
N22	222.867	3.7	35	0.035	85	24.14	295.50
N23	222.48	5.05	184	0.184	85	63.45	295.50
N24	222.4	10.14	213	0.213	85	52.38	977.00
N25	222.35	9.92	90	0.09	85	34.29	57.00
N26	222.31	7.96	95	0.095	85	35.19	606.00
N27	222.24	5.29	136	0.136	85	42.17	583.00
N28	222.18	4.21	137	0.137	85	41.52	209.00
N29	222.12	4.16	103	0.103	85	40.39	21.00
N30	222	4.08	5630	5.676	85	139.13	200.00
N31	221.95	3.82	41	0.041	85	22.69	129.00
N32	221.88	3.78	61	1.081	85	30.12	55.00
N33	221.87	3.05	138	0.138	85	47.18	140.00
N34	221.8	2.76	579	0.579	85	98.55	89.00
N35	221.78	2.62	473	0.473	85	72.49	40.00
N36	221.69	2.63	306	0.306	85	51.21	24.00
N37	221.66	2.6	253	0.253	85	50.85	23.00
N38	221	3.35	255	0.255	85	61.45	31.00
N39	220.9	3.4	183	0.183	85	58.56	12.00
N41	222.805	3.48	65	0.065	85	26.80	3.00
N43	220.95	3.2	10	0	85	0.00	0.00
N45	228.833	1.33	71	0.071	85	20.88	433.00
N46	227.046	1.38	56	0.056	85	20.74	319.00
N47	226.66	1.016	30	0.03	85	16.22	117.00
N48	226.28	1.14	314	0.314	85	38.06	25.00
N49	226.216	1.14	185	0.185	85	23.13	68.00
N50	226.103	1.08	186	0.186	85	23.40	45.00

N51	226.013	1.04	169	0.169	85	21.26	47.00
N52	225.984	0.95	226	0.226	85	28.25	27.00
N53	225.869	0.914	341	0.341	85	43.35	15.00
N54	225.73	1.016	158	0.158	85	22.25	284.00
N55	225.685	1.57	123	0.123	85	18.36	46.00
N56	225.591	1.8	89	0.089	85	17.28	154.00
N57	225.269	2.12	8	0.028	85	4.21	84.00
N58	227.264	1.47	50	0.05	85	8.33	346.00
N59	226.369	1.38	106	0.106	85	17.10	116.00
N60	226.161	1.24	217	0.217	85	29.17	31.00
N61	226.092	1.23	235	0.235	85	28.83	52.00
N62	226.008	1.18	214	0.214	85	25.94	47.00
N63	225.989	1.08	201	0.201	85	24.07	62.00
N64	225.924	0.99	256	0.256	85	29.94	36.00
N65	225.776	1.06	90	0.09	85	20.69	9.00
N66	225.67	1.191	149	0.149	85	17.84	143.00
N67	225.584	1.65	121	0.121	85	14.07	75.00
N68	225.396	2.06	21	0.021	85	16.15	84.00
N69	225.297	2.12	22	0.022	85	9.36	120.00
N70	226.795	1.3	640	0.64	85	46.97	120.00
N71	225.399	2.119	100	0.1	85	34.48	120.00
N72	225.195	2.14	60	0.06	85	24.32	125.00
N73	224.979	2.03	70	0.07	85	32.18	97.00

Table S2. Data for conduits in the network used as a case study.

Link ID	Node 1	Node 2	Length (m)	Manning Roughness	Diameter (m)
C1	N1	N2	29.00	0.017	0.7
C2	N2	N3	17.00	0.017	0.7
C3	N3	N4	2.00	0.017	0.7
C4	N4	N5	39.00	0.017	0.7
C5	N5	N6	29.00	0.017	0.7
C6	N6	N7	26.50	0.017	0.95
C7	N7	N8	35.00	0.017	0.95
C8	N8	N9	28.00	0.017	0.95
C9	N9	N10	3.00	0.017	0.95
C10	N10	N11	17.00	0.017	0.95
C11	N11	N12	17.00	0.017	0.95
C12	N12	N13	5.00	0.017	0.95
C13	N13	N14	12.00	0.017	0.95
C14	N14	N15	25.50	0.017	0.95
C15	N15	N16	2.00	0.017	0.95
C16	N16	N17	15.00	0.017	0.95
C17	N17	N18	34.50	0.017	0.95
C18	N18	N19	5.00	0.017	0.95
C19	N19	N20	7.00	0.017	0.95
C21	N21	N22	15.00	0.017	2.39
C22	N22	N23	4.00	0.017	1.06
C23	N23	N24	58.00	0.017	1.06
C24	N24	N25	47.50	0.017	1.06

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C25	N25	N26	33.00	0.017	1.06
C26	N26	N27	47.00	0.017	1.06
C27	N27	N28	54.50	0.017	1.06
C28	N28	N29	52.50	0.017	1.06
C29	N29	N30	29.50	0.017	1.06
C30	N30	N31	24.00	0.017	1.06
C31	N31	N32	20.00	0.017	1.06
C32	N32	N33	53.00	0.017	1.11
C33	N33	N34	40.50	0.017	1.11
C34	N34	N35	40.50	0.017	1.11
C35	N35	N36	33.50	0.017	1.11
C36	N36	N37	26.00	0.017	1.11
C37	N37	N38	30.00	0.017	1.11
C38	N38	N39	42.00	0.017	1.06
C39	N39	N40	36.00	0.017	1.06
C41	N20	N41	15.00	0.017	0.95
C42	N41	N21	28.00	0.017	0.95
C45	N38	N43	32.50	0.017	0.84
C46	N43	N44	30.00	0.017	0.84
C58	N45	N46	40.10	0.0143	0.5
C59	N46	N47	23.51	0.0143	0.5
C60	N47	N48	21.94	0.0143	0.5
C61	N48	N49	25.40	0.0143	0.5
C62	N49	N50	25.30	0.0143	0.5
C63	N50	N51	28.87	0.0143	0.5
C64	N51	N52	25.40	0.0143	0.5
C65	N52	N53	31.30	0.0143	0.5
C66	N53	N54	37.87	0.0143	0.5
C67	N54	N55	12.31	0.0143	0.5
C68	N55	N56	29.85	0.0143	0.5
C69	N56	N57	9.54	0.0143	0.5
C70	N58	N59	28.50	0.0143	0.5
C71	N59	N60	29.90	0.0143	0.5
C72	N60	N61	25.50	0.0143	0.5
C73	N61	N62	25.60	0.0143	0.5
C74	N62	N63	25.27	0.0143	0.5
C75	N63	N64	25.11	0.0143	0.5
C76	N64	N65	21.62	0.0143	0.5
C77	N65	N66	28.50	0.0143	0.5
C78	N66	N67	26.00	0.0143	0.5
C79	N67	N68	29.50	0.0143	0.5
C80	N68	N69	8.21	0.0143	0.5
C81	N70	N71	48.00	0.017	0.7
C82	N71	N69	11.00	0.017	0.7
C83	N69	N57	3.00	0.017	0.7
C84	N57	N72	8.00	0.017	0.7
C85	N72	N73	26.00	0.017	0.7
C86	N73	N5	27.00	0.017	0.7

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**Table S3.** Land uses in the study area of Balloon network.

Land Uses	Percentage
Streets and roads	28.97%
General trading	18.91%
Green zones	10.10%
Education	7.87%
Restaurants	7.56%
Hotels	7.50%
Offices	6.71%
Car parks	3.47%
Churches	2.27%
Museums	1.75%
Health	1.70%
Warehouses	1.68%
Dwellings	1.51%

## 2. Case Study Data of ES-N Network

ES-N network is presented in the Figure S3 below.

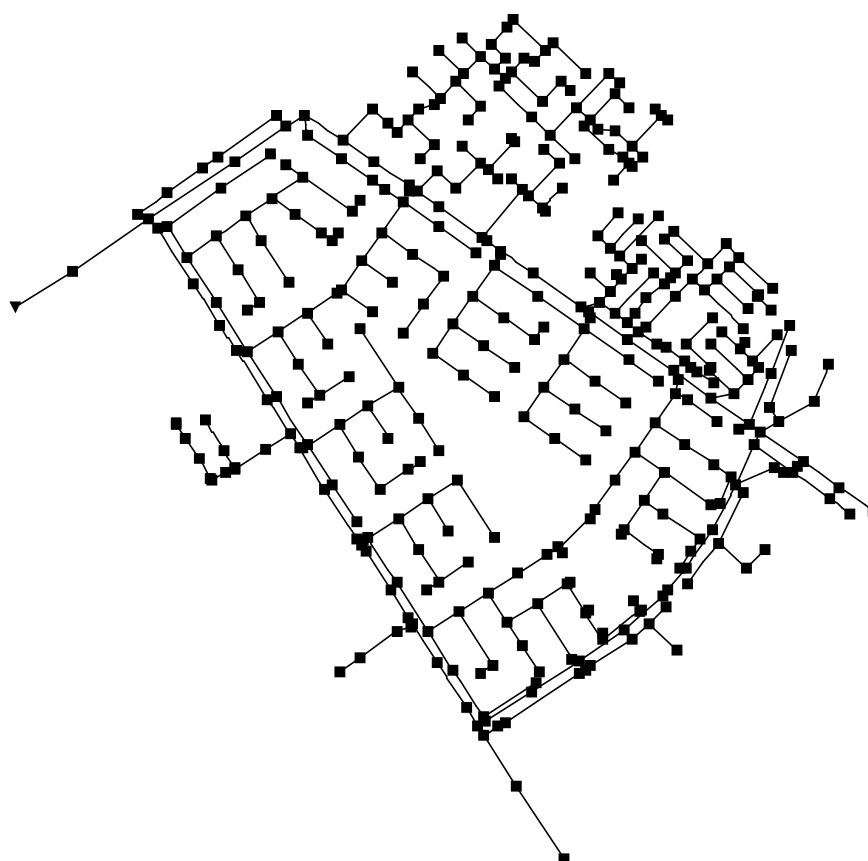
**Figure S2.** Representation of ES-N drainage network.

Table S4. Data for nodes and subcatchments in the ES-N network

Node ID	Invert Elevation [m]	Max. Depth [m]	Flooding Area [m <sup>2</sup> ]	Sub-catchment Area [ha]	Impervious Area [%]	Width [m]	Slope [%]
N01	2548.39	2.88	246.781	0.247	66.35	12.65	13.62
N02	2548.62	2.88	160.024	0.160	63.51	9.64	22.36
N03	2548.37	3.11	135.007	0.135	64.31	9.14	42.04
N04	2548.45	3.16	297.522	0.298	66.40	13.76	6.95
N05	2548.46	3.13	230.249	0.230	73.61	11.50	8.92
N06	2548.58	3.68	33.968	0.034	62.20	3.97	24.24
N07	2550.52	1.40	61.524	0.062	95.00	6.09	5.20
N08	2550.04	1.68	159.264	0.159	74.17	8.22	16.39
N09	2550.66	1.17	154.231	0.154	60.08	10.17	28.92
N10	2550.53	1.13	242.409	0.242	81.09	12.98	22.33
N11	2550.15	1.56	107.297	0.107	94.79	8.11	28.95
N12	2550.08	1.77	91.358	0.091	95.00	7.74	30.01
N13	2550.39	1.06	130.938	0.131	91.95	8.96	28.23
N14	2550.78	1.18	613.615	0.614	38.25	19.03	14.80
N15	2550.55	1.24	268.469	0.268	79.51	13.33	21.98
N16	2550.89	1.22	592.549	0.593	38.78	17.58	27.97
N17	2550.58	1.26	600.461	0.600	84.67	17.75	26.48
N18	2550.78	1.32	785.106	0.785	93.46	22.49	24.55
N19	2550.73	1.42	102.452	0.102	95.00	8.04	7.74
N20	2550.52	1.07	242.729	0.243	84.07	12.31	23.18
N21	2550.32	1.57	160.807	0.161	74.79	10.13	30.04
N22	2550.26	1.79	420.711	0.421	72.47	16.92	38.38
N23	2550.31	1.36	444.963	0.445	88.55	17.26	20.24
N24	2550.8	1.08	269.901	0.270	84.44	13.11	48.78
N25	2550.48	1.16	216.588	0.217	95.00	11.15	19.73
N26	2550.76	1.65	358.412	0.358	87.78	15.37	21.98
N27	2550.81	1.13	360.815	0.361	66.39	12.36	22.15
N28	2550.331	1.53	228.442	0.228	93.87	11.56	15.56
N29	2550.53	1.44	59.652	0.060	95.00	6.22	6.12
N30	2550.46	1.62	420.119	0.420	64.07	16.17	64.44
N31	2550.69	1.57	111.507	0.112	94.77	7.86	7.74
N32	2550.7	1.08	224.679	0.225	88.53	10.67	27.11
N33	2550.51	1.31	383.231	0.383	95.00	15.49	26.40
N34	2550.56	1.17	96.567	0.097	81.40	7.35	27.30
N35	2550.6	1.67	119.227	0.119	83.98	7.90	7.74
N36	2550.53	1.11	211.952	0.212	82.10	11.00	7.88
N37	2550.49	1.51	313.360	0.313	67.90	13.17	29.10
N38	2550.45	1.50	173.905	0.174	67.96	10.95	28.13
N39	2550.32	1.12	251.830	0.252	84.30	12.57	21.17
N40	2550.4	1.09	677.749	0.678	90.00	21.44	28.41
N41	2549.61	2.48	1150.493	1.150	78.25	26.79	48.79
N42	2550.77	1.20	521.814	0.522	60.45	18.00	12.15
N43	2550.35	1.40	399.784	0.400	74.51	15.97	40.50
N44	2550.34	1.15	242.847	0.243	84.90	12.38	27.14
N45	2550.48	1.26	401.502	0.402	75.87	15.89	35.47
N46	2550.61	1.05	116.357	0.116	83.05	8.21	27.77
N47	2550.33	1.25	463.279	0.463	95.00	17.33	25.62

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N48	2550.75	1.29	383.874	0.384	95.00	15.52	22.90
N49	2550.75	1.19	405.799	0.406	74.00	12.76	11.36
N50	2550.72	1.65	265.258	0.265	59.34	12.43	7.77
N51	2550.65	1.31	831.206	0.831	62.13	18.45	17.57
N52	2550.6	1.33	174.195	0.174	74.12	10.08	22.77
N53	2550.46	1.25	154.851	0.155	90.16	9.87	23.16
N54	2549.8	1.38	367.278	0.367	73.25	14.04	21.67
N55	2551.01	1.10	250.814	0.251	95.00	12.64	7.74
N56	2550.12	1.37	175.403	0.175	78.85	7.91	20.21
N57	2550.42	1.38	958.174	0.958	44.01	25.42	11.95
N58	2549.68	1.52	325.573	0.326	52.86	13.62	9.64
N59	2550.45	1.24	553.564	0.554	52.71	19.63	43.17
N60	2550.55	1.18	313.549	0.314	85.16	13.22	19.73
N61	2550.37	1.60	138.940	0.139	75.21	8.97	28.23
N62	2549.99	1.78	302.950	0.303	88.93	14.07	38.80
N63	2550.66	1.24	469.721	0.470	53.75	17.36	43.89
N64	2550.43	1.14	319.957	0.320	93.22	13.73	24.61
N65	2550.14	1.23	1208.309	1.208	83.33	27.08	24.44
N66	2550.42	1.22	287.512	0.288	95.00	13.61	17.94
N67	2550.58	1.14	238.522	0.239	95.00	11.15	18.35
N68	2550.48	1.22	389.188	0.389	95.00	15.78	11.99
N69	2550.44	1.45	182.890	0.183	81.46	10.55	28.23
N70	2550.6	1.16	251.151	0.251	95.00	12.66	28.23
N71	2549.05	1.67	350.446	0.350	76.78	14.11	26.33
N72	2550.2	1.24	243.593	0.244	84.35	12.71	6.60
N73	2550.49	1.24	537.171	0.537	43.07	18.04	13.89
N74	2551	1.20	184.103	0.184	95.00	9.43	21.98
N75	2551	1.14	291.253	0.291	95.00	14.06	21.97
N76	2550.8	1.24	204.840	0.205	95.00	11.38	7.74
N77	2550.46	1.06	279.342	0.279	85.73	11.28	15.98
N78	2549.78	1.64	2101.489	2.101	70.29	36.60	33.14
N79	2550.38	1.37	199.247	0.199	92.80	10.18	45.67
N80	2549.84	1.40	1719.522	1.720	78.78	31.51	9.42
N81	2550.06	1.72	416.335	0.416	95.00	16.33	33.41
N82	2547.49	4.00	123.223	0.123	34.93	6.66	71.36
N83	2549.1	2.80	463.043	0.463	20.00	16.03	73.21
N84	2550.44	1.56	240.372	0.240	61.79	10.71	23.75
N85	2550.27	1.42	212.049	0.212	79.96	11.80	22.30
N86	2549.87	1.63	505.415	0.505	86.22	15.57	19.70
N87	2550.01	1.80	55.934	0.056	62.53	5.21	22.33
N88	2549.97	2.30	68.080	0.068	71.60	6.13	22.33
N89	2549.87	2.02	132.243	0.132	80.26	7.74	22.62
N90	2549.8	2.08	144.374	0.144	73.37	8.52	22.33
N91	2549.36	2.19	64.761	0.065	80.40	5.97	22.33
N92	2550.33	1.60	239.371	0.239	74.74	11.52	21.98
N93	2550.19	1.41	321.830	0.322	38.02	12.99	9.94
N94	2550.13	1.69	889.835	0.890	87.28	22.59	15.73
N95	2550.33	1.68	402.952	0.403	95.00	16.64	18.85
N96	2549.5	1.26	171.545	0.172	73.95	9.89	36.85
N97	2549.73	1.86	141.528	0.142	77.20	7.81	11.66
N98	2550.99	1.28	221.933	0.222	73.04	11.22	49.94

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N99	2550.57	1.47	149.915	0.150	95.00	9.49	28.38
N100	2550.1	1.70	80.255	0.080	63.26	6.64	22.33
N101	2550.75	1.45	333.194	0.333	75.48	12.91	118.37
N102	2551.12	1.30	960.146	0.960	79.43	23.88	41.84
N103	2550.02	1.69	258.240	0.258	93.91	12.96	18.59
N104	2551.13	1.07	478.429	0.478	64.60	16.70	43.61
N105	2549.11	2.03	195.975	0.196	73.81	9.92	30.92
N106	2550.11	1.33	232.099	0.232	95.00	10.85	38.66
N107	2549.54	1.90	231.765	0.232	95.00	12.14	30.66
N108	2548.98	1.99	177.155	0.177	78.04	9.50	41.00
N109	2550.58	1.48	181.478	0.181	94.04	9.39	7.73
N110	2549.43	1.97	33.642	0.034	67.51	3.93	42.03
N111	2550.46	1.34	125.364	0.125	95.00	7.82	5.20
N112	2550.7	1.09	309.201	0.309	76.20	13.74	12.22
N113	2550.96	0.90	397.359	0.397	90.54	16.78	5.70
N114	2550.99	1.13	402.596	0.403	83.82	16.46	6.79
N115	2549.65	1.60	1008.510	1.009	70.61	22.67	18.70
N116	2548.47	3.21	450.084	0.450	74.09	15.54	19.98
N117	2548.46	2.85	97.691	0.098	81.31	5.29	14.14
N118	2548.97	1.75	12.424	0.012	70.29	2.33	29.45
N119	2549.31	1.86	74.128	0.074	58.48	5.10	11.17
N120	2549.78	2.23	140.620	0.141	89.79	6.62	8.62
N121	2549.93	1.74	559.450	0.559	61.97	18.32	8.62
N122	2549.93	1.86	191.462	0.191	90.00	8.64	10.63
N123	2550	1.45	386.795	0.387	90.00	14.18	19.91
N124	2550.15	1.38	331.779	0.332	90.00	12.76	29.03
N125	2550.42	0.79	192.705	0.193	90.00	8.43	22.86
N126	2550.45	0.77	547.325	0.547	78.05	16.97	25.26
N127	2548.16	3.94	427.281	0.427	75.76	15.71	40.92
N128	2549.89	1.78	690.497	0.690	62.18	19.54	82.21
N129	2550.23	1.95	79.774	0.080	57.50	4.60	24.59
N130	2549.46	1.27	156.732	0.157	73.31	9.39	55.61
N131	2549.84	1.73	380.734	0.381	95.00	15.95	18.21
N132	2550.31	1.58	427.164	0.427	84.37	16.49	34.48
N133	2547.69	3.96	157.641	0.158	37.04	9.67	20.32
N134	2549.18	1.55	272.943	0.273	76.90	13.44	44.68
N135	2550.15	1.52	77.342	1.835	51.01	34.86	60.84
N136	2550.4	1.40	107.747	0.077	89.35	6.94	28.23
N137	2550.14	1.33	272.309	0.108	72.96	7.33	19.74
N138	2550.5	1.42	212.800	0.272	86.83	12.82	27.14
N139	2548.6	4.05	86.450	0.213	73.52	11.69	24.18
N140	2549.99	1.56	557.915	0.086	60.03	7.31	22.33
N141	2550.09	1.79	242.322	0.558	64.78	18.93	29.64
N142	2548.67	3.45	117.202	0.242	77.88	12.49	21.98
N143	2550.21	1.86	516.425	0.117	71.88	8.36	21.98
N144	2550.55	1.44	372.857	0.516	80.23	17.77	27.10
N145	2550	2.00	87.641	0.373	87.74	15.29	22.07
N146	2550.24	1.76	306.504	0.088	95.00	5.88	21.98
N147	2549.07	1.73	152.260	0.307	95.00	13.82	22.08
N148	2550.05	1.65	75.048	0.152	92.41	9.62	36.00
N149	2549	2.30	568.374	0.075	95.00	6.16	10.73



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N150	2550.35	1.74	454.125	0.568	58.04	18.65	12.53
N151	2550.28	0.55	382.326	0.454	60.73	15.59	8.99
N152	2550.38	1.49	692.415	0.382	95.00	15.47	20.70
N153	2550.29	1.35	551.169	0.692	33.24	19.93	14.91
N154	2549.02	2.80	385.196	0.551	67.02	18.58	16.76
N155	2548.97	2.80	873.015	0.385	20.08	15.33	102.93
N156	2548.78	1.74	538.060	0.873	24.83	22.65	109.34
N157	2550.14	1.69	141.045	0.538	71.71	15.23	58.50
N158	2549.71	1.75	109.561	0.141	71.50	9.07	19.89
N159	2550.3	1.42	256.446	0.110	95.00	8.61	28.23
N160	2549.65	2.05	258.189	0.256	50.00	11.31	16.87
N161	2548.57	3.48	249.988	0.258	89.07	13.84	28.23
N162	2549.61	2.07	101.871	0.250	65.65	13.16	60.25
N163	2549.74	1.74	75.841	0.102	66.74	7.87	28.51
N164	2550.08	1.74	379.742	0.076	62.43	6.04	23.10
N165	2550.01	1.38	374.252	0.380	95.00	15.66	53.50
N166	2549.65	1.96	549.597	0.374	78.37	15.31	6.60
N167	2550.89	1.43	171.322	0.550	90.00	17.10	11.69
N168	2548.99	2.80	572.826	0.171	91.47	9.39	21.98
N169	2549.96	1.63	920.693	0.573	25.06	18.91	109.31
N170	2549.81	2.44	174.735	0.921	75.28	24.02	27.41
N171	2550.13	1.36	306.667	0.175	72.10	10.10	21.98
N172	2549.93	1.43	410.036	0.307	90.00	13.96	11.16
N173	2550.07	1.44	399.768	0.410	95.00	16.28	30.67
N174	2549.67	1.67	379.218	0.400	95.00	16.31	35.20
N175	2550.5	1.50	302.822	0.379	95.00	15.63	38.52
N176	2550.51	1.27	385.083	0.303	80.31	12.99	11.84
N177	2549.79	2.40	210.855	0.385	90.92	16.01	21.98
N178	2548.42	2.62	711.111	0.211	84.11	11.32	21.98
N179	2550.17	1.83	169.494	0.711	73.18	20.61	12.05
N180	2550.19	1.55	264.874	0.169	95.00	8.75	21.75
N181	2550.36	1.63	147.584	0.265	95.00	13.29	15.86
N182	2550.32	1.47	181.356	0.148	95.00	9.24	5.20
N183	2548.66	2.66	616.116	0.181	91.63	9.70	5.52
N184	2550.13	1.41	397.107	0.616	75.75	17.40	15.67
N185	2550.2	1.89	80.549	0.397	95.00	15.89	22.15
N186	2550.74	1.18	382.118	0.081	59.65	6.33	22.33
N187	2550.51	1.34	556.008	0.382	92.58	15.47	16.54
N188	2550.17	1.56	120.807	0.556	46.23	18.41	14.66
N189	2548.44	2.60	355.912	0.121	82.14	4.38	12.42
N190	2550	1.85	207.040	0.356	79.81	14.11	11.75
N191	2548.64	2.98	50.373	0.207	95.00	11.06	17.71
N192	2549.9	1.50	677.797	0.050	74.58	4.77	17.12
N193	2549.85	1.45	133.885	0.678	85.73	17.60	20.07
N194	2550.43	1.41	320.750	0.134	90.58	8.94	15.20
N195	2549.65	1.43	355.718	0.321	82.03	14.28	22.33
N196	2549.97	1.81	77.096	0.356	75.77	14.34	38.54
N197	2550.41	1.14	125.153	0.077	83.43	6.54	22.85
N198	2550.07	2.05	34.601	0.125	92.37	9.01	22.73
N199	2550.36	1.46	425.959	0.035	57.50	3.90	22.33
N200	2550.23	1.70	574.094	0.426	95.00	16.67	28.05

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N201	2549.71	2.40	295.426	0.574	60.88	17.10	11.75
N202	2549.44	1.91	407.496	0.295	76.07	13.75	22.00
N203	2550.3	1.38	233.422	0.407	72.57	16.32	54.76
N204	2550.09	1.23	339.100	0.233	28.03	12.11	7.77
N205	2550.12	1.78	100.100	0.339	83.26	14.26	25.20
N206	2548.47	3.45	521.721	0.100	95.00	7.53	30.05
N207	2550.16	1.50	273.484	0.522	75.99	17.94	37.38
N208	2550.53	1.46	83.136	0.273	52.26	11.88	32.35
N209	2548.89	1.45	312.254	0.083	57.50	6.07	23.38
N210	2549.61	1.64	383.442	0.312	72.76	12.55	28.38
N211	2550.53	1.30	267.530	0.383	94.65	15.73	26.21
N212	2550.34	1.34	462.147	0.268	95.00	12.69	18.34
N213	2550.15	2.02	118.647	0.462	43.90	16.92	28.12
N214	2550.09	2.13	164.566	0.119	79.12	8.46	22.33
N215	2549.23	1.43	253.300	0.165	72.84	10.01	22.31
N216	2548.7	3.30	115.755	0.253	84.92	11.84	21.20
N217	2550.02	1.20	388.098	0.116	69.66	7.78	21.98
N218	2550.65	1.30	825.890	0.388	95.00	15.83	30.59
N219	2550.02	1.88	374.104	0.826	31.11	21.98	19.22
N220	2550.18	1.94	166.587	0.374	95.00	15.36	22.03
N221	2550.271	1.51	403.570	0.167	69.59	8.39	26.81
N222	2550.18	1.55	329.189	0.404	63.30	14.51	12.07
N223	2550.56	1.54	646.034	0.329	92.73	13.09	12.15
N224	2550	1.65	407.836	0.646	72.11	19.25	21.19
N225	2549.25	1.42	251.872	0.408	95.00	16.14	12.19
N226	2549.69	1.61	32.961	0.252	80.73	12.16	30.24
N227	2549.25	2.35	2253.393	0.033	95.00	4.15	13.34
N228	2550.56	1.44	185.991	2.253	64.17	35.44	13.99
N229	2550.24	1.40	147.370	0.186	70.48	10.93	5.60
N230	2550.06	1.60	251.282	0.147	95.00	9.02	30.86
N231	2549.25	1.46	343.743	0.251	82.06	12.65	22.22
N232	2548.28	3.04	298.315	0.344	83.87	15.11	56.24
N233	2550.43	1.29	279.836	0.298	61.41	14.19	51.19
N234	2549.41	1.86	98.610	0.280	95.00	12.26	11.16
N235	2550.17	1.26	89.986	0.099	61.50	6.62	13.09
N236	2550.34	1.37	403.034	0.090	81.26	7.07	28.23
N237	2550.24	1.25	396.920	0.403	95.00	16.31	6.62
N238	2549.8	1.97	124.361	0.397	95.00	15.74	27.11
N239	2549.99	1.81	183.244	0.124	66.62	8.68	28.65
N240	2549.38	2.13	149.158	0.183	90.15	10.81	28.23
N241	2548.24	3.32	443.846	0.149	84.98	9.75	25.44
N242	2550.26	1.78	109.076	0.444	76.21	14.44	29.13
N243	2549.77	1.76	382.911	0.109	71.72	7.43	22.54
N244	2550.08	1.92	378.598	0.383	80.16	15.10	11.33
N245	2549.99	1.46	374.245	0.379	77.12	15.51	21.98
N246	2550.08	1.40	476.201	0.374	95.00	15.54	20.48
N247	2550.06	1.39	419.077	0.476	95.00	17.59	11.92
N248	2549.74	1.90	452.566	0.419	95.00	16.69	31.21
N249	2549.47	1.90	475.746	0.453	95.00	17.17	16.42
N250	2549.96	1.27	361.942	0.476	95.00	18.05	12.63
N251	2549.81	1.57	347.755	0.362	95.00	13.97	16.24

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N252	2548.72	2.36	572.722	0.348	73.31	12.39	15.73
N253	2549.51	1.74	468.333	0.573	71.49	18.48	13.70
N254	2549.66	1.85	229.876	0.468	88.22	15.93	21.11
N255	2548.61	3.60	141.695	0.230	88.80	12.29	13.68
N256	2549.59	1.65	379.040	0.142	59.60	9.21	22.31
N257	2547.62	3.90	368.467	0.379	95.00	15.67	22.16
N258	2550.17	1.38	386.560	0.368	39.86	13.87	23.89
N259	2548.39	3.38	123.313	0.387	95.00	16.10	7.85
N260	2548.41	3.29	226.278	0.123	64.46	8.59	39.01
N261	2550.27	1.35	181.336	0.226	64.75	10.86	19.57
N262	2549.94	1.37	440.349	0.181	83.85	10.50	26.76
N263	2550.06	1.18	154.416	0.440	95.00	17.49	39.84
N264	2549.89	1.58	162.087	0.154	79.11	9.65	28.23
N265	2549.81	1.84	140.409	0.162	95.00	9.61	28.23
N266	2549.85	1.57	384.492	0.140	70.84	9.09	25.14
N267	2550.29	1.37	418.430	0.384	84.55	15.52	25.14
N268	2548.59	4.12	175.521	0.418	95.00	16.59	17.40
N269	2549.1	3.10	482.603	0.176	62.20	9.95	22.33
N270	2549.99	1.50	71.406	0.483	77.19	16.78	26.45
N271	2550.13	1.82	434.004	0.071	90.00	6.18	12.29
N272	2550.08	1.50	955.513	0.434	95.00	17.01	21.98
N273	2549.66	1.48	309.132	0.956	38.78	25.46	12.17
N274	2550.56	1.45	173.841	0.309	82.33	13.56	13.57
N275	2548.54	3.18	512.508	0.174	95.00	9.86	13.48
N276	2549.53	1.94	372.711	0.513	67.57	16.90	27.52
N277	2549.66	1.92	396.055	0.373	95.00	15.28	12.19
N278	2549.43	1.94	288.527	0.396	95.00	15.92	13.44
N279	2549.45	2.53	72.553	0.289	80.10	12.54	17.12
N280	2547.72	4.00	746.596	0.073	60.59	5.63	17.12
N281	2549.05	2.80	341.598	0.747	41.53	21.68	79.35
N282	2548.04	2.66	411.860	0.342	20.00	13.37	94.76
N283	2548.58	2.05	288.249	0.412	78.92	14.46	82.98
N284	2548.45	3.49	137.432	0.288	76.78	13.17	82.90
N285	2550.03	1.50	407.072	0.137	68.61	7.90	6.60
N286	2549.49	1.83	246.163	0.407	95.00	16.11	11.25
N287	2549.86	1.76	92.772	0.246	87.83	12.63	12.53
N288	2550.43	1.30	318.737	0.093	79.98	7.61	28.24
N289	2550.03	1.60	382.072	0.319	70.93	14.01	29.54
N290	2549.84	1.99	200.426	0.382	94.63	15.46	20.39
N291	2550.14	1.28	268.877	0.200	71.76	11.47	22.18
N292	2549.75	1.95	125.761	0.269	95.00	12.73	21.37
N293	2550.37	1.88	108.204	0.126	86.75	8.56	22.33
N294	2550.29	1.76	251.741	0.108	84.55	7.02	7.74
N295	2550.03	1.35	452.069	0.252	91.26	12.38	6.20
N296	2549.39	2.75	73.179	0.452	51.93	17.43	52.63
N297	2548.25	3.44	494.465	0.073	57.65	6.69	22.33
N298	2549.78	1.70	357.175	0.494	67.79	18.10	21.12
N299	2549.96	1.58	395.221	0.357	67.16	15.51	10.75
N300	2549.45	1.74	471.617	0.395	44.71	15.15	9.35
N301	2550.02	1.55	378.453	0.472	94.20	17.78	53.33
N302	2549.92	1.50	148.663	0.378	72.48	15.58	20.79

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N303	2550	1.61	88.411	0.149	95.00	9.42	23.75
N304	2548.05	3.98	607.617	0.088	89.30	7.37	28.74
N305	2549.88	1.70	382.946	0.608	81.01	16.95	47.09
N306	2550.42	1.33	394.541	0.383	93.52	15.71	11.54
N307	2550.56	1.38	384.811	0.395	95.00	15.71	16.21
N308	2549.82	1.58	379.274	0.385	95.00	16.03	22.33
N309	2549.96	1.86	372.502	0.379	95.00	15.40	27.98
N310	2549.42	1.77	232.692	0.373	95.00	15.80	22.24
N311	2550.21	1.42	268.535	0.233	89.96	12.03	11.17
N312	2550.55	1.59	223.667	0.269	95.00	12.73	35.59
N313	2550.3	1.27	270.052	0.224	95.00	11.46	9.85
N314	2550.19	1.44	369.476	0.270	95.00	12.74	12.34
N315	2549.56	1.80	328.315	0.369	95.00	15.12	17.92
N316	2549.93	1.41	422.317	0.328	72.16	14.29	52.63
N317	2550.52	1.17	394.623	0.422	95.00	16.69	21.20
N318	2550.23	1.37	805.683	0.395	92.03	15.71	40.16
N319	2549.21	2.07	136.994	0.806	66.06	22.41	89.40
N320	2549.32	1.82	100.677	0.137	95.00	9.24	34.72
N321	2549.2	2.14	176.291	0.101	95.00	8.00	30.66
N322	2549.19	2.21	183.506	0.176	92.45	10.36	31.37
N323	2550.36	1.96	125.237	0.184	91.34	10.14	30.66
N324	2550.28	2.07	197.328	0.125	95.00	8.19	18.47
N325	2550.63	1.17	339.861	0.197	71.23	11.27	18.47
N326	2550.12	1.43	603.667	0.340	85.48	13.10	65.06
N327	2549.98	1.56	150.234	0.604	76.38	19.39	109.76
N328	2550.5	1.10	860.644	0.150	95.00	8.39	41.96
N329	2550.63	1.31	219.660	0.861	62.79	22.57	117.97
N330	2549.96	1.55	144.489	0.220	0.00	9.53	82.03
N331	2550.4	1.48	166.080	0.144	93.41	9.24	18.47
N332	2550.07	1.82	102.927	0.166	77.48	9.67	54.61
N333	2549.75	1.69	107.176	0.103	72.97	8.16	29.01
N334	2549.36	1.75	80.347	0.107	95.00	7.89	24.08
N335	2549.47	1.50	183.147	0.080	95.00	6.10	30.03
N336	2549.84	1.85	124.073	0.183	95.00	10.14	30.66
N337	2549.91	1.87	246.000	0.124	94.15	8.30	18.52
N338	2550.1	1.68	212.950	0.246	95.00	12.27	24.22
N339	2550.44	1.60	99.203	0.213	95.00	11.77	18.47
N340	2550.71	1.28	170.797	0.191	95.00	10.63	18.47
N341	2550.81	1.34	260.183	0.099	95.00	7.76	18.69
N342	2550.48	1.59	116.046	0.171	95.00	10.52	21.95
N343	2550.8	1.39	158.140	0.260	70.57	12.67	146.29
N344	2550.46	1.42	144.188	0.116	95.00	7.62	22.15
N345	2549.96	1.63	269.720	0.158	95.00	10.26	38.27
N346	2550.19	1.49	267.854	0.144	95.00	9.83	18.63
N347	2549.96	1.50	257.516	0.270	95.00	12.76	30.66
N348	2549.28	2.01	199.159	0.268	69.25	12.54	30.66
N349	2549.12	2.37	338.345	0.258	78.47	12.12	31.56
N350	2549.37	1.98	128.750	0.199	95.00	10.36	32.98
N351	2550.25	1.20	175.624	0.338	82.44	14.71	39.11
N352	2549.64	1.88	180.587	0.129	95.00	7.48	34.24
N353	2549.42	2.02	170.542	0.176	81.66	9.32	31.36

N354	2550.66	1.36	200.109	0.181	94.99	8.33	32.97
N355	2550.42	1.25	172.771	0.171	82.18	10.05	30.50
N356	2549.79	1.82	194.241	0.200	79.90	10.93	21.52
N357	2550.51	1.39	379.341	0.173	95.00	9.84	18.54
N358	2550.47	1.49	270.360	0.194	82.29	8.99	26.26
N359	2550.9	1.44	41.427	0.379	72.13	15.83	21.54
N360	2551.08	1.34	181.039	0.270	92.58	13.47	20.92
N361	2550.75	1.49	65.451	0.041	85.68	4.57	38.18
N362	2551.25	1.24	339.401	0.181	77.30	10.49	29.56
N363	2550.59	1.43	168.039	0.065	95.00	6.06	31.84
N364	2551.04	1.24	121.213	0.339	67.62	14.58	25.36
N365	2551.05	1.18	307.332	0.168	95.00	10.58	22.46
N366	2550.32	1.34	1012.394	0.121	87.85	5.96	49.94
N367	2549.16	2.11	173.207	0.307	76.34	12.67	84.22
N368	2549.12	2.13	153.668	1.012	63.73	24.89	79.26
N369	2549.06	2.02	158.299	0.173	87.28	9.58	30.66
N370	2549.8	1.50	240.938	0.154	78.62	8.67	30.66
N371	2549.05	1.89	183.644	0.158	89.82	8.66	31.34
N372	2548.92	2.15	923.271	0.241	87.81	12.78	34.63
N373	2550.1	1.54	217.700	0.184	71.82	10.73	41.87
N374	2549.04	2.88	206.518	0.923	61.85	23.83	93.28
N375	2550.35	1.26	172.069	0.218	62.64	11.99	42.03
N376	2548.4	2.51	212.113	0.207	86.10	11.73	42.04
N377	2549.98	1.81	109.398	0.172	95.00	9.67	10.13
N378	2548.93	2.24	217.653	0.212	70.33	10.56	11.29
N379	2550.21	1.29	228.645	0.109	94.63	8.12	28.11
N380	2550.16	1.38	50.127	0.218	86.68	10.19	13.16
N381	2550.33	1.66	115.424	0.229	78.44	12.03	19.74
N382	2549.6	2.54	603.119	0.050	95.00	4.94	28.23
N383	2548.16	3.46	372.686	0.115	69.40	7.94	22.33
N384	2550.27	1.74	191.156	0.603	77.85	19.79	29.80
N385	2547.41	3.00	1834.982	0.373	62.80	15.42	83.52

Table S5. Data for pipes in the ES-N network

Link ID	Node 1	Node 2	Length (m)	Manning Roughness	Diameter (m)
P01	N62	N195	100.23	0.015	0.4
P02	N228	N150	39.27	0.015	0.7
P03	N223	N175	64.93	0.015	0.6
P04	N175	N244	97.58	0.015	0.6
P05	N293	N179	80.01	0.015	0.5
P06	N154	N168	74.35	0.015	0.6
P07	N168	N155	64.06	0.015	0.6
P08	N233	N258	105.33	0.015	0.4
P09	N251	N278	80.10	0.015	0.5
P10	N67	N314	51.67	0.015	0.3
P11	N66	N248	113.77	0.015	0.4
P12	N319	N321	42.40	0.015	0.8
P13	N34	N197	14.50	0.015	0.3
P14	N332	N320	26.53	0.015	0.35

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P15	N370	N369	61.94	0.015	0.4
P16	N347	N348	45.21	0.015	0.35
P17	N349	N374	45.78	0.015	0.8
P18	N374	N259	50.57	0.015	0.8
P19	N348	N349	60.05	0.015	0.8
P20	N352	N04	106.66	0.015	0.6
P21	N219	N309	60.42	0.015	0.7
P22	N176	N309	63.12	0.015	0.4
P23	N71	N209	99.89	0.015	0.5
P24	N356	N352	14.79	0.015	0.6
P25	N131	N254	63.25	0.015	0.4
P26	N359	N361	15.41	0.015	0.3
P27	N209	N156	93.31	0.015	0.5
P28	N56	N193	110.23	0.015	0.5
P29	N115	N253	79.79	0.015	0.7
P30	N253	N279	23.89	0.015	0.7
P31	N33	N236	60.12	0.015	0.4
P32	N225	N147	91.29	0.015	0.6
P33	N375	N203	17.21	0.015	0.3
P34	N229	N205	21.09	0.015	0.3
P35	N152	N151	61.48	0.015	0.6
P36	N37	N132	52.99	0.015	0.3
P37	N289	N305	60.09	0.015	0.6
P38	N308	N256	58.88	0.015	0.5
P39	N274	N95	77.67	0.015	0.5
P40	N102	N364	12.04	0.015	0.3
P41	N101	N384	81.87	0.015	0.4
P42	N339	N384	32.61	0.015	0.5
P43	N325	N326	79.08	0.015	0.3
P44	N295	N315	50.08	0.015	0.4
P45	N203	N93	23.09	0.015	0.4
P46	N365	N364	15.50	0.015	0.3
P47	N324	N103	46.69	0.015	0.35
P48	N103	N333	73.14	0.015	0.45
P49	N357	N08	50.62	0.015	0.3
P50	N81	N08	8.07	0.015	0.5
P51	N19	N109	36.44	0.015	0.5
P52	N194	N62	93.42	0.015	0.5
P53	N238	N162	27.98	0.015	0.4
P54	N89	N90	17.13	0.015	0.3
P55	N341	N101	24.83	0.015	0.3
P56	N153	N140	64.87	0.015	0.45
P57	N140	N308	61.44	0.015	0.5
P58	N93	N299	54.81	0.015	0.4
P59	N279	N191	6.18	0.015	0.7
P60	N380	N135	15.59	0.015	0.35
P61	N72	N165	79.85	0.015	0.4
P62	N331	N332	35.02	0.015	0.3
P63	N230	N142	95.39	0.015	0.45
P64	N235	N380	12.01	0.015	0.3
P65	N181	N148	92.10	0.015	0.6

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P66	N329	N331	39.83	0.015	0.3
P67	N73	N153	65.03	0.015	0.4
P68	N192	N226	94.43	0.015	0.6
P69	N174	N147	63.26	0.015	0.7
P70	N47	N291	59.29	0.015	0.4
P71	N78	N227	151.51	0.015	0.8
P72	N288	N159	65.40	0.015	0.4
P73	N63	N33	61.60	0.015	0.4
P74	N373	N370	33.71	0.015	0.3
P75	N309	N292	63.05	0.015	0.7
P76	N130	N231	65.16	0.015	0.45
P77	N77	N250	25.12	0.015	0.3
P78	N250	N249	109.57	0.015	0.4
P79	N351	N352	25.62	0.015	0.3
P80	N355	N356	75.40	0.015	0.3
P81	N08	N356	31.88	0.015	0.5
P82	N354	N355	35.78	0.015	0.3
P83	N138	N213	58.00	0.015	0.3
P84	N198	N290	59.71	0.015	0.3
P85	N207	N266	61.40	0.015	0.4
P86	N12	N287	13.76	0.015	0.3
P87	N287	N238	27.88	0.015	0.4
P88	N22	N238	48.06	0.015	0.3
P89	N150	N200	84.46	0.015	0.8
P90	N323	N324	22.71	0.015	0.3
P91	N367	N368	16.35	0.015	0.9
P92	N106	N350	23.04	0.015	0.3
P93	N163	N06	9.75	0.015	0.7
P94	N300	N156	62.99	0.015	0.6
P95	N262	N300	68.08	0.015	0.4
P96	N315	N300	61.16	0.015	0.6
P97	N164	N62	63.16	0.015	0.7
P98	N79	N229	69.87	0.015	0.3
P99	N30	N205	94.16	0.015	0.3
P100	N179	N145	87.98	0.015	0.6
P101	N145	N177	74.77	0.015	0.6
P102	N210	N71	63.39	0.015	0.5
P103	N18	N223	45.12	0.015	0.4
P104	N193	N251	94.85	0.015	0.5
P105	N278	N225	100.09	0.015	0.6
P106	N60	N379	80.07	0.015	0.35
P107	N100	N87	15.08	0.015	0.3
P108	N87	N88	13.93	0.015	0.3
P109	N88	N89	38.27	0.015	0.3
P110	N212	N289	61.58	0.015	0.4
P111	N38	N242	61.86	0.015	0.3
P112	N52	N208	34.99	0.015	0.3
P113	N90	N91	38.31	0.015	0.3
P114	N91	N268	22.29	0.015	0.6
P115	N15	N85	64.85	0.015	0.3
P116	N360	N359	8.96	0.015	0.3

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P117	N362	N359	40.17	0.015	0.3
P118	N364	N343	76.52	0.015	0.4
P119	N104	N343	27.12	0.015	0.3
P120	N98	N340	32.82	0.015	0.3
P121	N69	N263	73.67	0.015	0.3
P122	N281	N154	32.44	0.015	0.6
P123	N65	N169	68.03	0.015	0.45
P124	N377	N196	22.44	0.015	0.35
P125	N317	N151	64.99	0.015	0.35
P126	N290	N255	41.46	0.015	0.45
P127	N61	N264	92.55	0.015	0.3
P128	N07	N182	80.44	0.015	0.5
P129	N84	N92	18.55	0.015	0.3
P130	N92	N145	72.50	0.015	0.3
P131	N202	N283	112.00	0.015	0.6
P132	N49	N221	74.43	0.015	0.35
P133	N160	N240	73.14	0.015	0.6
P134	N313	N247	65.15	0.015	0.4
P135	N134	N280	36.30	0.015	1
P136	N318	N319	44.93	0.015	0.3
P137	N333	N334	16.67	0.015	0.6
P138	N335	N334	15.62	0.015	0.6
P139	N336	N333	30.59	0.015	0.5
P140	N330	N336	19.21	0.015	0.45
P141	N321	N322	19.05	0.015	0.8
P142	N128	N321	58.52	0.015	0.4
P143	N310	N215	100.06	0.015	0.5
P144	N144	N219	61.09	0.015	0.4
P145	N222	N224	60.05	0.015	0.5
P146	N28	N221	12.32	0.015	0.5
P147	N379	N204	30.96	0.015	0.35
P148	N76	N312	73.83	0.015	0.4
P149	N197	N242	29.90	0.015	0.3
P150	N316	N210	65.29	0.015	0.4
P151	N215	N71	91.36	0.015	0.5
P152	N266	N210	60.09	0.015	0.5
P153	N113	N07	19.46	0.015	0.2
P154	N132	N229	29.06	0.015	0.3
P155	N13	N265	96.63	0.015	0.3
P156	N196	N265	27.89	0.015	0.4
P157	N345	N322	59.59	0.015	0.4
P158	N96	N130	27.08	0.015	0.4
P159	N83	N281	123.42	0.015	0.6
P160	N17	N143	42.18	0.015	0.4
P161	N172	N256	64.72	0.015	0.5
P162	N54	N273	77.91	0.015	0.5
P163	N273	N310	80.17	0.015	0.5
P164	N256	N310	64.58	0.015	0.5
P165	N271	N219	61.62	0.015	0.6
P166	N137	N262	65.56	0.015	0.4
P167	N291	N316	65.43	0.015	0.4



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P168	N184	N266	65.21	0.015	0.4
P169	N242	N185	17.14	0.015	0.35
P170	N185	N214	26.83	0.015	0.35
P171	N296	N139	17.92	0.015	0.7
P172	N46	N197	42.02	0.015	0.3
P173	N36	N258	34.04	0.015	0.3
P174	N258	N298	64.64	0.015	0.4
P175	N298	N315	53.74	0.015	0.6
P176	N213	N198	4.77	0.015	0.3
P177	N267	N305	64.74	0.015	0.4
P178	N211	N267	64.84	0.015	0.4
P179	N224	N276	61.65	0.015	0.6
P180	N214	N290	34.86	0.015	0.35
P181	N53	N214	88.19	0.015	0.3
P182	N254	N96	37.63	0.015	0.4
P183	N57	N272	117.94	0.015	0.5
P184	N246	N245	64.62	0.015	0.5
P185	N43	N302	80.79	0.015	0.3
P186	N21	N235	80.59	0.015	0.3
P187	N135	N239	39.37	0.015	0.35
P188	N143	N220	79.77	0.015	0.6
P189	N294	N180	8.24	0.015	0.4
P190	N180	N190	58.70	0.015	0.6
P191	N301	N131	60.00	0.015	0.4
P192	N85	N292	23.31	0.015	0.3
P193	N186	N306	65.02	0.015	0.35
P194	N234	N05	7.42	0.015	0.7
P195	N111	N182	10.75	0.015	0.2
P196	N09	N261	54.03	0.015	0.3
P197	N305	N286	63.14	0.015	0.7
P198	N286	N234	21.41	0.015	0.7
P199	N157	N263	30.85	0.015	0.3
P200	N263	N264	27.22	0.015	0.3
P201	N204	N302	44.85	0.015	0.4
P202	N302	N158	37.87	0.015	0.4
P203	N20	N313	25.33	0.015	0.3
P204	N261	N235	29.60	0.015	0.3
P205	N322	N367	38.97	0.015	0.9
P206	N346	N345	32.94	0.015	0.3
P207	N244	N145	16.56	0.015	0.6
P208	N173	N172	65.79	0.015	0.5
P209	N311	N173	60.04	0.015	0.5
P210	N220	N177	80.11	0.015	0.6
P211	N11	N303	21.86	0.015	0.3
P212	N48	N317	64.92	0.015	0.35
P213	N80	N115	41.99	0.015	0.5
P214	N167	N26	36.12	0.015	0.4
P215	N74	N167	50.22	0.015	0.4
P216	N217	N308	64.67	0.015	0.4
P217	N170	N142	19.19	0.015	0.5
P218	N247	N174	64.67	0.015	0.4

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P219	N27	N144	60.26	0.015	0.3
P220	N199	N164	64.82	0.015	0.45
P221	N307	N199	65.18	0.015	0.4
P222	N14	N187	64.32	0.015	0.4
P223	N187	N212	65.50	0.015	0.4
P224	N42	N175	88.31	0.015	0.6
P225	N200	N188	11.23	0.015	0.8
P226	N51	N228	63.78	0.015	0.6
P227	N50	N228	41.37	0.015	0.7
P228	N64	N141	104.64	0.015	0.4
P229	N45	N140	118.04	0.015	0.4
P230	N201	N216	37.95	0.015	0.6
P231	N110	N03	11.10	0.015	0.7
P232	N32	N233	25.02	0.015	0.3
P233	N109	N274	25.32	0.015	0.5
P234	N239	N377	31.04	0.015	0.35
P235	N195	N286	90.33	0.015	0.5
P236	N165	N254	75.14	0.015	0.4
P237	N312	N146	61.50	0.015	0.4
P238	N146	N271	60.10	0.015	0.5
P239	N155	N82	21.27	0.015	0.6
P240	N112	N190	8.47	0.015	0.25
P241	N58	N202	105.02	0.015	0.5
P242	N314	N277	47.46	0.015	0.35
P243	N25	N311	25.25	0.015	0.3
P244	N136	N157	70.75	0.015	0.3
P245	N226	N378	14.02	0.015	0.7
P246	N119	N376	7.94	0.015	0.7
P247	N35	N293	48.95	0.015	0.4
P248	N190	N248	60.79	0.015	0.6
P249	N248	N277	60.70	0.015	0.6
P250	N350	N348	15.61	0.015	0.8
P251	N107	N353	6.46	0.015	0.6
P252	N208	N136	4.62	0.015	0.3
P253	N29	N07	4.30	0.015	0.5
P254	N326	N327	19.69	0.015	0.35
P255	N328	N327	77.50	0.015	0.3
P256	N327	N330	25.93	0.015	0.45
P257	N276	N249	59.79	0.015	0.6
P258	N277	N276	34.53	0.015	0.6
P259	N24	N211	25.13	0.015	0.3
P260	N114	N312	8.93	0.015	0.3
P261	N55	N76	7.58	0.015	0.2
P262	N75	N271	97.01	0.015	0.3
P263	N26	N176	62.09	0.015	0.4
P264	N264	N158	29.38	0.015	0.4
P265	N381	N100	34.91	0.015	0.3
P266	N243	N166	61.92	0.015	0.4
P267	N292	N296	21.99	0.015	0.7
P268	N31	N181	89.72	0.015	0.6
P269	N156	N283	63.07	0.015	0.7

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P270	N120	N243	17.72	0.015	0.4
P271	N177	N216	22.79	0.015	0.7
P272	N249	N278	63.43	0.015	0.6
P273	N236	N285	65.10	0.015	0.4
P274	N237	N301	65.49	0.015	0.35
P275	N218	N152	64.84	0.015	0.45
P276	N334	N320	22.54	0.015	0.6
P277	N320	N319	34.43	0.015	0.7
P278	N363	N344	60.06	0.015	0.45
P279	N99	N342	28.03	0.015	0.45
P280	N343	N99	39.88	0.015	0.4
P281	N361	N363	25.24	0.015	0.4
P282	N231	N134	70.07	0.015	0.45
P283	N169	N201	70.74	0.015	0.6
P284	N141	N201	28.79	0.015	0.4
P285	N353	N350	67.23	0.015	0.8
P286	N245	N174	59.98	0.015	0.6
P287	N272	N245	61.74	0.015	0.6
P288	N70	N138	62.97	0.015	0.3
P289	N86	N97	14.02	0.015	0.8
P290	N188	N94	10.77	0.015	0.8
P291	N94	N86	154.65	0.015	0.8
P292	N118	N189	10.75	0.015	0.7
P293	N166	N01	49.75	0.015	0.4
P294	N121	N120	26.96	0.015	0.25
P295	N23	N230	90.10	0.015	0.4
P296	N151	N164	60.16	0.015	0.6
P297	N39	N291	25.99	0.015	0.3
P298	N221	N222	22.79	0.015	0.5
P299	N108	N372	34.64	0.015	0.9
P300	N372	N383	73.26	0.015	0.9
P301	N366	N367	66.12	0.015	0.3
P302	N368	N105	27.81	0.015	0.9
P303	N105	N369	26.16	0.015	0.9
P304	N337	N335	79.51	0.015	0.6
P305	N338	N337	43.56	0.015	0.6
P306	N358	N338	59.81	0.015	0.4
P307	N265	N162	31.93	0.015	0.4
P308	N162	N161	31.89	0.015	0.6
P309	N306	N289	64.78	0.015	0.4
P310	N148	N192	98.89	0.015	0.6
P311	N44	N137	24.89	0.015	0.3
P312	N285	N131	65.57	0.015	0.4
P313	N299	N298	49.66	0.015	0.4
P314	N59	N295	85.95	0.015	0.35
P315	N283	N282	17.81	0.015	0.9
P316	N240	N91	15.77	0.015	0.6
P317	N158	N160	41.67	0.015	0.6
P318	N344	N339	13.02	0.015	0.45
P319	N342	N339	20.31	0.015	0.45
P320	N340	N339	61.94	0.015	0.4

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P321	N95	N146	39.41	0.015	0.5
P322	N303	N287	27.03	0.015	0.4
P323	N369	N371	27.46	0.015	0.9
P324	N371	N108	21.46	0.015	0.9
P325	N159	N301	61.56	0.015	0.4
P326	N205	N303	30.31	0.015	0.35
P327	N122	N121	4.88	0.015	0.25
P328	N123	N122	38.51	0.015	0.25
P329	N68	N313	60.06	0.015	0.4
P330	N124	N123	41.91	0.015	0.25
P331	N126	N125	4.03	0.015	0.2
P332	N129	N269	13.61	0.015	0.3
P333	N97	N149	28.59	0.015	0.9
P334	N40	N171	63.03	0.015	0.3
P335	N171	N270	32.08	0.015	0.3
P336	N270	N243	3.85	0.015	0.3
P337	N16	N218	65.08	0.015	0.4
P338	N182	N180	54.71	0.015	0.5
P339	N10	N194	61.84	0.015	0.3
P340	N125	N124	28.17	0.015	0.2
P341	N147	N118	8.56	0.015	0.7
P342	N161	N206	99.71	0.015	1.3
P343	N216	N142	22.62	0.015	1.2
P344	N259	N03	17.42	0.015	1.4
P345	N149	N378	19.38	0.015	1.2
P346	N304	N282	116.49	0.015	1.4
P347	N116	N117	11.51	0.015	1.4
P348	N206	N05	69.09	0.015	1.4
P349	N133	N257	106.37	0.015	1.4
P350	N183	N191	80.02	0.015	1.3
P351	N255	N139	80.25	0.015	1.3
P352	N232	N383	64.37	0.015	1.4
P353	N02	N275	55.67	0.015	1.3
P354	N139	N268	95.48	0.015	1.3
P355	N383	N280	79.71	0.015	1.4
P356	N178	N376	82.29	0.015	1.4
P357	N191	N02	12.96	0.015	1.3
P358	N227	N149	102.71	0.015	1.2
P359	N01	N297	70.92	0.015	1.4
P360	N275	N116	79.79	0.015	1.3
P361	N252	N183	92.44	0.015	1.3
P362	N260	N259	46.60	0.015	1.4
P363	N282	N82	19.77	0.015	1.4
P364	N03	N232	72.96	0.015	1.4
P365	N378	N252	37.35	0.015	1.1
P366	N376	N01	28.89	0.015	1.4
P367	N268	N06	81.05	0.015	1.3
P368	N05	N284	30.95	0.015	1.4
P369	N41	N382	70.31	0.015	0.9
P370	N142	N255	79.96	0.015	1.3
P371	N117	N189	13.40	0.015	1.4

P372	N297	N241	100.05	0.015	1.4
P373	N284	N04	8.84	0.015	1.4
P374	N189	N178	103.66	0.015	1.4
P375	N04	N260	90.32	0.015	1.4
P376	N382	N269	76.43	0.015	0.9
P377	N269	N216	90.05	0.015	1.2
P378	N06	N161	16.81	0.015	1.3
P379	N280	N133	38.17	0.015	1.4
P380	N257	N82	178.19	0.015	1.4
P381	N127	N304	84.51	0.015	1.4
P382	N241	N127	50.36	0.015	1.4
P383	N384	N338	65.07	0.015	0.6
P384	N385	V87702	50.00	0.015	1.4
P385	N82	N385	160.53	0.015	1.4

**Table S6.** Land uses in the study area of ES-N network

Land Uses	Percentage
Restaurant	8.17%
Road	23.28%
General trading	24.42%
Dwelling	32.31%
Sports	1.25%
Green Zones	3.08%
Health	1.24%
Office	4.55%
Education	1.12%
Churches	0.58%

### 3. Goodness of Fit for Land Uses Curves

**Table S7.** Goodness of fit for the different land uses with Equation 5.

Type	SSE	R-Square	Adjusted R-Square	RMSE
Restaurant	$1.01 \times 10^4$	0.99	0.99	44.97
Sports	$2.07 \times 10^3$	0.99	0.99	18.59
Education	$5.40 \times 10$	1.00	1.00	3.00
Hotels	$8.46 \times 10^2$	1.00	1.00	13.01
Industries	$1.25 \times 10^5$	0.97	0.97	157.90
Office	$1.95 \times 10^4$	0.98	0.97	62.49
Health	$5.40 \times 10^4$	0.99	0.99	103.90
Warehouse	$1.94 \times 10^4$	0.99	0.99	62.31
Car parks	$4.58 \times 10^2$	0.99	0.99	9.57
General trading	$4.34 \times 10^3$	1.00	0.99	29.44
Dwelling	$9.02 \times 10^3$	0.97	0.96	42.48
Workshops	$2.47 \times 10^3$	0.99	0.99	22.24
Churches and singular buildings	$2.63 \times 10^3$	0.98	0.97	22.93

**Table S8.** Coefficients of equation 5 for different land uses.

<b>Land Uses</b>	<b>C<sub>max</sub></b>	<b>y<sub>max</sub></b>	<b>λ</b>	<b>v</b>
Restaurant	1150	2.20	2.30	1.30
Sports	550	1.00	4.50	1.20
Education	520	1.10	4.50	1.80
Hotels	530	2.20	3.90	1.40
Industries	2200	2.20	2.89	2.69
Office	1000	2.00	3.00	2.50
Health	2500	2.30	2.94	1.89
Warehouse	1600	1.80	1.80	1.50
Car_parks	205	2.00	7.38	76.74
General_trading	1025	2.00	2.90	2.60
Dwelling	565	2.00	2.45	1.63
Workshops	710	1.50	2.30	1.90
Churches	400	2.70	2.77	1.87