







Phase 1A

Drainage Assessment

November 2012

Document Ref. 72054/DA/002 (Issue 4)





CONTROL SHEET

CLIENT: Elsick Development Company

PROJECT TITLE: Chapelton of Elsick

REPORT TITLE: Drainage Assessment – Phase 1A

PROJECT REF: 72054

Issue and Approval Schedule:

ISSUE 1	Name	Signature	Date
Prepared by	K Thomson		
Reviewed by	R Wildi		
Approved by	I Ross		
Issue details	Final	•	

Revision Record:

Issue	Date	Status	Description	Ву	Chk	Арр
2a	31/08/11	Final	Updated to reflect revised Phase 1A proposals and Scottish Water comments.	KT	RALW	JSMR
3	13/11/12	Final	Updated to reflect current Phase 1A layout and drainage proposals.	KT	RALW	JSMR
4	30/11/12	Final	Surface water treatment strategy amended.	KT	RALW	JSMR
5						
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7						

This report has been prepared in accordance with procedure OP/P03 of Fairhurst's Quality Assurance System.



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Drainage Assessment

This drainage assessment is prepared in accordance with the guidance given in the following documents:-

- Drainage Assessment A guide for Scotland, produced by SEPA on behalf of the Sustainable Urban Drainage Scottish Working Party (SUDSWP), May 2005.
- Planning Advice Note (PAN) 61: Planning and Sustainable Urban Drainage Systems, issued by the Scottish Executive Development Department, July 2001.
- The SUDS Manual (CIRIA C697).
- Sewers for Scotland, Second Edition, November 2007, published by WRc plc.

For details of the drainage strategy for the overall Chapelton of Elsick development reference should be made to the Masterplan (4045 units) Drainage Assessment (Document Ref. 72054/DA/001).

The Development Proposal

The Elsick Development Company propose to develop a 57.2 hectare greenfield site as Phase 1A of their Chapelton of Elsick development. Phase 1A will comprise 802 residential units and associated retail and commercial units. The development is on the Elsick Estate to the west of Newtonhill and Phase 1A lies at the south east corner of the overall development at OS Grid Reference NO89409355.

Refer to Drainage Layout drawing Nos. 72054/2004C & 2005B for details of the Phase 1A site layout and drainage proposals.



Existing Drainage

The majority of the site generally falls from its highest point at the west end of the Phase 1A towards the south east.

The Pheppie Burn flows from the west, along the southern edge of the site, towards the sea to the east. The southern part of the site drains naturally to the Pheppie Burn, via a network of field drains and ditches.

The north part of phase 1A generally falls towards the north east.

To the north of Phase 1A, the Elsick Burn flows from the west, through the Elsick Estate towards the sea to the east. The north edge of the site drains naturally to the Elsick Burn, via a network of field drains and ditches.

Any existing drainage encountered during the development will be reinstated or re-routed as necessary.

There are no public sewers in the vicinity of the site. The nearest public sewers are within the existing Newtonhill settlement to the east of the A90. Scottish Water have advised that there is no capacity in these sewers for flows from the Chapelton of Elsick development.

There is a 525mm diameter foul sewer to the north of Newtonhill and to the east of the A90. This sewer discharges to the Portlethen South PFI pumping station and Scottish Water have confirmed in their letter of 21 June 2012 that there is capacity available in this system for the foul flows from the equivalent of 850 houses.

There is also an existing PFI pumped drainage system passing through the east edge of the development. This system pumps sewage flows from Stonehaven to the waste water treatment plant at Nigg. Scottish Water have advised that a connection to this system would not be preferred.

The existing properties within the development area are assumed to drain to private septic tanks with soakaways or discharges to the watercourses.



Foul Drainage

New gravity foul sewers will be provided to serve the development and these will, where possible, be located within the proposed roads, driveways and areas of open space.

Individual houses and properties will each be connected to the foul sewers via a disconnection chamber.

The north edge of Phase 1A will drain via gravity sewers towards the north. In the long term gravity foul sewers will convey the flows to the north east corner of the development, however in the short term the sewers will discharge to two temporary pumping stations, which will pump flows south to the gravity sewers which serve the majority of the Phase 1A. The majority of Phase 1A will drain via new gravity sewers to a new foul pumping station located at the south east corner of the site. This pumping station will pump flows to the existing 525mm diameter public foul sewer which lies to the north of Newtonhill and to the east of the A90.

Scottish Water have confirmed in their letter of 21 June 2012 that there is capacity available in this system for the foul flows from the equivalent of 850 houses.

Sewers and pumping stations will be designed and installed in accordance with Sewers for Scotland, Second Edition, November 2007.



Surface Water Drainage

Referring to Chapter 5 of The SUDS Manual (CIRIA C697), the surface water run-off will be dealt with as follows:-

- Where subsoil infiltration permits and where practicable, source control measures will be considered.
- New gravity surface water sewers and road drains will be provided to serve the development and these will, where possible, be located within the proposed roads, driveways and areas of open space.
- Individual houses and properties will each be connected to the surface water sewers via a disconnection chamber.
- The proposed link road from the site to the A90 will be drained to grass roadside swales with a stone filled filter trench below.
- The site will be drained in areas, based on the existing topography, and flows will be directed to an extended detention basin or pond. The basins and ponds will discharge to the existing watercourses at a controlled rate no greater than the current greenfield run-off rate.
- Grass conveyance swales will be provided upstream of the basins and ponds to provide treatment and sediment removal.
- Sewers and SUDS measures will be designed and installed in accordance with Sewers for Scotland, Second Edition, November 2007 and / or The SUDS Manual (CIRIA C697).

Surface water treatment requirements for the areas to be drained are as follows:-

- Roofs and driveways to be provided with one level of surface water treatment.
- Car parking areas and service areas for commercial development will be provided with two levels of surface water treatment.
- Roads to be provided with two levels of surface water treatment.

The surface water drainage system will drain and treat the run-off as follows:-

- Run-off from roofs and driveways will drain to a basin or pond via a grass swale and surface water sewers. A minimum of one level of treatment will be provided.
- Consideration will be given to draining driveways to ground at source, where infiltration rates permit. A minimum of one level of treatment will be provided.
- Run-off from parking areas and commercial service areas will, where practicable, be treated at source and discharge to a basin or pond via a grass conveyance swale and surface water sewers. A minimum of two levels of treatment will be provided.
- Run-off from roads will drain to a basin or pond via a grass conveyance swale, road drains, grass roadside swales, stone filled filter trenches or surface water sewers. A minimum of two levels of treatment will be provided.



Hydraulic Control

Surface water run-off from Phase 1A will be drained based on the existing topography with the majority of the site draining to an extended detention basin (B1) at the south east corner of the site. The north edge of phase 1A will be drained to a proposed pond (P1) adjacent to the Elsick Burn.

In accordance with the Drainage Assessment guide, the rate and volume of surface water run-off from the post development situation should not exceed the surface water run-off from the existing greenfield site.

The total development area that will drain to Basin B1 is 66.93 hectares and includes the area to the south of Phase 1A. We have calculated that the 10 year greenfield run-off to the Pheppie Burn from the area draining to Basin B3 is 360 l/s which is approximately 5.4 l/s/hectare. Refer to Appendix B for details of calculations.

The total development area that will drain to Pond P1 is 53.95 hectares and includes the area to the north of Phase 1A. We have calculated that the 10 year greenfield run-off to the Elsick Burn from the area draining to Pond P1 is 297 l/s which is approximately 5.5 l/s/hectare. Refer to Appendix B for details of calculations.

Attenuation volume will be provided within the extended detention basin and the pond in order to contain the run-off volumes generated by the critical 10 year, plus climate change, rainfall return event, whilst retaining at least a 500mm freeboard. The basin and the pond will also contain the run-off volumes generated by critical rainfall events up to and including the 200 year, plus climate change, rainfall return event. The basin and the pond will discharge the attenuated run-off at a controlled rate, not exceeding the greenfield run-off rate, to the Pheppie Burn and Elsick Burn respectively. Refer to Appendix B for details of calculations.

Soakaways or infiltration trenches will be designed in accordance with BRE Digest 365 and will contain the run-off volume generated by the critical 30 year return period rainfall event.

As part of the detailed drainage design for each of the development areas, sensitivity tests to assess flood risk from the drainage system will be carried out for rainfall events up to and including the 200 year, plus climate change, rainfall return event. Site levels will be set in order to prevent water entering buildings or restricting access for emergency vehicles.



Maintenance

- Drainage within the house plots, including disconnection chambers and, where provided, soakaways or infiltration trenches will remain private and will be owned and maintained by the individual house owners.
- Road gullies, road drains and grass swales will be adopted and maintained by Aberdeenshire Council as part of the roads adoption.
- Scottish Water will adopt and maintain the new foul and surface water sewers.
- The adoption and maintenance of the basin and the pond will be discussed and agreed with Scottish Water and Aberdeenshire Council at the time of detailed design. This agreement will form the basis of the Section 7 Agreement.
- The developer will own the drainage system until it is adopted. The developer will also remain responsible for maintenance of the drainage system until Scottish Water issue a Completion Certificate for the drainage system, at which time they will assume responsibility for maintenance of the elements they are to adopt.

Construction Phase SUDS

A method statement, detailing how surface water arising during construction will be dealt with, will be prepared by the contractor for approval prior to commencement of works on site.

During the development of the site a surface water management strategy will be prepared for each individual construction phase. This strategy will be submitted to the Planning Authority for their approval prior to the commencement of works.

The surface water management strategy will be based on the Contractor's Method Statement and will incorporate the following measures to prevent the surface water run-off from the construction works discharging direct to the watercourses.

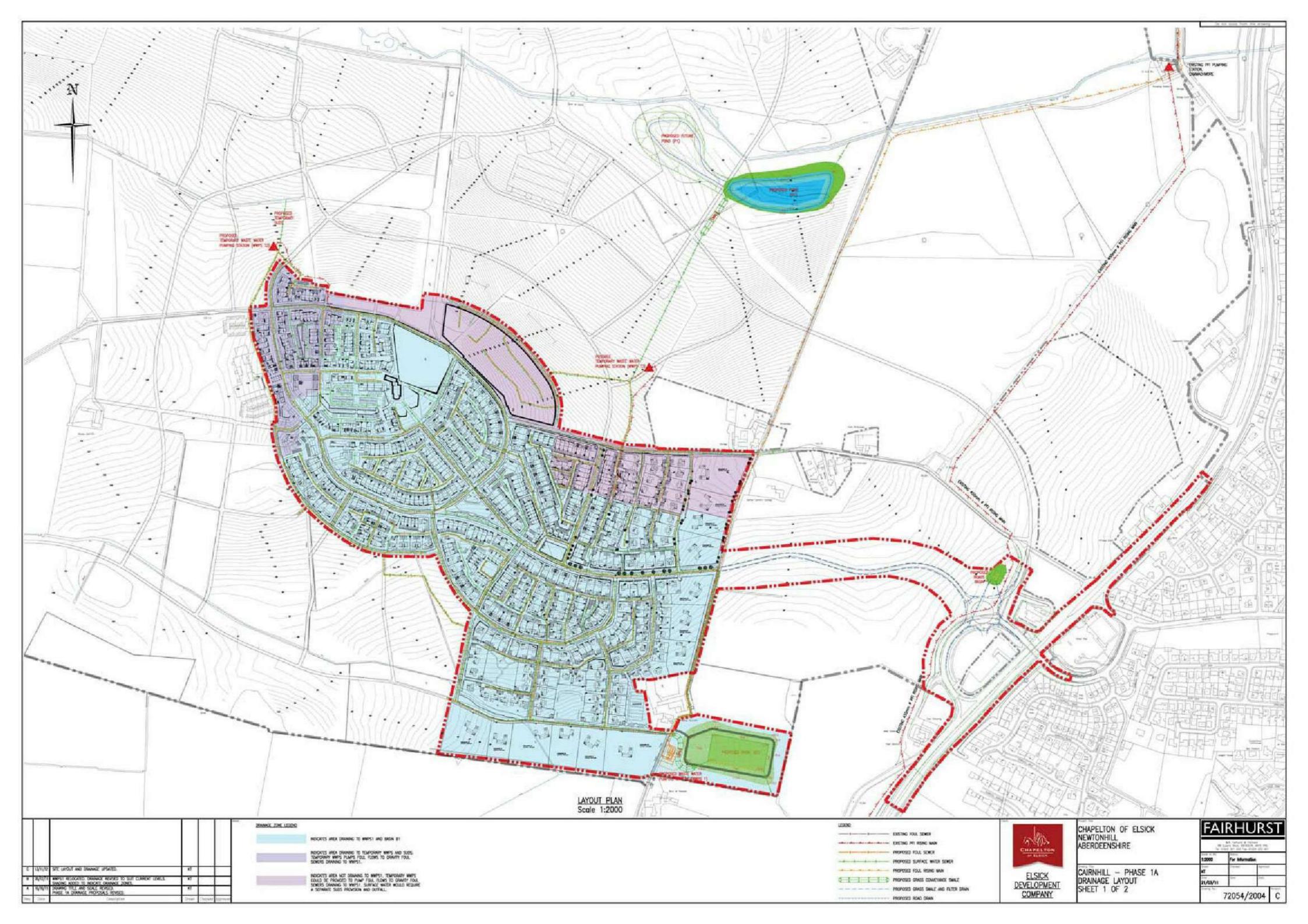
- <u>Localised interception of surface water run-off.</u> Temporary ditches or channels around the area of works would provide this. Check dams or silt traps can be provided to encourage the settlement of silt.
- Surface water settlement and filtration. Temporary settlement ponds will be formed
 and water intercepted at the construction area will be directed to these where it will be
 retained to allow silt suspended in the run-off to settle. A high level outlet will be
 formed from the settlement pond to allow treated run-off to discharge to the
 watercourse. Additional protection could be provided by placing straw bales in the high
 level outlet so that all flows pass through these before entering the watercourse.
- Protection of permanent drainage system. Surface water run-off from construction areas will, where practicable, not be drained to the permanent drainage system. This will prevent silt and other construction debris from building up in the system. Where the use of the permanent system cannot be avoided then the system will need to be thoroughly cleaned on the completion of the construction phase.

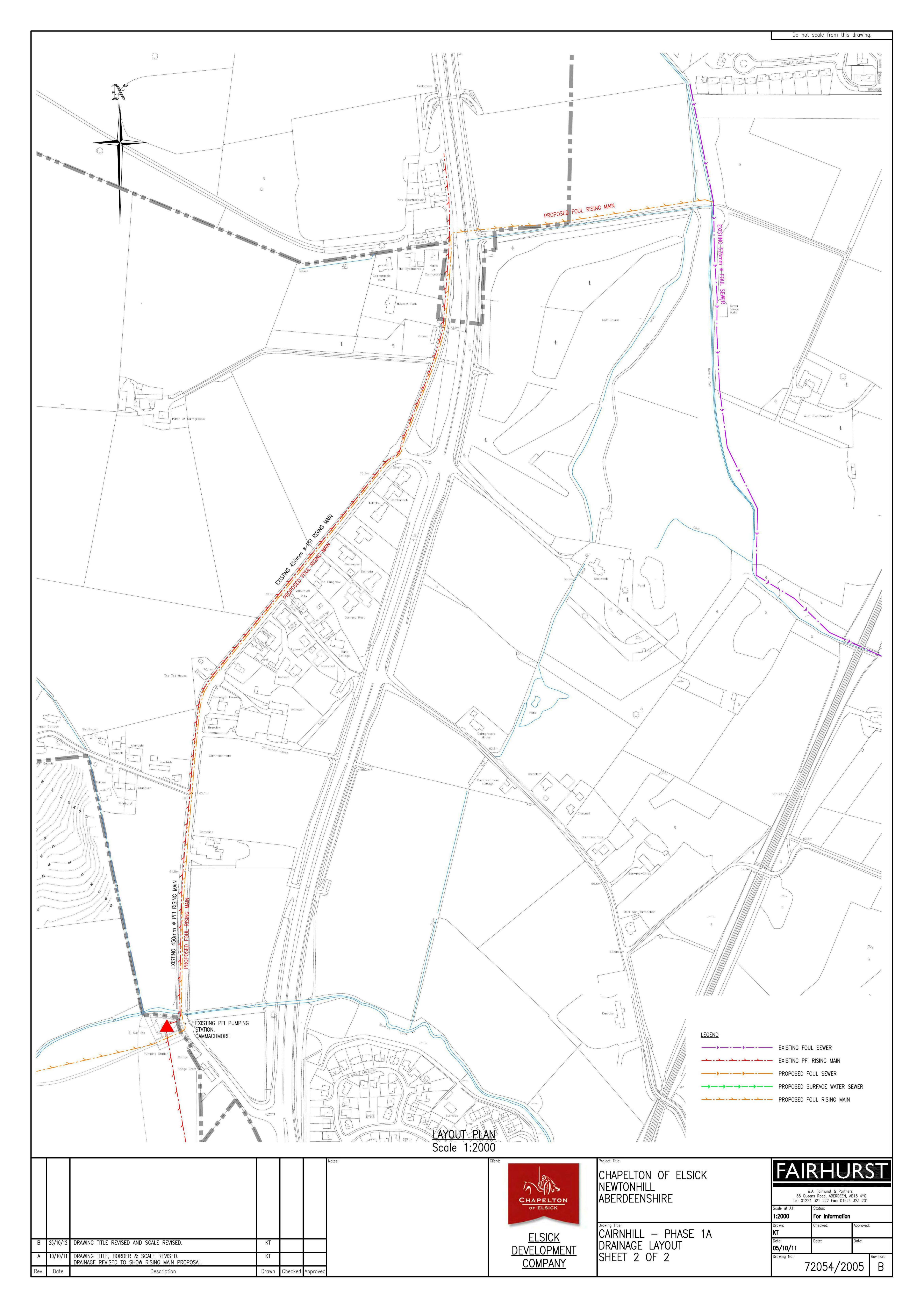


Appendix A - Drawings

• 72054/2004C Cairnhill – Phase 1A – Drainage Layout – Sheet 1 of 2

• 72054/2005B Cairnhill – Phase 1A – Drainage Layout – Sheet 2 of 2







Appendix B - Calculations

- Pre-development Surface Water Run-off calculations.
- Extended Detention Basin B1 − 10, 30 & 200 year rainfall return event calculations.
- Pond P1 − 10, 30 & 200 year rainfall return event calculations.



W.A. FAIRHURST & PARTNERS

CALCULATION SHEET

CONSULTING STRUCTURAL AND CIVIL ENGINEERS PROJECT	JOB No.	72054	Calculated by	Kevin Thomson
Elsick Development Company Chapelton of Elsick	SHEET No.	1		Homson
Newtonhill Pre-development Run-off Calculation - Phase 1 (Basin B1)	DATE	14/06/11	Checked by	

To establish Winter Rain Acceptance Potential (WRAP) for site from site investigation results

From FSR Clause 4

- A Drainage group:
- B Depth to impermeable layers:
- C Permeability group:
- D Slope:

From Table 4.5 of FSR a WRAP of 3 is obtained.

Establish Pre-development Peak Surface Water Run-off

The following formula is used to calculate the peak flow in m³/s;-

Apply Regional Growth Factors from Table 1(2.39) of FSSR 14

Site is in Region 1 (Fig. 2.4), therefore Factors are:

10 year event is 1.45, therefore 10 year pre-development Run-off =	248.41	X	1.45	=	360.19	l/\$
30 year event is 1.90, therefore 30 year pre-development Run-off =	248.41	x	1.90	=	471.98	l/s
100 year event is 2.60, therefore 100 year pre-development Run-off =	248.41	x	2.60	=	645.87	l/s
200 year event is 2.81, therefore 200 year pre-development Run-off =	248.41	x	2.81	=	698.03	l/s



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CALCULATION SHEET

CONSULTING STRUCTURAL AND CIVIL ENGINEERS	PROJECT	JOB No.	72054	Calculated by	Kevin Thomson
Elsick Development Company Chapelton of Elsick		SHEET No.	2		Honson
Newtonhill Pre-development Run-off Calculation - Ph	ase 1 (Pond P1)	DATE	14/06/11	Checked by	

To establish Winter Rain Acceptance Potential (WRAP) for site from site investigation results

From FSR Clause 4

- A Drainage group:
- B Depth to impermeable layers:
- C Permeability group:
- D Slope:

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The following formula is used to calculate the peak flow in m³/s;-

Apply Regional Growth Factors from Table 1(2.39) of FSSR 14

Site is in Region 1 (Fig. 2.4), therefore Factors are:

10 year event is 1.45, therefore 10 year pre-development Run-off =	205.04	X	1.45	=	297.31	l/s
30 year event is 1.90, therefore 30 year pre-development Run-off =	205.04	x	1.90	=	389.58	l/s
100 year event is 2.60, therefore 100 year pre-development Run-off =	205.04	x	2.60	=	533.10	l/s
200 year event is 2.81, therefore 200 year pre-development Run-off =	205.04	x	2.81	=	576.16	l/s

W A Fairhurst & Partners		Page 1
88 Queens Road	72054	
Aberdeen	Chapelton of Elsick	
AB15 4YQ	Newtonhill	Tracko a
Date 14/06/11	Designed By KT) Denser
File Basin B1 (10yr).srcx	Checked By	
Micro Drainage	Source Control W.12.4	***

Summary of Results for 10 year Return Period (+20%)

Storm		Max	Max	Max	Max	Max	Max	Statu	s	
Event		E	Level	Depth	Control	Overflow	Σ Outflow	Volume		
			(m)	(m)	(1/s)	(1/s)	(1/s)	(m³)		
ALC L	PERSONAL PROPERTY.	Avirga villanda incluido	70220020 17528020	BAN MARKA			100 No. 100 No	arrangana ii sas	S2077 - 12	
15		Winter	79.035	0.435	116.5	0.0	116.5	2224.9	0	K
30	min	Winter	79.170	0.570	135.4	0.0	135.4	3001.6	0	K
60	min	Winter	79.333	0.733	155.2	0.0	155.2	3995.3	0	K
120	min	Winter	79.515	0.915	174.7	0.0	174.7	5191.3	0	K
180	min	Winter	79.622	1.022	185.2	1.4	186.6	5943.2	0	K
240	min	Winter	79.689	1.089	191.5	11.3	202.7	6439.5	0	K
360	min	Winter	79.769	1.169	198.7	29.7	228.4	7057.8	0	K
480	min	Winter	79.824	1.224	203.6	45.2	248.8	7490.5	0	K
600	min	Winter	79.860	1.260	206.6	56.4	263.0	7772.4	0	K
720	min	Winter	79.882	1.282	208.5	63.9	272.4	7955.9	0	K
960	min	Winter	79.893	1.293	209.5	67.6	277.1	8043.4	0	K
1440	min	Winter	79.880	1.280	208.4	63.2	271.6	7936.7	0	K
2160	min	Winter	79.833	1.233	204.3	48.0	252.3	7563.2	0	K
2880	min	Winter	79.781	1.181	199.8	32.7	232.5	7147.6	0	K
4320	min	Winter	79.578	0.978	181.0	0.0	181.0	5631.5	0	K
5760	min	Winter	79.387	0.787	161.2	0.0	161.2	4340.0	0	K
7200	min	Winter	79.243	0.643	144.6	0.0	144.6	3439.4	0	K
8640	min	Winter	79.135	0.535	130.8	0.0	130.8	2795.6	0	K
10080	min	Winter	79.053	0.453	119.2	0.0	119.2	2325.6	0	K

Storm		Rain	Overflow	Time-Peak		
Event		(mm/hr)	Volume	(mins)		
					(m³)	
	15	min	Winter	39.459	0.0	29
	30	min	Winter	27.017	0.0	43
	60	min	Winter	18.498	0.0	70
	120	min	Winter	12.665	0.0	126
	180	min	Winter	10.148	1.9	182
	240	min	Winter	8.671	52.6	236
	360	min	Winter	6.948	256.9	294
	480	min	Winter	5.937	487.2	368
	600	min	Winter	5.256	699.5	444
	720	min	Winter	4.757	881.6	518
	960	min	Winter	4.013	1065.2	664
	1440	min	Winter	3.157	1160.9	948
	2160	min	Winter	2.484	1026.8	1368
	2880	min	Winter	2.095	751.2	1772
	4320	min	Winter	1.517	0.0	2604
	5760	min	Winter	1.206	0.0	3344
	7200	min	Winter	1.010	0.0	4040
	8640	min	Winter	0.873	0.0	4760
	10080	min	Winter	0.772	0.0	5448

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88 Queens Road	72054	
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AB15 4YQ	Newtonhill	
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Micro Drainage	Source Control W.12.4	

Rainfall Details

Rainfall Model	FEH	F (1km)	2.220
Return Period (years)	10	Summer Storms	No
Site Location	Newtonhill	Winter Storms	Yes
C (1km)	-0.010	Cv (Summer)	0.750
D1 (1km)	0.476	Cv (Winter)	0.840
D2 (1km)	0.431	Shortest Storm (mins)	15
D3 (1km)	0.226	Longest Storm (mins)	10080
E (1km)	0.229	Climate Change %	+20

Time / Area Diagram

Total Area (ha) 28.050

	Description of the second	E-024 324 855 314 525 C-	2000000 Nec 96.0000	And the control of th		Time (mins)	
0-4	0.000	4-8	10.000	8-12	10.000	12-16	8.050

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88 Queens Road Aberdeen	72054 Chapelton of Elsick	Mara -		
AB15 4YQ Date 14/06/11	Newtonhill Designed By KT	Dranage		
File Basin B1 (10yr).srcx	Checked By			
Micro Drainage	Source Control W.12.4			

Model Details

Storage is Online Cover Level (m) 80.600

Tank or Pond Structure

Invert Level (m) 78.600

Depth (m)	Area (m²)						
0.000	4640.0	2.800	9390.0	5.600	9390.0	8.400	9390.0
0.400	5520.0	3.200	9390.0	6.000	9390.0	8.800	9390.0
0.800	6440.0	3.600	9390.0	6.400	9390.0	9.200	9390.0
1.200	7930.0	4.000	9390.0	6.800	9390.0	9.600	9390.0
1.600	8380.0	4.400	9390.0	7.200	9390.0	10.000	9390.0
2.000	9390.0	4.800	9390.0	7.600	9390.0		
2.400	9390.0	5.200	9390.0	8.000	9390.0		

Orifice Outflow Control

Diameter (m) 0.300 Discharge Coefficient 0.600 Invert Level (m) 78.500

Weir Overflow Control

Discharge Coef 0.544 Width (m) 0.250 Invert Level (m) 79.600