Back Lane Quarry

Phase E: *Operations*

Leapers Wood

Over Kellet

Weighbridge & Offices

Surface Water Management

Quarry Entrance

Continuity between Leapers Wood Quarry Base of Extraction

PHASE E
Base of Extraction

Kit Bill Wood

Helks Wood

Aggregate Industries High Roads Concrete Block Works

Stocking Area

Nether Kellet Road

Hawthorns Caravan Park

M6

RAMP

82.0 70.0 90.0 32.0 45.0 80.0 -37.0 50.0 23.0 110.0 100.0 60.0

Operations - *Phase E*

- Mineral extraction to continue, with deepening to a depth of -37mAOD within the Phase period.
- Extracted mineral to be processed on site utilising mobile plant, to be located adjacent to the extraction face. Material to be temporarily stocked within the quarry void and transported off-Site by HGV to point of sale.
- Post rock extraction, processing and sale of stock, all quarry plant and machinery is to be decommissioned and removed from Site. This will include the High Roads Concrete Block Works.

Mineral to be released within Phase E: 18,237,000 tonnes

LEGEND

- Application Boundary
- Other Land Under the Ownership of the Applicant
- Leapers Wood Quarry
- Surrounding Woodland / Vegetation Structure
- Buildings & Roads
- Disturbed Land - Leapers Wood & Back Lane Quarries
- Existing Overburden Tip / Landform
- 70.0 Contours (2m Intervals) & Spot Heights (mAOD)
- Limit of Extraction within Phase E
- Public Rights of Way (PROW)

AGGREGATE INDUSTRIES

KEDD Limited

PROJECT:
Back Lane Quarry

TITLE:
Phase E: *Operations*

REF NO:
KD.BKLN.D.1.015

DATE:
December 2023

SCALE:
1:5,000 @ A3

STATUS:
FINAL

N

Fox Studio, Much Wenlock, Shropshire TF13 6BL

APPENDIX 3095/FRA/A3

Restoration Plan

Back Lane Quarry

Concept Restoration

Over Kellet

Leapers Wood

Potential Wardens Office

Retained Viewpoint

Possible Car Parking / Boat Trailer Parking

Possible Car Viewpoint & Platform

Spillway from Lake

Surface Water Management Discharge / Wildlife Pond

Open Mosaic Habitat

Lakeside Shallows, Reed & Ephemeral Margins

Site Access - *to be retained*

New Native Scrub

Viewpoint & Roadside Parking

Controlled Water Level: 45.0mAOD

Naturally Regenerating Quarry Benches & Faces

Kit Bill Wood

Helks Wood

New Native Woodland

Campsite - Possible overnight camping site for tents and touring caravans

Hawthorns Caravan Park

Nether Kellet Road

Site Access - *to be retained*

M6

45.0 50.0 50.0 50.0 80.0 82.0 70.0 90.0 110.0 100.0 110.0 50.0 90.0 90.0 100.0

Concept Restoration

Aim - *To restore and establish landform and habitats to support wildlife and leisure land uses, set and integrated within the local landscape setting.*

Objectives

- Retain the two separate controlled access points into Back Lane, with the main Back Lane entrance leading to a public, principally wildlife enhanced / leisure walk area / car park, with viewpoints over both the restored quarries.
- A linking public multi-use path / track running along the eastern boundary of the restored Site to connect into two sections of PROW, from Helks Wood to Over Kellet, via the existing Leapers Wood viewpoint, and south west to Nether Kellet.
- The second access to be retained to the south east of the Site off Nether Kellet Road. The access to lead to an area of land for use as a potential camping site for tents and touring
- To establish a long term aftercare and management plan, to ensure the quality and maintenance of the Site's restored land uses.
- To establish and maintain a permanent lake water level discharge point
- The provision and implementation of detailed habitat plans and protected species enhancement measures.

LEGEND

- Application Boundary
- Other Land Under the Ownership of the Applicant
- Leapers Wood Quarry
- Surrounding Woodland / Vegetation Structure
- Buildings & Roads
- Exposed Quarry Benches & Faces - Natural Regeneration
- Proposed Calcareous Grassland
- Proposed Open Mosaic Habitat
- Proposed Internal Access Infrastructure / Tracks
- Proposed Native Woodland
- Proposed Native Scrub
- Proposed Amenity Lake & Shallow Margins
- Proposed Reed Development / Aquatic Marginals
- 70.0 Contours (2m Intervals) & Spot Heights (mAOD)
- Public Rights of Way (PROW)

AGGREGATE INDUSTRIES

KEDD Limited

PROJECT:
Back Lane Quarry

TITLE:
Concept Restoration

REF NO:
KD.BKLN.D.1.016

DATE: December 2023

SCALE: 1:5,000 @ A3

STATUS: FINAL

N

Fox Studio, Much Wenlock, Shropshire TF13 6BL

APPENDIX 3095/FRA/A4

M6 culvert: pipe flow calculation

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M6 culvert: pipe flow calculation

Source: https://www.calctool.org/fluid-mechanics/pipe-flow

Formula: Hazen–Williams equation

Pipe diameter	0.6 m
Material	Concrete
Roughness coefficient	110
Pipe length	49.2 m
Drop	0.3 m
Flow velocity	1.8 m/s
Flow discharge	509 liters /s

Material	Roughness coefficient
Cast iron	100
Concrete	110
Copper	140
Plastic (PVC)	150
Steel	120

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APPENDIX 3095/FRA/A5

Storm run-off: operational phase

Incident rainfall storm runoff calculation

	Vegetated	Hardstanding	Open Water	Exposed bedrock
Runoff Coefficient	0.35	0.85	1.00	0.70
Area Ha	1.5	10.5	0.5	63.0

The Rational Method to give peak flow Q_p is in the form:

$$Q_p = 2.78\ CiA$$

Where:

C	co-efficient of run-off (dimensionless)
i	rainfall intensity (mm/hr)
A	catchment area (Ha)

Climate change (% rainfall increase)	0	%

Outflow rate - not used	0.0	l/s

Groundwater seepage - not used	0.0	l/s

Duration	Rainfall *2	Rainfall intensity	Runoff from vegetated area *3	Runoff from hardstanding *3	Runoff from open water *3	Runoff from exposed bedrock *3	Total Runoff	Total Volume
	2 year event							
hours	mm	mm/hr	l/s	l/s	l/s	l/s	l/s	m^3
0.25	6.7	26.9	39	667	37	3295	4039	3635
0.5	9.1	18.2	27	451	25	2226	2729	4912
1	11.9	11.9	17	295	17	1459	1788	6437
2	16.6	8.3	12	206	12	1018	1247	8979
4	22.7	5.7	8	141	8	697	854	12301
6	27.1	4.5	7	112	6	554	**679**	**14659**
8	30.5	3.8	6	95	5	467	572	16482
12	35.6	3.0	4	74	4	364	**446**	**19263**
16	39.5	2.5	4	61	3	303	371	21367
20	42.6	2.1	3	53	3	261	320	23055
24	45.3	1.9	3	47	3	231	283	24483
28	47.6	1.7	2	42	2	208	255	25727
32	49.7	1.6	2	38	2	190	233	26857
36	51.6	1.4	2	36	2	176	215	27896
40	53.4	1.3	2	33	2	164	200	28870
44	55.1	1.3	2	31	2	153	188	29789
48	56.7	1.2	2	29	2	145	177	30665

*2 Obtained from FEH website

*3 Climate change factored into rainfall intensity at this stage

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Client: **Aggregate Industries UK Ltd**
Tarmac Trading Ltd

Title: 1 in 2-year event runoff rates and volumes

Project: Back Lane and Leapers Wood Quarries

Date: Sep-23

Incident rainfall storm runoff calculation

	Vegetated	Hardstanding	Open Water	Exposed bedrock
Runoff Coefficient	0.35	0.85	1.00	0.70
Area Ha	1.5	10.5	0.5	63.0

The Rational Method to give peak flow Q_p is in the form:

$$Q_p = 2.78\ CiA$$

Where:

C	co-efficient of run-off (dimensionless)
i	rainfall intensity (mm/hr)
A	catchment area (Ha)

Climate change (% rainfall increase)	0	%

Outflow rate - not used	0.0	l/s

Groundwater seepage - not used	0.0	l/s

Duration	Rainfall *2	Rainfall intensity	Runoff from vegetated area *3	Runoff from hardstanding *3	Runoff from open water *3	Runoff from exposed bedrock *3	Total Runoff	Total Volume
	10 year event							
hours	mm	mm/hr	l/s	l/s	l/s	l/s	l/s	m^3
0.25	12.2	48.6	71	1207	68	5963	7309	6578
0.5	16.5	33.0	48	819	46	4046	4959	8925
1	21.6	21.6	32	536	30	2647	3244	11679
2	27.8	13.9	20	345	19	1703	2088	15033
4	35.8	8.9	13	222	12	1097	1344	19360
6	41.3	6.9	10	171	10	844	**1035**	**22346**
8	45.5	5.7	8	141	8	697	854	24591
12	51.6	4.3	6	107	6	528	**647**	**27934**
16	56.2	3.5	5	87	5	431	528	30406
20	59.9	3.0	4	74	4	367	450	32380
24	62.9	2.6	4	65	4	321	394	34035
28	65.6	2.3	3	58	3	287	352	35501
32	68.1	2.1	3	53	3	261	320	36832
36	70.4	2.0	3	49	3	240	294	38071
40	72.5	1.8	3	45	3	222	272	39234
44	74.6	1.7	2	42	2	208	255	40337
48	76.5	1.6	2	40	2	195	240	41387

*2 Obtained from FEH website

*3 Climate change factored into rainfall intensity at this stage

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Client: **Aggregate Industries UK Ltd**
Tarmac Trading Ltd

Title: 1 in 10-year event runoff rates and volumes

Project: Back Lane and Leapers Wood Quarries

Date: Sep-23

Incident rainfall storm runoff calculation

	Vegetated	Hardstanding	Open Water	Exposed bedrock
Runoff Coefficient	0.35	0.85	1.00	0.70
Area Ha	1.5	10.5	0.5	63.0

The Rational Method to give peak flow Q_p is in the form:

$$Q_p = 2.78\ CiA$$

Where:

C co-efficient of run-off (dimensionless)
i rainfall intensity (mm/hr)
A catchment area (Ha)

Climate change (% rainfall increase)	0	%

Outflow rate - not used	0.0	l/s
Groundwater seepage - not used	0.0	l/s

Duration	Rainfall *2	Rainfall intensity	Runoff from vegetated area *3	Runoff from hardstanding *3	Runoff from open water *3	Runoff from exposed bedrock *3	Total Runoff	Total Volume
	100 year event							
hours	mm	mm/hr	l/s	l/s	l/s	l/s	l/s	m^3
0.25	21.3	85.3	124	2116	119	10455	12814	11533
0.5	29.6	59.3	87	1471	82	7268	8907	16033
1	39.1	39.1	57	970	54	4795	5877	21156
2	49.9	25.0	36	619	35	3061	3751	27009
4	63.4	15.9	23	394	22	1944	2383	34317
6	71.9	12.0	17	297	17	1468	**1800**	**38871**
8	77.8	9.7	14	241	14	1192	1461	42063
12	85.9	7.2	10	178	10	877	**1075**	**46444**
16	91.4	5.7	8	142	8	700	858	49436
20	95.5	4.8	7	118	7	585	718	51664
24	98.8	4.1	6	102	6	505	619	53460
28	101.6	3.6	5	90	5	445	545	54964
32	104.1	3.3	5	81	5	399	489	56322
36	106.4	3.0	4	73	4	362	444	57571
40	108.6	2.7	4	67	4	333	408	58745
44	110.7	2.5	4	62	3	308	378	59865
48	112.7	2.3	3	58	3	288	353	60936

*2 Obtained from FEH website

*3 Climate change factored into rainfall intensity at this stage

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Client: **Aggregate Industries UK Ltd**
Tarmac Trading Ltd

Title: 1 in 100-year event runoff rates and volumes

Project: Back Lane and Leapers Wood Quarries

Date: Sep-23

Incident rainfall storm runoff calculation

	Vegetated	Hardstanding	Open Water	Exposed bedrock
Runoff Coefficient	0.35	0.85	1.00	0.70
Area Ha	1.5	10.5	0.5	63.0

The Rational Method to give peak flow Q_p is in the form:

$$Q_p = 2.78\ CiA$$

Where:

C	co-efficient of run-off (dimensionless)
i	rainfall intensity (mm/hr)
A	catchment area (Ha)

Climate change (% rainfall increase)	50	%

Outflow rate - not used	0.0	l/s

Groundwater seepage - not used	0.0	l/s

Duration	Rainfall *2	Rainfall intensity	Runoff from vegetated area *3	Runoff from hardstanding *3	Runoff from open water *3	Runoff from exposed bedrock *3	Total Runoff	Total Volume
	100 year event							
hours	mm	mm/hr	l/s	l/s	l/s	l/s	l/s	m^3
0.25	21.3	85.3	187	3174	178	15683	19221	17299
0.5	29.6	59.3	130	2206	124	10901	13361	24050
1	39.1	39.1	86	1456	82	7192	8815	31734
2	49.9	25.0	55	929	52	4591	5627	40513
4	63.4	15.9	35	590	33	2917	3575	51475
6	71.9	12.0	26	446	25	2202	**2699**	**58307**
8	77.8	9.7	21	362	20	1787	2191	63094
12	85.9	7.2	16	266	15	1316	**1613**	**69667**
16	91.4	5.7	13	213	12	1050	1287	74154
20	95.5	4.8	10	178	10	878	1076	77497
24	98.8	4.1	9	153	9	757	928	80191
28	101.6	3.6	8	135	8	667	818	82446
32	104.1	3.3	7	121	7	598	733	84483
36	106.4	3.0	6	110	6	544	666	86357
40	108.6	2.7	6	101	6	499	612	88118
44	110.7	2.5	6	94	5	463	567	89797
48	112.7	2.3	5	87	5	432	529	91404

*2 Obtained from FEH website

*3 Climate change factored into rainfall intensity at this stage

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Client: **Aggregate Industries UK Ltd**
Tarmac Trading Ltd

Title: 1 in 100-year plus climate change event runoff rates and volumes

Project: Back Lane and Leapers Wood Quarries

Date: Sep-23

Storm runoff calculation - Dunald Mill Hole Cave catchment

	Dunald Mill Cave - catchment
Runoff Coefficient	0.35
Area Ha	196.5

Climate change (% rainfall increase)	0	%

Outflow rate - not used	0.0	l/s

Groundwater seepage - not used	0.0	l/s

Duration	Rainfall *2	Rainfall intensity	Runoff from Dunald Mill Cave - catchment *3	Total Runoff	Total Volume
	2 year event				
hours	mm	mm/hr	l/s	l/s	m^3
0.25	6.7	26.9	5139	5139	4625
0.5	9.1	18.2	3472	3472	6250
1	11.9	11.9	2275	2275	8191
2	16.6	8.3	1587	1587	11426
4	22.7	5.7	1087	1087	15652
6	27.1	4.5	864	**864**	**18653**
8	30.5	3.8	728	728	20973
12	35.6	3.0	567	**567**	**24510**
16	39.5	2.5	472	472	27188
20	42.6	2.1	407	407	29335
24	45.3	1.9	361	361	31152
28	47.6	1.7	325	325	32736
32	49.7	1.6	297	297	34174
36	51.6	1.4	274	274	35496
40	53.4	1.3	255	255	36735
44	55.1	1.3	239	239	37905
48	56.7	1.2	226	226	39020

*2 Obtained from FEH website

*3 Climate change factored into rainfall intensity at this stage

The Rational Method to give peak flow Q_p is in the form:

$$Q_p = 2.78\ CiA$$

Where:

C	co-efficient of run-off (dimensionless)
i	rainfall intensity (mm/hr)
A	catchment area (Ha)

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Client: **Aggregate Industries UK Ltd**
Tarmac Trading Ltd

Title: 1 in 2-year event runoff rates and volumes for Dunald Mill Hole Cave Catchment

Project: Back Lane and Leapers Wood Quarries

Date: Sep-23

Storm runoff calculation - Dunald Mill Hole Cave catchment

	Dunald Mill Cave - catchment
Runoff Coefficient	0.35
Area Ha	196.5

Climate change (% rainfall increase)	0	%

Outflow rate - not used	0.0	l/s

Groundwater seepage - not used	0.0	l/s

Duration	Rainfall *2	Rainfall intensity	Runoff from Dunald Mill Cave - catchment *3	Total Runoff	Total Volume
	10 year event				
hours	mm	mm/hr	l/s	l/s	m^3
0.25	12.2	48.6	9300	9300	8370
0.5	16.5	33.0	6309	6309	11357
1	21.6	21.6	4128	4128	14860
2	27.8	13.9	2657	2657	19128
4	35.8	8.9	1711	1711	24634
6	41.3	6.9	1316	**1316**	**28434**
8	45.5	5.7	1086	1086	31290
12	51.6	4.3	823	**823**	**35544**
16	56.2	3.5	672	672	38689
20	59.9	3.0	572	572	41202
24	62.9	2.6	501	501	43308
28	65.6	2.3	448	448	45173
32	68.1	2.1	407	407	46866
36	70.4	2.0	374	374	48443
40	72.5	1.8	347	347	49922
44	74.6	1.7	324	324	51327
48	76.5	1.6	305	305	52662

*2 Obtained from FEH website

*3 Climate change factored into rainfall intensity at this stage

The Rational Method to give peak flow Q_p is in the form:

$$Q_p = 2.78\ CiA$$

Where:

C	co-efficient of run-off (dimensionless)
i	rainfall intensity (mm/hr)
A	catchment area (Ha)

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Client: **Aggregate Industries UK Ltd**
Tarmac Trading Ltd

Title: 1 in 10-year event runoff rates and volumes for Dunald Mill Hole Cave Catchment

Project: Back Lane and Leapers Wood Quarries

Date: Sep-23

Storm runoff calculation - Dunald Mill Hole Cave catchment

	Dunald Mill Cave - catchment
Runoff Coefficient	0.35
Area Ha	196.5

Climate change (% rainfall increase)	0	%

Outflow rate - not used	0.0	l/s

Groundwater seepage - not used	0.0	l/s

	Rainfall *2	Rainfall intensity	Runoff from Dunald Mill Cave - catchment *3	Total Runoff	Total Volume
Duration	**100 year event**				
hours	mm	mm/hr	l/s	l/s	m^3
0.25	21.3	85.3	16305	16305	14675
0.5	29.6	59.3	11334	11334	20401
1	39.1	39.1	7478	7478	26919
2	49.9	25.0	4773	4773	34367
4	63.4	15.9	3032	3032	43666
6	71.9	12.0	2290	**2290**	**49461**
8	77.8	9.7	1858	1858	53522
12	85.9	7.2	1368	**1368**	**59097**
16	91.4	5.7	1092	1092	62904
20	95.5	4.8	913	913	65740
24	98.8	4.1	787	787	68025
28	101.6	3.6	694	694	69938
32	104.1	3.3	622	622	71666
36	106.4	3.0	565	565	73256
40	108.6	2.7	519	519	74749
44	110.7	2.5	481	481	76174
48	112.7	2.3	449	449	77537

*2 Obtained from FEH website

*3 Climate change factored into rainfall intensity at this stage

The Rational Method to give peak flow Q_p is in the form:

$$Q_p = 2.78\ CiA$$

Where:

C	co-efficient of run-off (dimensionless)
i	rainfall intensity (mm/hr)
A	catchment area (Ha)

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Client: **Aggregate Industries UK Ltd**
Tarmac Trading Ltd

Title: 1 in 100-year event runoff rates and volumes for Dunald Mill Hole Cave Catchment

Project: Back Lane and Leapers Wood Quarries

Date: Sep-23

Storm runoff calculation - Dunald Mill Hole Cave catchment

	Dunald Mill Cave - catchment
Runoff Coefficient	0.35
Area Ha	196.5

Climate change (% rainfall increase)	50	%

Outflow rate - not used	0.0	l/s

Groundwater seepage - not used	0.0	l/s

Duration	Rainfall *2	Rainfall intensity	Runoff from Dunald Mill Cave - catchment *3	Total Runoff	Total Volume
	100 year event				
hours	mm	mm/hr	l/s	l/s	m^3
0.25	21.3	85.3	24458	24458	22012
0.5	29.6	59.3	17001	17001	30602
1	39.1	39.1	11216	11216	40379
2	49.9	25.0	7160	7160	51550
4	63.4	15.9	4549	4549	65499
6	71.9	12.0	3435	**3435**	**74192**
8	77.8	9.7	2788	2788	80283
12	85.9	7.2	2052	**2052**	**88646**
16	91.4	5.7	1638	1638	94356
20	95.5	4.8	1370	1370	98609
24	98.8	4.1	1181	1181	102037
28	101.6	3.6	1041	1041	104907
32	104.1	3.3	933	933	107499
36	106.4	3.0	848	848	109884
40	108.6	2.7	779	779	112124
44	110.7	2.5	721	721	114261
48	112.7	2.3	673	673	116306

*2 Obtained from FEH website

*3 Climate change factored into rainfall intensity at this stage

The Rational Method to give peak flow Q_p is in the form:

$$Q_p = 2.78\ CiA$$

Where:

C	co-efficient of run-off (dimensionless)
i	rainfall intensity (mm/hr)
A	catchment area (Ha)

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Client: **Aggregate Industries UK Ltd**
Tarmac Trading Ltd

Title: 1 in 100-year plus climate change event runoff rates and volumes for Dunald Mill Hole Cave Catchment

Project: Back Lane and Leapers Wood Quarries

Date: Sep-23

APPENDIX 3095/FRA/A6

Storm run-off: restoration phase

Incident rainfall storm runoff calculation - Restored Phase

	Vegetated restored quarry faces	Open water
Runoff Coefficient	0.35	1.00
Area Ha	7.5	68.0

The Rational Method to give peak flow Q_p is in the form:

$$Q_p = 2.78\ CiA$$

Where:

C	co-efficient of run-off (dimensionless)
i	rainfall intensity (mm/hr)
A	catchment area (Ha)

Climate change (% rainfall increase)	0	%

Outflow rate - not used	0.0	l/s

Groundwater seepage - not used	0.0	l/s

	Rainfall *2	Rainfall intensity	Runoff from vegetated area *3	Runoff from hardstanding *3	Total Runoff	Total Volume
Duration	**2 year event**					
hours	mm	mm/hr	l/s	l/s	l/s	m^3
0.25	6.7	26.9	196	5081	5278	4750
0.5	9.1	18.2	133	3433	3565	6418
1	11.9	11.9	87	2250	2336	8411
2	16.6	8.3	61	1569	1630	11733
4	22.7	5.7	41	1075	1116	16073
6	27.1	4.5	33	854	**887**	**19155**
8	30.5	3.8	28	720	748	21537
12	35.6	3.0	22	561	**583**	**25170**
16	39.5	2.5	18	467	485	27919
20	42.6	2.1	16	403	418	30124
24	45.3	1.9	14	356	370	31990
28	47.6	1.7	12	321	333	33616
32	49.7	1.6	11	293	305	35093
36	51.6	1.4	10	271	281	36450
40	53.4	1.3	10	252	262	37723
44	55.1	1.3	9	237	246	38924
48	56.7	1.2	9	223	232	40069

*2 Obtained from FEH website

*3 Climate change factored into rainfall intensity at this stage

hafrenwater
environmental water management

Barkers Chambers
Barker Street
Shrewsbury, Shropshire SY1 1SB
UK
Tel: 01743 355770
www.hafrenwater.com

Client: **Aggregate Industries UK Ltd**
Tarmac Trading Ltd

Title: 1 in 2-year event runoff rates and volumes

Project: Back Lane and Leapers Wood Quarries

Date: Sep-23

Incident rainfall storm runoff calculation - Restored Phase

		Vegetated restored quarry faces	Open water
Runoff Coefficient		0.35	1.00
Area	Ha	7.5	68.0

Climate change (% rainfall increase)	0	%

Outflow rate - not used	0.0	l/s

Groundwater seepage - not used	0.0	l/s

The Rational Method to give peak flow Q_p is in the form:

$$Q_p = 2.78\,CiA$$

Where:

C	co-efficient of run-off (dimensionless)
i	rainfall intensity (mm/hr)
A	catchment area (Ha)

Duration	Rainfall *2	Rainfall intensity	Runoff from vegetated area *3	Runoff from hardstanding *3	Total Runoff	Total Volume
	10 year event					
hours	mm	mm/hr	l/s	l/s	l/s	m^3
0.25	12.2	48.6	355	9195	9550	8595
0.5	16.5	33.0	241	6238	6479	11662
1	21.6	21.6	158	4081	4239	15260
2	27.8	13.9	101	2627	2728	19642
4	35.8	8.9	65	1691	1757	25297
6	41.3	6.9	50	1302	**1352**	**29199**
8	45.5	5.7	41	1074	1116	32132
12	51.6	4.3	31	814	**845**	**36500**
16	56.2	3.5	26	664	690	39730
20	59.9	3.0	22	566	588	42310
24	62.9	2.6	19	496	515	44473
28	65.6	2.3	17	443	460	46388
32	68.1	2.1	16	402	418	48127
36	70.4	2.0	14	370	384	49746
40	72.5	1.8	13	343	356	51265
44	74.6	1.7	12	320	333	52707
48	76.5	1.6	12	301	313	54078

*2 Obtained from FEH website

*3 Climate change factored into rainfall intensity at this stage

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Client: **Aggregate Industries UK Ltd**
Tarmac Trading Ltd

Title: 1 in 10-year plus climate change event runoff rates and volumes

Project: Back Lane and Leapers Wood Quarries

Date: Sep-23

Incident rainfall storm runoff calculation - Restored Phase

		Vegetated restored quarry faces	Open water
Runoff Coefficient		0.35	1.00
Area	Ha	7.5	68.0

Climate change (% rainfall increase)	0	%

Outflow rate - not used	0.0	l/s

Groundwater seepage - not used	0.0	l/s

The Rational Method to give peak flow Q_p is in the form:

$$Q_p = 2.78\ CiA$$

Where:

C	co-efficient of run-off (dimensionless)
i	rainfall intensity (mm/hr)
A	catchment area (Ha)

Duration	Rainfall *2	Rainfall intensity	Runoff from vegetated area *3	Runoff from hardstanding *3	Total Runoff	Total Volume
	100 year event					
hours	mm	mm/hr	l/s	l/s	l/s	m^3
0.25	21.3	85.3	622	16121	16744	15069
0.5	29.6	59.3	433	11206	11639	20950
1	39.1	39.1	285	7393	7679	27644
2	49.9	25.0	182	4719	4902	35291
4	63.4	15.9	116	2998	3114	44840
6	71.9	12.0	87	2264	**2351**	**50792**
8	77.8	9.7	71	1837	1908	54962
12	85.9	7.2	52	1353	**1405**	**60687**
16	91.4	5.7	42	1080	1121	64596
20	95.5	4.8	35	903	938	67508
24	98.8	4.1	30	778	809	69855
28	101.6	3.6	26	686	712	71819
32	104.1	3.3	24	615	639	73594
36	106.4	3.0	22	559	580	75226
40	108.6	2.7	20	513	533	76760
44	110.7	2.5	18	475	494	78223
48	112.7	2.3	17	444	461	79623

*2 Obtained from FEH website

*3 Climate change factored into rainfall intensity at this stage

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Client: **Aggregate Industries UK Ltd**
Tarmac Trading Ltd

Title: 1 in 100-year event runoff rates and volumes

Project: Back Lane and Leapers Wood Quarries

Date: Sep-23

Incident rainfall storm runoff calculation - Restored Phase

		Vegetated restored quarry faces	Open water
Runoff Coefficient		0.35	1.00
Area	Ha	7.5	68.0

The Rational Method to give peak flow Q_p is in the form:

$$Q_p = 2.78\ CiA$$

Where:

C	co-efficient of run-off (dimensionless)
i	rainfall intensity (mm/hr)
A	catchment area (Ha)

Climate change (% rainfall increase)	50	%

Outflow rate - not used	0.0	l/s

Groundwater seepage - not used	0.0	l/s

Duration	Rainfall *2	Rainfall intensity	Runoff from vegetated area *3	Runoff from hardstanding *3	Total Runoff	Total Volume
	100 year event					
hours	mm	mm/hr	l/s	l/s	l/s	m^3
0.25	21.3	85.3	933	24182	25115	22604
0.5	29.6	59.3	649	16809	17458	31425
1	39.1	39.1	428	11090	11518	41465
2	49.9	25.0	273	7079	7352	52937
4	63.4	15.9	174	4497	4671	67261
6	71.9	12.0	131	3396	**3527**	**76188**
8	77.8	9.7	106	2756	2863	82443
12	85.9	7.2	78	2029	**2107**	**91031**
16	91.4	5.7	63	1620	1682	96894
20	95.5	4.8	52	1354	1406	101262
24	98.8	4.1	45	1168	1213	104782
28	101.6	3.6	40	1029	1069	107729
32	104.1	3.3	36	923	958	110390
36	106.4	3.0	32	838	871	112839
40	108.6	2.7	30	770	800	115140
44	110.7	2.5	28	713	741	117335
48	112.7	2.3	26	665	691	119434

*2 Obtained from FEH website

*3 Climate change factored into rainfall intensity at this stage

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Project: Back Lane and Leapers Wood Quarries

Date: Sep-23

APPENDIX 3095/FRA/A7

Greenfield run-off

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	Rosie Morrant
Site name:	Leapers Wood/Back Lane
Site location:	Carnforth

This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013) , the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Site Details

Latitude:	54.11771° N
Longitude:	2.74673° W
Reference:	1592490029
Date:	May 26 2021 10:01

Runoff estimation approach

IH124

Site characteristics

Total site area (ha): 75.5

Methodology

Q_{BAR} estimation method:	Calculate from SPR and SAAR
SPR estimation method:	Calculate from SOIL type

Soil characteristics

	Default	Edited
SOIL type:	2	2
HOST class:	N/A	N/A
SPR/SPRHOST:	0.3	0.3

Hydrological characteristics

	Default	Edited
SAAR (mm):	1137	1137
Hydrological region:	10	10
Growth curve factor 1 year:	0.87	0.87
Growth curve factor 30 years:	1.7	1.7
Growth curve factor 100 years:	2.08	2.08
Growth curve factor 200 years:	2.37	2.37

Notes

(1) Is Q_{BAR} < 2.0 l/s/ha?

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

(2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

(3) Is SPR/SPRHOST ≤ 0.3?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates

	Default	Edited
Q_{BAR} (l/s):	231.95	231.95
1 in 1 year (l/s):	201.79	201.79
1 in 30 years (l/s):	394.31	394.31
1 in 100 year (l/s):	482.45	482.45
1 in 200 years (l/s):	549.72	549.72