OXFORDSHIRE
STRATEGIC RAIL FREIGHT INTERCHANGE

DCO Submission

Environmental Statement

Chapter 9: Water Environment
Appendix 9.2: Flood Risk Assessment – Part 2 of 2

Document 6.9B.02 (tracked)
Rev P0~~4~~

On behalf of
Oxfordshire Railfreight Limited

Prepared by BWB Consulting Ltd
~~May~~ **October 2026**

PINS REF:	TR050008
Document Reference	6.9B.02
APFP Regulation	5(2)(e)
Author	BWB Consulting Ltd
Date	October~~May~~ 2026
Revision	P05~~4~~

0 100 200 300 400 500 m

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4. Any discrepancies noted on site are to be reported to the engineer immediately.

5. Model not yet peer reviewed.

5. Contains OS data © Licence no. 100019980.

Key

Model Domain

Modelled Flood Depths (m)

- <= 0.25
- 0.25 - 0.50
- 0.50 - 0.75
- 0.75 - 1.00
- 1.00 - 1.25
- > 1.25

Rev	Date	Details of issues/ revision	Drw	Rev
P03	26.03.26	Updated following EA comments	MN	LR
P02	30.07.25	Updated to include latest hydrology	MN	LR
P01	06.04.23	PRELIMINARY ISSUE	LR	MB

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Client

OxSRFI OXFORDSHIRE STRATEGIC RAIL FREIGHT INTERCHANGE

Project Title

Oxfordshire Railfreight Limited

Drawing Title

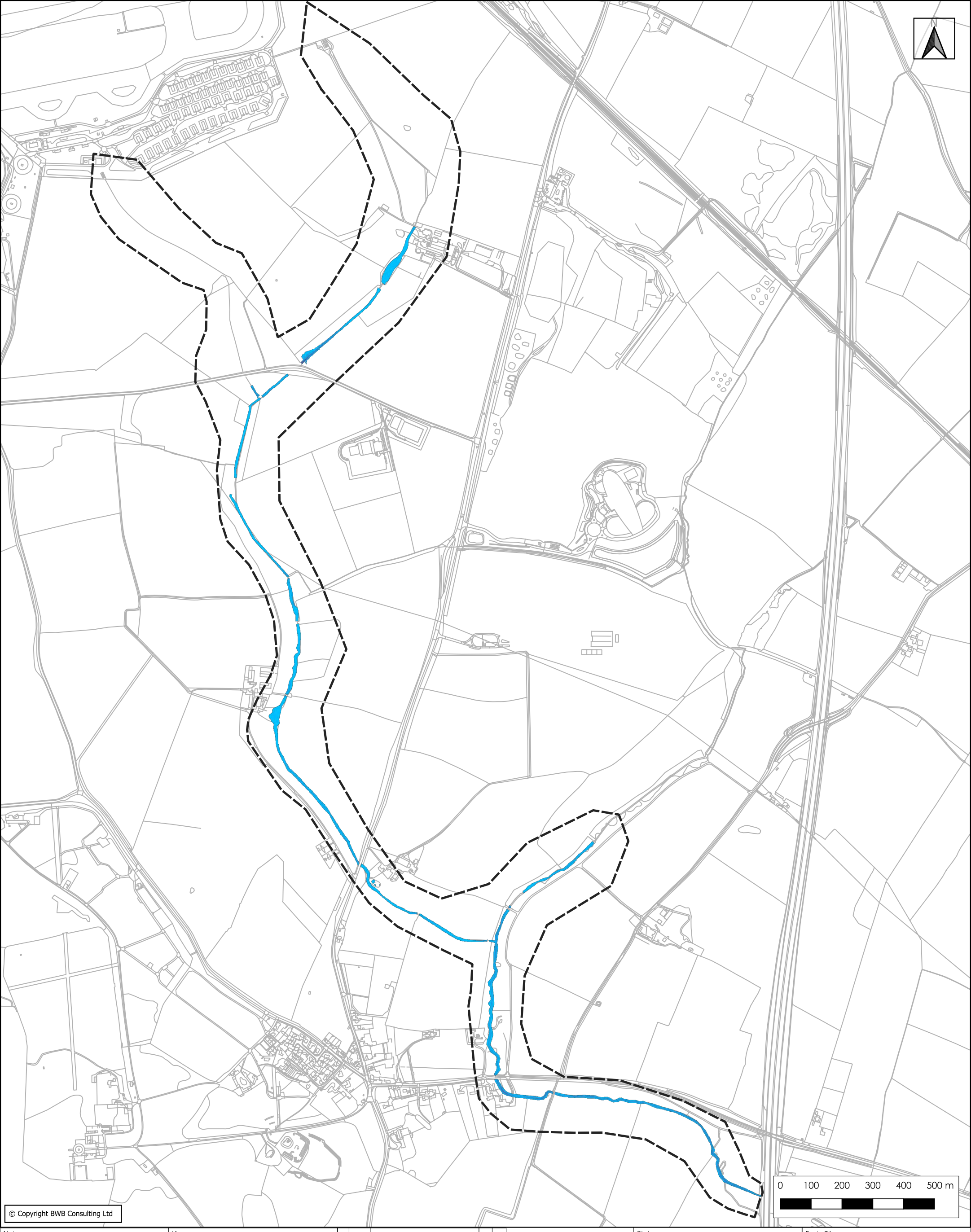
Proposed Modelled Flood Depths: 1 in 100-Year

Drawn:	[redacted]				
BWB Ref:	NTH2479	Date:	06.04.23	Scale@A3:	1:11,000

Drawing Status

PRELIMINARY

Project - Originator - Zone - Level - Type - Role - Number	Status	Rev
OXSRFI-BWB-ZZ-XX-D-W-1023	S2	P03



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Key

Model Domain

Modelled Flood Depths (m)

- <= 0.25
- 0.25 - 0.50
- 0.50 - 0.75
- 0.75 - 1.00
- 1.00 - 1.25
- > 1.25

Rev	Date	Details of issues/ revision	Drw	Rev
P03	26.03.26	Updated following EA comments	MN	LR
P02	30.07.25	Updated to include latest hydrology	MN	LR
P01	06.04.23	PRELIMINARY ISSUE	LR	MB

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Client

OxSRFI
OXFORDSHIRE
STRATEGIC RAIL FREIGHT INTERCHANGE

Project Title

Oxfordshire Railfreight Limited

Drawing Title

Proposed Modelled Flood Depths: 1 in 100-Year + 15%CC

Drawn:	[redacted]				
BWB Ref:	NTH2479	Date:	06.04.23	Scale@A3:	1:11,000

Drawing Status

PRELIMINARY

Project - Originator - Zone - Level - Type - Role - Number	Status	Rev
OXSRFI-BWB-ZZ-XX-D-W-1024	S2	P03

0 100 200 300 400 500 m

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5. Contains OS data © Licence no. 100019980.

Key

Model Domain

Modelled Flood Depths (m)

- <= 0.25
- 0.25 - 0.50
- 0.50 - 0.75
- 0.75 - 1.00
- 1.00 - 1.25
- > 1.25

Rev	Date	Details of issues/ revision	Drw	Rev
P03	26.03.26	Updated following EA comments	MN	LR
P02	30.07.25	Updated to include latest hydrology	MN	LR
P01	06.04.23	PRELIMINARY ISSUE	LR	MB

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Client

OxSRFI
OXFORDSHIRE
STRATEGIC RAIL FREIGHT INTERCHANGE

Project Title

Oxfordshire Railfreight Limited

Drawing Title

Proposed Modelled Flood Depths: 1 in 100-Year + 25%CC

Drawn:	[redacted]				
BWB Ref:	NTH2479	Date:	06.04.23	Scale@A3:	1:11,000

Drawing Status

PRELIMINARY

Project - Originator - Zone - Level - Type - Role - Number	Status	Rev
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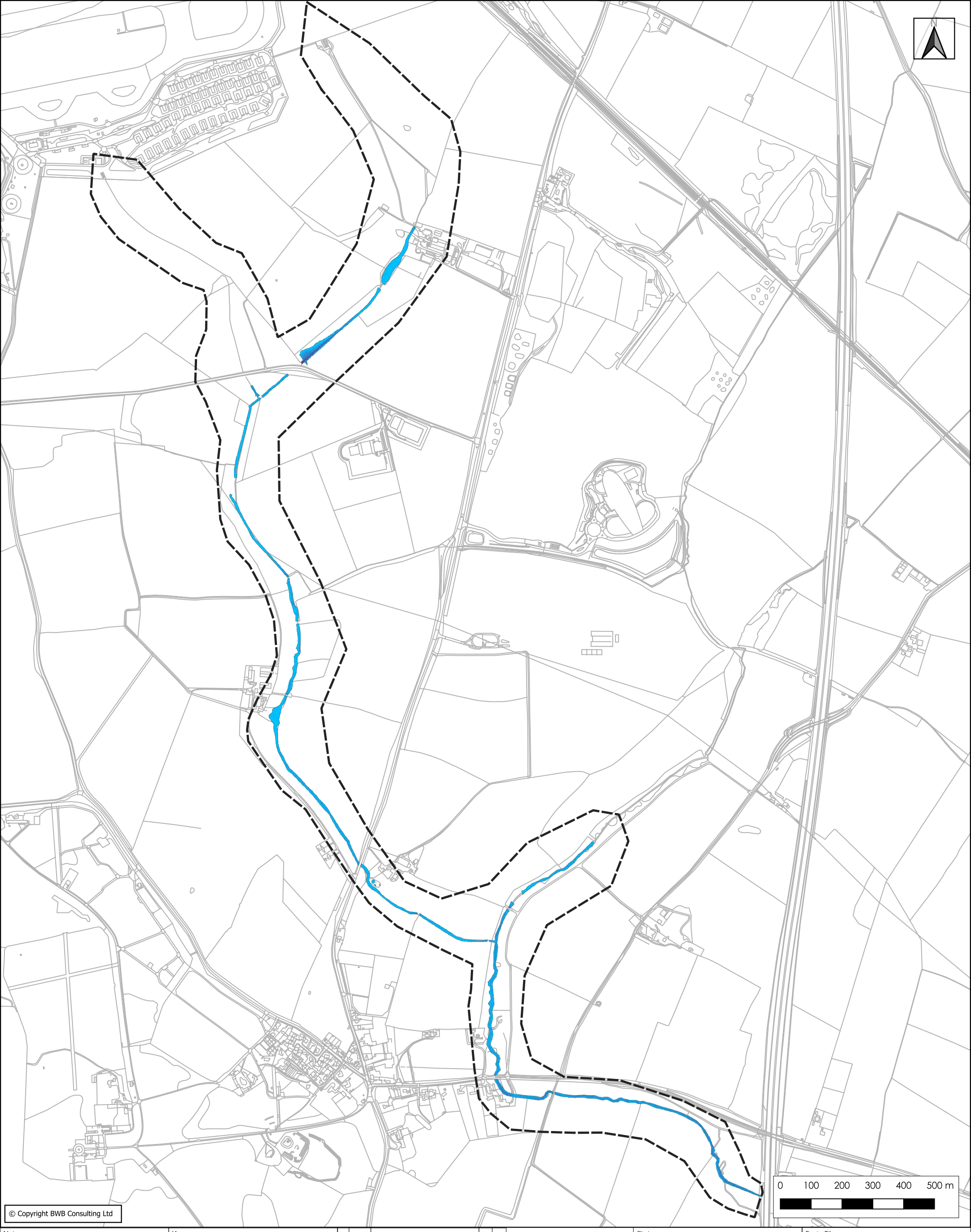

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Key

Model Domain

Modelled Flood Depths (m)

- <= 0.25
- 0.25 - 0.50
- 0.50 - 0.75
- 0.75 - 1.00
- 1.00 - 1.25
- > 1.25

Rev	Date	Details of issues/ revision	Drw	Rev
P03	26.03.26	Updated following EA comments	MN	LR
P02	30.07.25	Updated to include latest hydrology	MN	LR
P01	06.04.23	PRELIMINARY ISSUE	LR	MB

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Client

OxSRFI
OXFORDSHIRE
STRATEGIC RAIL FREIGHT INTERCHANGE

Project Title

Oxfordshire Railfreight Limited

Drawing Title

Proposed Modelled Flood Depths: 1 in 100-Year + 49%CC

Drawn:					
BWB Ref:	NTH2479	Date:	06.04.23	Scale@A3:	1:11,000

Drawing Status

PRELIMINARY

Project - Originator - Zone - Level - Type - Role - Number	Status	Rev
OXSRFI-BWB-ZZ-XX-D-W-1026	S2	P03

0 100 200 300 400 500 m

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4. Any discrepancies noted on site are to be reported to the engineer immediately.

5. Model not yet peer reviewed.

5. Contains OS data © Licence no. 100019980.

Key

Model Domain

Modelled Flood Depths (m)

- <= 0.25
- 0.25 - 0.50
- 0.50 - 0.75
- 0.75 - 1.00
- 1.00 - 1.25
- > 1.25

Rev	Date	Details of issues/ revision	Drw	Rev
P03	26.03.26	Updated following EA comments	MN	LR
P02	30.07.25	Updated to include latest hydrology	MN	LR
P01	06.04.23	PRELIMINARY ISSUE	LR	MB

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STRATEGIC RAIL FREIGHT INTERCHANGE

Project Title

Oxfordshire Railfreight Limited

Drawing Title

Proposed Modelled Flood Depths: 1 in 1000-Year

Drawn:	[redacted]				
BWB Ref:	NTH2479	Date:	06.04.23	Scale@A3:	1:11,000

Drawing Status

PRELIMINARY

Project - Originator - Zone - Level - Type - Role - Number	Status	Rev
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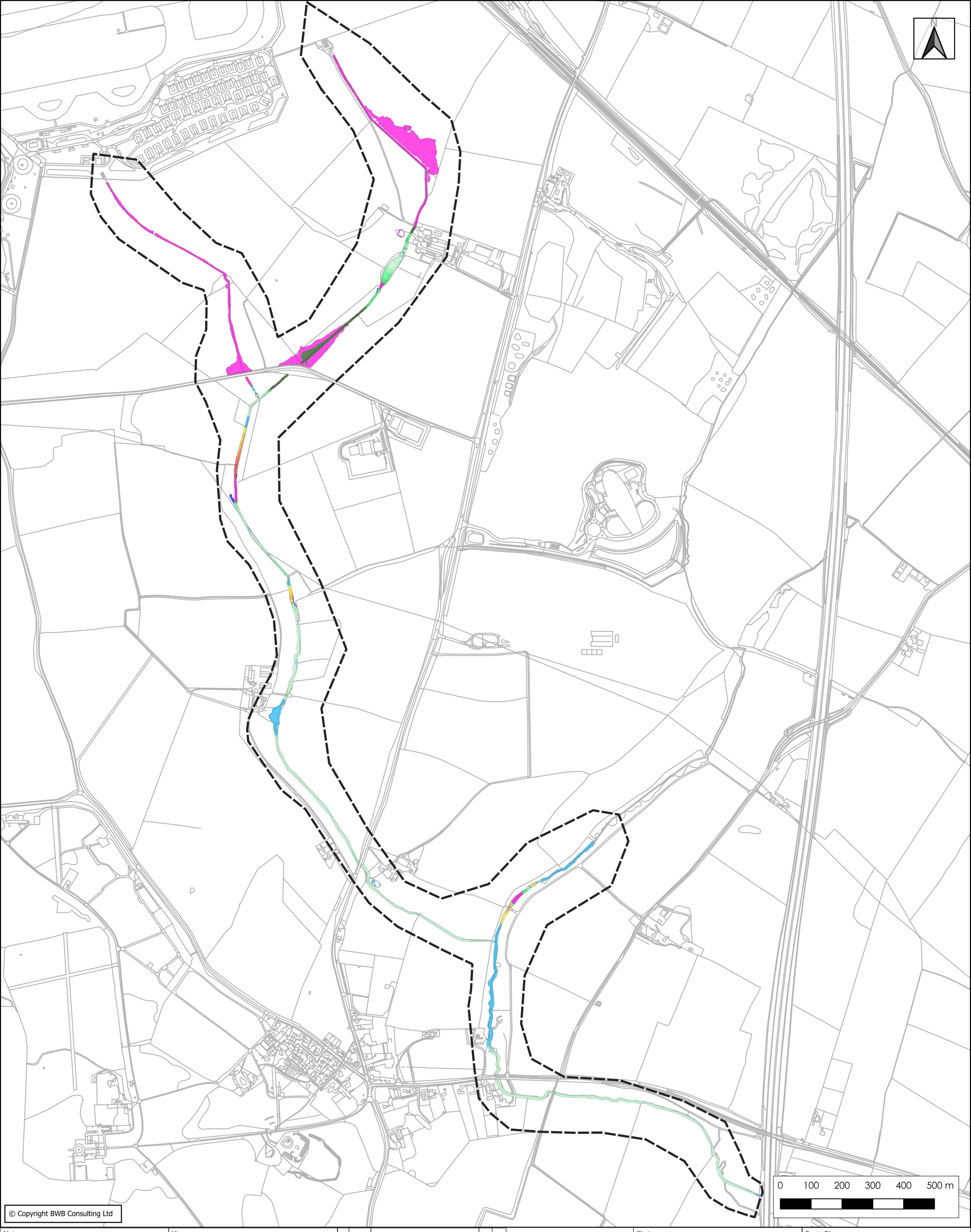
Appendix 7: Comparison Mapping



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5. Contains OS data © Licence no. 100019980.

Key

Model Domain

Change in Modelled Peak Flood Levels

- Former Wet Areas Now Dry
- Former Dry Areas Now Wet
- <= -0.125
- -0.125 - -0.100
- -0.100 - -0.075
- -0.075 - -0.050
- -0.050 - -0.025
- -0.025 - -0.01
- -0.01 - 0.01 (No Change)
- 0.01 - 0.025
- 0.025 - 0.050
- 0.050 - 0.075
- 0.075 - 0.100
- 0.100 - 0.125
- > 0.125

Rev	Date	Details of issues/ revision	Drw	Rev
P04	25.03.26	Updated following EA comments	MN	LR
P03	13.01.26	Minor Amendments	MN	LR
P02	30.07.25	Updated to include latest hydrology	MN	LR
P01	06.04.23	PRELIMINARY ISSUE	LR	MB

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OXFORDSHIRE
STRATEGIC RAIL FREIGHT INTERCHANGE

Project Title

Oxfordshire Railfreight Limited

Drawing Title

Proposed Impact Analysis: 1 in 100-Year + 25%CC

Drawn:	[redacted]				
BWB Ref:	NTH2479	Date:	06.04.23	Scale@A3:	1:11,000

Drawing Status

PRELIMINARY

Project - Originator - Zone - Level - Type - Role - Number	Status	Rev
OXSRFI-BWB-ZZ-XX-D-W-1031	S2	P04

0 100 200 300 400 500 m

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Key

Model Domain

Change in Modelled Peak Flood Levels

- Former Wet Areas Now Dry
- Former Dry Areas Now Wet
- <= -0.125
- -0.125 - -0.100
- -0.100 - -0.075
- -0.075 - -0.050
- -0.050 - -0.025
- -0.025 - -0.01
- -0.01 - 0.01 (No Change)
- 0.01 - 0.025
- 0.025 - 0.050
- 0.050 - 0.075
- 0.075 - 0.100
- 0.100 - 0.125
- > 0.125

Rev	Date	Details of issues/ revision	Drw	Rev
P04	25.03.26	Updated following EA comments	MN	LR
P03	13.01.26	Minor Amendments	MN	LR
P02	30.07.25	Updated to include latest hydrology	MN	LR
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OxSRFI OXFORDSHIRE STRATEGIC RAIL FREIGHT INTERCHANGE

Project Title

Oxfordshire Railfreight Limited

Drawing Title

Proposed Impact Analysis: 1 in 1000-Year

Drawn:	[redacted]				
BWB Ref:	NTH2479	Date:	06.04.23	Scale@A3:	1:11,000

Drawing Status

PRELIMINARY

Project - Originator - Zone - Level - Type - Role - Number	Status	Rev
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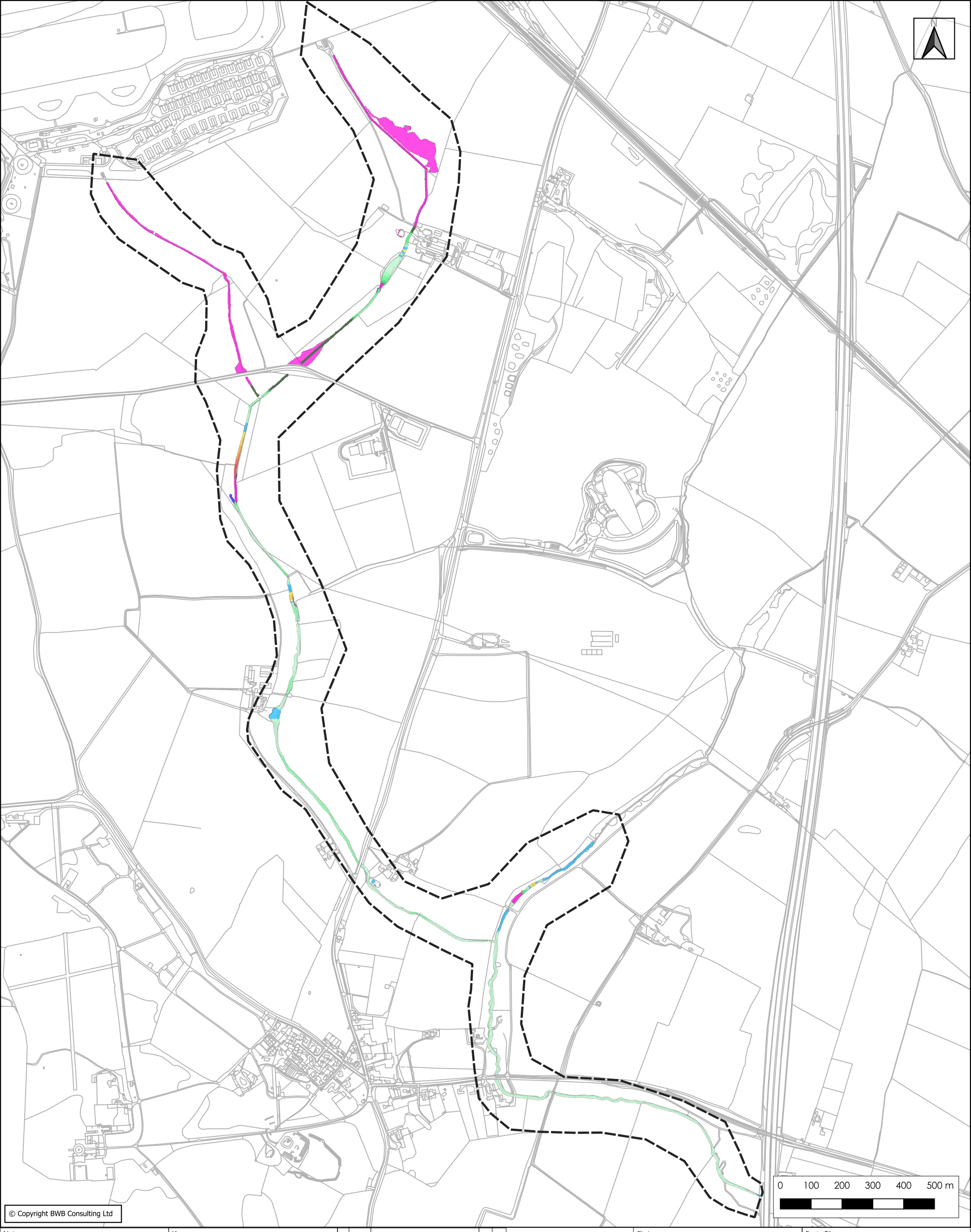

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- Former Dry Areas Now Wet
- <= -0.125
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- -0.100 - -0.075
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- -0.050 - -0.025
- -0.025 - -0.01
- -0.01 - 0.01 (No Change)
- 0.01 - 0.025
- 0.025 - 0.050
- 0.050 - 0.075
- 0.075 - 0.100
- 0.100 - 0.125
- > 0.125

Rev	Date	Details of issues/ revision	Drw	Rev
P04	25.03.26	Updated following EA comments	MN	LR
P03	13.01.26	Minor Amendments	MN	LR
P02	30.07.25	Updated to include latest hydrology	MN	LR
P01	06.04.23	PRELIMINARY ISSUE	LR	MB

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STRATEGIC RAIL FREIGHT INTERCHANGE

Project Title

Oxfordshire Railfreight Limited

Drawing Title

Proposed Impact Analysis: 1 in 30-Year

Drawn:					
BWB Ref:	NTH2479	Date:	06.04.23	Scale@A3:	1:11,000

Drawing Status

PRELIMINARY

Project - Originator - Zone - Level - Type - Role - Number	Status	Rev
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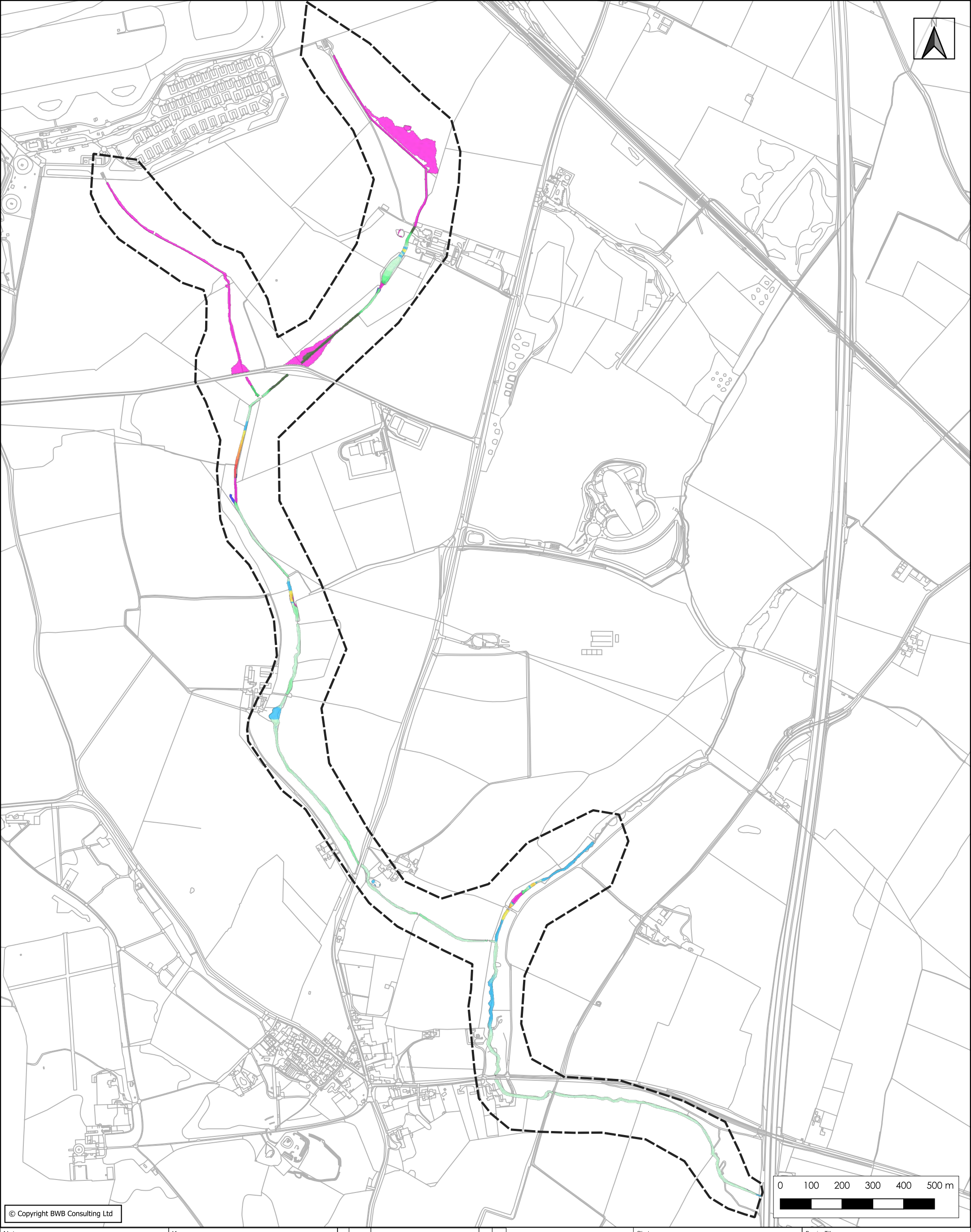

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- Former Dry Areas Now Wet
- <= -0.125
- -0.125 - -0.100
- -0.100 - -0.075
- -0.075 - -0.050
- -0.050 - -0.025
- -0.025 - -0.01
- -0.01 - 0.01 (No Change)
- 0.01 - 0.025
- 0.025 - 0.050
- 0.050 - 0.075
- 0.075 - 0.100
- 0.100 - 0.125
- > 0.125

Rev	Date	Details of issues/ revision	Drw	Rev
P04	25.03.26	Updated following EA comments	MN	LR
P03	13.01.26	Minor Amendments	MN	LR
P02	30.07.25	Updated to include latest hydrology	MN	LR
P01	06.04.23	PRELIMINARY ISSUE	LR	MB

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OxSRFI
OXFORDSHIRE
STRATEGIC RAIL FREIGHT INTERCHANGE

Project Title

Oxfordshire Railfreight Limited

Drawing Title

Proposed Impact Analysis: 1 in 100-Year

Drawn:	[redacted]				
BWB Ref:	NTH2479	Date:	06.04.23	Scale@A3:	1:11,000

Drawing Status

PRELIMINARY

Project - Originator - Zone - Level - Type - Role - Number	Status	Rev
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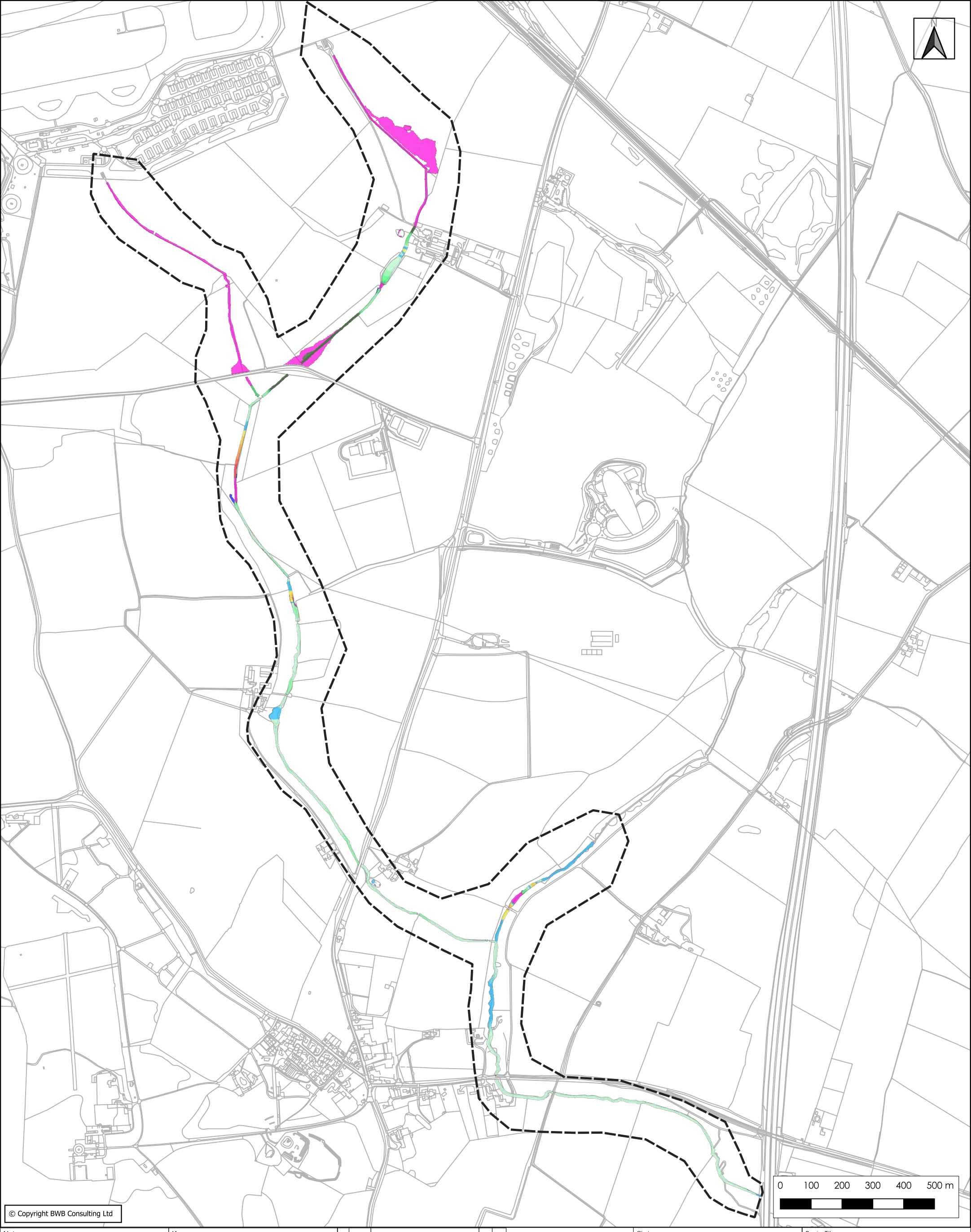

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- Former Dry Areas Now Wet
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- -0.100 - -0.075
- -0.075 - -0.050
- -0.050 - -0.025
- -0.025 - -0.01
- -0.01 - 0.01 (No Change)
- 0.01 - 0.025
- 0.025 - 0.050
- 0.050 - 0.075
- 0.075 - 0.100
- 0.100 - 0.125
- > 0.125

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P04	25.03.26	Updated following EA comments	MN	LR
P03	13.01.26	Minor Amendments	MN	LR
P02	30.07.25	Updated to include latest hydrology	MN	LR
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OXFORDSHIRE
STRATEGIC RAIL FREIGHT INTERCHANGE

Project Title

Oxfordshire Railfreight Limited

Drawing Title

Proposed Impact Analysis: 1 in 100-Year

Drawn:	[redacted]				
BWB Ref:	NTH2479	Date:	06.04.23	Scale@A3:	1:11,000

Drawing Status

PRELIMINARY

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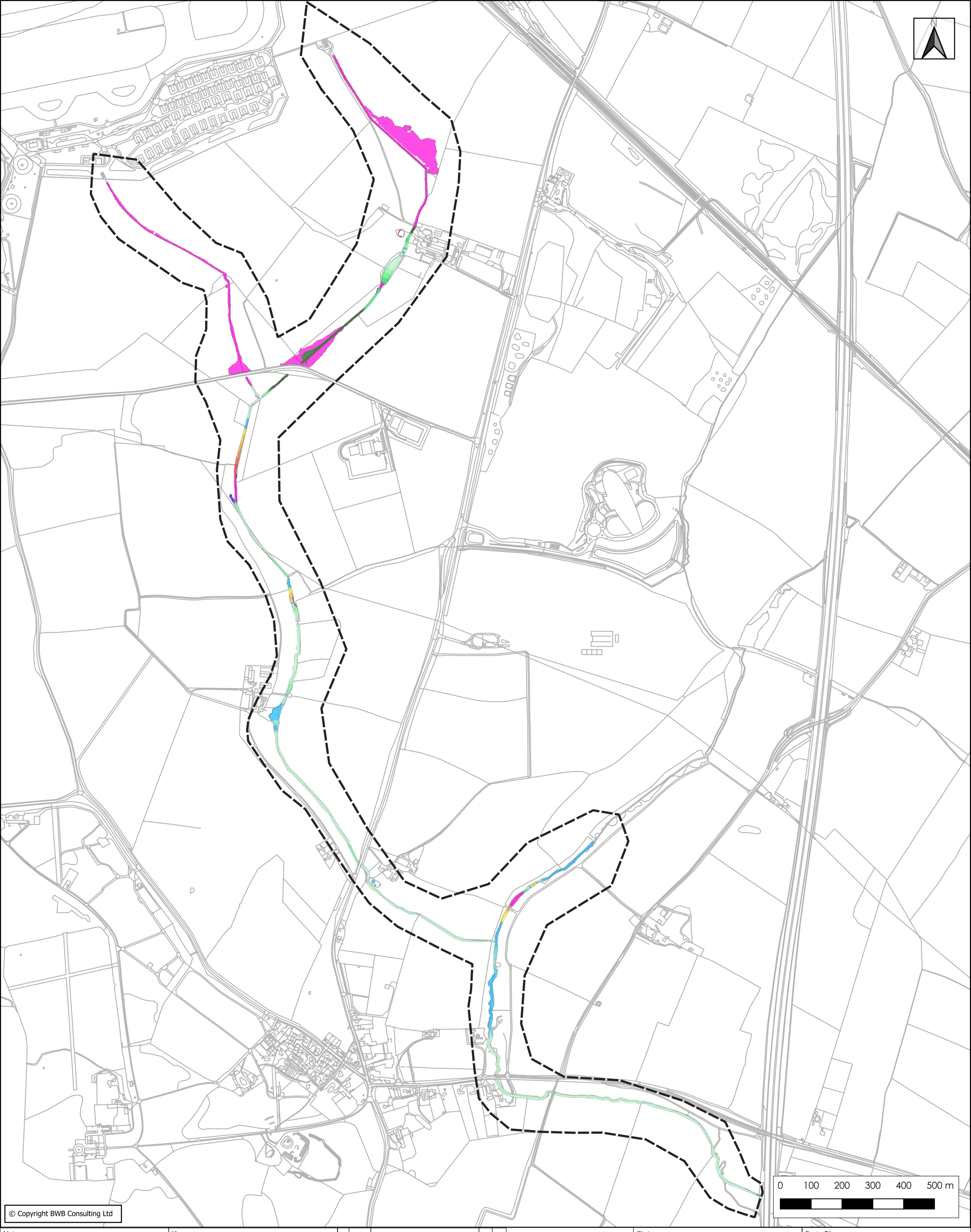

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P02	30.07.25	Updated to include latest hydrology	MN	LR
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OXFORDSHIRE
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Project Title

Oxfordshire Railfreight Limited

Drawing Title

Proposed Impact Analysis: 1 in 100-Year + 15%CC

Drawn:	[redacted]				
BWB Ref:	NTH2479	Date:	06.04.23	Scale@A3:	1:11,000

Drawing Status

PRELIMINARY

Project - Originator - Zone - Level - Type - Role - Number	Status	Rev
OXSRFI-BWB-ZZ-XX-D-W-1030	S2	P04

0 100 200 300 400 500 m

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- Former Dry Areas Now Wet
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- -0.125 - -0.100
- -0.100 - -0.075
- -0.075 - -0.050
- -0.050 - -0.025
- -0.025 - -0.01
- -0.01 - 0.01 (No Change)
- 0.01 - 0.025
- 0.025 - 0.050
- 0.050 - 0.075
- 0.075 - 0.100
- 0.100 - 0.125
- > 0.125

Rev	Date	Details of issues/ revision	Drw	Rev
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P03	13.01.26	Minor Amendments	MN	LR
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P01	06.04.23	PRELIMINARY ISSUE	LR	MB

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OxSRFI OXFORDSHIRE STRATEGIC RAIL FREIGHT INTERCHANGE

Project Title

Oxfordshire Railfreight Limited

Drawing Title

Proposed Impact Analysis: 1 in 100-Year + 49%CC

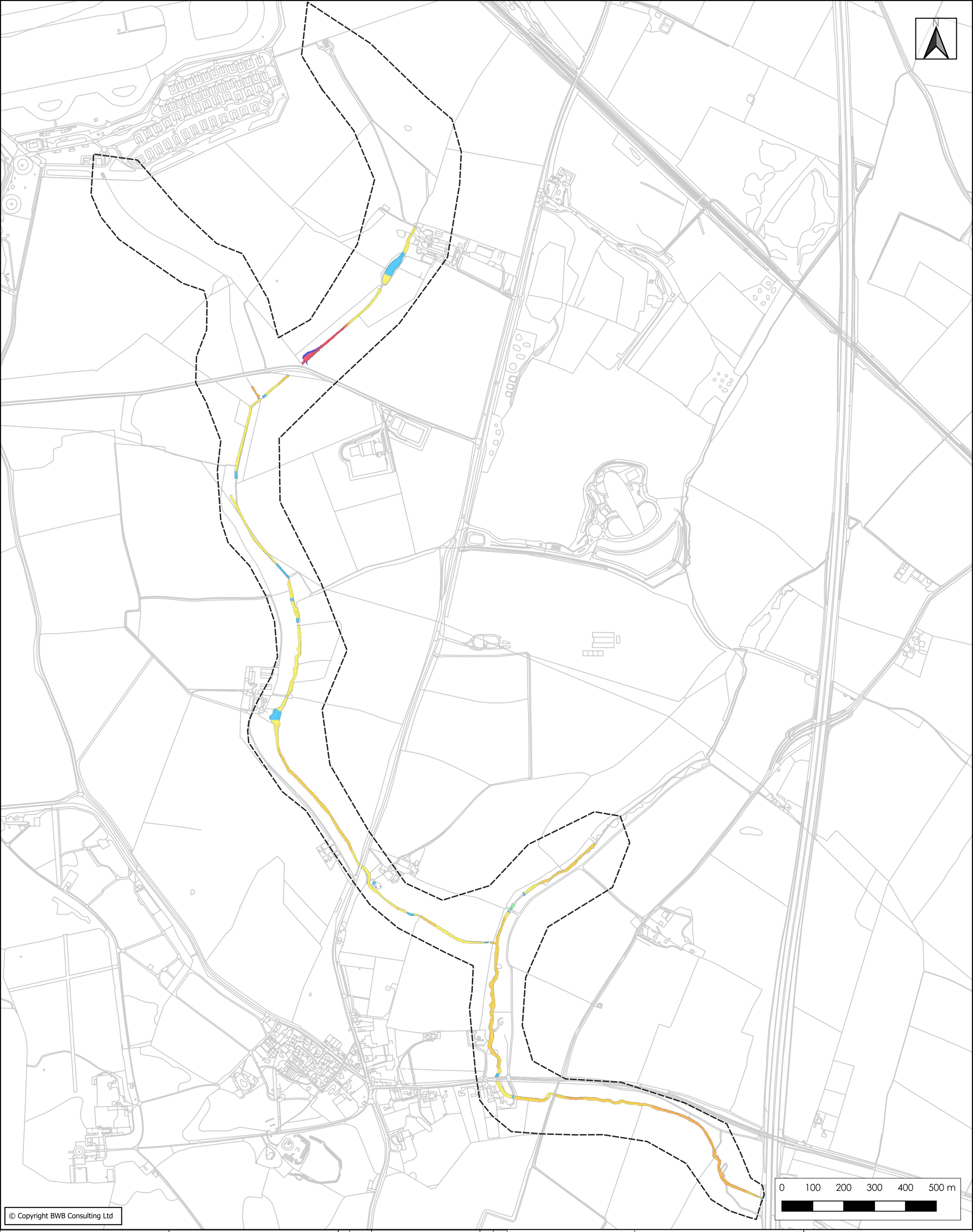
Drawn:	[redacted]				
BWB Ref:	NTH2479	Date:	06.04.23	Scale@A3:	1:11,000

Drawing Status

PRELIMINARY

Project - Originator - Zone - Level - Type - Role - Number	Status	Rev
OXSRFI-BWB-ZZ-XX-D-W-1032	S2	P04

Appendix 8: Sensitivity Testing



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3. All dimensions in millimetres unless noted otherwise. All levels in metres unless noted otherwise.

4. Any discrepancies noted on site are to be reported to the engineer immediately.

5. Model not yet peer reviewed.

5. Contains OS data © Licence no. 100019980.

Key

Model Domain

Change in Modelled Floodplain Extent

Former Wet Areas Now Dry

Former Dry Areas Now Wet

Change in Modelled Peak Flood Level (m)

<= -0.125

-0.125 - -0.100

-0.100 - -0.075

-0.075 - -0.050

-0.050 - -0.025

-0.025 - -0.01

-0.01 - 0.01 (No Change)

0.01 - 0.025

0.025 - 0.050

0.050 - 0.075

0.075 - 0.100

0.100 - 0.125

> 0.125

Rev	Date	Details of issues/ revision	Drw	Rev
P03	25.03.26	Update following EA comments	MN	LR
P02	26.08.25	UPDATED HYDROLOGY AND SOFTWARE	MN	LR
P01	06.04.23	PRELIMINARY ISSUE	LR	MB

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Client

OxSRFI
OXFORDSHIRE
STRATEGIC RAIL FREIGHT INTERCHANGE

Project Title

Oxfordshire Railfreight Limited

Drawing Title

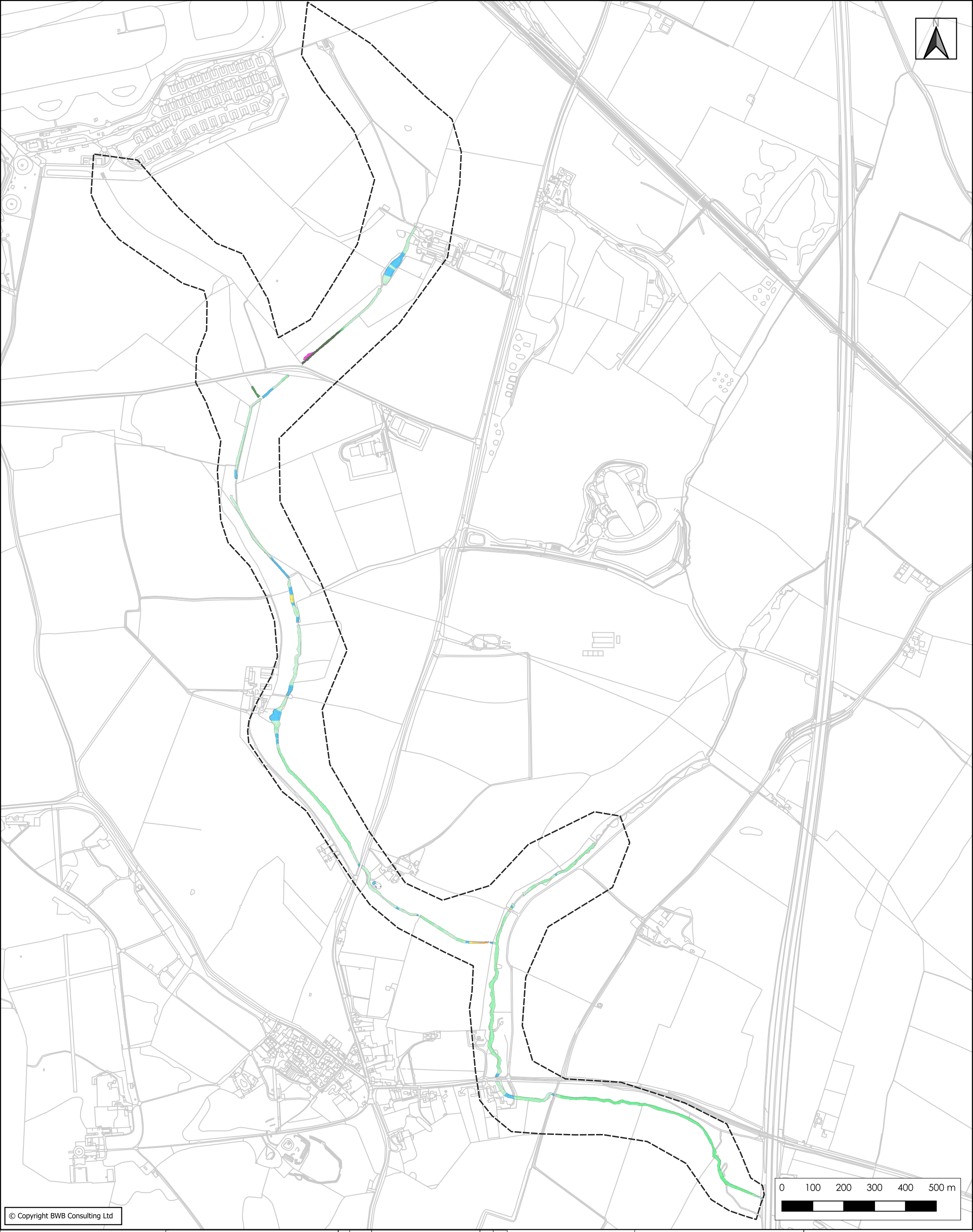
Gagle Brook - Post-Development Sensitivity: Increased Roughness (20%) 1 in 100-Year

Drawn:	[redacted]				
BWB Ref:	NTH2479	Date:	06.04.23	Scale@A3:	1:11,000

Drawing Status

PRELIMINARY

Project - Originator - Zone - Level - Type - Role - Number	Status	Rev
OXSRFI-BWB-ZZ-XX-D-W-1040	S2	P03



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5. Contains OS data © Licence no. 100019980.

Key

Model Domain

Change in Modelled Floodplain Extent

Former Wet Areas Now Dry

Former Dry Areas Now Wet

Change in Modelled Peak Flood Level (m)

<= -0.125

-0.125 - -0.100

-0.100 - -0.075

-0.075 - -0.050

-0.050 - -0.025

-0.025 - -0.01

-0.01 - 0.01 (No Change)

0.01 - 0.025

0.025 - 0.050

0.050 - 0.075

0.075 - 0.100

0.100 - 0.125

> 0.125

Rev	Date	Details of issues/ revision	Drw	Rev
P03	25.03.26	Updated following EA comments	MN	LR
P02	26.08.25	UPDATED HYDROLOGY AND SOFTWARE	MN	LR
P01	06.04.23	PRELIMINARY ISSUE	LR	MB

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Client

OxSRFI
OXFORDSHIRE
STRATEGIC RAIL FREIGHT INTERCHANGE

Project Title

Oxfordshire Railfreight Limited

Drawing Title

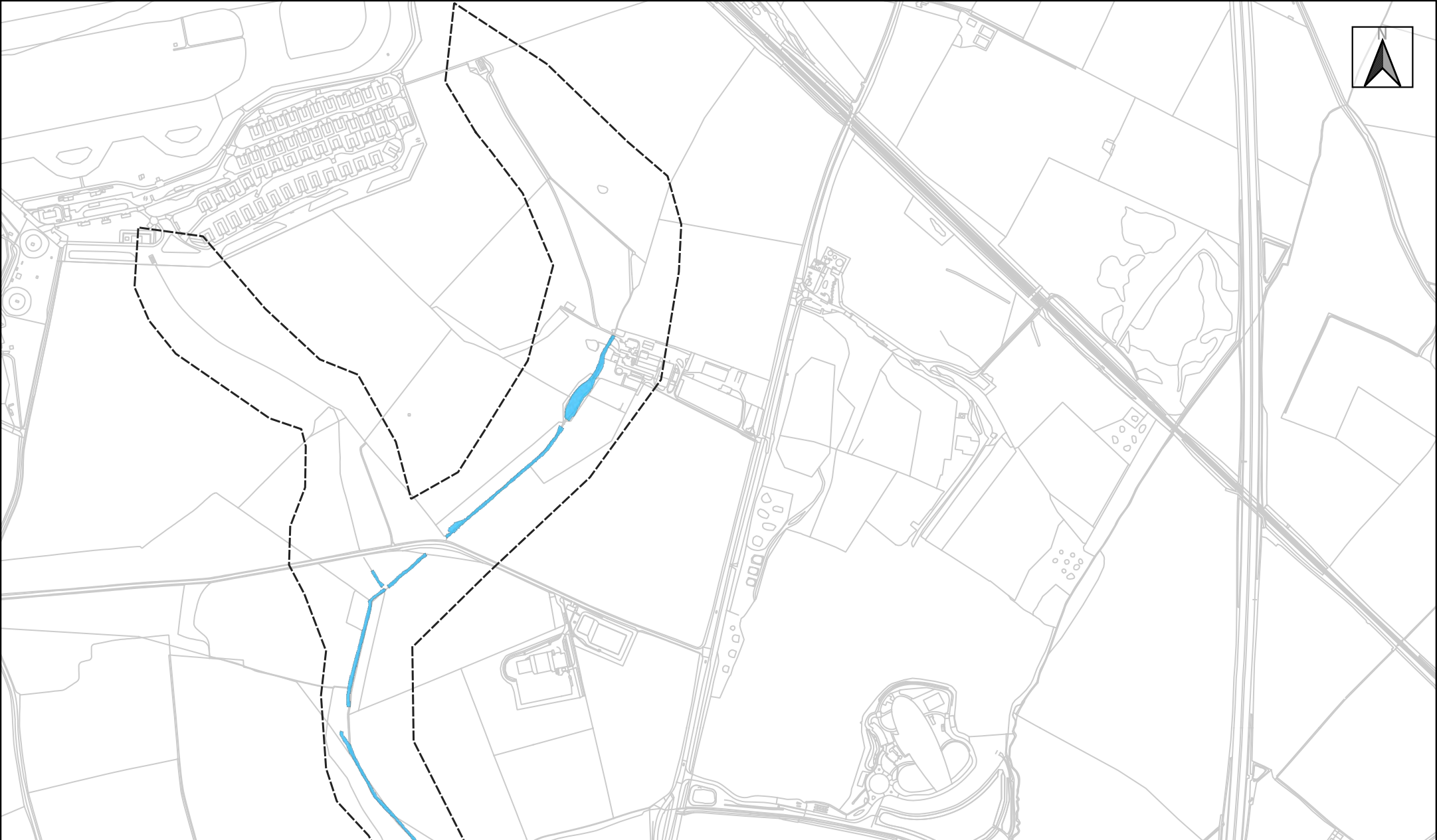
Gagle Brook - Post-Development Sensitivity: Decreased Roughness (20%) 1 in 100-Year

Drawn:	[redacted]				
BWB Ref:	NTH2479	Date:	06.04.23	Scale@A3:	1:11,000

Drawing Status

PRELIMINARY

Project - Originator - Zone - Level - Type - Role - Number	Status	Rev
OXSRFI-BWB-ZZ-XX-D-W-1041	S2	P03



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Key

Model Domain

Change in Modelled Floodplain Extent

- Former Wet Areas Now Dry
- Former Dry Areas Now Wet

Change in Modelled Peak Flood Level (m)

- <= -0.125
- -0.125 - -0.100
- -0.100 - -0.075
- -0.075 - -0.050
- -0.050 - -0.025
- -0.025 - -0.01
- -0.01 - 0.01 (No Change)
- 0.01 - 0.025
- 0.025 - 0.050
- 0.050 - 0.075
- 0.075 - 0.100
- 0.100 - 0.125
- > 0.125

Rev	Date	Details of issues/ revision	Drw	Rev
P03	25.03.26	Updated following EA comments	MN	LR
P02	26.08.25	UPDATED HYDROLOGY AND SOFTWARE	MN	LR
P01	06.04.23	PRELIMINARY ISSUE	LR	MB

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Client

OxSRFI OXFORDSHIRE STRATEGIC RAIL FREIGHT INTERCHANGE

Project Title

Oxfordshire Railfreight Limited

Drawing Title

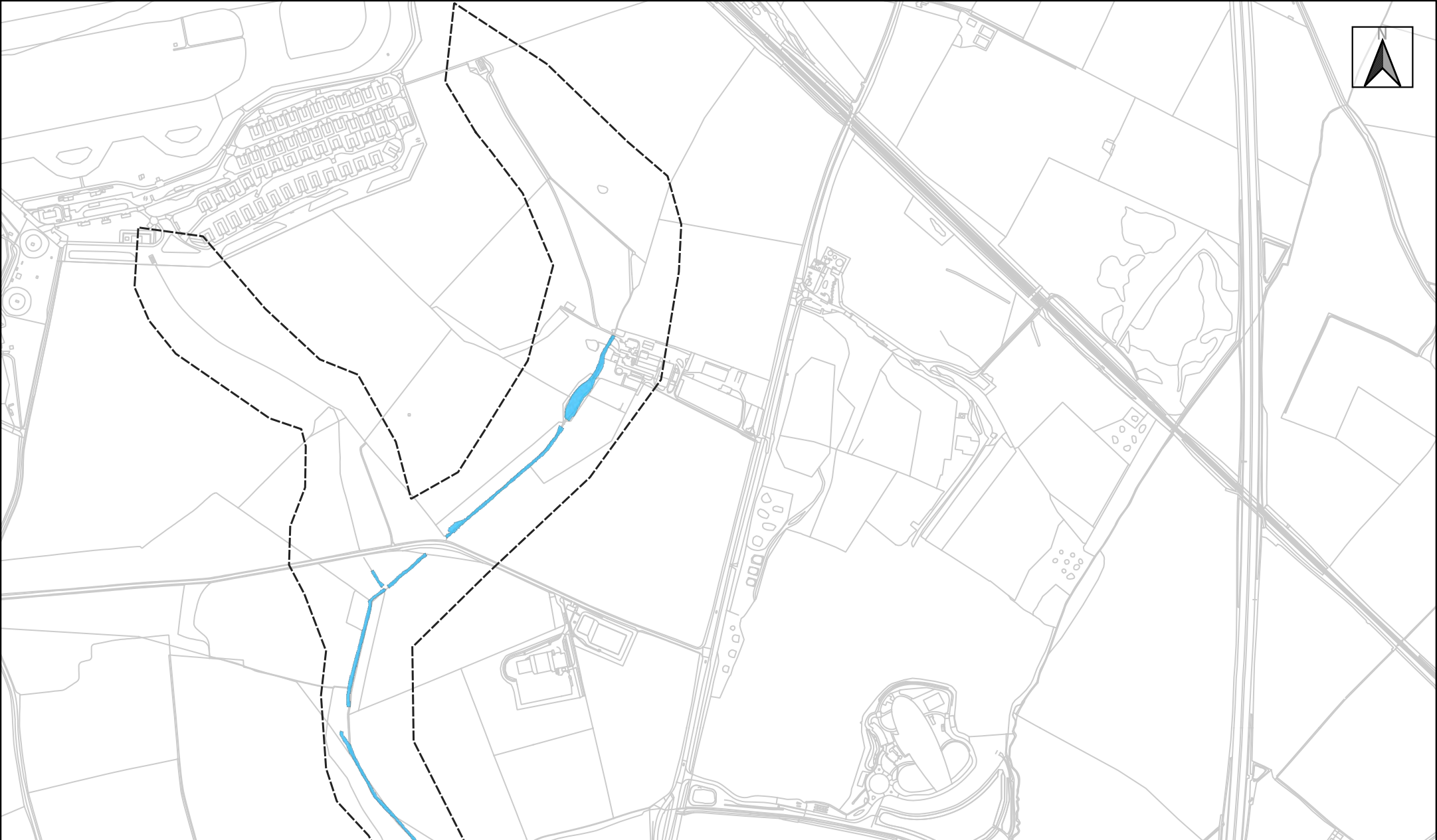
Gagle Brook - Post-Development Sensitivity: Increased Downsteam Boundary (20%) 1 in 100-Year

Drawn:	[redacted]				
BWB Ref:	NTH2479	Date:	06.04.23	Scale@A3:	1:11,000

Drawing Status

PRELIMINARY

Project - Originator - Zone - Level - Type - Role - Number	Status	Rev
OXSRFI-BWB-ZZ-XX-D-W-1042	S2	P03



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5. Contains OS data © Licence no. 100019980.

Key

- Model Domain

Change in Modelled Floodplain Extents

- Former Wet Areas Now Dry
- Former Dry Areas Now Wet

Change in Modelled Peak Flood Level (m)

- <= -0.125
- -0.125 - -0.100
- -0.100 - -0.075
- -0.075 - -0.050
- -0.050 - -0.025
- -0.025 - -0.01
- -0.01 - 0.01 (No Change)
- 0.01 - 0.025
- 0.025 - 0.050
- 0.050 - 0.075
- 0.075 - 0.100
- 0.100 - 0.125
- > 0.125

Rev	Date	Details of issues/ revision	Drw	Rev
P03	25.03.26	Updated following EA comments	MN	LR
P02	26.08.25	UPDATED HYDROLOGY AND SOFTWARE	MN	LR
P01	06.04.23	PRELIMINARY ISSUE	LR	MB

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Client

OxSRFI
OXFORDSHIRE
STRATEGIC RAIL FREIGHT INTERCHANGE

Project Title

Oxfordshire Railfreight Limited

Drawing Title

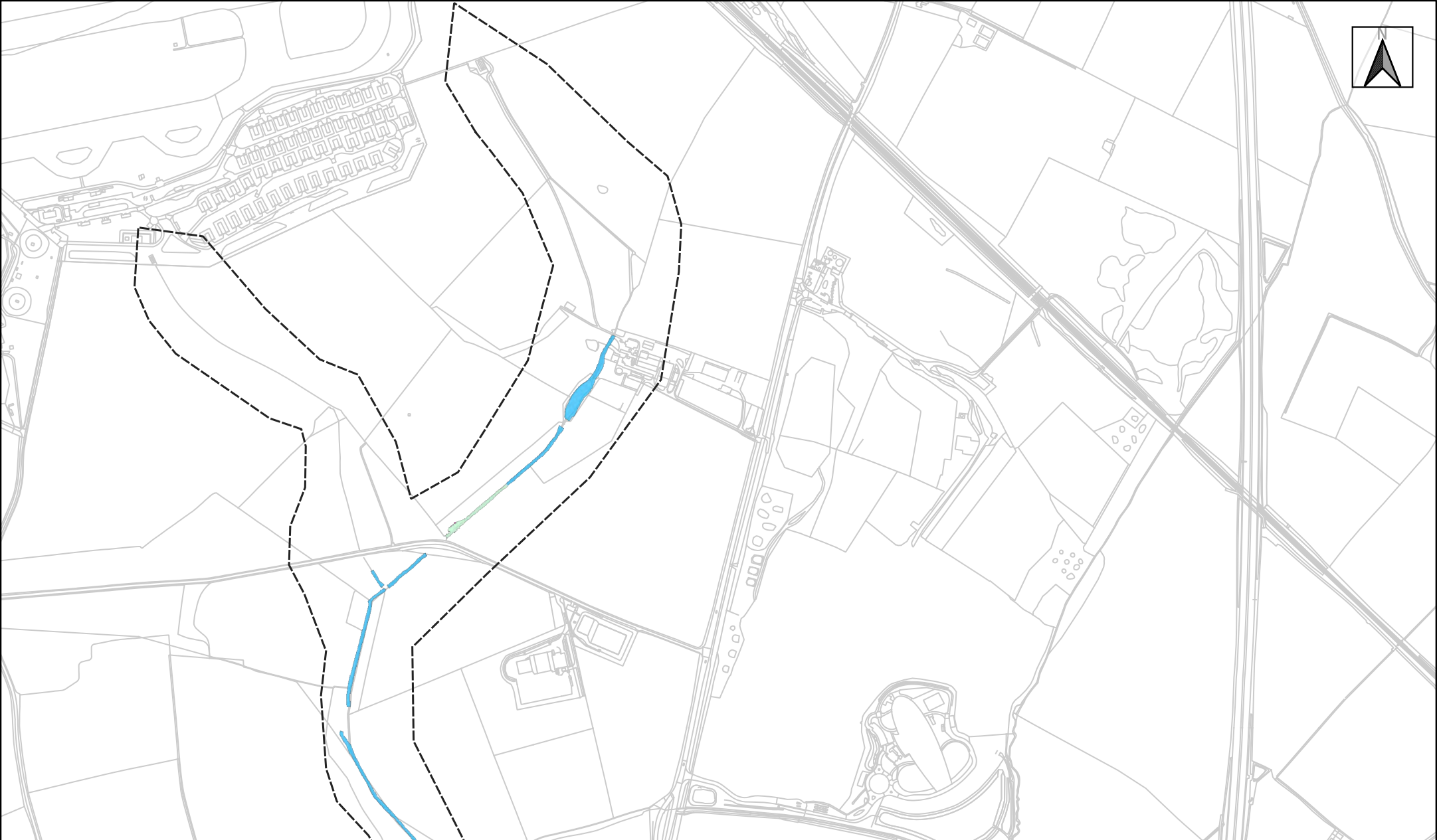
Gagle Brook - Post-Development Sensitivity: Decreased Downsteam Boundary (20%) 1 in 100-Year

Drawn:	[redacted]				
BWB Ref:	NTH2479	Date:	06.04.23	Scale@A3:	1:11,000

Drawing Status

PRELIMINARY

Project - Originator - Zone - Level - Type - Role - Number	Status	Rev
OXSRFI-BWB-ZZ-XX-D-W-1043	S2	P03



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5. Model not yet peer reviewed.

5. Contains OS data © Licence no. 100019980.

Key

Model Domain

Change in Modelled Floodplain Extents

Former Wet Areas Now Dry

Former Dry Areas Now Wet

Change in Modelled Peak Flood Level (m)

<= -0.125

-0.125 - -0.100

-0.100 - -0.075

-0.075 - -0.050

-0.050 - -0.025

-0.025 - -0.01

-0.01 - 0.01 (No Change)

0.01 - 0.025

0.025 - 0.050

0.050 - 0.075

0.075 - 0.100

0.100 - 0.125

> 0.125

Rev	Date	Details of issues/ revision	Drw	Rev
P03	25.03.26	Updated following EA comments	MN	LR
P02	26.08.25	UPDATED HYDROLOGY AND SOFTWARE	MN	LR
P01	06.04.23	PRELIMINARY ISSUE	LR	MB

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OxSRFI
OXFORDSHIRE
STRATEGIC RAIL FREIGHT INTERCHANGE

Project Title

Oxfordshire Railfreight Limited

Drawing Title

Gagle Brook - Post-Development Sensitivity: Storm Duration (7.5hr) 1 in 100-Year

Drawn:	[redacted]				
BWB Ref:	NTH2479	Date:	06.04.23	Scale@A3:	1:11,000

Drawing Status

PRELIMINARY

Project - Originator - Zone - Level - Type - Role - Number	Status	Rev
OXSRFI-BWB-ZZ-XX-D-W-1044	S2	P03



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5. Model not yet peer reviewed.

5. Contains OS data © Licence no. 100019980.

Key

Model Domain

Change in Modelled Floodplain Extent

- Former Wet Areas Now Dry
- Former Dry Areas Now Wet

Change in Modelled Peak Flood Level (m)

- <= -0.125
- -0.125 - -0.100
- -0.100 - -0.075
- -0.075 - -0.050
- -0.050 - -0.025
- -0.025 - -0.01
- -0.01 - 0.01 (No Change)
- 0.01 - 0.025
- 0.025 - 0.050
- 0.050 - 0.075
- 0.075 - 0.100
- 0.100 - 0.125
- > 0.125

Rev	Date	Details of issues/ revision	Drw	Rev
P03	25.03.26	Updated following EA comments	MN	LR
P02	26.08.25	UPDATED HYDROLOGY AND SOFTWARE	MN	LR
P01	06.04.23	PRELIMINARY ISSUE	LR	MB

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Client

OxSRFI OXFORDSHIRE STRATEGIC RAIL FREIGHT INTERCHANGE

Project Title

Oxfordshire Railfreight Limited

Drawing Title

Gagle Brook - Post-Development Sensitivity: Blockage 1 1 in 100-Year

Drawn:	[redacted]				
BWB Ref:	NTH2479	Date:	06.04.23	Scale@A3:	1:11,000

Drawing Status

PRELIMINARY

Project - Originator - Zone - Level - Type - Role - Number	Status	Rev
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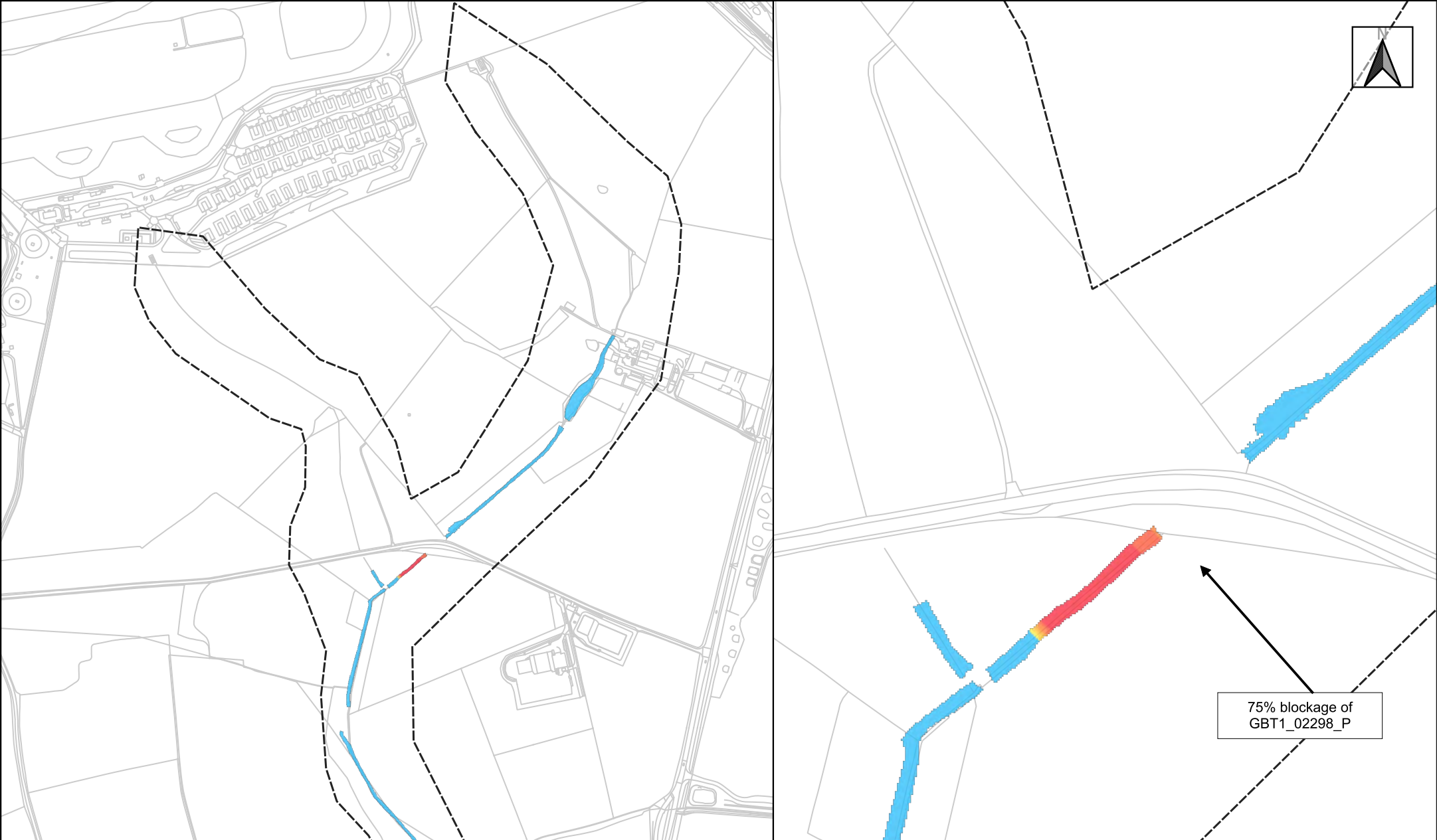

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5. Model not yet peer reviewed.

5. Contains OS data © Licence no. 100019980.

Key

Model Domain

Change in Modelled Floodplain Extents

Former Wet Areas Now Dry

Former Dry Areas Now Wet

Change in Modelled Peak Flood Level (m)

<= -0.125

-0.125 - -0.100

-0.100 - -0.075

-0.075 - -0.050

-0.050 - -0.025

-0.025 - -0.01

-0.01 - 0.01 (No Change)

0.01 - 0.025

0.025 - 0.050

0.050 - 0.075

0.075 - 0.100

0.100 - 0.125

> 0.125

Rev	Date	Details of issues/ revision	Drw	Rev
P03	25.03.26	Updated following EA comments	MN	LR
P02	26.08.25	UPDATED HYDROLOGY AND SOFTWARE	MN	LR
P01	06.04.23	PRELIMINARY ISSUE	LR	MB

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OxSRFI
OXFORDSHIRE
STRATEGIC RAIL FREIGHT INTERCHANGE

Project Title

Oxfordshire Railfreight Limited

Drawing Title

Gagle Brook - Post-Development Sensitivity: Blockage 2 1 in 100-Year

Drawn:	[redacted]				
BWB Ref:	NTH2479	Date:	06.04.23	Scale@A3:	1:11,000

Drawing Status

PRELIMINARY

Project - Originator - Zone - Level - Type - Role - Number	Status	Rev
OXSRFI-BWB-ZZ-XX-D-W-1047	S2	P03



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Key

Model Domain

Change in Modelled Floodplain Extents

Former Wet Areas Now Dry

Former Dry Areas Now Wet

Change in Modelled Peak Flood Level (m)

<= -0.125

-0.125 - -0.100

-0.100 - -0.075

-0.075 - -0.050

-0.050 - -0.025

-0.025 - -0.01

-0.01 - 0.01 (No Change)

0.01 - 0.025

0.025 - 0.050

0.050 - 0.075

0.075 - 0.100

0.100 - 0.125

> 0.125

Rev	Date	Details of issues/ revision	Drw	Rev
P03	25.03.26	Updated following EA comments	MN	LR
P02	26.08.25	UPDATED HYDROLOGY AND SOFTWARE	MN	LR
P01	06.04.23	PRELIMINARY ISSUE	LR	MB

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Client

OxSRFI
OXFORDSHIRE
STRATEGIC RAIL FREIGHT INTERCHANGE

Project Title

Oxfordshire Railfreight Limited

Drawing Title

Gagle Brook - Post-Development Sensitivity: Blockage 3 1 in 100-Year

Drawn:	[redacted]				
BWB Ref:	NTH2479	Date:	06.04.23	Scale@A3:	1:11,000

Drawing Status

PRELIMINARY

Project - Originator - Zone - Level - Type - Role - Number	Status	Rev
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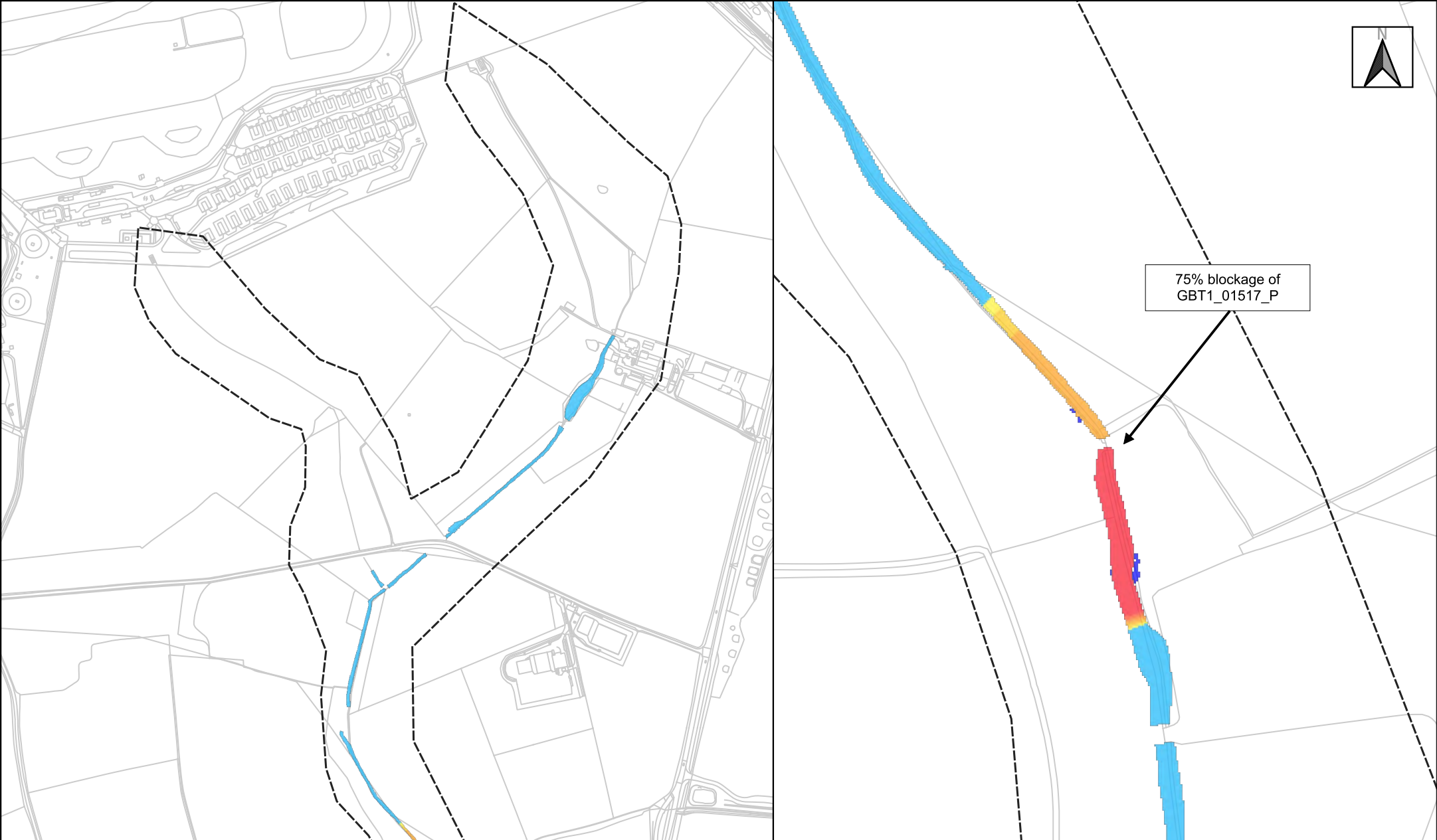

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Key

- Model Domain

Change in Modelled Floodplain Extents

- Former Wet Areas Now Dry
- Former Dry Areas Now Wet

Change in Modelled Peak Flood Level (m)

- <= -0.125
- -0.125 - -0.100
- -0.100 - -0.075
- -0.075 - -0.050
- -0.050 - -0.025
- -0.025 - -0.01
- -0.01 - 0.01 (No Change)
- 0.01 - 0.025
- 0.025 - 0.050
- 0.050 - 0.075
- 0.075 - 0.100
- 0.100 - 0.125
- > 0.125

Rev	Date	Details of issues/ revision	Drw	Rev
P03	25.03.26	Updated following EA comments	MN	LR
P02	26.08.25	UPDATED HYDROLOGY AND SOFTWARE	MN	LR
P01	06.04.23	PRELIMINARY ISSUE	LR	MB

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Client

OxSRFI
OXFORDSHIRE
STRATEGIC RAIL FREIGHT INTERCHANGE

Project Title

Oxfordshire Railfreight Limited

Drawing Title

Gagle Brook - Post-Development Sensitivity: Blockage 4 1 in 100 Year

Drawn:	[redacted]				
BWB Ref:	NTH2479	Date:	06.04.23	Scale@A3:	1:11,000

Drawing Status

PRELIMINARY

Project - Originator - Zone - Level - Type - Role - Number	Status	Rev
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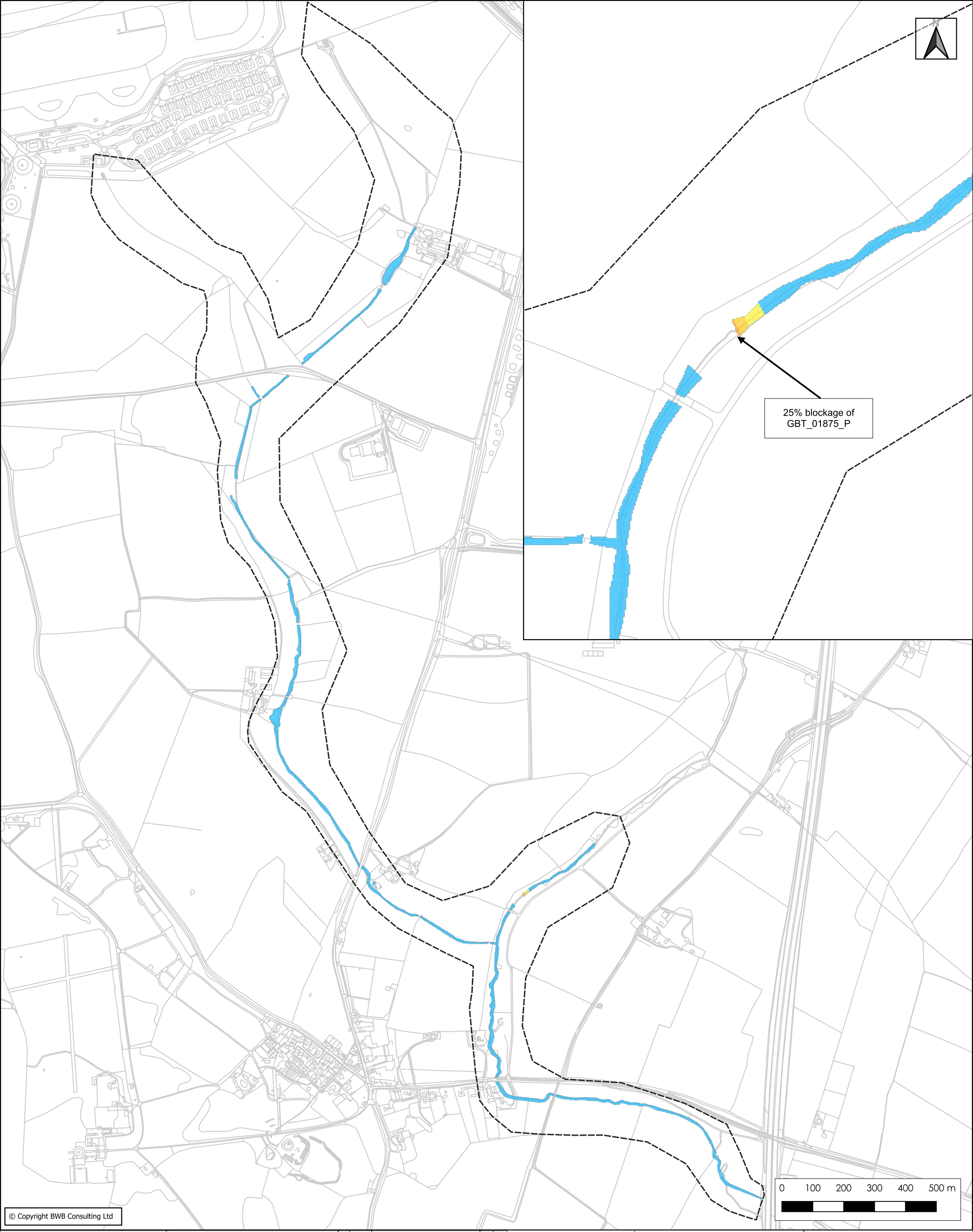

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Key

Model Domain

Change in Modelled Floodplain Extent

- Former Wet Areas Now Dry
- Former Dry Areas Now Wet

Change in Modelled Peak Flood Level (m)

- <= -0.125
- -0.125 - -0.100
- -0.100 - -0.075
- -0.075 - -0.050
- -0.050 - -0.025
- -0.025 - -0.01
- -0.01 - 0.01 (No Change)
- 0.01 - 0.025
- 0.025 - 0.050
- 0.050 - 0.075
- 0.075 - 0.100
- 0.100 - 0.125
- > 0.125

Rev	Date	Details of issues/ revision	Drw	Rev
P03	25.03.26	Updated following EA comments	MN	LR
P02	26.08.25	UPDATED HYDROLOGY AND SOFTWARE	MN	LR
P01	06.04.23	PRELIMINARY ISSUE	LR	MB

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Client

OxSRFI OXFORDSHIRE STRATEGIC RAIL FREIGHT INTERCHANGE

Project Title

Oxfordshire Railfreight Limited

Drawing Title

Gagle Brook - Post-Development Sensitivity: Blockage 5 1 in 100-Year

Drawn:	[redacted]				
BWB Ref:	NTH2479	Date:	06.04.23	Scale@A3:	1:11,000

Drawing Status

PRELIMINARY

Project - Originator - Zone - Level - Type - Role - Number	Status	Rev
OXSRFI-BWB-ZZ-XX-D-W-1050	S2	P03

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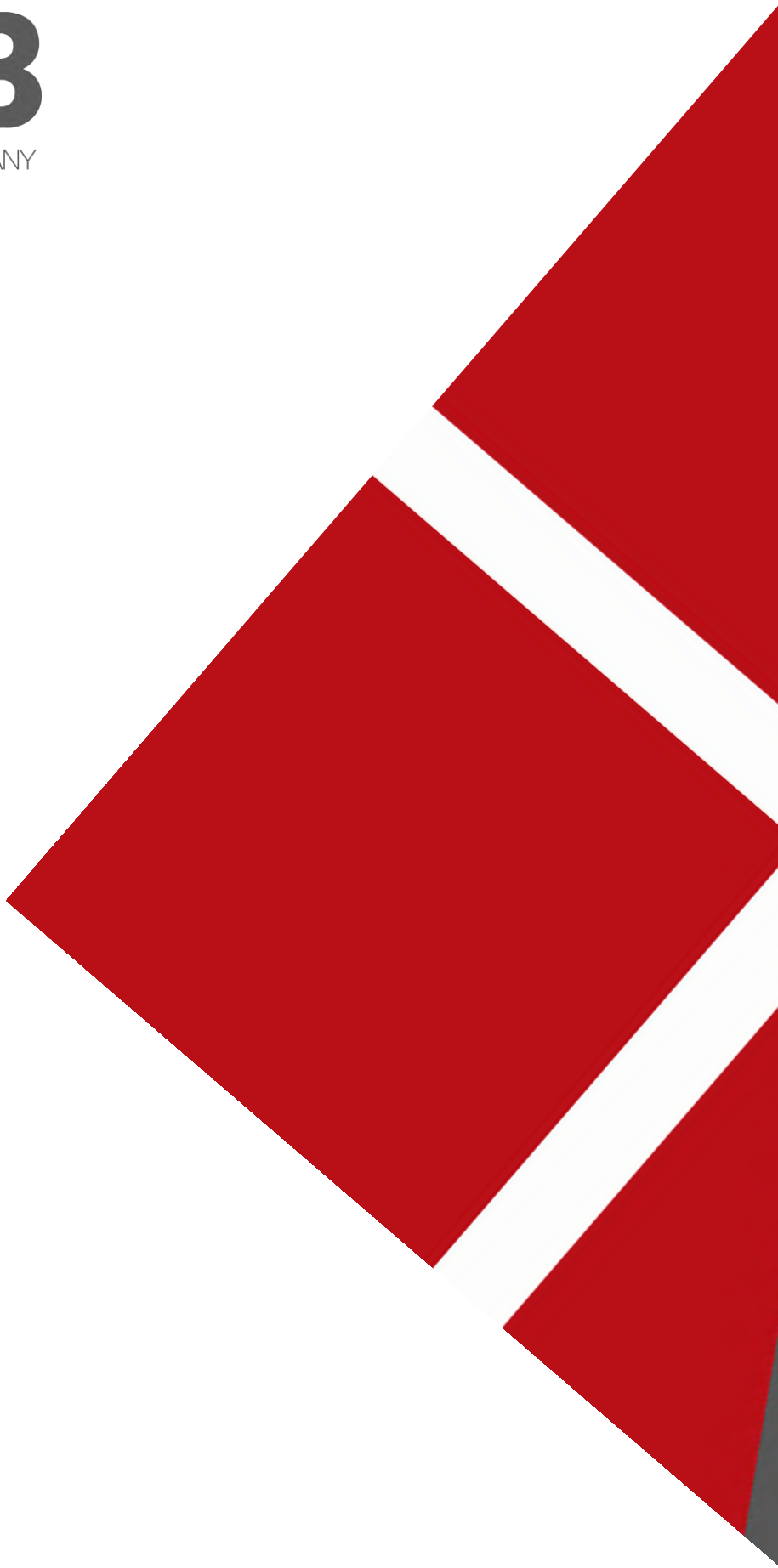

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October 2026

DOCUMENT ISSUE RECORD

Document Number:	OXSRFI-BWB-ZZ-XX-T-W-1005_HMR
BWB Reference:	NTH2479_PBT_HMR

Rev	Date	Status	Comment
P01	29/08/25	S2	Preliminary Issue
P02	21/10/26	S2	Updated to reflect EA review



Notice

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GLOSSARY & NOTATION

1D – one-dimensional hydraulic model, good for representing the hydraulics of a definitive channel or flow pathway and hydraulic structure.

2D – two-dimensional hydraulic model, good for representing complex flow routing present within the floodplain.

Annual Exceedance Probability (AEP) - the probability (%) of a flood event occurring in any year.

Catchment - the land area that drains (normally naturally) to a given point on a river, drainage system or body of water.

CME – Cumulative Mass Error

Design flood event - magnitude of the flood adopted for the design of the whole or part of a development, usually defined in relation to the severity of the flood in terms of its return period. Typically, the 1 in 100-year return period event including an allowance for future climate change for fluvial flood events.

DTM – Digital Terrain Model

EA – Environment Agency

ESTRY - a 1D hydraulic modelling software package published by BMT.

Flood Estimation Handbook (FEH) – industry standard guidance on rainfall and river flood frequency estimation across the UK.

Floodplain - any area of land over which water flows or is stored during a flood event.

FRA – Flood Risk Assessment

Freeboard - the height of the top of a bank, floodwall or other flood defence structure, above the design water level. Freeboard can be seen as a safety margin that makes allowance for uncertainty associated with the potentially damaging effects of flood rise or wave action.

Hydraulic Model - a mathematical (generally computer based) model of a water/sewer/storm system which is used to analyse the system's hydraulic behaviour.

LiDAR – Light Detection and Ranging aerial survey data

LLFA – Lead Local Flood Authority

mAOD – metres above Ordnance Datum

m BGL – metres below ground level

Main River - a statutory type of watercourse in England and Wales, usually larger streams and rivers. The EA can carry out maintenance, improvement or construction work on main rivers to manage flood risk as part of its duties and powers.

NRFA – National River Flow Archive

OS – Ordnance Survey

Preliminary Flood Risk Assessment (PFRA) - an assessment of floods that have taken place in the past and floods that could take place in the future. It generally considers flooding from surface water runoff, groundwater and ordinary watercourses, and is prepared by the Lead Local Flood Authority.

ReFH – Revitalised Flood Hydrograph rainfall-runoff hydrological model

Return period - a statistical term defining the probability of occurrence of a flood event. Thus a 1 in 50-year flood is one likely to be equalled or exceeded on average only once in a 50-year period: a flood with a 2.0% annual probability exceedance (AEP).

Strategic Flood Risk Assessment (SFRA) - a study carried out by one or more local planning authorities to assess the risk to an area from flooding from all sources, now and in the future.

TUFLOW – a 2D fixed grid hydraulic modelling software package published by BMT.

UOW – Unnamed Ordinary Watercourse

Watercourse – a natural or man-made open channel for the conveyance of water.

Z-line – a break line layer in TUFLOW which can be used to reinforce linear features in the 2D model domain such as a riverbank, flood defence, or channel bed.

Z-Shape – a layer in TUFLOW which can be used to manipulate the 2D model geometry.

1. INTRODUCTION

BWB Consulting Ltd (BWB) has been commissioned by Oxfordshire Railfreight Limited (the Client) to undertake a site-specific hydraulic modelling exercise of the Padbury Brook Tributary to support the development of the Oxfordshire Strategic Rail Freight Interchange (SRFI), Oxfordshire (NGR: SP537269).

1.1 Site Description

1.2 The Order Limits of the DCO are located approximately 4.3km north-west of Bicester town centre. The M40 motorway and the A43 form the north-eastern boundary and the Ardley Road (B460) forms the south-eastern boundary. Heyford Park is located to the west of the site and the Upper Heyford Airfield (disused) is located to the north-west. The extent of the Order Limits is shown in **Figure 1.1.**

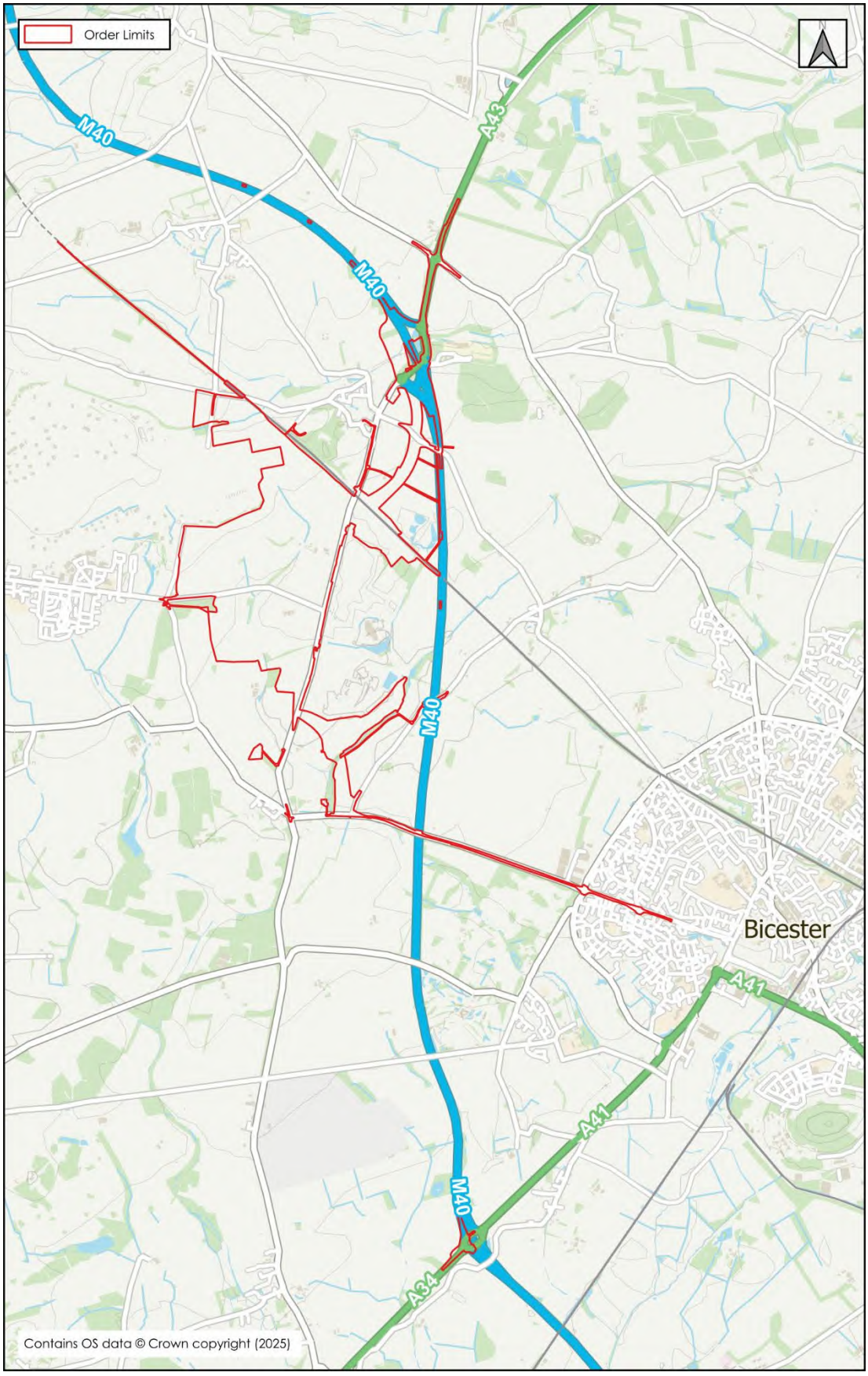
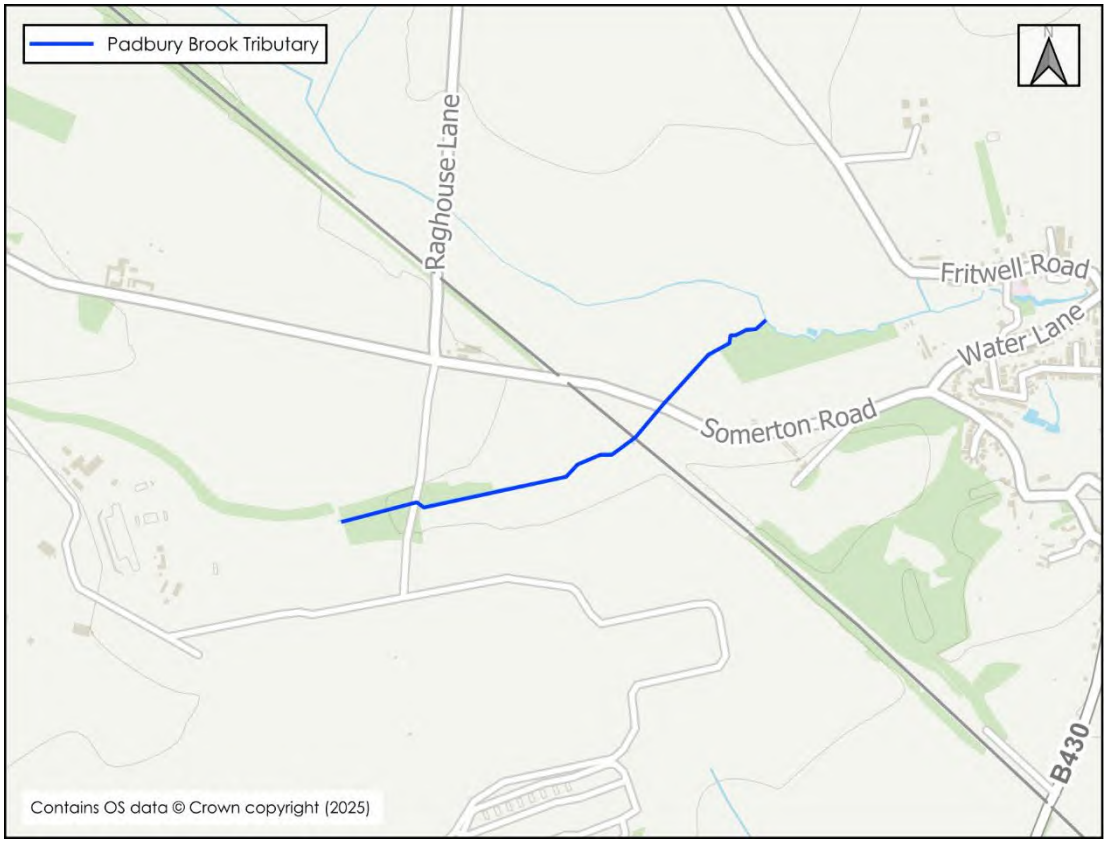


Figure 1.1: Site Location

Padbury Brook Tributary

Figure 1.2 shows the extent of the Padbury Brook Tributary to be modelled in this study.

1.3



1.4 **Figure 1.2: Watercourse Network**

The Padbury Brook Tributary rises to the west of the Order Limits, upstream of Raghouse Lane. The watercourse generally flows in an easterly direction and is culverted beneath Raghouse Lane, a farm access track, the railway and Somerton Road, where it then
1.5 continues to flow in a north-easterly direction as open channel to its confluence with the Padbury Brook.

The upper catchment of the Padbury Brook Tributary has elevations of approximately 139mAOD. The upper reaches flow through a narrow, defined channel with valley-like topography. Downstream of the railway, the watercourse flows through a wider valley, with levels falling to approximately 112mAOD in the vicinity of the confluence with the Padbury Brook. The catchment topography is shown in **Figure 1.3**.

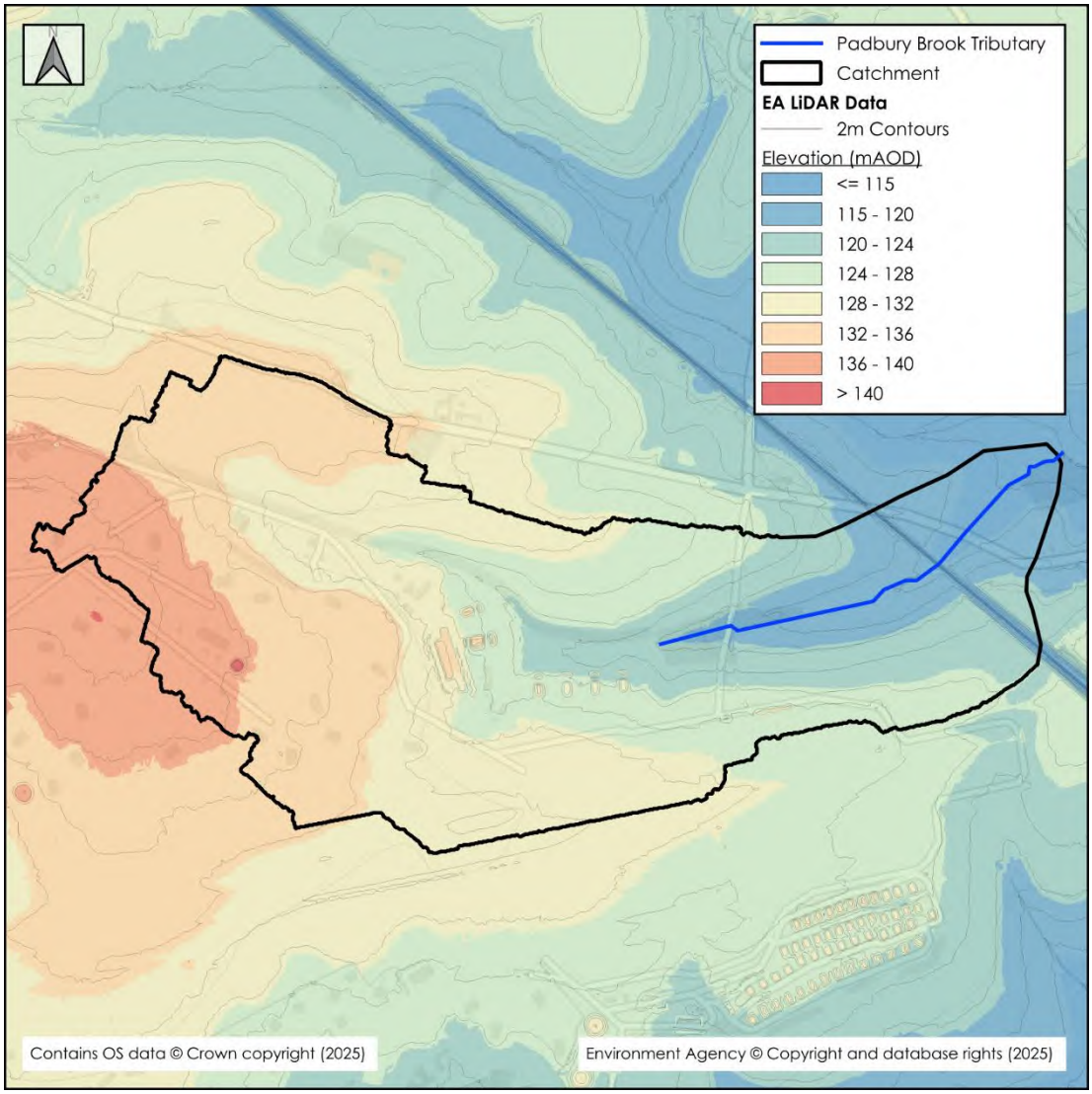


Figure 1.3: Padbury Brook Tributary Catchment Topography

Previous Studies & Available Data

1.6

Historical Flooding

A review of the Cherwell Level 1 Strategic Flood Risk Assessment (SFRA) Update[1], Cherwell Level 2 SRFA[2], Oxfordshire County Council Preliminary Flood Risk Assessment (PFRA)[3] and Addendum[4], EA recorded flood data, and local news outlets did not return any reports of flooding within the vicinity of the site.

[1] Level 1 Strategic Flood Risk Assessment Update (WHS, November 2022)
[2] Level 2 Strategic Flood Risk Assessment (AECOM, May 2017)
[3] Preliminary Flood Risk Assessment (JBA Consulting, June 2011)
[4] Preliminary Flood Risk Assessment Addendum (Oxfordshire County Council, December 2017)

Hydraulic Models

In 2021, BWB contacted the EA and Oxfordshire County Council, the Lead Local Flood Authority (LLFA), to request any hydraulic model data/files that were held for the area. Both authorities confirmed that they hold no such information at this location.

BWB Site Visit (August 2021)

1.7 A site visit was undertaken by BWB during August 2021 to walk the local watercourse reaches and observe any key features that either needed surveying or needed to be considered during the hydraulic modelling process. The key considerations have been summarised below:

1.8

- The Padbury Brook Tributary is understood to flow from the former airfield in an easterly direction.
- The watercourse is culverted underneath the railway by a siphon culvert before flowing as open channel for a short reach, to then be culverted beneath Somerton Road.
- The Padbury Brook Tributary flows in open channel in a north-easterly direction where it outfalls to the Padbury Brook.

1.9 A further site visit was undertaken in March 2025; however, no additional key considerations were noted.

Environment Agency Flood Maps

1.10 The Order Limits in the vicinity of the Padbury Brook Tributary are located in Flood Zone 1. However, the Padbury Brook Tributary is not included within the Flood Map for Planning due to the small catchment associated with the upper reaches of these

1.11 watercourses (<3km^2).

In the absence of Flood Zones, the EA Risk of Flooding from Surface Water mapping can be used to identify the potential floodplain associated with small watercourses omitted from the EA strategic fluvial flood risk datasets. The mapping, shown in **Figure 1.4**, shows the probability of surface water flooding based on the Central climate change allowances for the '2050s' epoch and is the most precautionary surface water data projection currently published by the EA.

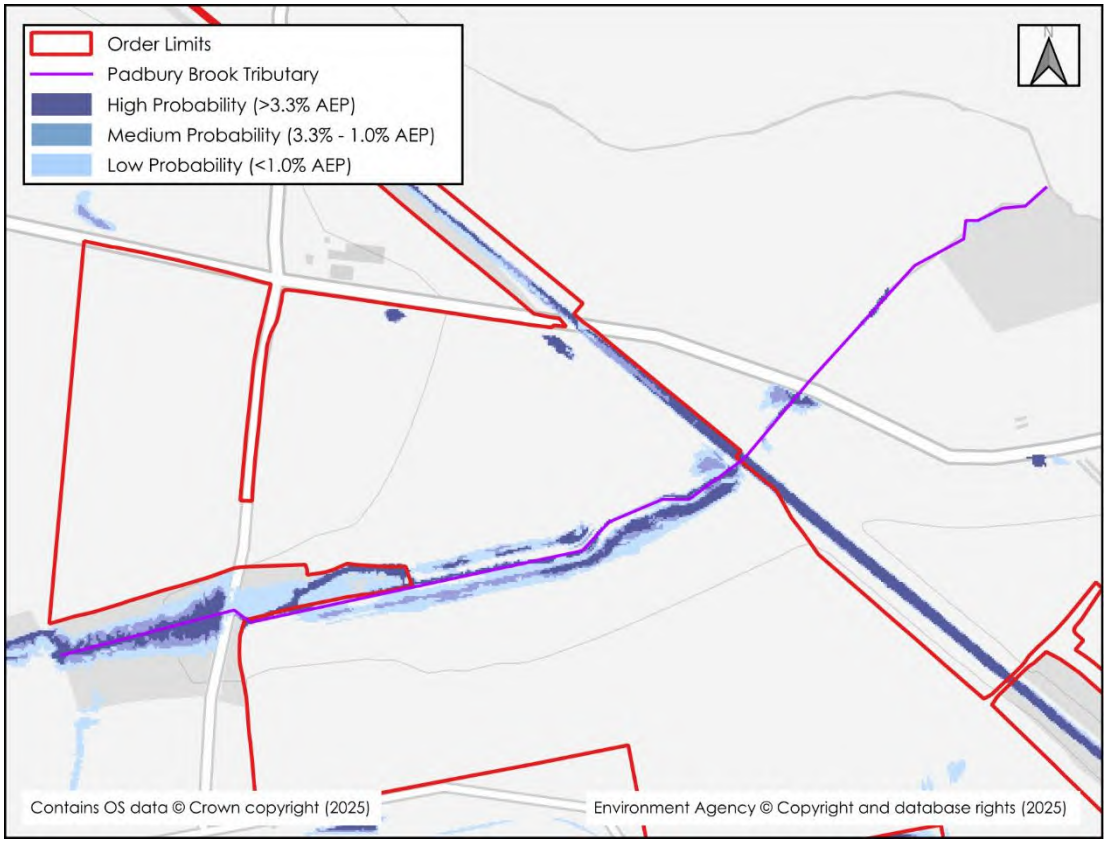


Figure 1.4: EA Risk of Flooding from Surface Water Mapping (Yearly Chance Between 2040 and 2060)

Other Sources of Data

1.12 The following additional datasets were used within the hydraulic modelling exercise:

- EA 2022 LiDAR 1m spatial resolution DTM.
- 3D Topographical Survey by Greenhatch Group in July 2022 (drawing reference: 36646_T_REV4).
- Cross-sectional watercourse survey, undertaken in October 2021 by BWB Consulting (included as **Appendix 1**).
- Photographs and observations from site visit undertaken in August 2021 and March 2025 by BWB Consulting.
- A hydrological assessment of flood flows undertaken in May 2025 by BWB Consulting (included as **Appendix 2**).
- Proposed finished levels surface (model reference: OxSRFI-BWB-HGN-ZZ-M3-CH-0101).

Aims and Objectives

This modelling exercise will be used to establish a good hydrological and hydraulic representation of the fluvial flooding mechanisms and magnitude within the vicinity of the Order Limits and test development conditions. The following objectives have been identified:

1.13

i. Undertake a hydrological review of the Padbury Brook Tributary to estimate peak flows and general flood hydrograph profiles.
ii. Construct a 1D representation of the in-channel environment, including structures using ESTRY software.
iii. Construct a 2D representation of the floodplain using TULOW software.
iv. Combine and link the 1D and 2D model domains.
v. Undertake simulations of key flood return period events to understand the floodplain extents and peak flood levels within and adjacent to the Order Limits.
vi. Undertake simulations to account for climate change flows within the model.
vii. Undertake simulations of post-development conditions for key flood return period events and compare to baseline conditions.
viii. Undertake sensitivity analysis of post-development conditions.

Approach

1.14 In order to achieve the objectives identified above, a new 1D/2D ESTRY-TUFLOW model was constructed, based on a watercourse survey completed by BWB Consulting in October 2021 (reference: OXSRFI-BWB-ZZ-M2-G-0060; see **Appendix 1**).

1.15

The model has been simulated for a series of design storm events. These modelled events include the 1 in 30-year, 1 in 100-year and 1 in 1000-year events that are typically
1.16 used by the EA to define Flood Zones 3b (Functional Floodplain), 3a and 2 respectively.

Simulations have been run to account for the impacts of climate change in accordance with the allowances released by the EA[5]. This is necessary so that any future FRA can assess the risk of flooding over the anticipated lifetime of the proposed development.

[5] https://environment.data.gov.uk/hydrology/climate-change-allowances/river-flow

Assumptions and Limitations

Several assumptions were made during the study which may lead to implications on the modelled results. However, the study has been based on the data available at the time of writing. The key assumptions and limitations are as follows:

1.17

- The modelling exercise has made use of the available data at the time of construction and simulation. The model represents the floodplain and channel conditions at the time of survey.
- The modelling exercise has made use of the latest hydrological and hydraulic modelling software versions at the time of analysis and completion (the hydrological assessment was completed in May 2025 with the baseline hydraulic modelling completed in May 2025).
- The model contains no formal representation of the conveyance within minor watercourses or ditches other than that captured by the model grid and within the 1D model domain.
- The 2m resolution of the model may negate any small-scale topographic features, although all the significant features are believed to have been captured.
- The floodplain levels are derived from LiDAR, where topographical survey information is unavailable, which has limited accuracy (+/- 0.15m). However, this is considered to be sufficient for the purpose of this study.
- The bare earth DTM does not include for the presence of walls, buildings or other structures. Buildings have been modelled at ground level with an elevated roughness in line with best practice.
- The modelling exercise has been undertaken to produce a good representation of flood risk mechanisms in and around the study site. It has not been designed to accurately map flooding in the wider catchment.
- Cross sections PBT_00265 to PBT_00000 are based on LiDAR due to a lack of surveyed data.
- An invert level (113.2mAOD) for the existing siphon culvert underneath the railway has been assumed.
- It is assumed that the proposed culvert under the new railway will be the same diameter as the existing railway culvert.
- Cross-sections for the upstream and downstream faces of the proposed culvert have been derived from the nearby upstream and downstream faces of the existing culvert (PBT_00427 and PBT_00404). Channel levels have been interpolated based on the channel gradient between the surveyed cross-sections along this reach

2. HYDROLOGY

Flood Flow Estimation

A hydrological review of the catchment was undertaken using Flood Estimation Handbook (FEH) methodologies to estimate peak flood flows and derive an appropriate hydrograph shape. This was undertaken in relation to the EA's latest guidance[6]. This assessment is included within **Appendix 2**.

2.1 In summary, there was no hydrometric data available in the area to inform the hydrological analysis. Therefore, the industry standard FEH Statistical Method and Revitalised Flood Hydrograph (ReFH2 Version 4.1) rainfall-runoff model were both reviewed, and a comparative analysis undertaken.

2.2 The final choice of peak flows for input into the model was the FEH Statistical Method. This method was chosen as it benefits from an up-to-date peak flood dataset and is the preferred method for groundwater-dominated catchments. ReFH2 was used to provide a hydrograph shape; the hydrographs were subsequently scaled to the statistical peaks.

2.3 Flood flow estimates were derived for a range of return period events; the adopted peak flow estimates are provided within **Table 2.1** and the division of flow is shown in **Figure 2.1**.

Table 2.1: Adopted Peak Flood Flows

Return Period Event (years)	Annual Exceedance Probability	Catchment Peak Flow (m^3/s)
1 in 2	50%	0.08
1 in 5	20%	0.12
1 in 10	10%	0.15
1 in 30	3.3%	0.21
1 in 50	2.0%	0.24
1 in 75	1.3%	0.27
1 in 100	1.0%	0.29
1 in 200	0.5%	0.35
1 in 1000	0.1%	0.55

Note: Flow estimates are quoted to 2 decimal places to demonstrate change in flow estimates; this does not indicate a greater degree of accuracy.

[6] LIT 11832 Flood Estimation Guidelines Version 9, Environment Agency (November 2023)

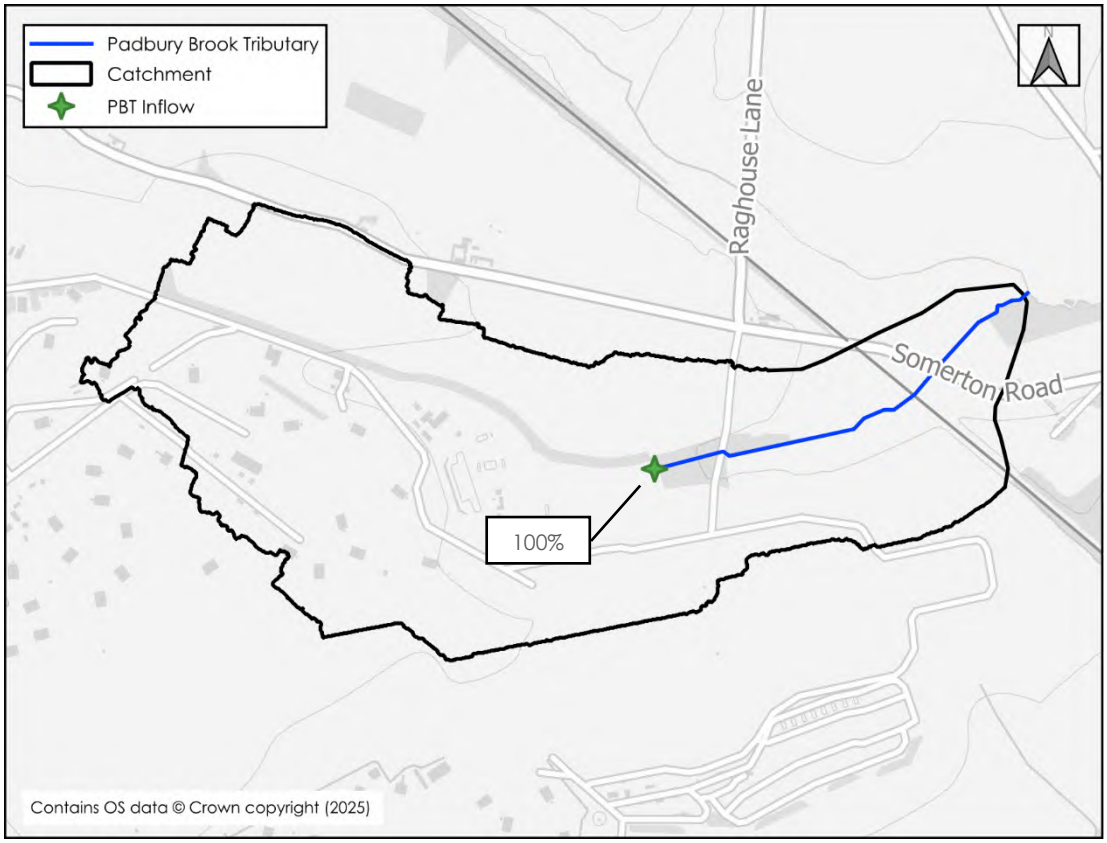


Figure 2.1: Distribution of Model Inflows

Climate Change

2.5 Predicted future change in peak river flows caused by climate change are provided by the EA within their online guidance[7], with a range of projections applied to regionalised 'River Basin Districts'. These districts are further split into 'Management Catchments'. The Padbury Brook Tributary falls within the Upper and Bedford Ouse Management Catchment. **Table 2.2** identifies the relevant peak river flow allowances.

Table 2.2: Peak River Flow Allowance for the Upper and Bedford Ouse Management Catchment

Allowance Category	Total potential change anticipated for the '2020s' (2015 to 2039)	Total potential change anticipated for the '2050s' (2040 to 2069)	Total potential change anticipated for the '2080s' (2070 to 2125)
Upper End	24%	30%	58%
Higher Central	10%	11%	30%
Central	5%	4%	19%

2.6 Nationally Significant Infrastructure Projects (NSIPs) may need to assess flood risk from a credible maximum climate change scenario. Or, in other cases, such as new settlements

[7] Environment Agency, Flood risk assessments: climate change allowances: https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances#table-1

or significant urban extensions, the flood risk may need to be assessed from a high impact climate change scenario. In these circumstances, the Upper End allowance for peak river flow should be used.

It should be noted that use of the credible maximum should be treated as a sensitivity test to help assess how sensitive the proposals are to changes in the climate and ensure the development can be adapted to large-scale climate change over its lifetime.

2.7 For this study, to estimate the potential future design floodplain under a range of scenarios, the Central, Higher Central and Upper End climate change allowances for the '2080s' will be applied to the 1% AEP flood flows.

2.8

3. THE HYDRAULIC MODEL

Software and Solver

TUFLOW version 2025.0.3-iDP was used for all model runs. The model was simulated using TUFLOW's double precision classic solver. TUFLOW's built in 1D component, ESTRY, was used to model the 1D domain/channel. The model set-up as outlined in the section below has been approved by the EA, as shown in **Appendix 3**.

3.1 The 1D Domain

Extent

3.2 The 1D domain for the Padbury Brook Tributary begins upstream of the Order Limits, adjacent to the former airfield. The Padbury Brook channel is represented within the 1D domain until its confluence with the Padbury Brook, at the downstream boundary. The extent of the 1D domain can be seen in **Figure 3.1**.

Channel Geometry

3.3 The river channel geometry is based on a watercourse survey carried out by BWB Consulting in October 2021. The survey also captured hydraulic structures that were present such as bridges and culverts. A series of cross sections are based on EA LiDAR data where access was unavailable at the time the survey was collected.

3.4 The maximum distance between cross sections is 115m. However, sections are more generally spaced 50m apart. The river channel survey is available as **Appendix 1**.

3.5 The channel sections were truncated at top-of-bank from survey data, at what would be the interface with the 2D domain.

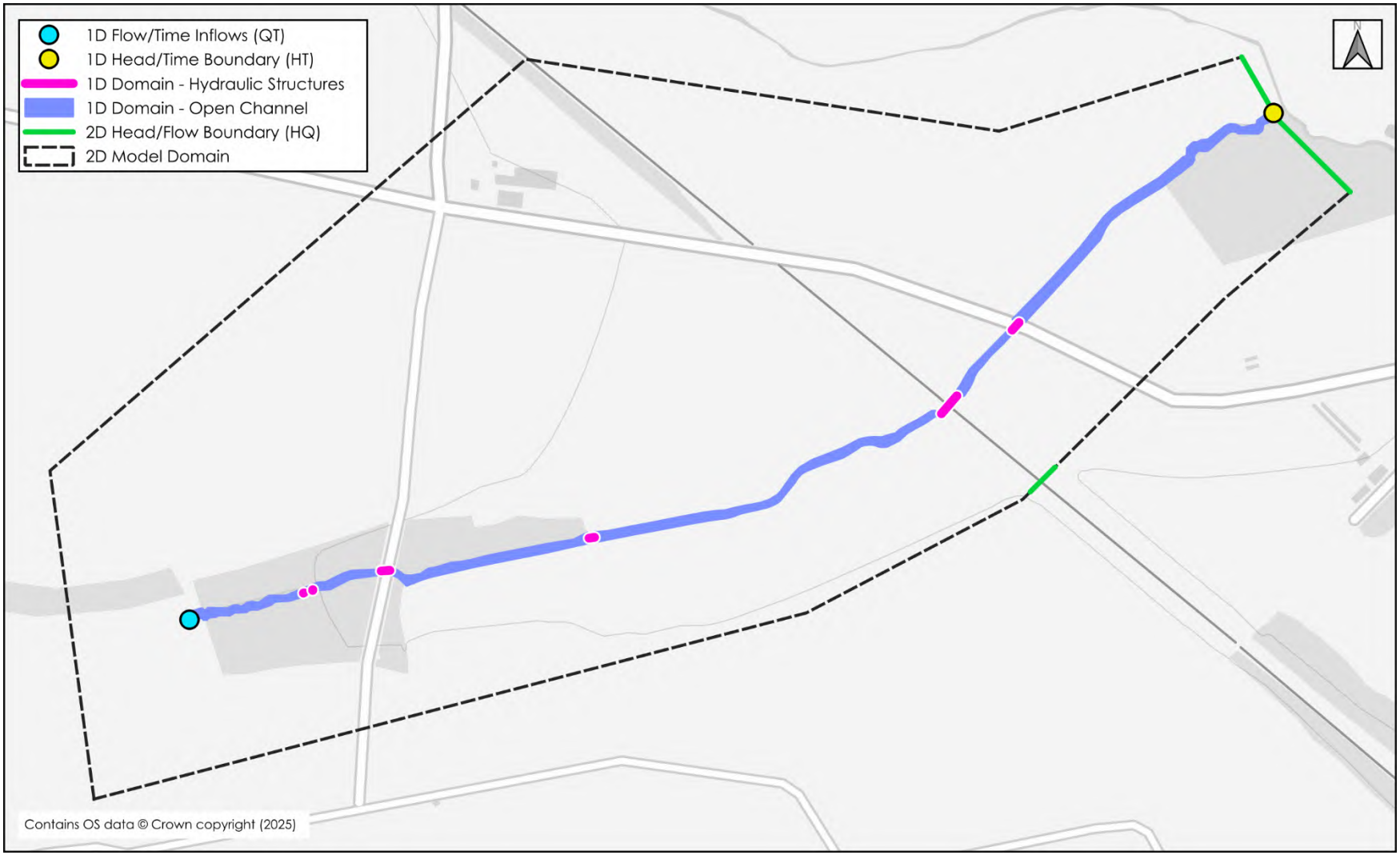


Figure 3.1: Baseline Model Schematic

Hydraulic Roughness

3.6 Hydraulic roughness has been represented using the Manning's n coefficient. The values applied are based on those stipulated in the literature, using Chow (1959)[8]. This study documents appropriate values based on channel bed material, sinuosity and presence of vegetation.

3.7 The guideline values are chosen using engineering judgement, based on photographs of the channel condition taken at the time of survey. Each cross section has a Manning's roughness value applied in the same way as the channel geometry and is read into TUFLOW within a CSV file.

3.8 The Padbury Brook Tributary was observed to be free flowing. The majority of the channel was considered to be clean, but winding with pools and riffles, as well as light bank vegetation with stones/weeds. There were some sections that appeared to be more sluggish. As such, a Manning's n coefficient of between 0.04 and 0.05 was deemed suitable to represent in-channel roughness for the majority of the cross sections.

3.9 The banks and top of banks were in some instances lined with long/short grass and in other instances bordered by light/dense brush and trees. Values of between 0.03 and 0.1 were used to represent the varying conditions.

3.10 Some examples from the watercourse survey are highlighted in **Table 3.1** below.

Table 3.1: Manning's n Examples

Model ID	Values Chosen and Description	Photograph
PBT_00979	**0.045** Main Channels Clean, but winding with pools and riffles, light bank vegetation, stones/weeds	

[8] http://www.fsl.orst.edu/geowater/FX3/help/8_Hydraulic_Reference/Mannings_n_Tables.htm

Model ID	Values Chosen and Description	Photograph
PBT_00530	**0.06** Floodplains Trees – medium density with sprouts	
PBT_00736	**0.03** Floodplains Grass, short	

Hydraulic Structures

3.11 A number of hydraulic structures were represented in the 1D domain, the data for which was collected during the watercourse survey.

3.12 In total, four culverts, two bridges and one weir were included in the model to represent structures. The weir was added to the model due to a difference in levels between sections. The details of the modelled structures are included as **Appendix 4**.

Boundary Conditions

3.13 Boundary conditions were applied to the 1D domain to both allow flow in and out of the model.

3.14 A QT (flow vs time) boundary was used to represent the fluvial inflow (**Section 2**) as hydrographs. This consisted of a point inflow at the upstream extent of the watercourse.

3.15 A HT (water level vs time) boundary was applied at the downstream limit of the 1D domain. This was set to 112.25mAOD which set just below the top of bank at the downstream cross section (PBT_00000).

1D/2D Links

3.16 The 1D channel was linked to the floodplain using 'HX' links. These transfer the calculated water level from the 1D cross sections into the 2D floodplain, providing that the water level is above the level of the cell that the HX link is located in. Therefore, 'HX' links should be digitised along the top of bank of the watercourse visible in the topographical survey, watercourse survey and LiDAR data.

3.17 The average modelled width of the channel was approximately 6-8m along the Padbury Brook Tributary.

The 2D Model Domain

Extent and Active Area

3.18 The main influence on the 2D domain extent is generally the expected width of the floodplain, meaning that it should be large enough to allow for flows to be routed through the floodplain where necessary and so that no "glass walling" occurs within the model domain.

3.19 The river channel was deactivated to ensure that it was modelled in the 1D domain. This deactivated area may appear fragmented in places where the deck of a structure is modelled in the 2D domain. The active area is displayed in **Figure 3.1.**

Grid Size and Orientation

3.20 The grid cell size should be chosen in order to sufficiently represent the average width of the modelled channel and its ability to capture key floodplain topographic features.

3.21 The selected grid size of 2m provides a high enough resolution to capture the capacity of the channel (6-8m width = 3-4 number of 2m cells) as well as provide appropriate representation of key floodplain features.

3.22 The orientation of the grid is important for flow routing as flow cannot pass to the neighbouring cell via its corner, only via the cell sides. Therefore, the location line (2d_loc) was drawn to orientate the grid in the predominant direction of flow.

Floodplain Roughness

3.23 Floodplain roughness is defined by the Manning's n coefficient, as per the 1D domain. However, the method in which it is applied differs.

3.24 Roughness has been applied by polygons using land use types as defined by OS MasterMap data. These are linked to a coefficient listed in a TUFLOW Materials File (TMF).

3.25 The values applied for different land use types are listed in **Table 3.2**.

Table 3.2: Floodplain Roughness Values

Land Use Type	Manning's n Coefficient
Long grass	0.035
Short grass	0.030
Roads	0.025 - 0.030
Rail	0.050
Woodland	0.080
Buildings	0.500

Floodplain Topography and Amendments

3.26 The general floodplain topography is based on the topographical survey (where available) and the latest available LiDAR data, which was downloaded from the DEFRA Open Survey website at a 1m resolution.

3.27 The following amendments to the base topography were made:

- River bank levels were reinforced through the use of a 'THICK' Z-line. Bank elevations were provided at 5m intervals along the Z-line. The levels are informed by surveyed cross-section data, topographical survey and LiDAR data (where survey data is unavailable).
- Road levels and railway levels were reinforced through the use of 2D Z-shapes. Elevations were provided at intervals along the Z-shape, as informed by LiDAR data.
- The inlet structure for the siphon culvert under the railway was reinforced through the use of a 2D Z-shape. This was set at 115.7mAOD, as informed by LiDAR data.

Floodplain Structures

3.28 There were no floodplain structures within the model. All hydraulic structures were in line with the channel and hence modelled in the 1D domain.

Boundary Conditions

3.29 Boundary conditions within the 2D domain are often used to prevent "glass walling" at the downstream end of the model through use of a "HQ" boundary. This is a flow vs stage relationship automatically defined in TUFLOW when the user inputs a slope value, to allow water to flow out of the model.

3.30 A "HQ" boundary was applied to the downstream extent of the model to allow water routing down to flow out of the model. The slope in the "HQ" boundary was calculated by assessing the fall in floodplain levels on both banks. The fall in levels was divided by the distance measured over to determine a slope value (0.011 and 0.021). Error! R eference source not found. shows where these boundaries were applied. Sensitivity testing has been undertaken on these boundaries and is discussed further in **Section 6**.

Calibration/Verification

3.31 A lack of detailed flow or level data for the catchment meant that there was limited opportunity to calibrate the model.

3.32 Due to the lack of documentation on previous historical instances of flooding, the model cannot be verified against historic events. A conservative approach adopted to the model build mitigates this.

Stability, Warnings and Messages

3.33 TUFLOW has a number of indicators available to assess the stability of a model. These differ slightly between the Classic and HPC solver (the Classic solver was used for this model). The following indicators were checked to ensure the model was performing as expected:

- **Stage and flow time series** – A number of spot checks should be completed to ensure that conveyance through the channel is as expected and that both the stage and flow time series are reasonably smooth, particularly around the study area.
- **1D negative depths** – Significant negative depths indicate that instabilities are present.
- **Cumulative Mass Error** – A value of +/-2% is considered acceptable.
- **Velocities** – Unusually high velocities or circulating vectors are usually a sign of instabilities.

3.34 The time series graphs were reviewed along the modelled reaches; no significant issues were identified that could compromise results within the Order Limits. The river channel stages were shown to peak approximately 9 hours into the event.

3.35 No 1D or 2D negative depths were reported during all simulations.

3.36 During all baseline model runs, the cumulative mass error stayed below +/- 0.5% for all simulations, as shown in **Figure 3.2**. This is within the range of acceptable values.

3.37 The remaining indicators highlighted above were considered acceptable.

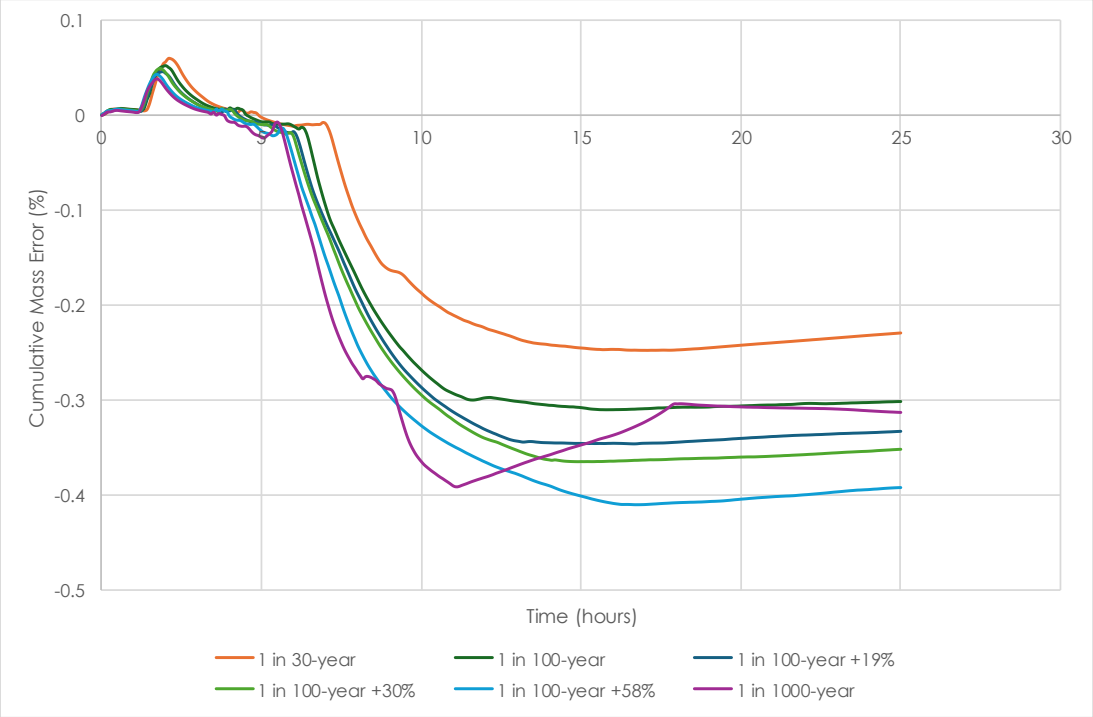


Figure 3.2: Cumulative Mass Error

3.38 There were a maximum of 193 warnings recorded prior to the simulation in all modelled events. The warnings produced by the hydraulic model prior to the simulation, included:

- 'Warning 2073' message relates to null shape objects. These were not expected to have an impact on the model results.
- 'Warning 1100' message relates to structure crest/invert below bed of upstream channel. The model input was reviewed and was found to be in line with the surveyed data.

3.39 No warnings are reported during any of the simulations.

Model Runs

3.40 In order to achieve the study objectives, the simulations summarised in **Table 3.3** were completed.

Table 3.3: Model Runs

Model Geometry	Return Periods	Comments
Baseline	1 in 30-Year 1 in 100-Year 1 in 1000-Year 1 in 100-Year+19%CC 1 in 100-Year+30%CC 1 in 100-Year+58%CC	Representative of 'as surveyed' conditions.
Proposed	1 in 30-Year 1 in 100-Year 1 in 1000-Year 1 in 100-Year+19%CC 1 in 100-Year+30%CC 1 in 100-Year+58%CC	Representative of 'as-built' conditions
Roughness + 20%	1 in 100-Year	Floodplain, channel and structure roughness increased by 20%
Roughness - 20%	1 in 100-Year	Floodplain, channel and structure roughness decreased by 20%
Downstream Boundary +	1 in 100-Year	20% increase of gradient at downstream boundary and 20% decrease in water depth at downstream boundary
Downstream Boundary -	1 in 100-Year	20% decrease of gradient at downstream boundary and 20% increase in water depth at downstream boundary
Blockage 1 (PBT_00451)	1 in 100-Year	75% blockage of proposed culvert

4. BASELINE RESULTS

4.1 The results from the existing conditions model are mapped within **Appendix 5** and are shown in **Figure 4.1**. The modelled flood levels in the vicinity of the Order Limits included within **Table 4.1**.

4.2 Key flood mechanisms are summarised below, with reference to the points labelled in **Figure 4.1**:

i. At the upstream reaches, in-channel levels exceed the channel capacity upstream of Raghouse Lane during all modelled events. Flood waters spill into the floodplain upstream of the crossing and back up along the floodplain. It is considered that this is due to the restrictive culvert underneath the road.

ii. During the 1 in 100-year + 58%CC and 1 in 1000-year events, flows overtop Raghouse Lane and are conveyed over the floodplain adjacent to the left bank of the Padbury Brook Tributary, prior to re-entering the channel downstream in the vicinity of the farm track crossing. Downstream of Raghouse Lane, the 1 in 30-year flood extents are shown to be contained within the channel. During the remaining modelled events, flows are shown to overtop the farm track crossing.

iii. After the flows from the 1 in 100-year + 58%CC and 1 in 1000-year events have re-entered the channel, flows remain in-channel for all modelled flood events until upstream of the railway.

iv. Upstream of the railway culvert, flows overtop the left bank during the 1 in 100-year + 58%CC and 1 in 1000-year event and the right bank during events greater than and equal to the 1 in 100-year event.

v. During the 1 in 1000-year event, flows overtop onto the railway and flow southwards. All remaining events are shown to either remain in-channel or back up behind the railway.

vi. Downstream of the railway, water overtops both the left and right banks and flows along the floodplain.

vii. The road embankment for the Somerton Road interrupts the flows within the floodplain, resulting in an area of ponding. However, during all modelled events, flow overtop Somerton Road and continue downstream along the left and right floodplain.

viii. Flows along the right bank re-enter the Padbury Brook Tributary channel downstream of Somerton Road. Flows along the left bank continue to flow along the floodplain and outfall to the Padbury Brook.

4.3 The modelled outputs provide a more complete representation of the flood extents in comparison to the EA strategic flood mapping. This is considered to be as a result of improved representation of the channel and structures within the hydraulic model, providing more accurate channel geometry and capacity.

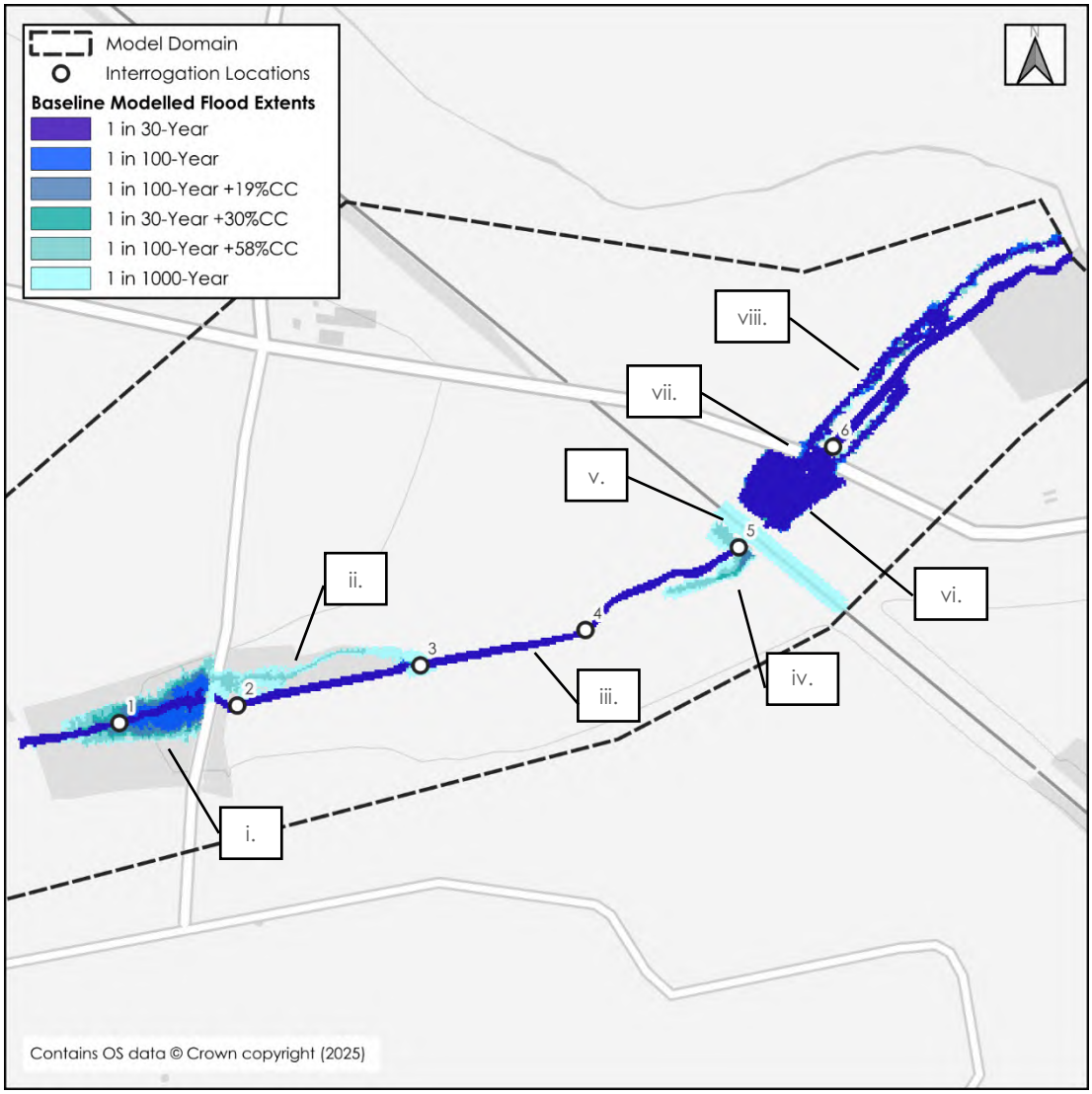


Figure 4.1: Baseline Fluvial Flood Extents

Table 4.1: Baseline Modelled Flood Levels

Node	1 in 30-Year	1 in 100-Year	1 in 100-Year + 19%CC	1 in 100-Year + 30%CC	1 in 100-Year + 58%CC	1 in 1000-Year
1	119.05	119.21	119.33	119.40	119.58	119.65
2	118.04	118.09	118.11	118.12	118.14	118.16
3	116.98	117.03	117.05	117.06	117.08	117.17
4	116.26	116.30	116.32	116.33	116.34	116.41
5	115.53	115.58	115.61	115.62	115.65	115.73
6	114.11	114.15	114.16	114.17	114.18	114.20

5. PROPOSED DEVELOPMENT MODELLING

Philosophy

5.1 The proposed development comprises a SRFI which includes the construction of several warehouses, a new slip road off the M40 motorway, and an intermodal rail terminal with a new track that connects to the existing railway.

5.2 An earthworks exercise has been undertaken to determine the proposed levels within the development. A new track, associated with the intermodal rail terminal, crosses the Padbury Brook Tributary. A reach of the Padbury Brook Tributary is to be culverted to facilitate the proposed rail track.

Representation in Hydraulic Model

5.3 The baseline hydraulic model was updated to include the proposed development levels. The proposed levels were added to the hydraulic model as a DTM, overlying the topographical survey and LiDAR data.

5.4 The Padbury Brook Tributary is proposed to be culverted beneath the proposed track. As part of the proposals, an additional inverted siphon and culvert is proposed which will be separate to the existing culvert, with approximately 10m of open channel between these structures.

5.5 It is assumed that the proposed culvert will be the same diameter as the existing culvert under the existing railway, with a proposed length of approximately 15m. Cross-sections for the upstream and downstream faces of the proposed culvert have been derived from the nearby upstream and downstream faces of the existing culvert (PBT_00427 and PBT_00404). Channel levels have been interpolated based on the channel gradient between the surveyed cross-sections along this reach.

5.6 The proposed track is to be situated over 3m lower than existing levels in the vicinity of the Padbury Brook Tributary. It is therefore proposed that two bunds, located adjacent to the inlet and outlet of the proposed culvert respectively, and set approximately 1m above surrounding ground levels, are included to prevent flows from overtopping onto the railway and posing a flood risk to the development. A 2D Z-Shape was modelled to represent this feature; this was set at an arbitrary height for the purposes of the modelling exercise and should be confirmed during the detailed design stage.

5.7 To provide additional storage upstream of the proposed culvert, a two-stage channel was proposed within the Order Limits. Amendments were made to surveyed cross-sections (PBT_00581 and PBT_00654) to extend further into the floodplain and to introduce the inset floodplain, with consideration to the existing levels from the watercourse survey data as well as the topographical survey and proposed earthworks levels. The 1D and 2D model domains were amended to reflect these changes.

5.8 A slot weir was proposed upstream of the proposed culvert, with a slot width of 0.5m. This was based on the surveyed cross-section in this location (PBT_00474).

5.9 No further changes were made to the existing model. A model schematic, showing the changes from the baseline model only, is illustrated in **Figure 5.1**.

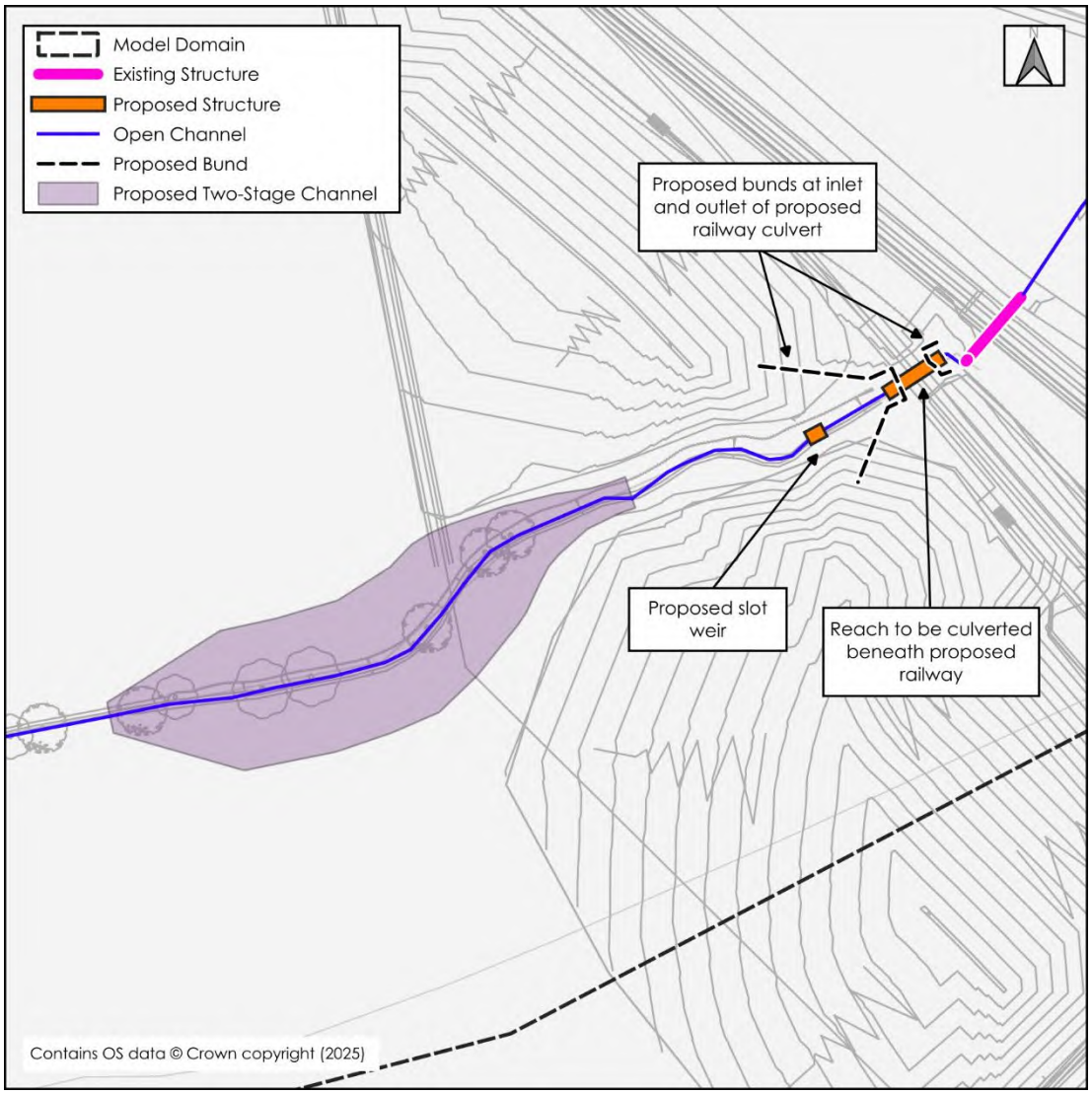


Figure 5.1: Proposed Model Schematic

Stability, Warnings and Messages

5.10 The indicators for assessing stability outlined in **Section 3** have been reviewed for all proposed development simulations. Similar to the baseline scenarios, the peak cumulative mass error was within the acceptable range for all simulations.

5.11 No 1D or 2D negative depths were reported during all simulations.

5.12 No additional warnings were reported prior or during the simulations.

Model Results

5.13 Mapping of the proposed development conditions is included within **Appendix 6** and summarised below. The floodplain extents are shown in **Figure 5.2**, with modelled flood levels outlined within **Table 5.1**.

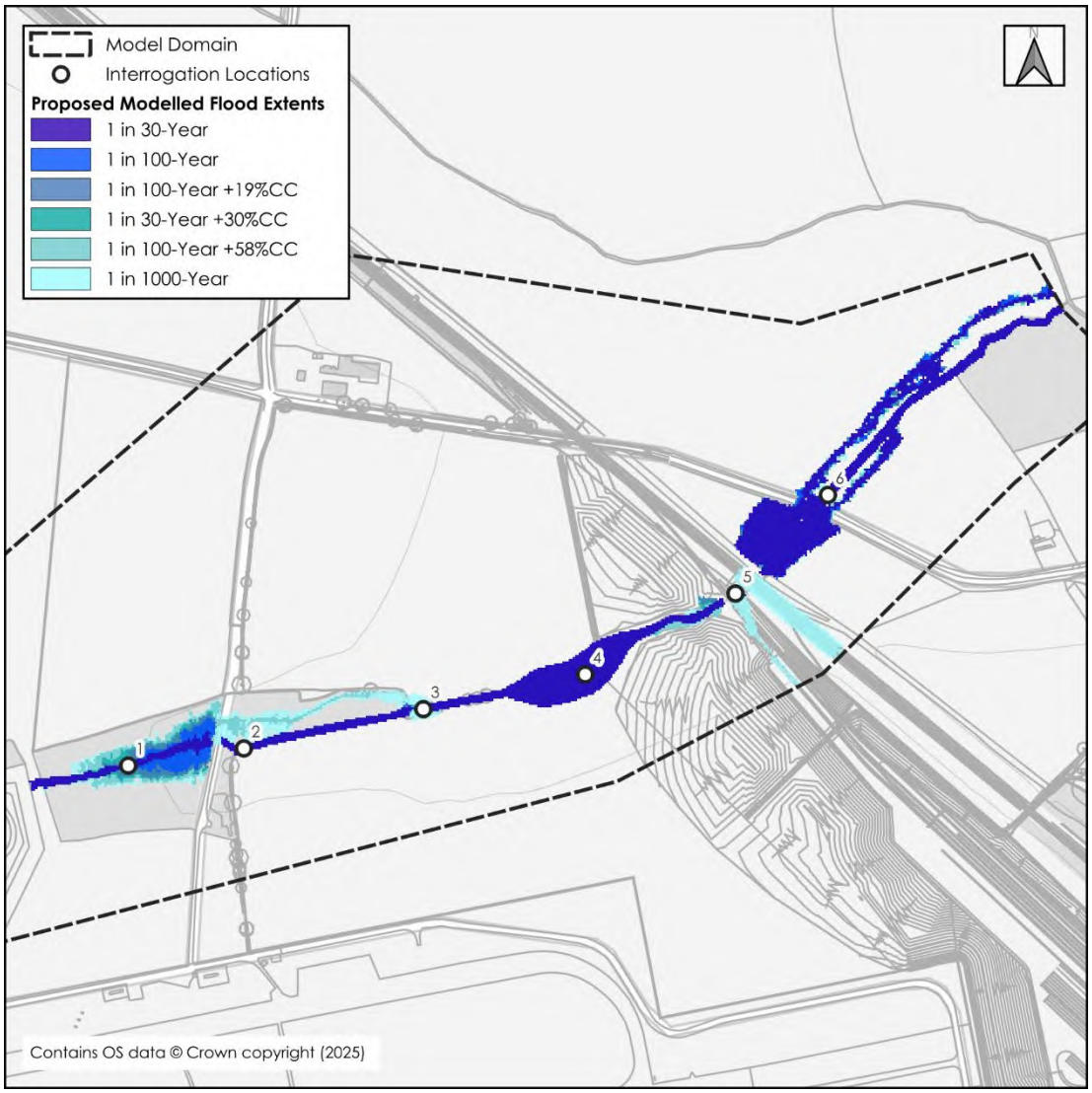


Figure 5.2: Proposed Development Floodplain Extents

Table 5.1: Proposed Development Modelled Flood Levels

Node	1 in 30-Year	1 in 100-Year	1 in 100-Year + 19%CC	1 in 100-Year + 30%CC	1 in 100-Year + 58%CC	1 in 1000-Year
1	119.05	119.21	119.33	119.40	119.58	119.65
2	118.04	118.09	118.11	118.12	118.14	118.16
3	116.98	117.03	117.05	117.06	117.08	117.17
4	116.26	116.30	116.32	116.32	116.34	116.40

Node	1 in 30-Year	1 in 100-Year	1 in 100-Year + 19%CC	1 in 100-Year + 30%CC	1 in 100-Year + 58%CC	1 in 1000-Year
5	115.53	115.58	115.60	115.62	115.65	115.74
6	114.11	114.15	114.16	114.17	114.18	114.21

5.14 The results under the proposed development conditions are broadly similar to those under the baseline conditions, with no change to the flood mechanisms upstream or downstream of the Order Limits.

5.15 Within the Order Limits, the modelled flood extents are increased as a result of the proposed two-stage channel, as intended. Flows are shown to back up behind the proposed railway culvert, in a similar manner to those seen in the baseline conditions, with an increase in modelled flood levels. Flows are also shown to back up behind the proposed bund, which is shown to prevent flows from overtopping onto the proposed railway during all modelled events.

5.16 Following a review of the modelled flood levels, it was established that the proposed bund should be set to a level of 116.3mAOD, with consideration of a 300mm freeboard during the 1 in 100-year +19%CC design event.

5.17 During the 1 in 1000-year event, flows are shown to overtop from the open channel prior to entering the existing railway culvert, to flow onto both the existing and proposed railways. However, both railways are shown to be removed from the flood extents during all modelled events up to and including the 1 in 100-year +58%CC event, inclusive of the design event.

Impact Analysis

5.18 The proposed development modelled peak flood levels have been compared to the equivalent baseline peak flood levels to establish off site impacts. Mapping for all events is included in **Appendix 7**; the comparison mapping for the design event (1 in 100-year +19% climate change event) is illustrated in **Figure 5.3** and discussed below.

5.19 The mapping shows that the proposed siphon culvert, proposed bund and proposed two-stage channel results in no detriment downstream of the Order Limits in all modelled flood events (within the model tolerances of +/-10mm).

5.20 During the 1 in 100-year + 19%CC event, flood levels upstream of the proposed culvert are shown to increase by up to 300mm, as shown in **Figure 5.3**. There is also an increase in flood extent, associated with the widened channel. However, these changes are within the Order Limits and are not anticipated to affect the proposed development.

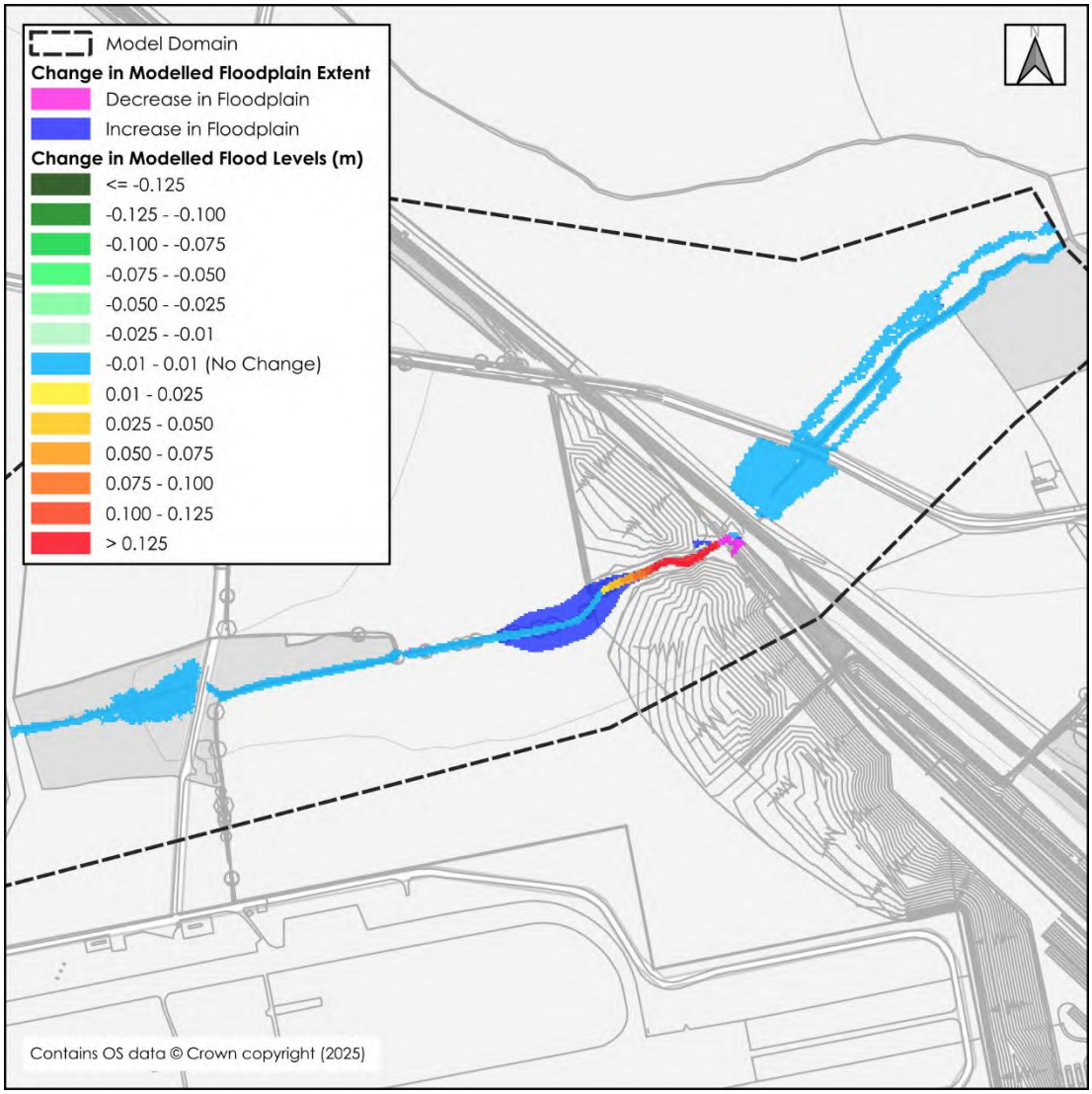


Figure 5.3: Baseline vs Proposed Comparison Mapping - 1 in 100-Year + 19% Climate Change

6. SENSITIVITY TESTING

6.1 To account for seasonal variations in vegetation, test the blockage of proposed structures and to ensure the robustness of boundary conditions, a series of sensitivity tests were conducted using the proposed scenario 1 in 100-year flood return period event. Comparison mappings for the sensitivity tests are included in **Appendix 8**.

6.2 Robust sensitivity analysis also provides improved confidence in the model outputs, particularly in absence of calibration data.

Flow Estimates

6.3 As climate change allowances have been assessed, it was not considered necessary to test further variations on the predicted flood flows.

Roughness

6.4 The modelled roughness coefficients were determined from aerial imagery, site photographs and OS mapping. Increasing and decreasing the roughness values in the channel and at structures as well as in the floodplain tests how seasonal variation and maintenance regimes may affect the flood risk posed to the proposed development.

6.5 A 20% increase in Manning's n roughness coefficient, representative of a period without maintenance, results in an increase in peak flood levels of up to 50mm. Within the Order Limits, there is no increase in floodplain extent and in-channel peak flood levels were shown to increase by up to 30mm. This is to be expected given that an increase in roughness values would be associated with greater frictional forces against the flow of water.

6.6 A 20% decrease in Manning's n roughness coefficient, representative of a period with maintenance, generally leads to reduced peak flood levels within the Padbury Brook Tributary. Within the Order Limits, peak flood levels are expected to decrease by up to 40mm compared to the equivalent proposed development scenario. This is to be expected, as the reduced roughness will increase the conveyance of the floodplain and culverts, allowing water to flow more freely through the system.

6.7 Overall, there is potential for seasonal variations in vegetation and maintenance periods to alter the peak flood levels within the channel, although, there are limited changes to the flood extents. These results therefore show that the model results are not significantly sensitive to changes in Manning's n roughness, which increases confidence in the model outputs.

Downstream Boundary

6.8 To test the implications on variations in the downstream boundary parameters, a sensitivity test has been undertaken. The 2D downstream boundary slope was updated by 20% and the 1D downstream boundary water depth was updated by 20%.

6.9 A 20% increase in slope gradient and a 20% decrease in water depth leads to an increase in peak flood level towards the downstream boundary, which propagates up to approximately 50m upstream. There is no change in peak flood levels or extents (within the model tolerances of +/-10mm) within the Order Limits. This result provides confidence in the location of the downstream boundary, with changes in water level not impacting on results at the Order Limits.

6.10 A 20% decrease in slope gradient and a 20% increase in water depth leads to a decrease in peak flood level towards the downstream boundary. However, a small area is shown to increase in flood level in-channel approximately 50m upstream of the downstream boundary. There is also noted to be a limited area of increased flood levels in-channel within the Order Limits; however, across the majority of the reach within the Order Limits, there is no change in peak flood levels (within the model tolerances of +/-10mm) or floodplain extents.

6.11 Overall, the model results are considered to be robust to changes in the downstream boundary, which increases confidence in the model outputs.

Blockage Scenarios

6.12 Blockage testing was undertaken at one location to understand the impacts of blocking key structures. The location of the blockage is annotated on the respective mapping, included as **Appendix 8**.

6.13 Smaller culverts are more at risk of a significant blockage due to their limited capacity to convey flows and debris, whereas large culverts are less at risk. Therefore, the magnitude of the blockage was determined by the size of the culvert, as shown in **Table 6.1**.

Table 6.1: Sensitivity Test Blockage Percentages

Culvert Diameter (m)	Blockage Applied
< 0.5	100%
0.5 – 1.0	75%
1.0 – 1.5	50%
1.5 >	25%

6.14 A blockage scenario was tested within the hydraulic model on the proposed culvert, underneath the proposed track and embankment. The culvert is 600mm in diameter and was therefore blocked 75%.

6.15 In the blockage scenario, flood levels and extents around the culvert, and on the floodplain adjacent to and upstream of the culvert, were predicted to increase. Flood levels within the Order Limits were predicted to increase by up to 0.74m.

6.16 Whilst it is noted that flows back-up behind the proposed culvert during the equivalent proposed development scenario, the blockage scenario shows that the model results

are sensitive to blockages of this structure. It is recommended that the proposed culvert should be regularly maintained to ensure it remains free of blockages.

7. SUMMARY & RECOMMENDATIONS

7.1 Please note that this conclusion should be read in conjunction with the study limitations and assumptions in **Section 1**.

7.2 BWB Consulting Ltd has been commissioned by Oxfordshire Railfreight Limited to undertake a site-specific hydraulic modelling exercise of the Padbury Brook Tributary to support the development of the Oxfordshire SRFI.

7.3 The modelled flood flows have been informed by a hydrological review of the catchment associated with the Padbury Brook Tributary. The latest climate change allowances have been incorporated into the hydrological assessment.

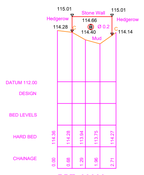
7.4 The baseline results show flows to overtop into the floodplain in the vicinity of existing culverts under Raghouse Lane, the farm access track, the railway and Somerton Road. Within the Order Limits, flows largely remain in-channel , with the exception of an area in the vicinity of the existing railway culvert.

7.5 The proposed development modelling includes consideration of the development of a SRFI. A new track, associated with the intermodal rail terminal, crosses the Padbury Brook Tributary. The proposed built development is located outside of the flood extents during the 1 in 100-year +19%CC design event.

7.6 Sensitivity testing has shown the model to be robust with respect to changes in seasonal variations in vegetation, blockage of the proposed structure and robustness of boundary conditions.

APPENDICES

Appendix 1: River Channel Survey



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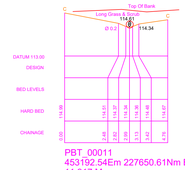
Culvert



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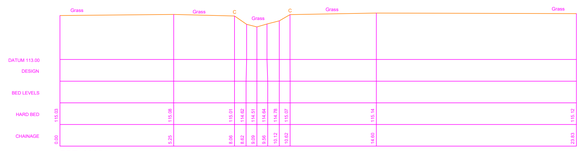
11.317 M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DESIGN
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HARD BED
CHAINAGE
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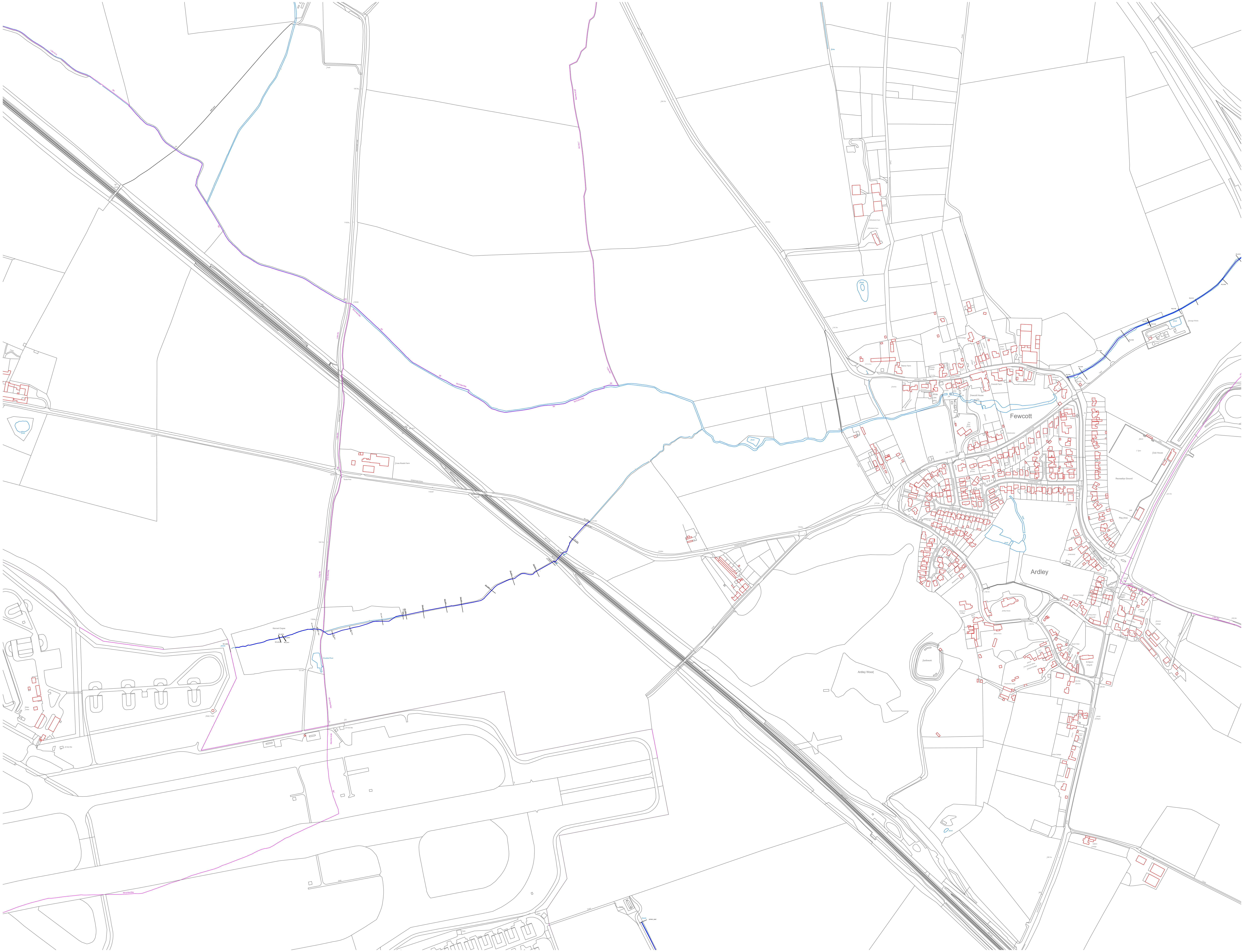
113.91
113.91



Notes

1. Do not scale this drawing. All dimensions must be checked/ verified on site. If in doubt ask.
2. This drawing is to be read in conjunction with all relevant architects, engineers and specialists drawings and specifications.
3. All dimensions in metres unless noted otherwise. All levels in metres unless noted otherwise.
4. Any discrepancies noted on site are to be reported to the engineer immediately.
5. No scale factor has been applied to this survey, therefore the os coordinates are to be treated as arbitrary. Please refer to survey station information below for on site control establishment.
6. All coordinates and height data relate to OSGB36(15). Control stations are coordinated by means of GPS receiving real time corrections via OS smart net.
7. All manhole data is collected from ground level therefore discrepancies may occur. More accurate data is only achievable via confined space entry.
8. OS license number: 100022432

Key Plan

Legend

- OS Buildings
- Surveyed Buildings
- Building
- Wall
- Kerb Channel Line
- Top of Kerb
- Edge of Surface
- Top of Bank
- Bottom of Bank
- Canopy / Overhang
- Line Marking
- Centre Line
- Watercourse Centre Line
- Barrier
- Fence
- Gate
- Overhead Powerline
- Overhead Utilities
- Contour Lines
- Inspection Chamber
- 0.25 Flow direction and pipe diameter
- 1 Station and Name
- BH 1 Monitoring Borehole
- Tree / Bush / Sapling
- Area of Vegetation/ Extent of Tree Canopy
- Hedge
- Body of Water
- Body of Water from OS
- +50.00 Spot Level
- Assumed Surface Water Drainage Line
- Surface Water Drainage Line

AP	Anchor Point	FBW	Fence Barbed Wire	LB	Litter Bin
BG	Back Gully	FCB	Fence Closed Board	LP	Lamp Post
BO	Bollard	FCL	Fence Chain Link	MH	Manhole
BS	Bus Stop	FEL	Fence Electric	Mkr	Service Marker
BT	British Telecom	FMP	Fence Metal Panel	PB	Post Box
C	Crest	FMR	Fence Metal Railing	PT	Post
CL	Cover Level	FOB	Fence Open Board	RE	Rodding Eye
CMP	Cable Marker Post	FPW	Fence Post & Wire	SP	Sign Post
		FSP	Fence Steel Palisade	ST	Stop Tap
CCTV	Security Camera	FWM	Fence Wire Mesh	SV	Stop Valve
CTV	Cable TV	FFL	Finished Floor Level	TCB	Telephone Call Box
DC	Drainage Channel	FP	Flagpole		
		Gas	Gas	THL	Threshold Level
DK	Drop Kerb	GV	Gas Valve	TL	Traffic Light
DP	Down Pipe	GY	Gully	TP	Telegraph Post
Elec	Electric	Ht	Height	TS	Traffic Signal
EP	Electricity Post	IC	Inspection Chamber	UTS	Unable to Survey
ER	Earth Rod	IFL	Internal Floor Level	WL	Water Level
FH	Fire Hydrant	IL	Invert Level (as a reduced level)	WM	Water Meter
FL	Floodlight			WO	Wash Out

Rev	Date	Details of issue / revision	Drw	Rev
P2	01.03.22	Extra Sections Added	IR	DS
P1	18.10.21	First Issue	IR	DS

Issues & Revisions

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OXFORDSHIRE RAILFRIEGHT LTD

Project Title

OXFORDSHIRE RFI

Drawing Title

EXISTING WATERCOURSE LAYOUT SHEET 12 Of 13

Drawn: [redacted] Reviewed: [redacted]

BWB Ref: NTH2479 Date: 18.10.21 Scale@A0: 1:2500

Drawing Status

INFORMATION

Project - Originator - Zone - Level - Type - Role - Number	Status	Rev
OXSRFI-BWB-12-ZZ-M2-G-0060	S2	P2

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Appendix 2: Hydrological Assessment

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ADVISORY

Oxfordshire Railfreight Limited
Oxfordshire RFI
Oxfordshire
Flow Estimation Record

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ADVISORY

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August 2025

DOCUMENT ISSUE RECORD

Document Number:	OXSRFI-BWB-ZZ-XX-T-W-1004_FER
BWB Reference:	NTH2479_PBT_FER

Author:	[redacted]
Checked:	[redacted]
Approved:	[redacted]

Rev	Date	Status	Comment	Author:	Checked:	Approved:
P01	28/08/25	S2	Preliminary Issue	SR	CG	MD

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All Environment Agency mapping data used under special license. Data is current as of August 2025 is subject to change.

The information presented, and conclusions drawn, are based on statistical data and are for guidance purposes only. The study provides no guarantee against flooding of the study site or elsewhere, nor of the absolute accuracy of water levels, flow rates and associated probabilities.

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1. METHOD STATEMENT

Overview of Requirements

1.1 Flow estimates are required for input into a hydraulic model of the Padbury Brook Tributary, to support a Development Consent Order (DCO) application for a Strategic Rail Freight Interchange (SRFI) in Oxfordshire.

1.2 The Padbury Brook Tributary flows through the Order Limits in an easterly direction. The location of the site of interest and the watercourse to be modelled is provided in **Figure 1.1.**



Figure 1.1: Site Location

1.3 Return periods to be assessed include: 2, 5, 10, 20, 30, 50, 75, 100, 200 and 1000-years. To inform the design event and potential future floodplain, the 1 in 100-year event with a range of climate change allowances applied will also be simulated. Hydrographs are required as well as peak flows.

1.4 The Client's agreed project scope does not include for detailed gauging station data quality review, rating reviews or updates, detailed flood history review or ReFH model parameter estimation.

1.5 The hydrological assessment was undertaken in May 2025. The Environment Agency (EA) Flood Estimation Guidelines[1] and River Modelling: Technical Standards and Assessment

[1] LIT 11832 Flood Estimation Guidelines Version 9, Environment Agency (November 2023)

Guidance (Estimate Flood Flow from rainfall and river flow data)[2] were referred to throughout the hydrological analysis.

Study Complexity

Table 1.1: Study Complexity

Complexity	Category for this Study
Simple	☐
Moderate	✓
Difficult	☐
Very Difficult	☐

Catchment Description

1.6 The Padbury Brook Tributary rises to the west of the Order Limits, upstream of Raghouse Lane. The watercourse generally flows in an easterly direction and is culverted under the railway and Somerton Road, before flowing in a north-easterly direction in open channel to its confluence with the Padbury Brook.

1.7 The upper catchment of the Padbury Brook Tributary has elevations of approximately 139metres Above Ordnance Datum (mAOD). The upper reaches flow through a narrow, defined channel with valley-like topography. Downstream of the railway, the watercourse flows through a wider valley, with levels falling to approximately 112mAOD in the vicinity of the confluence with the Padbury Brook. The catchment topography is shown in **Figure 1.2**.

[2] River Modelling: technical standards and assessment (estimate flood flow from rainfall and ricer flow data, Environment Agency (December 2023)

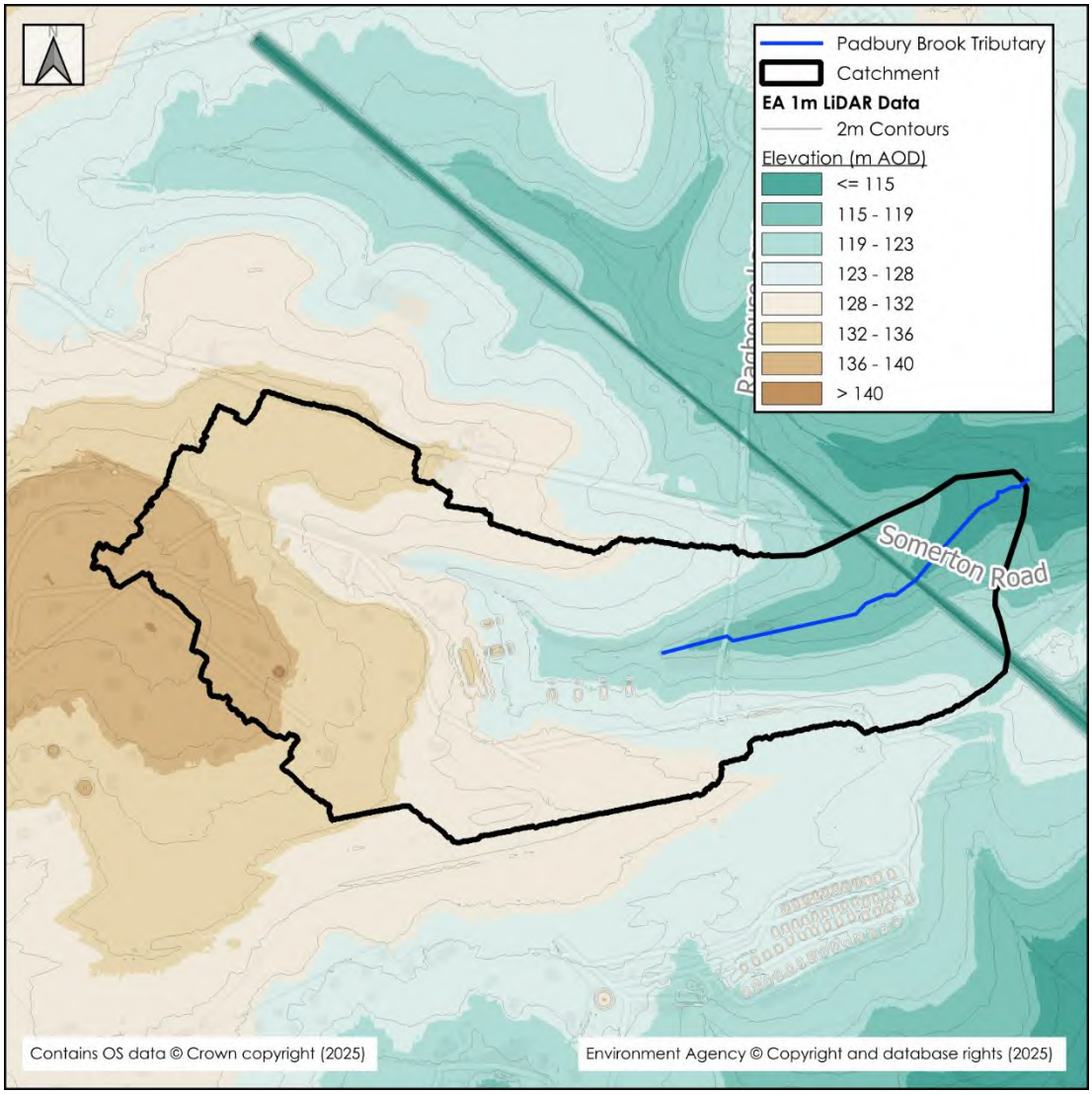

Figure 1.2: Catchment Topography

1.8 British Geological Survey (BGS) mapping indicates that the catchment is predominately underlain by White Limestone Formation (Limestone). The following bedrock is also present within the east of the catchment:

- Rutland Formation (Mudstone);
- Forest Marble Formation (Limestone); and
- Bladon Member (Mudstone and Limestone, Interbedded).

1.9 Superficial deposits of Head (Clay, Silt, Sand and Gravel) and Alluvium (Clay, Silt, Sand and Gravel) are mapped within the catchment, aligned with the watercourse corridor.

1.10 Soils in the catchment are expected to comprise 'freely draining lime-rich loamy soils'.

1.11 Land use in the catchment is predominantly rural, comprising agricultural land. Heyford Park, a former RAF airfield, is located in the upper catchment.

1.12 No features that may impact the flood hydrology, such as ponds, have been identified.

Climate Change

1.13 Predicted future change in peak river flows caused by climate change are provided by the EA, with a range of projections applied to regionalised 'River Basin Districts' which are subdivided into Management Catchments.

1.14 The catchment falls within the Upper and Bedford Ouse Management Catchment of the Anglian River Basin District. **Table 1.2** identifies the relevant peak river flow allowances from this River Basin District.

Table 1.2: Peak River Flow Allowance for the Upper and Bedford Ouse Management Catchment

Allowance Category	Total potential change anticipated for the '2020s' (2015 to 2039)	Total potential change anticipated for the '2050s' (2040 to 2069)	Total potential change anticipated for the '2080s' (2070 to 2125)
Upper End	24%	30%	58%
Higher Central	10%	11%	30%
Central	5%	4%	19%

Available Hydrometric Data

1.15 The National River Flow Archive (NRFA) Peak Flow Dataset Version 13.0.2 (released August 2024) will be utilised in this assessment for the purposes of identifying any potential donor stations and for the development of pooling groups. This contains data up to water year 2022-23.

1.16 There are no hydrometric gauges within the catchment. Therefore, there are no current hydrometric records of river flows or levels for the watercourse on which a hydrological assessment of flood flows can be made.

Other Data

Table 1.3: Other Data Sources

Type of Data	Data relevant to this study?	Data available?	Source of Data	Details
Check flow gaugings	There are no gauges within the study catchment and the project scope does not include for a review of gauging stations.			
Historical flood data	Yes	See **Section 7**		
Flow or river level data for events	The project scope does not include for a review of gauging stations/data. However, NRFA data will be used where available and applicable.			

Type of Data	Data relevant to this study?	Data available?	Source of Data	Details
Rainfall data for events	The lack of flow or level gauge data for the study catchment means it is not possible to use rainfall data to refine ReFH2 model parameters.			
Potential evaporation data	No	No		
Results from previous studies	No	No		
Other data or information	N/A			

Conceptual Model

Table 1.4: Conceptual Model

Where is the main site(s) of interest?	The main site of interest is the proposed development, comprising an SRFI in Oxfordshire. The watercourse to be modelled is shown in **Figure 1.1**. The Padbury Brook Tributary flows through the Order Limits in an easterly direction.
What is likely to cause flooding at those locations? (e.g. peak flows, flood volumes, combination of peaks, groundwater, snowmelt, tides…)	Peak flows from fluvial sources are likely to be the main cause of flooding at the site. The watercourse is culverted in several locations, and as such there is potential for backing up of flows if these structures have insufficient capacity. EA strategic flood risk mapping suggests that the floodplain associated with the watercourse is relatively confined to the watercourse corridor, although out of bank flows are depicted.
Might these locations flood from runoff generated on part of the catchment only e.g. downstream of a reservoir?	There are no significant attenuation features within the catchment.
Are there any unusual catchment features? E.g. highly permeable (BFIHOST19>0.66), heavily urbanised, pumped, major reservoir influence (FARL<0.9), FSAs, historical or operational mining?	The catchment is classed as highly permeable, with a BFIHOST19 value of 0.85. Due to the permeable nature of the study catchment, the Statistical method will be the preferred approach for estimating peak flows. This is because floods in groundwater dominated catchments are influenced by hydrogeological factors not adequately represented in rainfall-runoff approaches. The catchment is not classed as heavily urbanised (URBEXT greater than 0.6) and there is no major reservoir influence or attenuation features.

Initial Choice of Approach

Table 1.5: Method Statement

Is FEH appropriate?	Yes
Initial choice of method(s) and reason	Flows will be estimated using both Statistical and ReFH2 methods. Both methods are suitable for the catchment and using both will enable comparison between results before choosing the final method.
How will hydrograph shapes be derived?	It is anticipated that ReFH2 will be used to provide hydrograph shapes.
Will different storm durations need to be considered?	A uniform storm duration will be applied to the modelling.
Lumped or Distributed approach for model inputs	Flow estimates will be undertaken for lumped catchments. **Section 6** provides detail on how these will be applied to the model (i.e., distributed via area weighting, intervening hydrographs etc).
Software to be used	WINFAP version 5.1, ReFH2 version 4.1, Wallingford Hydro Solutions Non Flood Years Spreadsheet Beta v2.2

Previous Hydrological Assessments

1.17 No previous hydrological assessments have been undertaken for this catchment with which to compare results.

2. LOCATIONS WHERE FLOOD ESTIMATES ARE REQUIRED

Location of Flow Estimates

Table 2.1: Summary of Subject Sites

Site code	Watercourse	Site	Easting	Northing	Area on FEH Webservice (km^2)	Revised area (if altered) (km^2)
PBT001	Padbury Brook Tributary	Confluence of Padbury Brook Tributary and Padbury Brook	453400	227850	1.2	1.7
Reasons for choosing locations		The location is based on the downstream extent of the hydraulic model of the Padbury Brook Tributary. One flow estimation point is considered appropriate due to the relatively small difference in catchment area between the upstream and downstream extents of the model.				

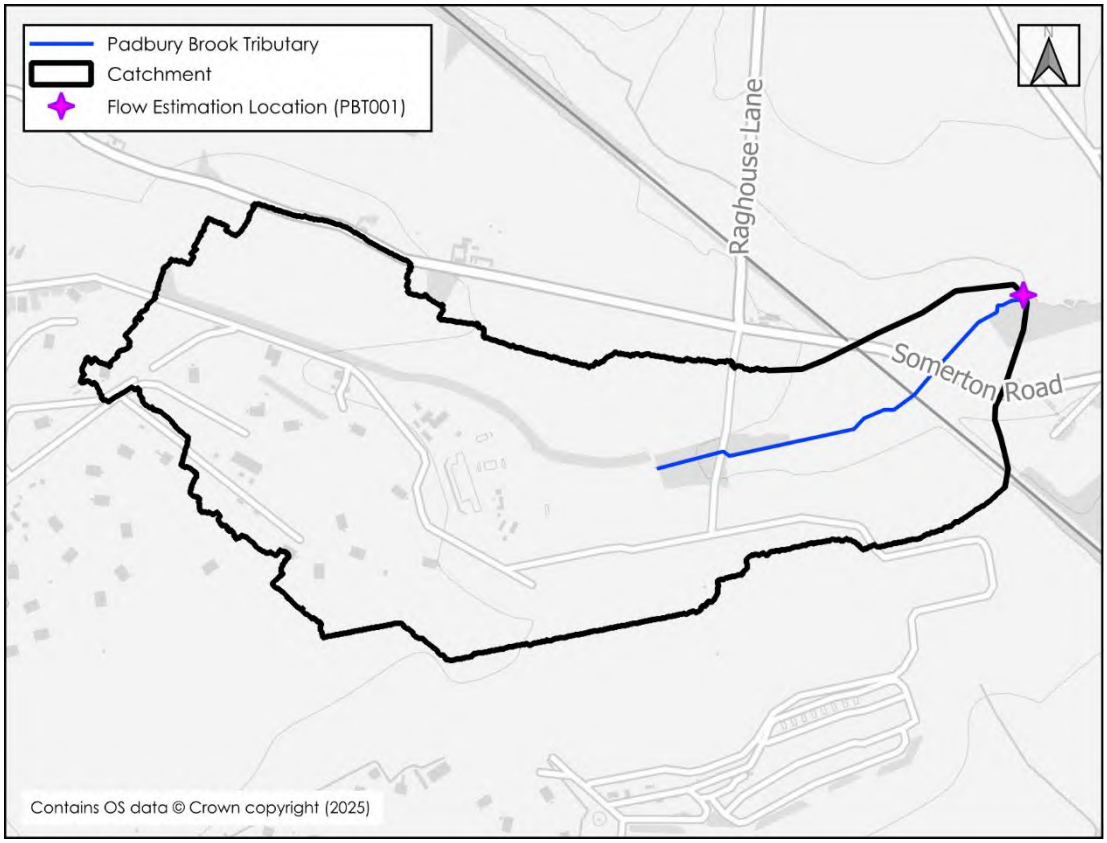

Figure 2.1: Flow Estimation Location

Checking Catchment Descriptors

Table 2.2: Catchment Descriptor Checks

Record how catchment boundary was checked and describe any changes.	The catchment boundary was initially identified using the FEH Web Service. The boundary was reviewed using EA LiDAR data and OS Mapping. A watershed analysis was also undertaken. Following this, adjustments to the catchment boundaries were required and these are illustrated in **Figure 2.2**.
Record how other catchment descriptors (especially soils) were checked and describe any changes. Include before/after table if necessary.	As the changes to catchment area are relatively small, with no significant change to the catchment shape, as well as the limitations of the standard DPLBAR equation within FEH Volume 5, the DPLBAR in the original FEH catchment descriptors has been retained. BFIHOST and SPRHOST values are reasonable based on the geology and soils of the catchments. FARL was checked against OS mapping and was considered appropriate for the catchment.
Source of URBEXT	$URBEXT_{2000}$
Method for updating of URBEXT to present day.	$URBEXT_{2000}$ for the catchment is 0. A review of aerial mapping for the catchment showed there has been no urbanisation in the catchment since 2000; therefore, the present day value of $URBEXT_{2000}$ will remain as 0.

Table 2.3: Important Catchment Descriptors

Site Code	FARL	PROPWET	BFIHOST19	DPLBAR (km)	DPSBAR (m/km)	SAAR	SPRHOST	URBEXT 2000	FPEXT
PBT001	1.00	0.32	0.85	1.41	17.1	674	5.50	0.00	0.071

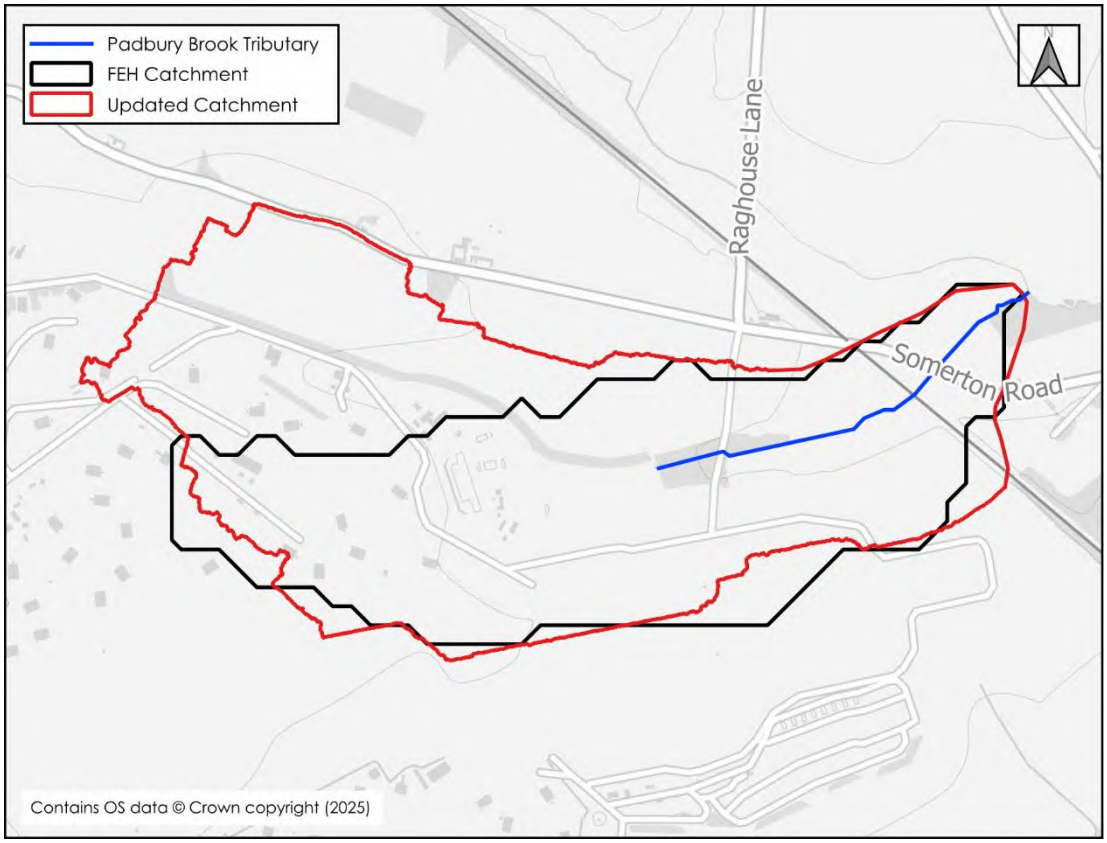

Figure 2.2: Original and Amended Catchment Boundaries

3. STATISTICAL METHOD

3.1 WINFAP was utilised to undertake a statistical analysis of the catchment using a hydrometric record of gauged catchments with similar characteristics.

QMED Development

3.2 Catchment descriptors were originally used to estimate the rural QMED of the study site using the revised equation from Science Report (SC050050). The FEH states that flood frequency is best estimated by gauged data and estimation of key variables from catchment descriptors alone should be a method of last resort. As such, a search was undertaken to identify any potential donor sites that could be used to adjust QMED.

3.3 Phase 2 of Science Report SC090031[3] recommends using a single donor, chosen based on proximity, to adjust QMED for 'small catchments' (defined as catchments with an area of less than 25km^2). This method can also be applied to catchments less than 40km^2 and is implemented in WINFAP5.

3.4 With the guidance in mind, a search was undertaken within WINFAP to identify the closest station to the flow estimation point(s). The data quality of potential donor(s) was also reviewed. Of the recommended donors, the following were rejected:

- *Cherwell at Enslow Mill* (NRFA reference: 39021) - station has limited utility for flood analysis; level measurement imprecise prior to 1967 and bypassing has varied in magnitude through time.
- *Bedford Ouse at Thornborough* (NRFA reference: 33005) - station closed in 1991 and therefore, recent flood events will not be captured within the record.

3.5 The next closest station to the subject site, the *Evenlode at Cassington Mill* (NRFA reference: 39034), was considered suitable for donor transfer following the review.

3.6 Details for the donor station(s) used to adjust QMED, and which flow estimation point(s) they have been applied to, are provided in **Table 3.1**. Details of the donor adjustment(s) and final QMED estimation are provided in **Table 3.2**.

3.7 Adjustment for climatic variation was not required as the donor station has a record length greater than 14 years.

Table 3.1: Donor Station Details

Station Number	QMED from 'as rural' Observed Data (A)* (m^3/s)	'As rural' QMED from Catchment Descriptors (B)** (m^3/s)	Adjustment Ratio (A/B)	Flow estimation point(s) donor is applied to
39034	20.02	21.14	0.95	PBT001

[3] Science Report SC090031/R0: Estimating flood peaks and hydrographs for small catchments (Phase 2), Environment Agency (2019).

Table 3.2: Overview of Estimation of QMED at the Subject Site

Site Code	Method	Initial Estimate of QMED (m^3/s) (Rural)	Data Transfer				Final estimate of QMED (m^3/s) (URBAN)
			Donor site NRFA no	Distance between centroids d_j (km)	Power term, a	Moderated QMED adjustment factor (A/B)[a]	
PBT001	Donor Transfer	0.09	39034	20.14	0.307	0.98	0.08
Are the values of QMED consistent, for example at successive points along the watercourse and at confluences?		QMED is consistent with the size and characteristics of the catchment.					
Which version of the urban adjustment was used for QMED?		Urban adjustment was applied using Kjeldsen (2010), as applied in WINFAP.					

Note: Flow estimates are quoted to 2 decimal places to demonstrate change in flow estimates; this does not indicate a greater degree of accuracy.

Derivation of Pooling Groups

3.8 A pooled group of hydrologically similar gauged sites was generated by the WINFAP software for the subject sites using the 'OK for Pooling' dataset. WINFAP uses the deurbanised pooling group L-moments as default.

3.9 The 'small catchment' pooling procedure implemented within WINFAP has been used. This procedure selects the pooling group using a similarity measure that only considers AREA and SAAR, as recommended by SC090031.

Pooling Group Review

3.10 The pooling group was reviewed to identify sites which may be inappropriate due to being significantly hydrologically dissimilar to the study site, or if they have any inaccuracies, uncertainties, or limitations in their data record.

Adjustment for Non-Flood Years

3.11 For some catchments there are years in which no floods occur (non-flood years), and the annual maximum flow is due to baseflow alone. To avoid a bias in the flood frequency analysis in which growth factors reach an upper limit (the growth curve is bounded above), the L-moments have been adjusted to remove the influence of non-flood years (classed as annual maximum flows smaller than 0.5QMED).

3.12 The adjustment for non-flood years has been undertaken using Wallingford HydroSolutions 'WHS Non-flood Years Spreadsheet Beta v2.2'.

Urban Adjustment

3.13 Growth curves were also adjusted for to reflect the urban influence, using the methods adopted in WINFAP[4] which is based on those published by Kjeldsen 2010[5].

Choice of Distribution

3.14 In accordance with the EA FEH Guidelines, the distribution has been chosen based on which gives the best fit from Generalised Logistic (GL), Generalised Extreme Value (GEV) and Kappa 3.

3.15 The only exception to this is when a pooling group has been adjusted for non-flood years as the procedure for the adjustment uses the GL distribution.

3.16 Further detail on pooling group composition is provided in **Section 8.**

Table 3.3: Derivation of Pooling Groups: PBT001

Name of group	Subject site treated as gauged? (enhanced single site analysis)	Distribution used	Change made to default pooling group with reasons, including any sites investigated but retained in the group	Weighted average L-moments L-CV and L-skew (before any urban and non-flood year adjustment)
PBT001_DS	No	GL	**Stations Removed:** 26016 – non-flood years over 15% of the record. Following a review of the station on the NRFA, the station was removed from the group as the watercourse is known to run dry for the part of the year and is, therefore, considered dissimilar from the subject site. 26014 - following a review of the station on the NRFA, the station was removed from the group as the watercourse is known to regularly dry up and is, therefore, considered dissimilar from the subject site. 7011 and 7012 – removed due to unusually steep growth curves which give very high 1 in 100-year growth factors (>10), which are not considered to be	L-CV: 0.275 L-Skew: 0.260

4 Wallingford HydroSolutions (2016), WINFAP 4 Urban adjustment procedures, Wallingford HydroSolutions Ltd 2016.
5 Kjeldsen, T.K., 2010. Modelling the impact of urbanization on flood frequency relationships in the UK. Hydrology Research, volume 41, issue 5, pp391-405

Name of group	Subject site treated as gauged? (enhanced single site analysis)	Distribution used	Change made to default pooling group with reasons, including any sites investigated but retained in the group	Weighted average L-moments L-CV and L-skew (before any urban and non-flood year adjustment)
			representative of the study catchment. 28058 – the station was noted to have a negative L-Skew value and shows the growth curve has reached a natural bound. **Stations Added:** 41020 and 39033 - added in to provide 500+ years of data. **Comments:** 49005 – station reviewed for high discordancy. No obvious explanation for this was found; the station was therefore retained. 36010 and 44008 - were flagged for non-flood years comprising over 15% of record. The catchment responses were reviewed and were not considered significantly different to that expected for the study catchment, and so the stations were retained and the adjustment for non-flood years applied. The pooling group is heterogeneous and a review of the pooling group is desirable. It is not considered possible to improve the pooling group any further.	

Table 3.4: Final Choice of Flood Growth Curves at the Subject Site

Site code	Method (SS, P, ESS)	Name of pooling group	Distribution used and reason for choice	Urban adjustment and/or non-flood years adjustment applied?	Growth factor for 1% AEP event
PBT001	P	PBT001_DS	GL distribution was chosen because it is the default distribution used	Urban adjustment and non-flood years adjustment applied within the WHS Non	3.45

Site code	Method (SS, P, ESS)	Name of pooling group	Distribution used and reason for choice	Urban adjustment and/or non-flood years adjustment applied?	Growth factor for 1% AEP event
			for the adjustment for non-flood years	Flood Years Spreadsheet Beta v2.2.	

Table 3.5: Flood Estimates from the Statistical Method

Site Code	Flood peak (m^3/s) for the following return periods / Annual Exceedance Probabilities									
	2 (50%)	5 (20%)	10 (10%)	20 (5%)	30 (3.33%)	50 (2%)	75 (1.33%)	100 (1%)	200 (0.5%)	1000 (0.1%)
PBT001	0.08	0.12	0.15	0.18	0.21	0.24	0.27	0.29	0.35	0.55

Note: Flow estimates are quoted to 2 decimal places to demonstrate change in flow estimates; this does not indicate a greater degree of accuracy.

4. REVITALISED FLOOD HYDROGRAPH (ReFH) METHOD

4.1 The ReFH2 Revitalised Flood Hydrograph Modelling Tool (Version 4.1) was used to undertake an estimation of the peak flows for the subject site.

Table 4.1: Overview of Parameters for ReFH2 Method

Site code	Method OPT: Optimisation BR: Baseflow recession fitting CD: Catchment descriptors DT: Data transfer	Tp (hours) Time to peak	C_{max} (mm) Maximum storage capacity	BL (hours) Baseflow lag	BR Baseflow recharge
PBT001	Parameters calculated using catchment descriptors.				
Description of flood event analysis carried out			Flood event analysis is not possible as study catchment is ungauged.		

Table 4.2: Design Events

Site code	Rainfall DDF model	Season of design event	Storm duration	Selected interval	Initial soil moisture (Cini)	Initial baseflow (BFO)
PBT001	FEH22	Winter	5.5hrs	0.5hrs	Default value	Default value
Comments	A uniform 5.5hr winter storm will be applied at the modelling stage.					

Table 4.3: Flood Estimates from the ReFH Method (based on recommended duration for individual catchments)

Site Code	Flood peak (m^3/s) for the following return periods / Annual Exceedance Probabilities									
	2 (50%)	5 (20%)	10 (10%)	20 (5%)	30 (3.33%)	50 (2%)	75 (1.33%)	100 (1%)	200 (0.5%)	1000 (0.1%)
PBT001	0.08	0.11	0.14	0.16	0.18	0.20	0.23	0.24	0.29	0.45

Note: Flow estimates are quoted to 2 decimal places to demonstrate change in flow estimates; this does not indicate a greater degree of accuracy.

5. DISCUSSION AND SUMMARY OF RESULTS

Comparison of Method

5.1 A comparison of the peak flow results for the different estimation methods for the 1 in 2-year and 1 in 100-year events is provided in **Table 5.1**. Comparisons of the growth curves for both methods are shown in **Figure 5.1**.

5.2 The Statistical method provided a steeper growth curve compared to the ReFH2 method. The Statistical method also provided higher peak flows for all return periods.

Table 5.1: Comparison of Results

Site code	1 in 2-year peak flows (50% Annual Exceedance Probability)			1 in 100-year peak flows (1% Annual Exceedance Probability)		
	Statistical	ReFH	Ratio	Statistical	ReFH	Ratio
PBT001	0.08	0.08	1.06	0.29	0.24	1.20

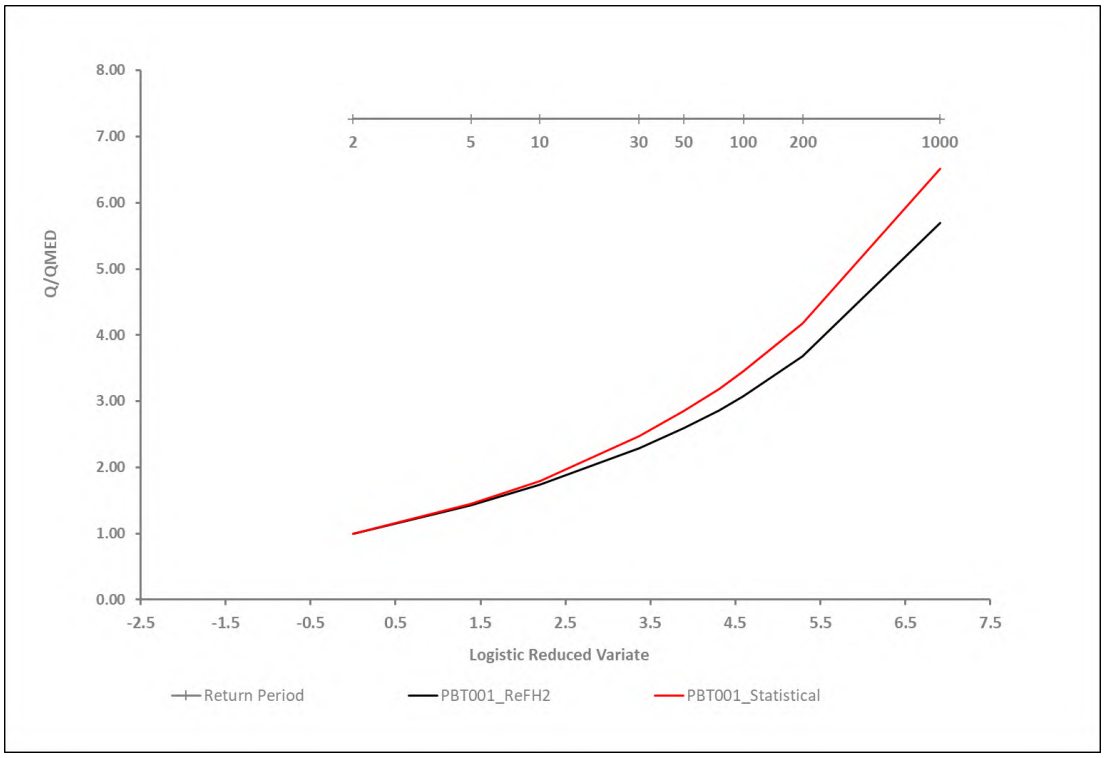

Figure 5.1: Comparison of Statistical method and ReFH Growth Curves

Final Method and Flows

Table 5.2: Final Choice of Method

Choice of method and justification	The final choice of peak flows for input into the model is the Statistical method, in line with EA FEH Guidelines recommendation that it is normally a more appropriate choice for groundwater-dominated catchments. The Statistical method benefits from an up-to-date peak flood dataset, using growth curves from hydrologically similar catchments to derive a growth curve. Flow estimates have been improved by utilising a catchment with similar characteristics for the QMED adjustment. In the absence of any suitable observed data with which to derive a hydrograph shape, ReFH2 will be used to provide a hydrograph shape for the model inflows, scaled to the Statistical peak. **Section 6** describes how flows will be applied to the model.

Table 5.3: Final Peak Flows from Chosen Method (Statistical)

Site Code	Flood peak (m^3/s) for the following return periods / Annual Exceedance Probabilities									
	2 (50%)	5 (20%)	10 (10%)	20 (5%)	30 (3.33%)	50 (2%)	75 (1.33%)	100 (1%)	200 (0.5%)	1000 (0.1%)
PBT001	0.08	0.12	0.15	0.18	0.21	0.24	0.27	0.29	0.35	0.55

Note: Flow estimates are quoted to 2 decimal places to demonstrate change in flow estimates; this does not indicate a greater degree of accuracy.

Table 5.4: Assumptions, Limitations and Uncertainty

List the main assumptions made	• The pooling groups are representative of the catchments. • The ReFH2 hydrograph shape is representative of the catchment response. • Tp and storm duration are representative of the catchment response. • The revised catchment boundary accurately reflects the actual catchment boundary. • The flow estimate derived at the downstream model extent is applicable to the catchment at the upstream model extent. • There are no swallow-holes or springs within the catchment and the groundwater catchment corresponds to the topographical catchment. • DPLBAR is representative of the amended catchment boundary.
Discuss any limitations e.g. applying methods outside the range of catchment types or return periods for which they were developed	• The FEH Statistical and ReFH2 methods are believed to be suitable up to the 1 in 200-year event. Estimates of flow beyond these events are extrapolations and, therefore, have a higher level of uncertainty. • There are only a small number of gauged sites in the UK. As such the representation in the pooling group is not

	ideal given the small size of some of the study catchments. • There is no observed flow data within the catchment with which to verify the flow estimates. • The FEH regression equation for QMED can result in overestimates on groundwater-dominated catchments. However, the calculated QMED value has been improved using donor transfer and appear sensible for the size and characteristics of the catchment. • The adjustment for non-flood years methodology uses a GL distribution. However, WINFAP showed a Kappa 3 distribution provided a better fit.
Give what information you can on uncertainty in the results	According to Table 2 of the EA FEH Guidelines, confidence intervals for the 1 in 100-year event for a rural catchment ($URBEXT_{2000}$ < 0.03) when calculated from catchment descriptors are quoted as 0.45-2.23 (for the 95% confidence interval). Confidence is improved when using observed data from a donor site. When one donor is used in the assessment, the confidence intervals changes to 0.47-2.12 (for the 95% confidence interval). It is more difficult to quantity uncertainty in design flows estimated from the ReFH rainfall-runoff model. However, evidence[6] suggests the factorial standard errors from ReFH2 are comparable to those observed for the FEH pooled Statistical method when the catchment is treated as ungauged.
Comment on the suitability of the results for future studies	The design flow estimates have been derived for the purpose of providing flow hydrographs for a hydraulic model to support a planning application. Prior to use in future different studies, these results should, at minimum, be reviewed to assess their suitability for the purpose of the study.
Give any other comments on the study	While the installation of temporary flow gauges would provide local data which may better inform the design peak flows and hydrograph shapes, this would not align with the scope and timescales of this project.

Table 5.5: Checks

Are the results consistent?	The peak flows are consistent with the size and characteristics of the catchment.
What do the results imply regarding the return periods of floods during the period of record?	It is not possible to imply return periods of floods due to the lack of gauged data within the study catchment and insufficient information on any historical flooding events.
What is the 1 in 100-year growth factor? (the guidance	Statistical Method: 3.45 ReFH2: 3.07

[6] Wallingford Hydrosolutions (2019) ReFH2 Science Report: Evaluation of the Rural Design Event Model.

suggests a typical range or 2.1 to 4.0)	Growth factors are within the typical range.
If 1 in 1000-year flows have been derived, what is the range of ratios for 1 in 1000-year flow over 1 in 100-year flow?	Statistical Method: 1.89 ReFH2: 1.85
How do the results compare with those of other studies? Explain any differences and conclude which results should be preferred	There are no previous studies with which to compare results.
Are the results consistent with the longer-term flood history?	There is no long-term flood record for the catchment with which to compare the modelled results to.
Describe any other checks on the results	Sensibility checks of modelled outlines will be undertaken at the modelling stage.

6. APPLICATION OF FLOWS TO MODEL

6.1 Flows will be applied to the model in the following way.

i. To derive the hydrographs, the ReFH2 hydrographs were scaled to meet the Statistical Method peak flows.

ii. Flows will be applied as a point inflow at the upstream extent of the modelled watercourse.

6.2 The proportion of the hydrograph applied at each inflow, as well as the type of inflow, is shown in **Table 6.1. Figure 6.1** demonstrates how the flows will be applied to the model.

Table 6.1: Hydrograph Proportions

Sub Catchment	Type of inflow	Proportion of Hydrograph
PBT001 Inflow	Point	100%

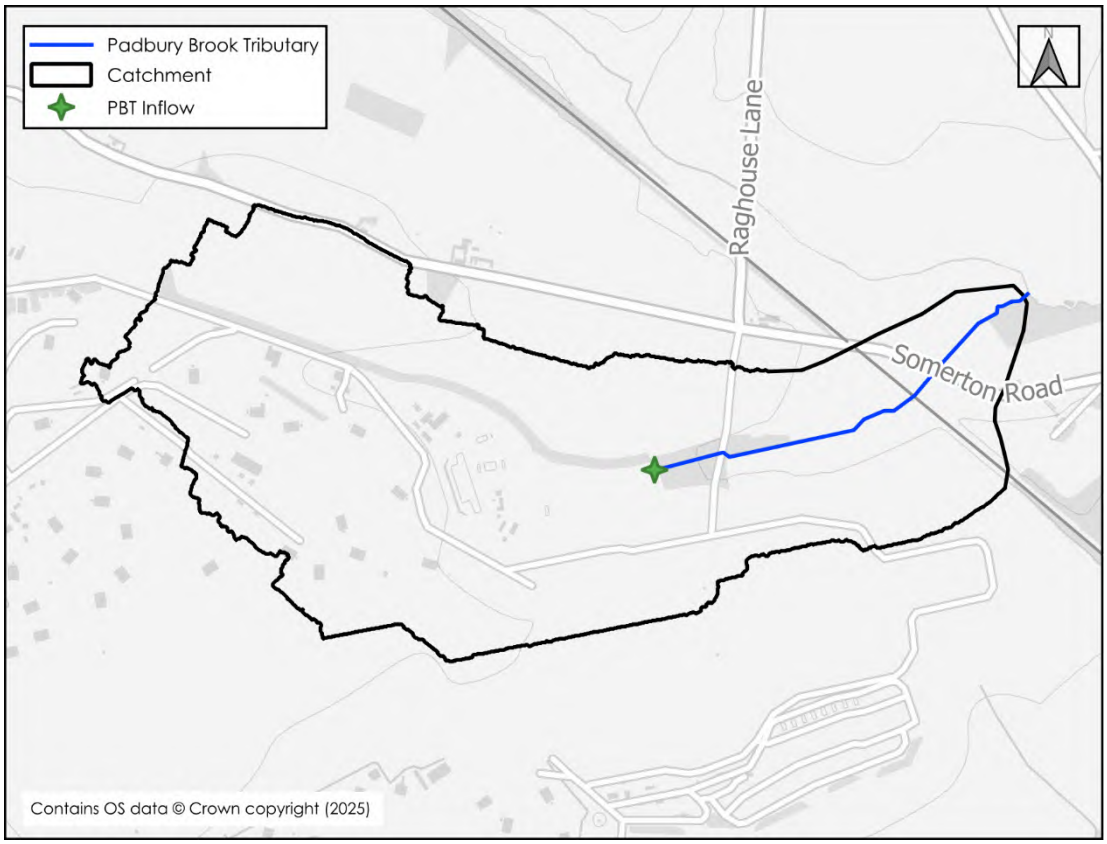

Figure 6.1: Application of Inflows into Model

7. FLOOD HISTORY

Flood History

7.1 A flood history review has been undertaken for the catchment. **Table 7.1** sets out the findings from this review.

Table 7.1: Flood History Review

Data Source	Flood Event Details
Strategic Flood Risk Assessments (SFRA)	No flood history relevant to the catchment was found within the Cherwell District Council Level 1[7] or Level 2[8] SFRAs.
EA Recorded Flood Outlines	There are no EA recorded flood outlines within the catchment.
Section 19 Flood Investigations	Oxfordshire County Council have produced 41 Section 19 Flood Investigation Reports; however, there are no records of flood investigations with the catchment.
British Chronology of Hydrological Events	No flood history relevant to the catchment was found.
Online News Articles	No flood history relevant to the catchment was found.
Other Sources	No additional records of historical flooding has been identified.

[7] Level 1 Strategic Flood Risk Assessment (Wallingford HydroSolutions, March 2025)
[8] Level 2 Strategic Flood Risk Assessment (Wallingford HydroSolutions, October 2024)

8. DETAILED POOLING GROUP INFORMATION

Table 8.1: Default Pooling Group: PBT001_DS

Station	Distance	Years of Data	QMED AM	Deurbanised L-CV	Deurbanised L-Skew	Discordancy
27073 (Brompton Beck @ Snainton Ings)	1.268	43	0.812	0.213	0.032	0.995
76011 (Coal Burn @ Coalburn)	1.393	46	1.826	0.170	0.296	1.359
27051 (Crimple @ Burn Bridge)	1.437	51	4.564	0.217	0.141	0.440
26016 (Gypsey Race @ Kirby Grindalythe)	1.819	26	0.100	0.318	0.253	0.168
25019 (Leven @ Easby)	1.849	45	5.090	0.342	0.372	0.098
45816 (Haddeo @ Upton)	2.016	30	3.352	0.289	0.407	0.395
49005 (Bolingey Stream @ Bolingey Cocks Bridge)	2.194	13	4.072	0.275	0.294	3.548
27010 (Hodge Beck @ Bransdale Weir)	2.213	41	9.420	0.224	0.293	0.542
36010 (Bumpstead Brook @ Broad Green)	2.260	56	7.855	0.350	0.106	1.885
44008 (South Winterbourne @ Winterbourne Steepleton)	2.297	32	0.572	0.406	0.254	0.955
7009 (Mosset Burn @ Wardend Bridge)	2.302	25	7.053	0.365	0.329	0.144
28033 (Dove @ Hollinsclough)	2.337	48	4.138	0.235	0.367	0.892
26014 (Water Forlornes @ Driffield)	2.363	25	0.424	0.319	0.204	0.342
7011 (Black Burn @ Pluscarden Abbey)	2.500	11	4.298	0.495	0.580	1.383
7012 (Lossie @ Ballachraggan)	2.523	9	7.262	0.488	0.670	1.854
27073 (Brompton Beck @ Snainton Ings)	1.268	43	0.812	0.213	0.032	0.995
Total		501				
Weighted Means				0.303	0.282	
H2 value	3.6786					

Goodness of Fit	Generalised Logistic	General Extreme Value	Kappa 3
	1.6679	0.2152	1.1872

Table 8.2: Final Pooling group (adjusted for non-flood years): PBT001_DS

Station	Distance	Years of Data	QMED AM	Deurbanised L-CV	Deurbanised L-Skew	Discordancy
27073 (Brompton Beck @ Snainton Ings)	1.268	43	0.812	0.213	0.032	1.461
76011 (Coal Burn @ Coalburn)	1.393	46	1.826	0.170	0.296	0.951
27051 (Crimple @ Burn Bridge)	1.437	51	4.564	0.217	0.141	0.572
25019 (Leven @ Easby)	1.849	45	5.090	0.342	0.372	0.463
45816 (Haddeo @ Upton)	2.016	30	3.352	0.289	0.407	0.574
49005 (Bolingey Stream @ Bolingey Cocks Bridge)	2.194	13	4.072	0.275	0.294	2.754
27010 (Hodge Beck @ Bransdale Weir)	2.213	41	9.420	0.224	0.293	0.283
36010 (Bumpstead Brook @ Broad Green)	2.260	56	7.855	0.350	0.106	1.623
44008 (South Winterbourne @ Winterbourne Steepleton)	2.297	32	0.572	0.406	0.254	1.27
7009 (Mosset Burn @ Wardend Bridge)	2.302	25	7.053	0.365	0.329	0.524
28033 (Dove @ Hollinsclough)	2.337	48	4.138	0.235	0.367	0.620
41020 (Bevern Stream @ Clappers Bridge)	2.550	54	13.78	0.200	0.162	0.778

Station	Distance	Years of Data	QMED AM	Deurbanised L-CV	Deurbanised L-Skew	Discordancy
39033 (Winterbourne Stream @ Bagnor)	2.626	61	0.399	0.337	0.377	1.126
Total		545				
Weighted Means				0.275	0.260	
H2 value	3.4029					

Goodness of Fit	Generalised Logistic	General Extreme Value	Kappa 3
	0.477	-0.8848	0.0216

Adjusted L-Moments following Adjustment for Non-Flood Years

Station	Adjusted L-CV	Adjusted L-Skew
27073 (Brompton Beck @ Snainton Ings)	0.199	0.066
76011 (Coal Burn @ Coalburn)	0.170	0.296
27051 (Crimple @ Burn Bridge)	0.209	0.158
25019 (Leven @ Easby)	0.327	0.404
45816 (Haddeo @ Upton)	0.284	0.421
49005 (Bolingey Stream @ Bolingey Cocks Bridge)	0.275	0.294
27010 (Hodge Beck @ Bransdale Weir)	0.220	0.306
36010 (Bumpstead Brook @ Broad Green)	0.287	0.174
44008 (South Winterbourne @ Winterbourne Steepleton)	0.450	0.134
7009 (Mosset Burn @ Wardend Bridge)	0.353	0.335
28033 (Dove @ Hollinsclough)	0.228	0.397
41020 (Bevern Stream @ Clappers Bridge)	0.187	0.208
39033 (Winterbourne Stream @ Bagnor)	0.309	0.440

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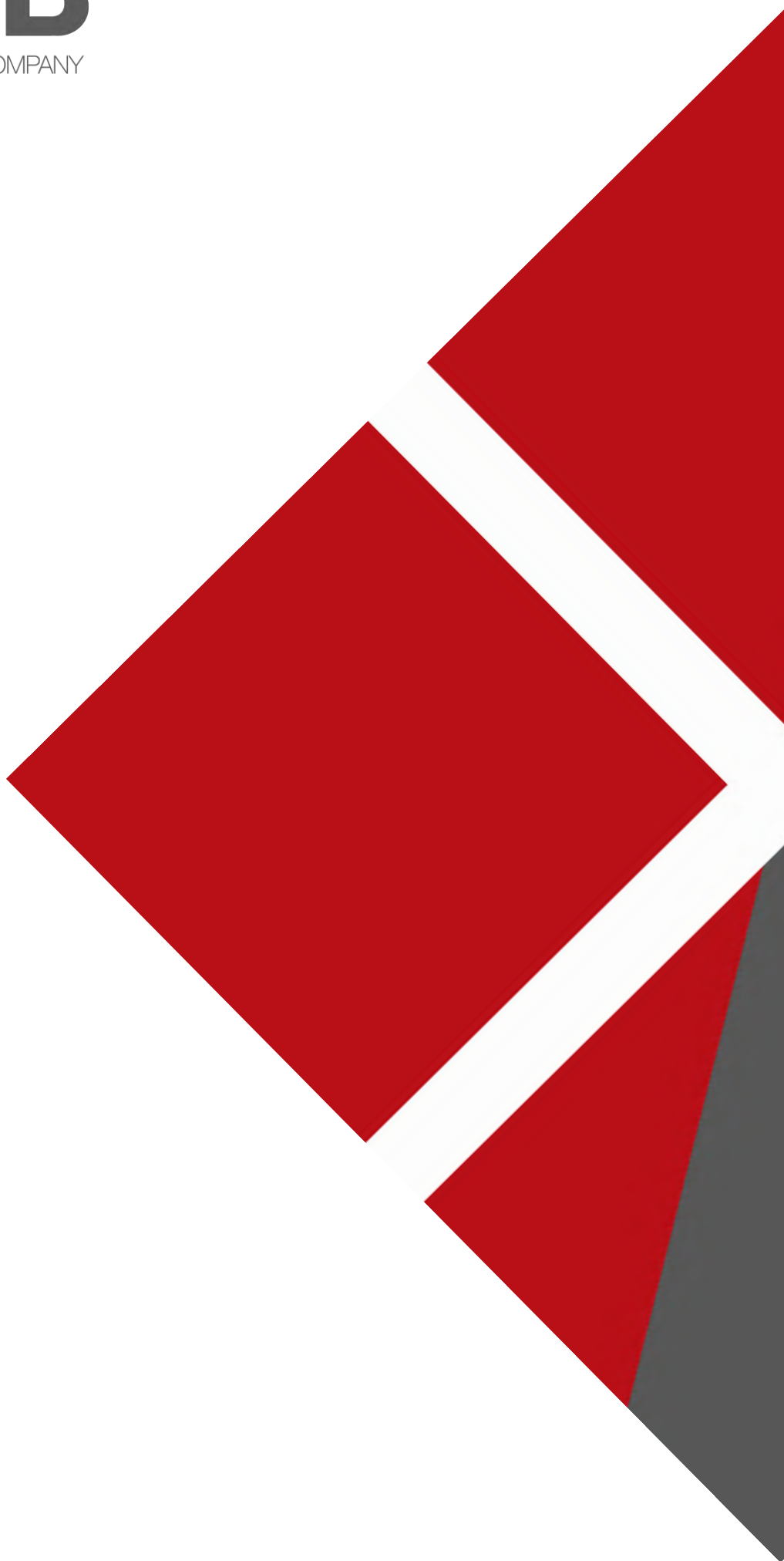

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Appendix 3: EA Model Review

creating a better place
for people and wildlife

Environment Agency

[redacted]
BWB Consulting
Waterfront House
35 Station Street
Nottingham
NG2 3DQ

Our ref: XA/2026/100543/01-L01
Your ref: TR050008

Date: 19 February 2026

Dear [redacted]

PADBURY BROOK TRIBUTARY HYDRAULIC MODEL REVIEW

OXFORDSHIRE STRATEGIC RAIL FREIGHT INTERCHANGE

LAND WEST OF THE B430, EAST OF UPPER HEYFORD FORMER AIRFIELD, AND SOUTH OF THE VILLAGE OF ARDLEY

Thank you for sending through the model files and report for the Padbury Brook tributary for the Oxfordshire Strategic Rail Freight Interchange Project.

The modelling and approach to hydrology are considered reasonable for the Padbury Brook tributary. We have no issues to raise with this model.

Please find our response in the enclosed spreadsheet.

We trust our advice is useful.

Yours sincerely

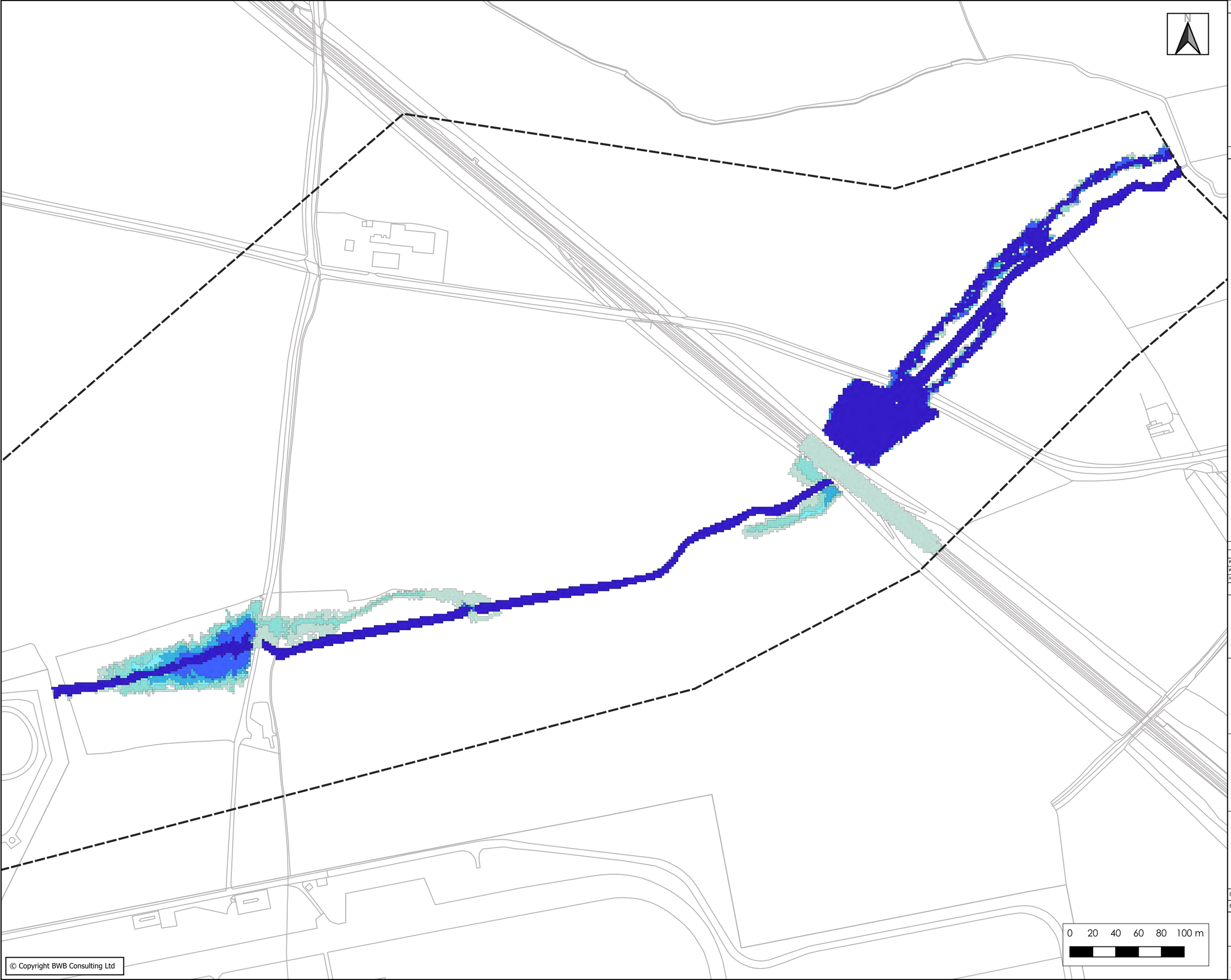
[redacted]
Planning Specialist – National Infrastructure Team
E-mail: NITeam@environment-agency.gov.uk

Appendix 4: Table of Hydraulic Structures

Network ID, Cross Section ID	Model Details	Photograph/Survey Section
PBT_01053	**Description:** Wooden Bridge **NGR:** 452549, 227418 **Domain:** 1D ESTRY **Unit Type:** Bridge Weir **Upstream Invert Level:** 119.00m AOD **Downstream Invert Level:** 119.02m AOD **Length:** 1m **Manning's N:** 0.04 **Blockage:** 0% **Spill/Bypass:** Modelled in 2D domain	
PBT_01044	**Description:** Wooden Bridge **NGR:** 452556, 227418 **Domain:** 1D ESTRY **Unit Type:** Bridge Weir **Upstream Invert Level:** 119.05m AOD **Downstream Invert Level:** 119.08m AOD **Length:** 1m **Manning's N:** 0.04 **Blockage:** 0% **Spill/Bypass:** Modelled in 2D domain	
PBT_00979	**Description:** Unnamed Road Culvert **NGR:** 452627, 227428 **Domain:** 1D ESTRY **Unit Type:** Circular Conduit **Dimensions:** 0.385 **Upstream Invert Level:** 118.34m AOD **Downstream Invert Level:** 118.19m AOD **Length:** 9.2m **Manning's N:** 0.015 **Blockage:** 0% **Spill/Bypass:** Modelled in 2D domain	
PBT_0779	**Description:** Farm Crossing Culvert **NGR:** 452815, 227461 **Domain:** 1D ESTRY **Unit Type:** Circular Conduit **Dimensions:** 0.361 **Upstream Invert Level:** 116.71m AOD **Downstream Invert Level:** 116.63m AOD **Length:** 6.2m **Manning's N:** 0.015 **Blockage:** 0% **Spill/Bypass:** Modelled in 2D domain	Not Available

Network ID, Cross Section ID	Model Details	Photograph/Survey Section
PBT_00427	**Description:** Railway Culvert **NGR:** 453139, 227584 **Domain:** 1D ESTRY **Unit Type:** Circular Conduit **Dimensions:** 0.607 **Upstream Invert Level (Surveyed):** 114.73m AOD **Upstream Invert of Siphon (Assumed):** 113.20m AOD **Downstream Invert Level:** 114.59m AOD **Length:** 23.7m **Manning's N:** 0.015 **Blockage:** 0% **Spill/Bypass:** Modelled in 2D domain	
PBT_00324	**Description:** Somerton Road Culvert **NGR:** 453190 , 227656 **Domain:** 1D ESTRY **Unit Type:** Circular Conduit **Dimensions:** 0.260 **Upstream Invert Level:** 114.29m AOD **Downstream Invert Level:** 114.40m AOD **Length:** 11.2m **Manning's N:** 0.015 **Blockage:** 0% **Spill/Bypass:** Modelled in 2D domain	

Appendix 5: Baseline Floodplain Maps



Notes

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2. This drawing is to be read in conjunction with all relevant architects, engineers and specialists drawings and specifications.

3. All dimensions in millimetres unless noted otherwise. All levels in metres unless noted otherwise.

4. Any discrepancies noted on site are to be reported to the engineer immediately.

5. Model not yet peer reviewed.

6. Contains OS data © Licence no. 100019980

Key

- Model Domain
- 1 in 30-Year
- 1 in 100-Year
- 1 in 100-Year + 19%CC
- 1 in 100-Year + 30%CC
- 1 in 100-Year + 58%CC
- 1 in 1000-Year

Rev	Date	Details of issues/ revision	Drw	Rev
P02	30.07.25	UPDATED HYDROLOGY AND SOFTWARE	MN	SR
P01	27.03.23	PRELIMINARY ISSUE	MPB	MB

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Oxfordshire Railfreight Limited

Project Title

OxSRFI
OXFORDSHIRE
STRATEGIC RAIL FREIGHT INTERCHANGE

Drawing Title

Baseline Model Floodplain Extents

Drawn: [redacted]

BWB Ref:	NTH2479	Date:	27.03.23	Scale@A3:	1:3,000

Drawing Status

PRELIMINARY

Project - Originator - Zone - Level - Type - Role - Number	Status	Rev
OXSRFI-BWB-ZZ-XX-D-W-1201	S2	P02

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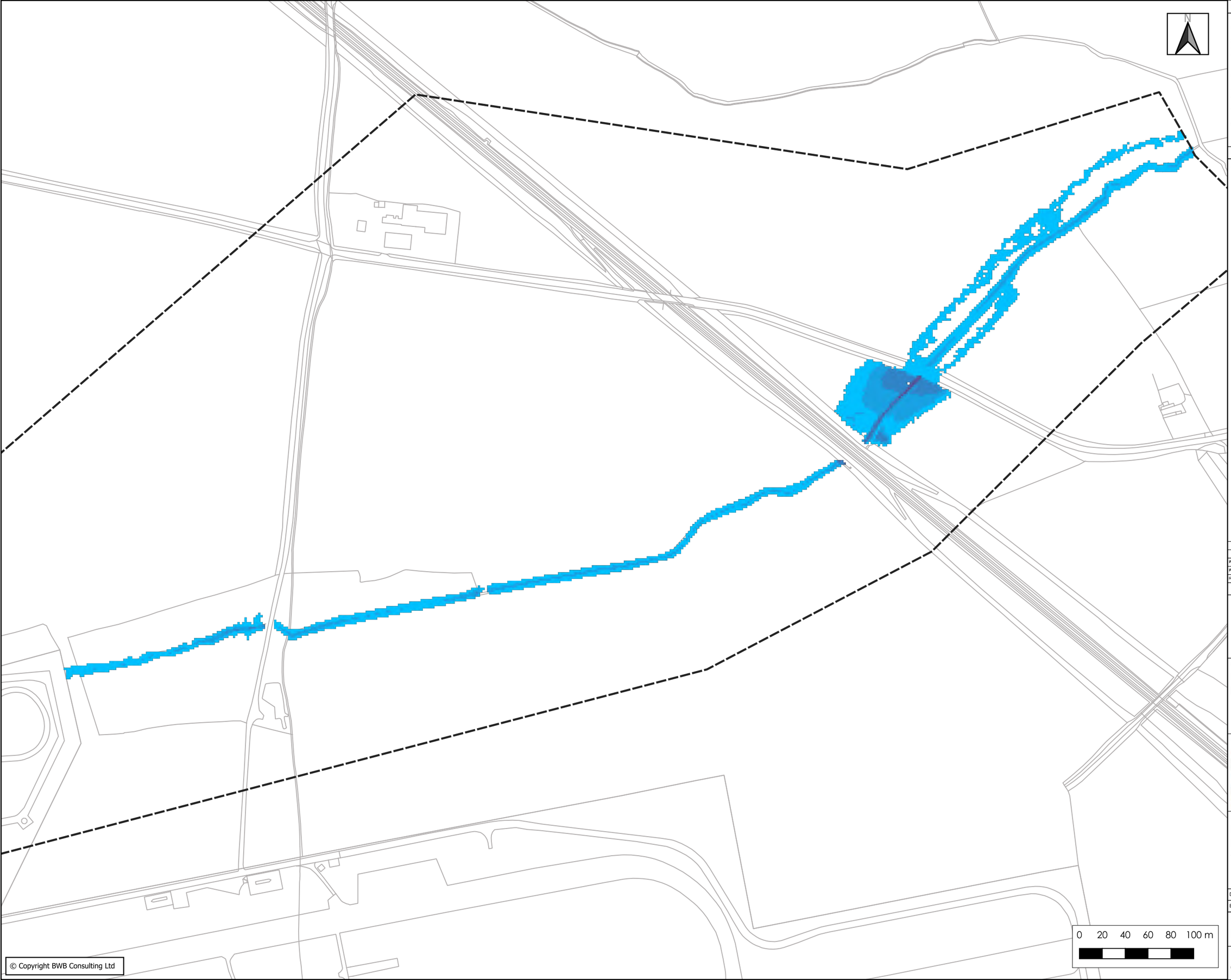

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Key

Model Domain

Modelled Flood Depths

- <= 0.25
- 0.25 - 0.50
- 0.50 - 0.75
- 0.75 - 1.00
- 1.00 - 1.25
- > 1.25

Rev	Date	Details of issues/ revision	Drw	Rev
P02	30.07.25	UPDATED HYDROLOGY AND SOFTWARE	MN	SR
P01	27.03.23	PRELIMINARY ISSUE	MPB	MB

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Drawing Title

Baseline Modelled Flood Depths 1 in 30-Year

Drawn:	[redacted]				
BWB Ref:	NTH2479	Date:	27.03.23	Scale@A3:	1:3,000

Drawing Status

PRELIMINARY

Project - Originator - Zone - Level - Type - Role - Number	Status	Rev
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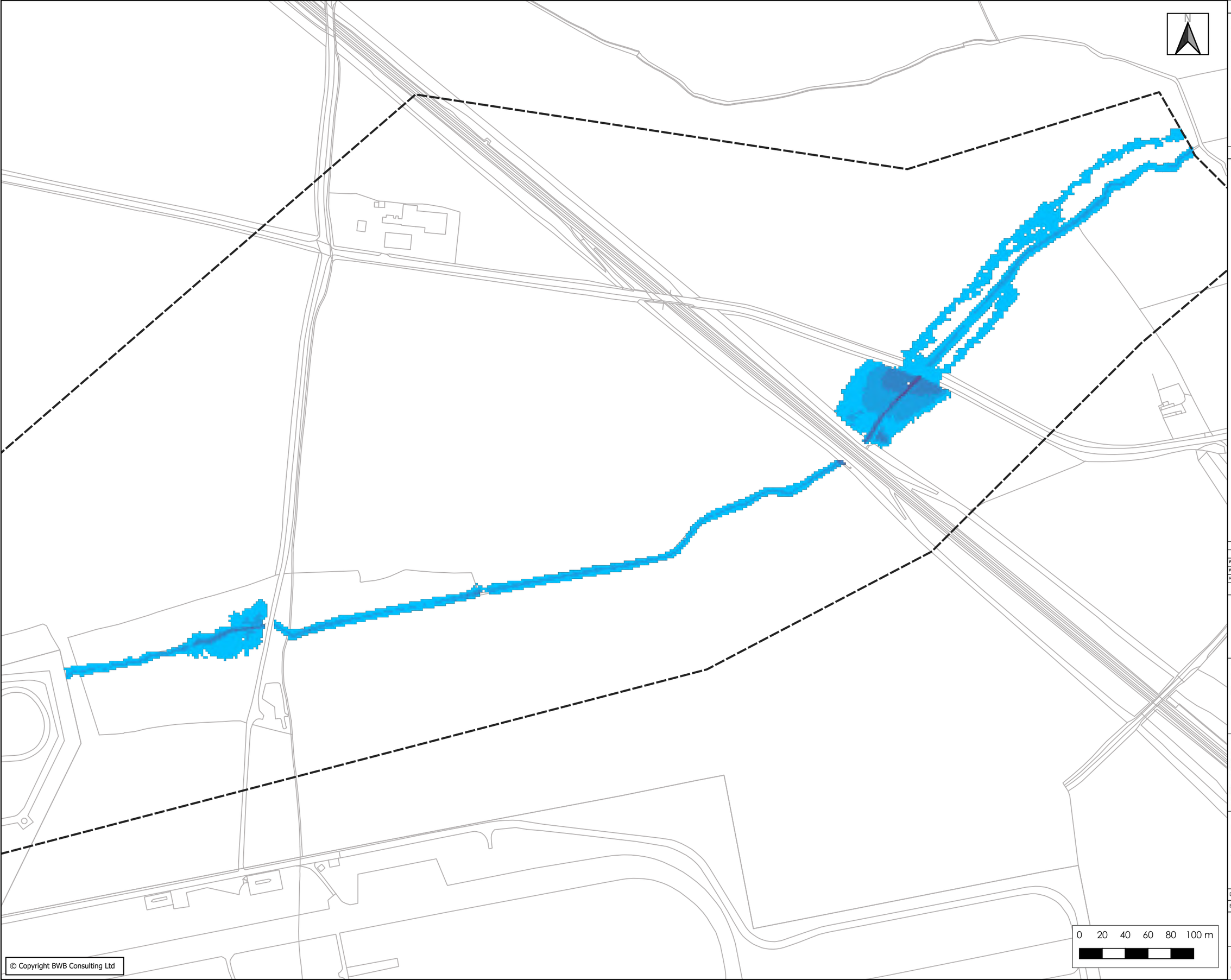

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Key

Model Domain

Modelled Flood Depths

- <= 0.25
- 0.25 - 0.50
- 0.50 - 0.75
- 0.75 - 1.00
- 1.00 - 1.25
- > 1.25

Rev	Date	Details of issues/ revision	Drw	Rev
P02	30.07.25	UPDATED HYDROLOGY AND SOFTWARE	MN	SR
P01	27.03.23	PRELIMINARY ISSUE	MPB	MB

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Drawing Title

Baseline
Modelled Flood Depths
1 in 100-Year

Drawn:	[redacted]				
BWB Ref:	NTH2479	Date:	27.03.23	Scale@A3:	1:3,000

Drawing Status

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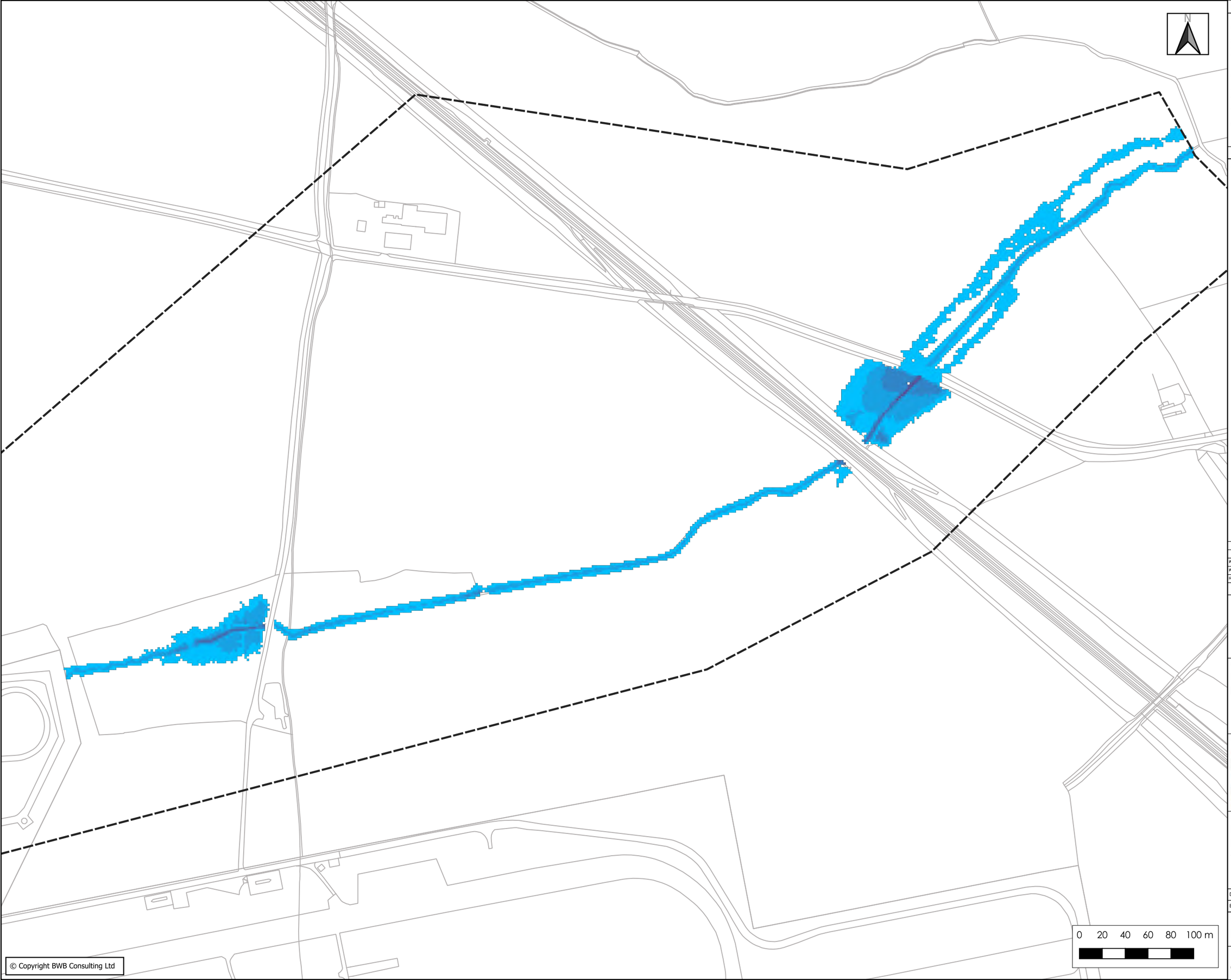

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Key

Model Domain

Modelled Flood Depths

- <= 0.25
- 0.25 - 0.50
- 0.50 - 0.75
- 0.75 - 1.00
- 1.00 - 1.25
- > 1.25

Rev	Date	Details of issues/ revision	Drw	Rev
P02	30.07.25	UPDATED HYDROLOGY AND SOFTWARE	MN	SR
P01	27.03.23	PRELIMINARY ISSUE	MPB	MB

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Baseline Modelled Flood Depths 1 in 100-Year + 19%CC

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Project - Originator - Zone - Level - Type - Role - Number	Status	Rev
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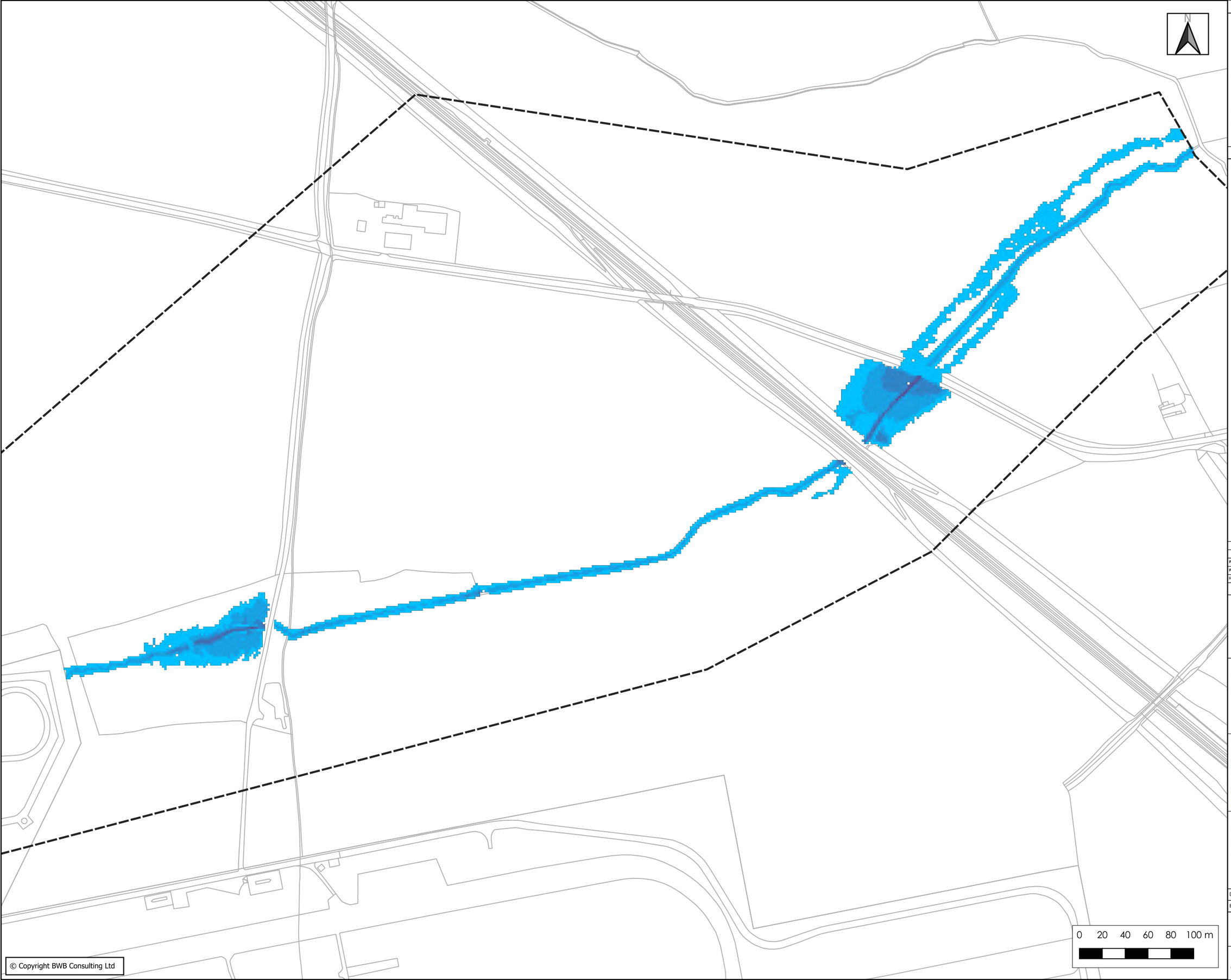

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Key

Model Domain

Modelled Flood Depths

- <= 0.25
- 0.25 - 0.50
- 0.50 - 0.75
- 0.75 - 1.00
- 1.00 - 1.25
- > 1.25

Rev	Date	Details of issues/ revision	Drw	Rev
P02	30.07.25	UPDATED HYDROLOGY AND SOFTWARE	MN	SR
P01	27.03.23	PRELIMINARY ISSUE	MPB	MB

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Drawing Title

Baseline
Modelled Flood Depths
1 in 100-Year + 30%CC

Drawn:	[redacted]				
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PRELIMINARY

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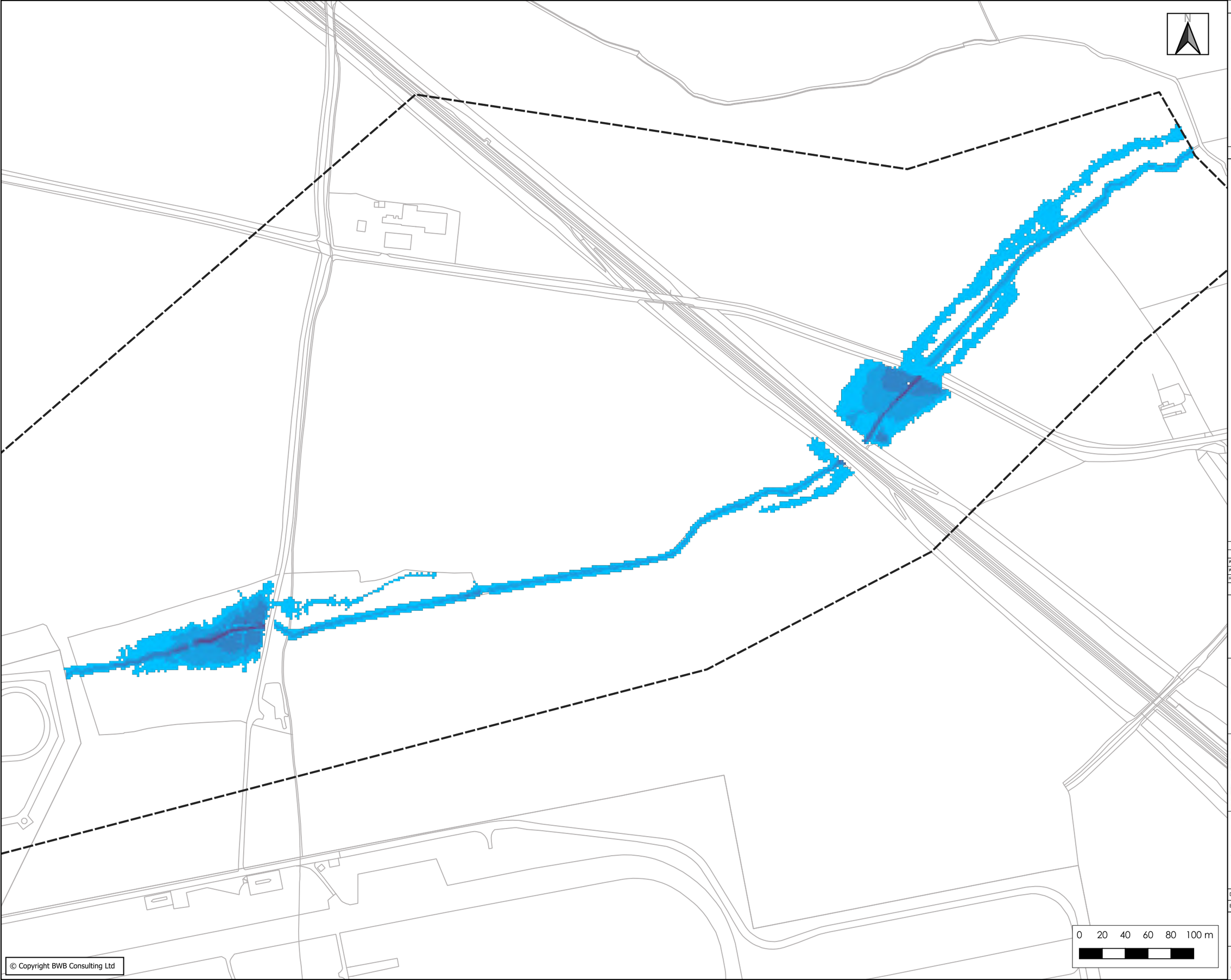

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Key

Model Domain

Modelled Flood Depths

- <= 0.25
- 0.25 - 0.50
- 0.50 - 0.75
- 0.75 - 1.00
- 1.00 - 1.25
- > 1.25

Rev	Date	Details of issues/ revision	Drw	Rev
P02	30.07.25	UPDATED HYDROLOGY AND SOFTWARE	MN	SR
P01	27.03.23	PRELIMINARY ISSUE	MPB	MB

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Drawing Title

Baseline Modelled Flood Depths 1 in 100-Year + 58%CC

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Drawing Status

PRELIMINARY

Project - Originator - Zone - Level - Type - Role - Number	Status	Rev
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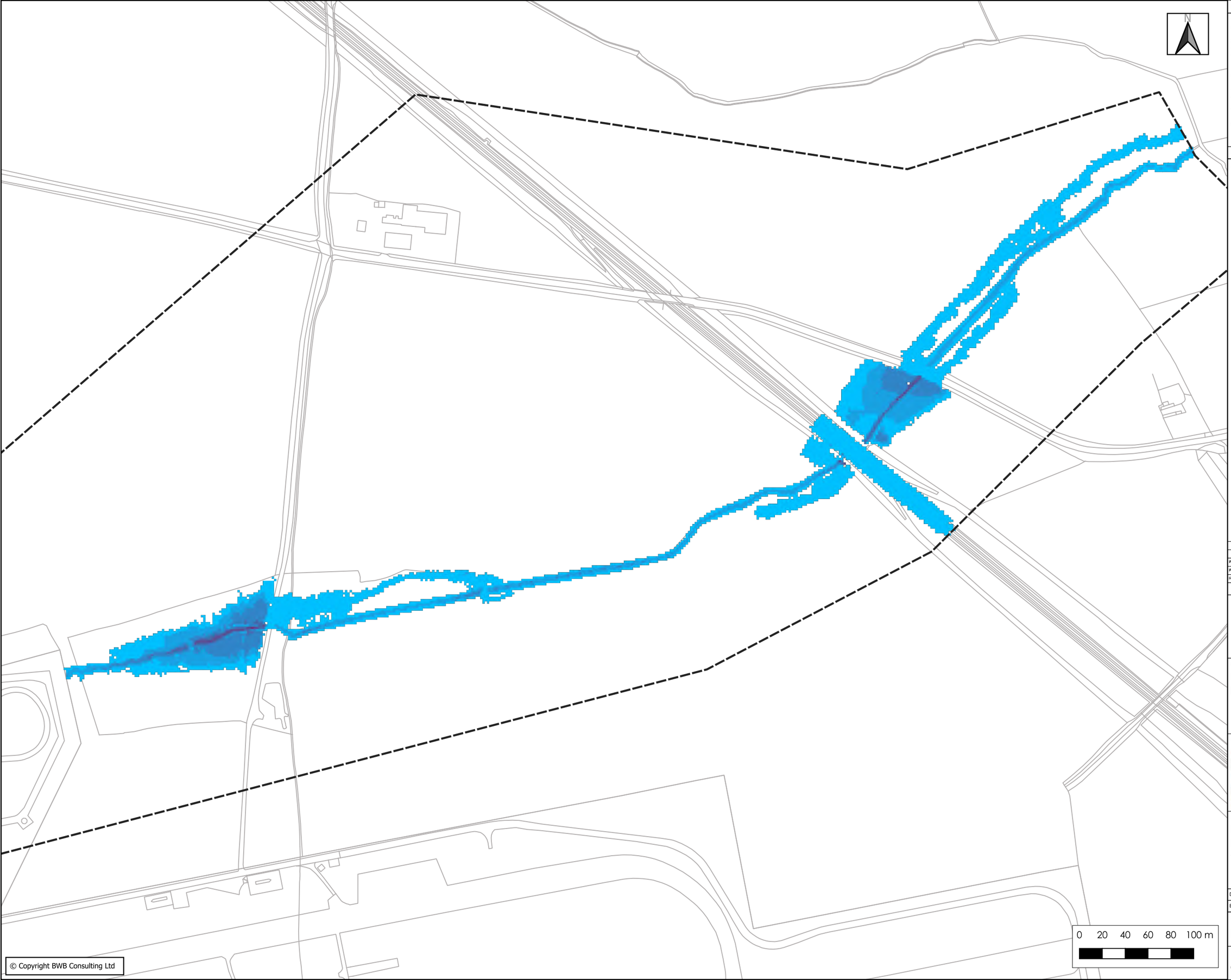

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Model Domain

Modelled Flood Depths

- <= 0.25
- 0.25 - 0.50
- 0.50 - 0.75
- 0.75 - 1.00
- 1.00 - 1.25
- > 1.25

Rev	Date	Details of issues/ revision	Drw	Rev
P02	30.07.25	UPDATED HYDROLOGY AND SOFTWARE	MN	SR
P01	27.03.23	PRELIMINARY ISSUE	MPB	MB

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Project Title

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Drawing Title

Baseline
Modelled Flood Depths
1 in 1000-Year

Drawn:	[redacted]				
BWB Ref:	NTH2479	Date:	27.03.23	Scale@A3:	1:3,000

Drawing Status

PRELIMINARY

Project - Originator - Zone - Level - Type - Role - Number	Status	Rev
OXSRFI-BWB-ZZ-XX-D-W-1207	S2	P02

Appendix 6: Proposed Floodplain Maps



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Notes

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4. Any discrepancies noted on site are to be reported to the engineer immediately.

5. Model not yet peer reviewed.

6. Contains OS data © Licence no. 100019980

Key

- Model Domain
- 1 in 30-Year
- 1 in 100-Year
- 1 in 100-Year + 19%CC
- 1 in 100-Year + 30%CC
- 1 in 100-Year + 58%CC
- 1 in 1000-Year

Rev	Date	Details of issues/ revision	Drw	Rev
P03	28.08.25	UPDATED MODEL RESULTS	MN	SR
P02	31.07.25	UPDATED HYDROLOGY AND SOFTWARE	MN	SR
P01	27.03.23	PRELIMINARY ISSUE	MPB	MB

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Project Title

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STRATEGIC RAIL FREIGHT INTERCHANGE

Drawing Title

Proposed Model Floodplain Extents

Drawn:	[redacted]				
BWB Ref:	NTH2479	Date:	27.03.23	Scale@A3:	1:3,000

Drawing Status

PRELIMINARY

Project - Originator - Zone - Level - Type - Role - Number	Status	Rev
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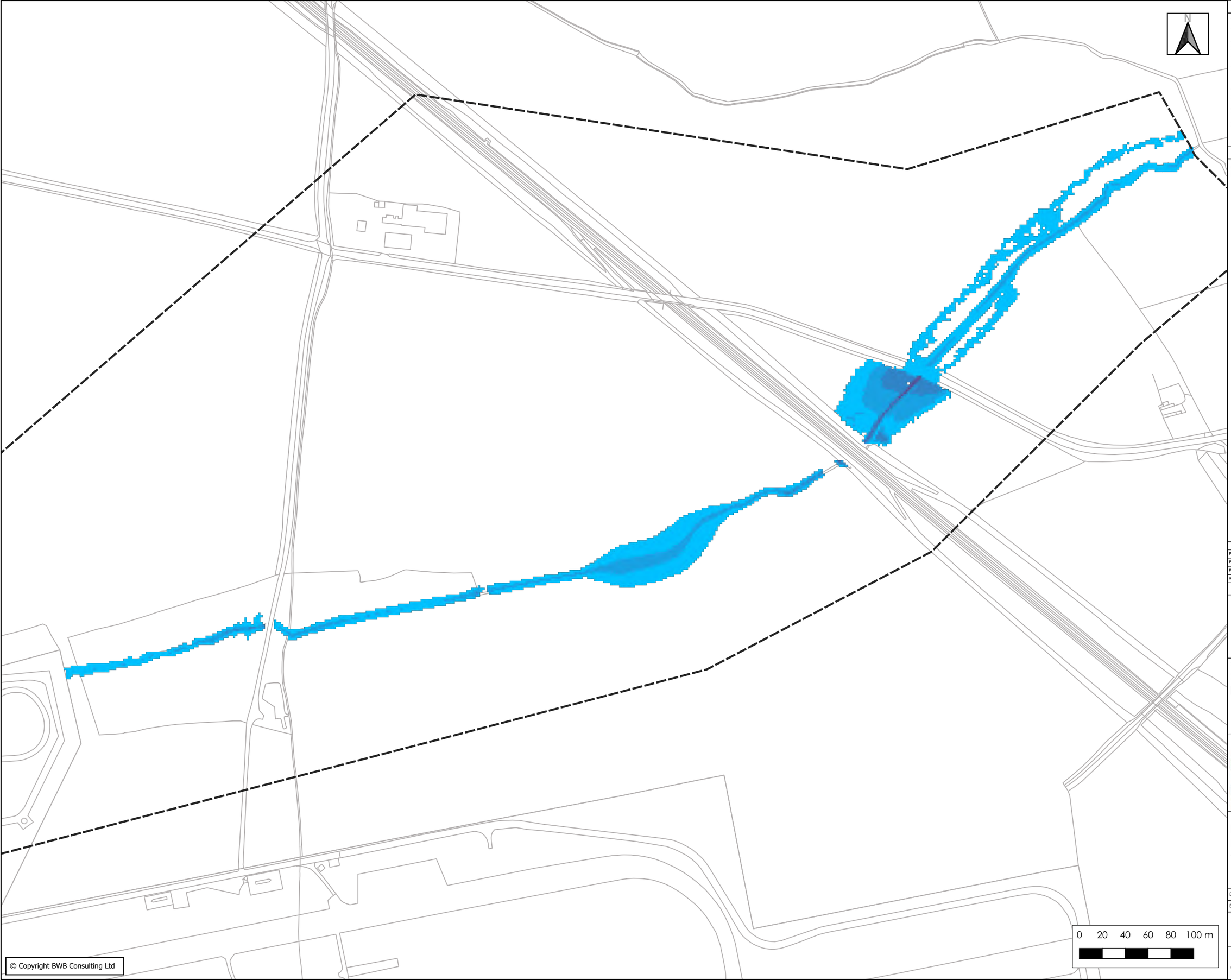

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4. Any discrepancies noted on site are to be reported to the engineer immediately.

5. Model not yet peer reviewed.

6. Contains OS data © Licence no. 100019980

Key

Model Domain

Modelled Flood Depths

- <= 0.25
- 0.25 - 0.50
- 0.50 - 0.75
- 0.75 - 1.00
- 1.00 - 1.25
- > 1.25

Rev	Date	Details of issues/ revision	Drw	Rev
P03	28.08.25	UPDATED MODEL RESULTS	MN	SR
P02	31.07.25	UPDATED HYDROLOGY AND SOFTWARE	MN	SR
P01	27.03.23	PRELIMINARY ISSUE	MPB	MB

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Client

Oxfordshire Railfreight Limited

Project Title

OxSRFI OXFORDSHIRE STRATEGIC RAIL FREIGHT INTERCHANGE

Drawing Title

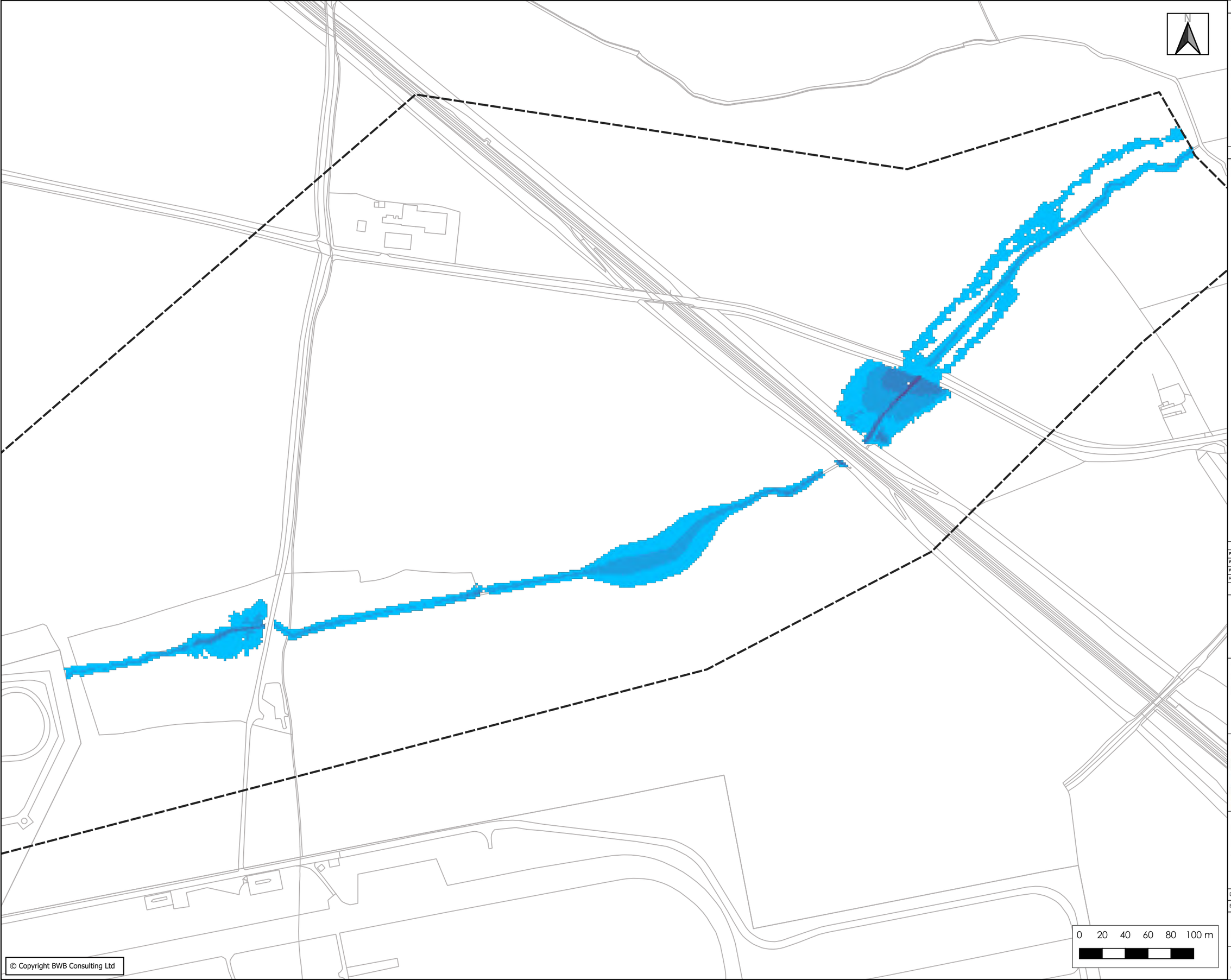
Proposed Modelled Flood Depths 1 in 30-Year

Drawn:	[redacted]				
BWB Ref:	NTH2479	Date:	27.03.23	Scale@A3:	1:3,000

Drawing Status

PRELIMINARY

Project - Originator - Zone - Level - Type - Role - Number	Status	Rev
OXSRFI-BWB-ZZ-XX-D-W-1222	S2	P03



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Notes

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3. All dimensions in millimetres unless noted otherwise. All levels in metres unless noted otherwise.

4. Any discrepancies noted on site are to be reported to the engineer immediately.

5. Model not yet peer reviewed.

6. Contains OS data © Licence no. 100019980

Key

Model Domain

Modelled Flood Depths

- <= 0.25
- 0.25 - 0.50
- 0.50 - 0.75
- 0.75 - 1.00
- 1.00 - 1.25
- > 1.25

Rev	Date	Details of issues/ revision	Drw	Rev
P03	28.08.25	UPDATED MODEL RESULTS	MN	SR
P02	31.07.25	UPDATED HYDROLOGY AND SOFTWARE	MN	SR
P01	27.03.23	PRELIMINARY ISSUE	MPB	MB

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Client

Oxfordshire Railfreight Limited

Project Title

OxSRFI
OXFORDSHIRE
STRATEGIC RAIL FREIGHT INTERCHANGE

Drawing Title

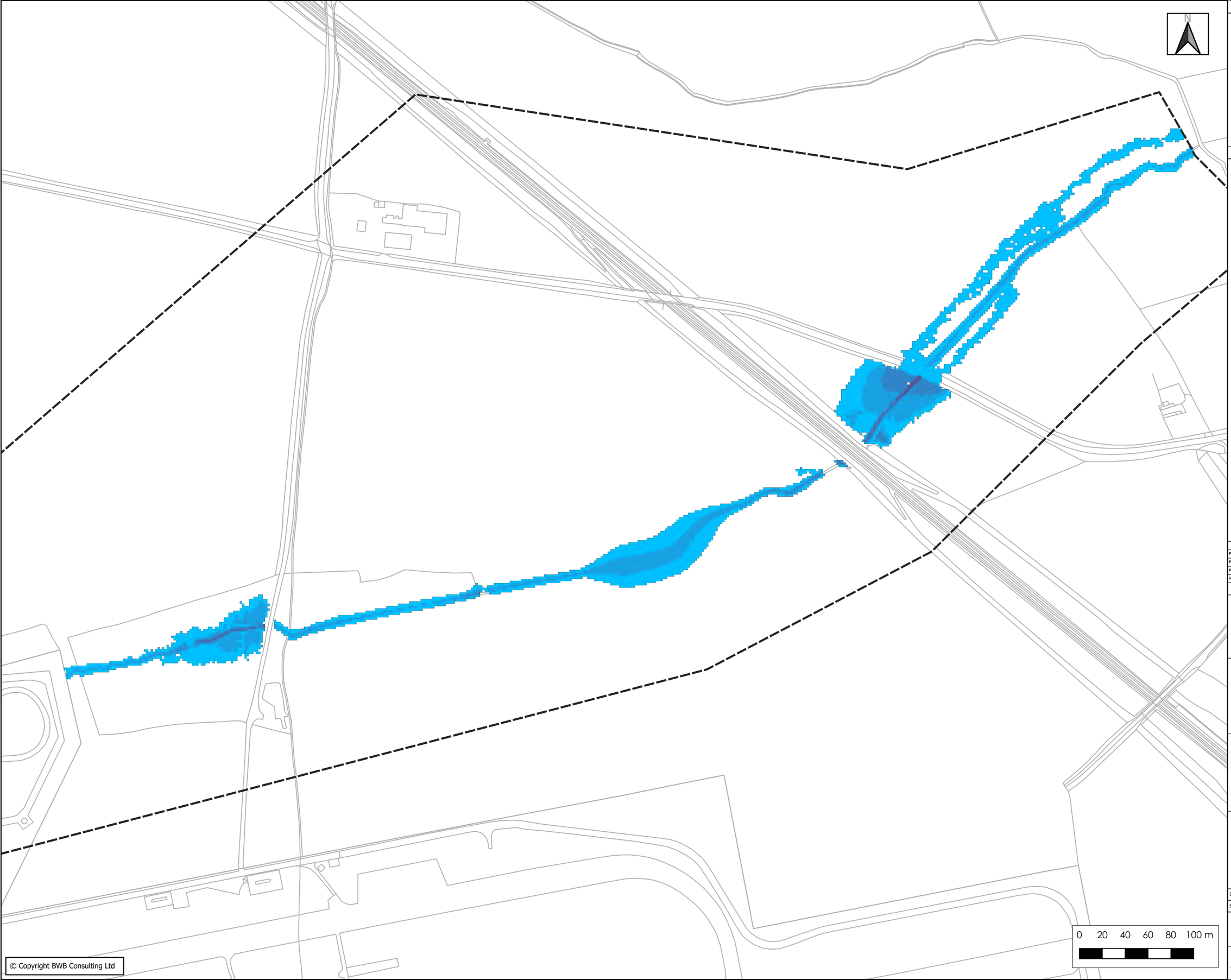
Proposed Modelled Flood Depths 1 in 100-Year

Drawn:	[redacted]				
BWB Ref:	NTH2479	Date:	27.03.23	Scale@A3:	1:3,000

Drawing Status

PRELIMINARY

Project - Originator - Zone - Level - Type - Role - Number	Status	Rev
OXSRFI-BWB-ZZ-XX-D-W-1223	S2	P03



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4. Any discrepancies noted on site are to be reported to the engineer immediately.

5. Model not yet peer reviewed.

6. Contains OS data © Licence no. 100019980

Key

Model Domain

Modelled Flood Depths

- <= 0.25
- 0.25 - 0.50
- 0.50 - 0.75
- 0.75 - 1.00
- 1.00 - 1.25
- > 1.25

Rev	Date	Details of issues/ revision	Drw	Rev
P03	28.08.25	UPDATED MODEL RESULTS	MN	SR
P02	31.07.25	UPDATED HYDROLOGY AND SOFTWARE	MN	SR
P01	27.03.23	PRELIMINARY ISSUE	MPB	MB

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Client

Oxfordshire Railfreight Limited

Project Title

OxSRFI
OXFORDSHIRE
STRATEGIC RAIL FREIGHT INTERCHANGE

Drawing Title

Proposed Modelled Flood Depths 1 in 100-Year + 19%CC

Drawn:	[redacted]				
BWB Ref:	NTH2479	Date:	27.03.23	Scale@A3:	1:3,000

Drawing Status

PRELIMINARY

Project - Originator - Zone - Level - Type - Role - Number	Status	Rev
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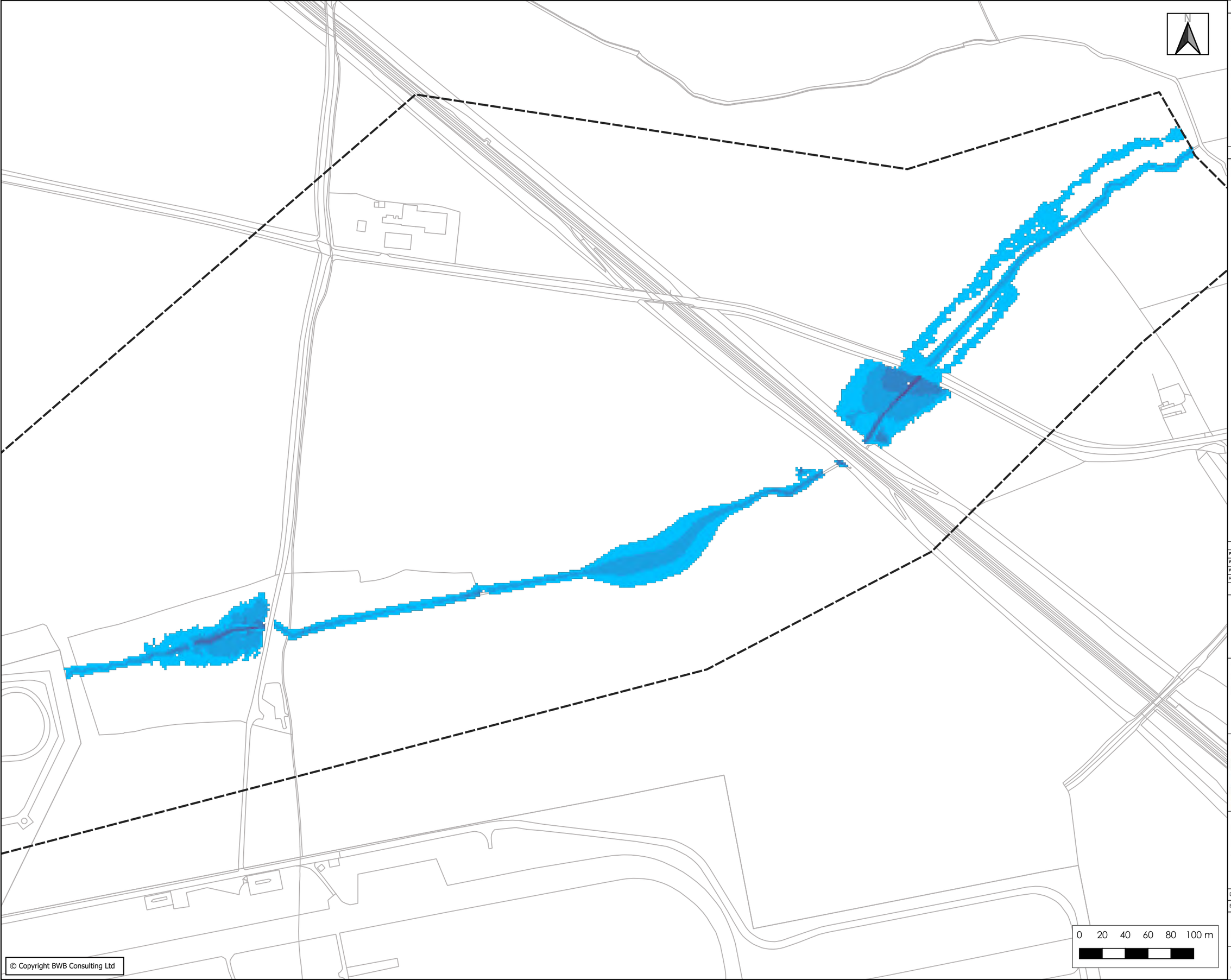

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3. All dimensions in millimetres unless noted otherwise. All levels in metres unless noted otherwise.

4. Any discrepancies noted on site are to be reported to the engineer immediately.

5. Model not yet peer reviewed.

6. Contains OS data © Licence no. 100019980

Key

Model Domain

Modelled Flood Depths

- <= 0.25
- 0.25 - 0.50
- 0.50 - 0.75
- 0.75 - 1.00
- 1.00 - 1.25
- > 1.25

Rev	Date	Details of issues/ revision	Drw	Rev
P03	28.08.25	UPDATED MODEL RESULTS	MN	SR
P02	31.07.25	UPDATED HYDROLOGY AND SOFTWARE	MN	SR
P01	27.03.23	PRELIMINARY ISSUE	MPB	MB

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Client

Oxfordshire Railfreight Limited

Project Title

OxSRFI
OXFORDSHIRE
STRATEGIC RAIL FREIGHT INTERCHANGE

Drawing Title

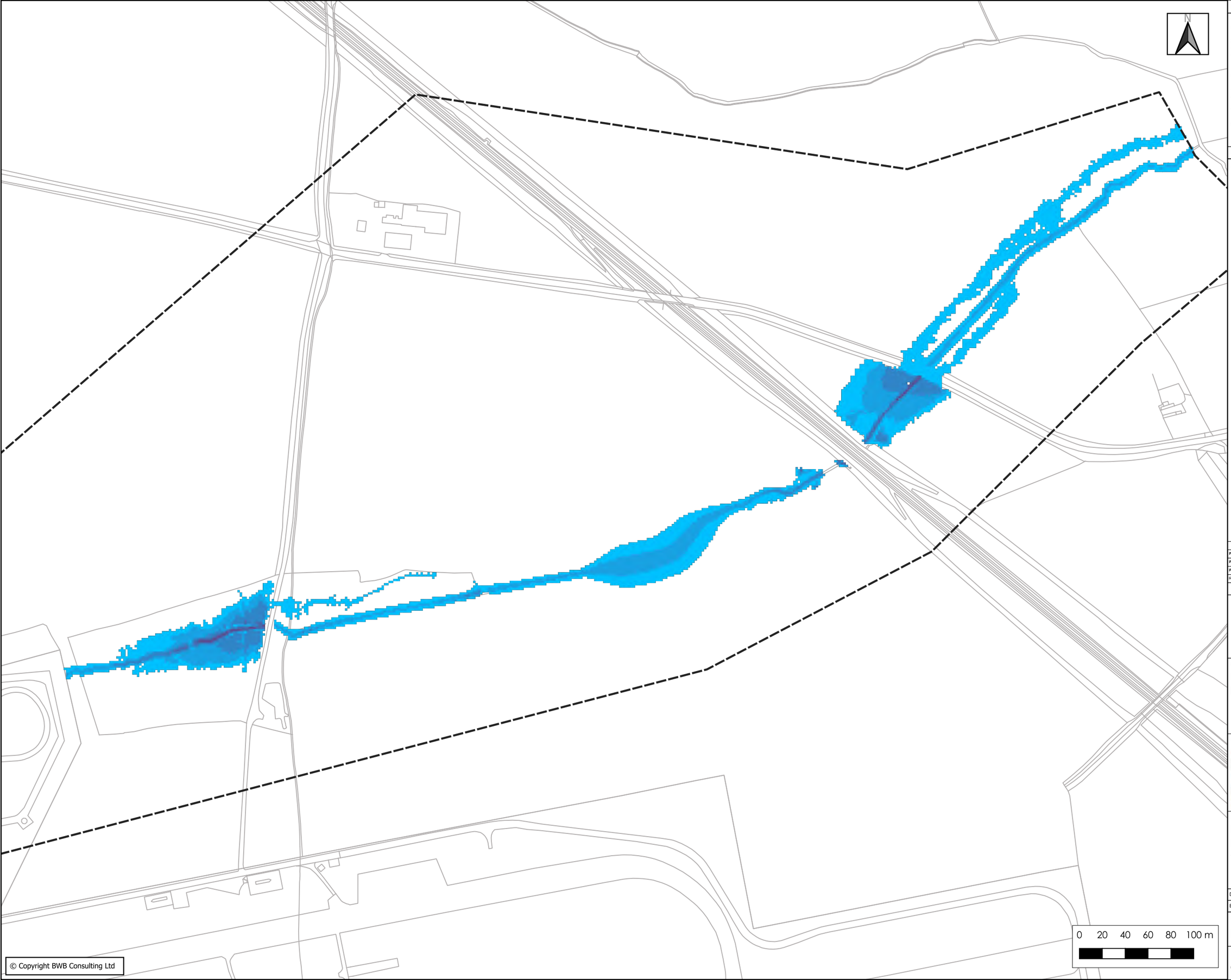
Proposed Modelled Flood Depths 1 in 100-Year + 30%CC

Drawn:	[redacted]				
BWB Ref:	NTH2479	Date:	27.03.23	Scale@A3:	1:3,000

Drawing Status

PRELIMINARY

Project - Originator - Zone - Level - Type - Role - Number	Status	Rev
OXSRFI-BWB-ZZ-XX-D-W-1225	S2	P03



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3. All dimensions in millimetres unless noted otherwise. All levels in metres unless noted otherwise.

4. Any discrepancies noted on site are to be reported to the engineer immediately.

5. Model not yet peer reviewed.

6. Contains OS data © Licence no. 100019980

Key

Model Domain

Modelled Flood Depths

- <= 0.25
- 0.25 - 0.50
- 0.50 - 0.75
- 0.75 - 1.00
- 1.00 - 1.25
- > 1.25

Rev	Date	Details of issues/ revision	Drw	Rev
P03	28.08.25	UPDATED MODEL RESULTS	MN	SR
P02	31.07.25	UPDATED HYDROLOGY AND SOFTWARE	MN	SR
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Client

Oxfordshire Railfreight Limited

Project Title

OxSRFI OXFORDSHIRE STRATEGIC RAIL FREIGHT INTERCHANGE

Drawing Title

Proposed Modelled Flood Depths 1 in 100-Year + 58%CC

Drawn:	[redacted]				
BWB Ref:	NTH2479	Date:	27.03.23	Scale@A3:	1:3,000

Drawing Status

PRELIMINARY

Project - Originator - Zone - Level - Type - Role - Number	Status	Rev
OXSRFI-BWB-ZZ-XX-D-W-1226	S2	P03

Notes

1. Do not scale this drawing. All dimensions must be checked/ verified on site. If in doubt ask.

2. This drawing is to be read in conjunction with all relevant architects, engineers and specialists drawings and specifications.

3. All dimensions in millimetres unless noted otherwise. All levels in metres unless noted otherwise.

4. Any discrepancies noted on site are to be reported to the engineer immediately.

5. Model not yet peer reviewed.

6. Contains OS data © Licence no. 100019980

Key

Model Domain

Modelled Flood Depths

- <= 0.25
- 0.25 - 0.50
- 0.50 - 0.75
- 0.75 - 1.00
- 1.00 - 1.25
- > 1.25

0 20 40 60 80 100 m

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Rev	Date	Details of issues/ revision	Drw	Rev
P03	28.08.25	UPDATED MODEL RESULTS	MN	SR
P02	31.07.25	UPDATED HYDROLOGY AND SOFTWARE	MN	SR
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Client

Oxfordshire Railfreight Limited

Project Title

OxSRFI
OXFORDSHIRE
STRATEGIC RAIL FREIGHT INTERCHANGE

Drawing Title

Proposed Modelled Flood Depths 1 in 1000-Year

Drawn: [redacted]

BWB Ref:	NTH2479	Date:	27.03.23	Scale@A3:	1:3,000

Drawing Status

PRELIMINARY

Project - Originator - Zone - Level - Type - Role - Number	Status	Rev
OXSRFI-BWB-ZZ-XX-D-W-1227	S2	P03

Appendix 7: Comparison Mapping

N

0 20 40 60 80 100 m

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Notes

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2. This drawing is to be read in conjunction with all relevant architects, engineers and specialists drawings and specifications.

3. All dimensions in millimetres unless noted otherwise. All levels in metres unless noted otherwise.

4. Any discrepancies noted on site are to be reported to the engineer immediately.

5. Model not yet peer reviewed.

6. Contains OS data © Licence no. 100019980

Key

- Model Domain
- Former Wet Areas Now Dry
- Former Dry Areas Now Wet

Change in Modelled Peak Flood Level (m)

- <= -0.125
- -0.125 - -0.100
- -0.100 - -0.075
- -0.075 - -0.050
- -0.050 - -0.025
- -0.025 - -0.01
- -0.01 - 0.01 (No Change)
- 0.01 - 0.025
- 0.025 - 0.050
- 0.050 - 0.075
- 0.075 - 0.100
- 0.100 - 0.125
- > 0.125

Rev	Date	Details of issues/ revision	Drw	Rev
P03	28.08.25	UPDATED MODEL RESULTS	MN	SR
P02	31.07.25	UPDATED HYDROLOGY AND SOFTWARE	MN	SR
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Project Title

OxSRFI
OXFORDSHIRE
STRATEGIC RAIL FREIGHT INTERCHANGE

Drawing Title

Proposed Impact Analysis 1 in 30-Year

Drawn:	[redacted]				
BWB Ref:	NTH2479	Date:	27.03.23	Scale@A3:	1:3,000

Drawing Status

PRELIMINARY

Project - Originator - Zone - Level - Type - Role - Number	Status	Rev
OXSRFI-BWB-ZZ-XX-D-W-1228	S2	P03

N

0 20 40 60 80 100 m

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Notes

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3. All dimensions in millimetres unless noted otherwise. All levels in metres unless noted otherwise.

4. Any discrepancies noted on site are to be reported to the engineer immediately.

5. Model not yet peer reviewed.

6. Contains OS data © Licence no. 100019980

Key

- Model Domain
- Former Wet Areas Now Dry
- Former Dry Areas Now Wet

Change in Modelled Peak Flood Level (m)

- <= -0.125
- -0.125 - -0.100
- -0.100 - -0.075
- -0.075 - -0.050
- -0.050 - -0.025
- -0.025 - -0.01
- -0.01 - 0.01 (No Change)
- 0.01 - 0.025
- 0.025 - 0.050
- 0.050 - 0.075
- 0.075 - 0.100
- 0.100 - 0.125
- > 0.125

Rev	Date	Details of issues/ revision	Drw	Rev
P03	28.08.25	UPDATED MODEL RESULTS	MN	SR
P02	31.07.25	UPDATED HYDROLOGY AND SOFTWARE	MN	SR
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Client

Oxfordshire Railfreight Limited

Project Title

OxSRFI
OXFORDSHIRE
STRATEGIC RAIL FREIGHT INTERCHANGE

Drawing Title

Proposed Impact Analysis 1 in 100-Year

Drawn: [redacted]

BWB Ref:	NTH2479	Date:	27.03.23	Scale@A3:	1:3,000

Drawing Status

PRELIMINARY

Project - Originator - Zone - Level - Type - Role - Number	Status	Rev
OXSRFI-BWB-ZZ-XX-D-W-1229	S2	P03

N

0 20 40 60 80 100 m

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Notes

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2. This drawing is to be read in conjunction with all relevant architects, engineers and specialists drawings and specifications.

3. All dimensions in millimetres unless noted otherwise. All levels in metres unless noted otherwise.

4. Any discrepancies noted on site are to be reported to the engineer immediately.

5. Model not yet peer reviewed.

6. Contains OS data © Licence no. 100019980

Key

- Model Domain
- Former Wet Areas Now Dry
- Former Dry Areas Now Wet

Change in Modelled Peak Flood Level (m)

- <= -0.125
- -0.125 - -0.100
- -0.100 - -0.075
- -0.075 - -0.050
- -0.050 - -0.025
- -0.025 - -0.01
- -0.01 - 0.01 (No Change)
- 0.01 - 0.025
- 0.025 - 0.050
- 0.050 - 0.075
- 0.075 - 0.100
- 0.100 - 0.125
- > 0.125

Rev	Date	Details of issues/ revision	Drw	Rev
P03	28.08.25	UPDATED MODEL RESULTS	MN	SR
P02	31.07.25	UPDATED HYDROLOGY AND SOFTWARE	MN	SR
P01	27.03.23	PRELIMINARY ISSUE	MPB	MB

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Client

Oxfordshire Railfreight Limited

Project Title

OxSRFI
OXFORDSHIRE
STRATEGIC RAIL FREIGHT INTERCHANGE

Drawing Title

Proposed Impact Analysis 1 in 100-Year + 19%CC

Drawn:	[redacted]				
BWB Ref:	NTH2479	Date:	27.03.23	Scale@A3:	1:3,000

Drawing Status

PRELIMINARY

Project - Originator - Zone - Level - Type - Role - Number	Status	Rev
OXSRFI-BWB-ZZ-XX-D-W-1230	S2	P03

Notes

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4. Any discrepancies noted on site are to be reported to the engineer immediately.

5. Model not yet peer reviewed.

6. Contains OS data © Licence no. 100019980

Key

- Model Domain
- Former Wet Areas Now Dry
- Former Dry Areas Now Wet

Change in Modelled Peak Flood Level (m)

- <= -0.125
- -0.125 - -0.100
- -0.100 - -0.075
- -0.075 - -0.050
- -0.050 - -0.025
- -0.025 - -0.01
- -0.01 - 0.01 (No Change)
- 0.01 - 0.025
- 0.025 - 0.050
- 0.050 - 0.075
- 0.075 - 0.100
- 0.100 - 0.125
- > 0.125

0 20 40 60 80 100 m

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Rev	Date	Details of issues/ revision	Drw	Rev
P03	28.08.25	UPDATED MODEL RESULTS	MN	SR
P02	31.07.25	UPDATED HYDROLOGY AND SOFTWARE	MN	SR
P01	27.03.23	PRELIMINARY ISSUE	MPB	MB

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Client

Oxfordshire Railfreight Limited

Project Title

OxSRFI OXFORDSHIRE STRATEGIC RAIL FREIGHT INTERCHANGE

Drawing Title

Proposed Impact Analysis 1 in 100-Year + 30%CC

Drawn:	[redacted]				
BWB Ref:	NTH2479	Date:	27.03.23	Scale@A3:	1:3,000

Drawing Status

PRELIMINARY

Project - Originator - Zone - Level - Type - Role - Number	Status	Rev
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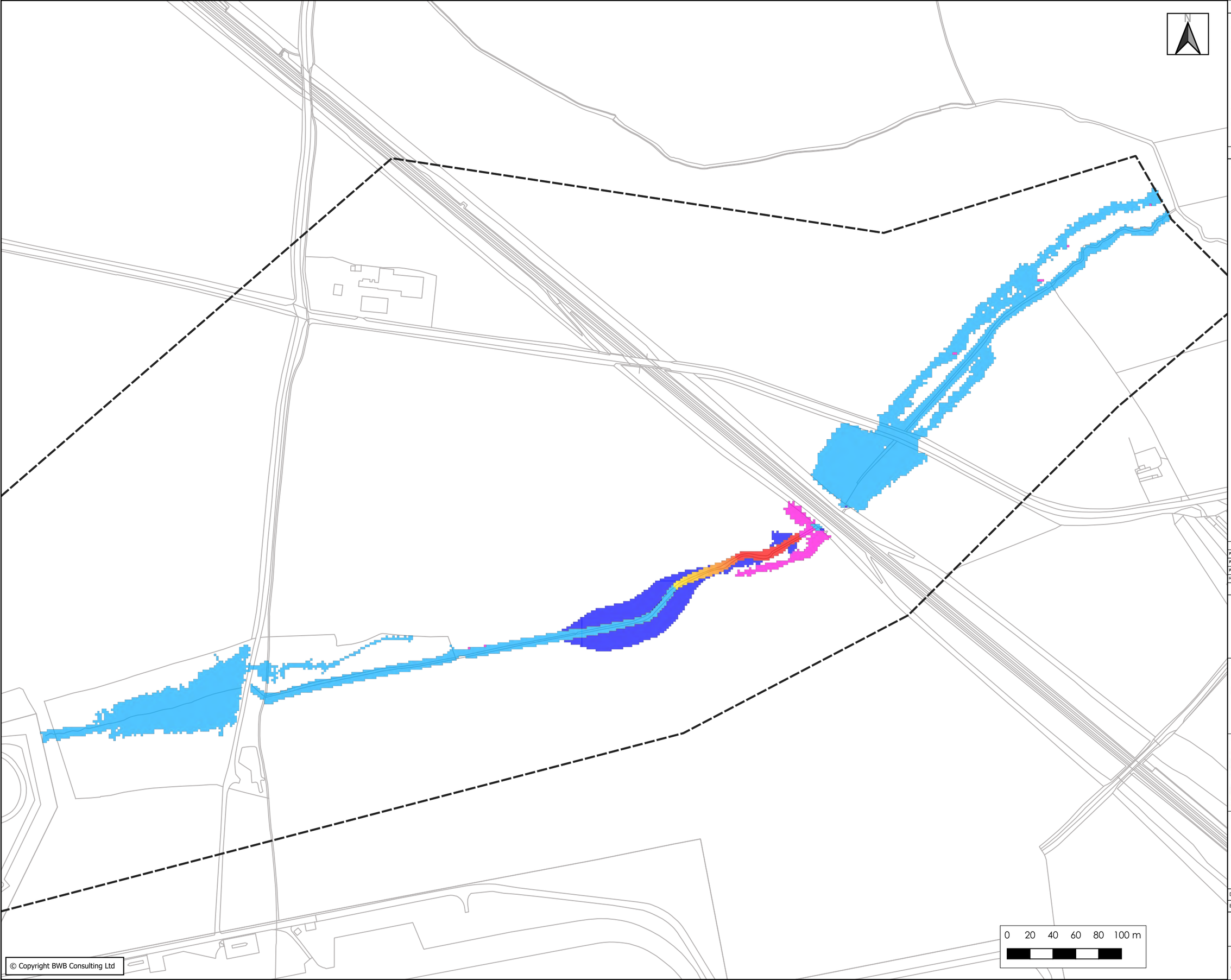

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3. All dimensions in millimetres unless noted otherwise. All levels in metres unless noted otherwise.

4. Any discrepancies noted on site are to be reported to the engineer immediately.

5. Model not yet peer reviewed.

6. Contains OS data © Licence no. 100019980

Key

- Model Domain
- Former Wet Areas Now Dry
- Former Dry Areas Now Wet

Change in Modelled Peak Flood Level (m)

- <= -0.125
- -0.125 - -0.100
- -0.100 - -0.075
- -0.075 - -0.050
- -0.050 - -0.025
- -0.025 - -0.01
- -0.01 - 0.01 (No Change)
- 0.01 - 0.025
- 0.025 - 0.050
- 0.050 - 0.075
- 0.075 - 0.100
- 0.100 - 0.125
- > 0.125

Rev	Date	Details of issues/ revision	Drw	Rev
P03	28.08.25	UPDATED MODEL RESULTS	MN	SR
P02	31.07.25	UPDATED HYDROLOGY AND SOFTWARE	MN	SR
P01	27.03.23	PRELIMINARY ISSUE	MPB	MB

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Client

Oxfordshire Railfreight Limited

Project Title

OxSRFI
OXFORDSHIRE
STRATEGIC RAIL FREIGHT INTERCHANGE

Drawing Title

Proposed
Impact Analysis
1 in 100-Year + 58%CC

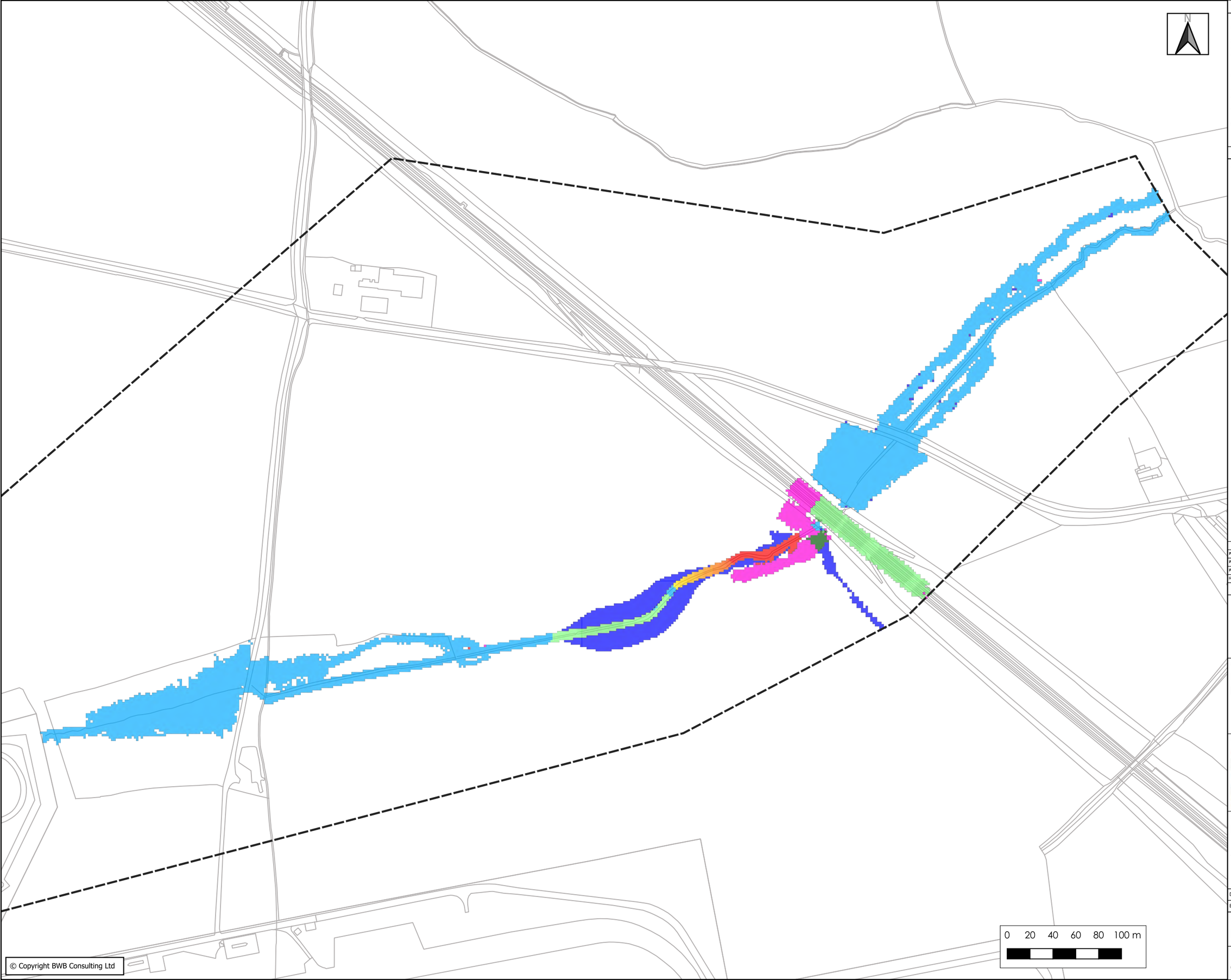
Drawn: [redacted]

BWB Ref:	NTH2479	Date:	27.03.23	Scale@A3:	1:3,000

Drawing Status

PRELIMINARY

Project - Originator - Zone - Level - Type - Role - Number	Status	Rev
OXSRFI-BWB-ZZ-XX-D-W-1232	S2	P03



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3. All dimensions in millimetres unless noted otherwise. All levels in metres unless noted otherwise.

4. Any discrepancies noted on site are to be reported to the engineer immediately.

5. Model not yet peer reviewed.

6. Contains OS data © Licence no. 100019980

Key

- Model Domain
- Former Wet Areas Now Dry
- Former Dry Areas Now Wet

Change in Modelled Peak Flood Level (m)

- <= -0.125
- -0.125 - -0.100
- -0.100 - -0.075
- -0.075 - -0.050
- -0.050 - -0.025
- -0.025 - -0.01
- -0.01 - 0.01 (No Change)
- 0.01 - 0.025
- 0.025 - 0.050
- 0.050 - 0.075
- 0.075 - 0.100
- 0.100 - 0.125
- > 0.125

Rev	Date	Details of issues/ revision	Drw	Rev
P03	28.08.25	UPDATED MODEL RESULTS	MN	SR
P02	31.07.25	UPDATED HYDROLOGY AND SOFTWARE	MN	SR
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Project Title

OxSRFI
OXFORDSHIRE
STRATEGIC RAIL FREIGHT INTERCHANGE

Drawing Title

Proposed Impact Analysis 1 in 1000-Year

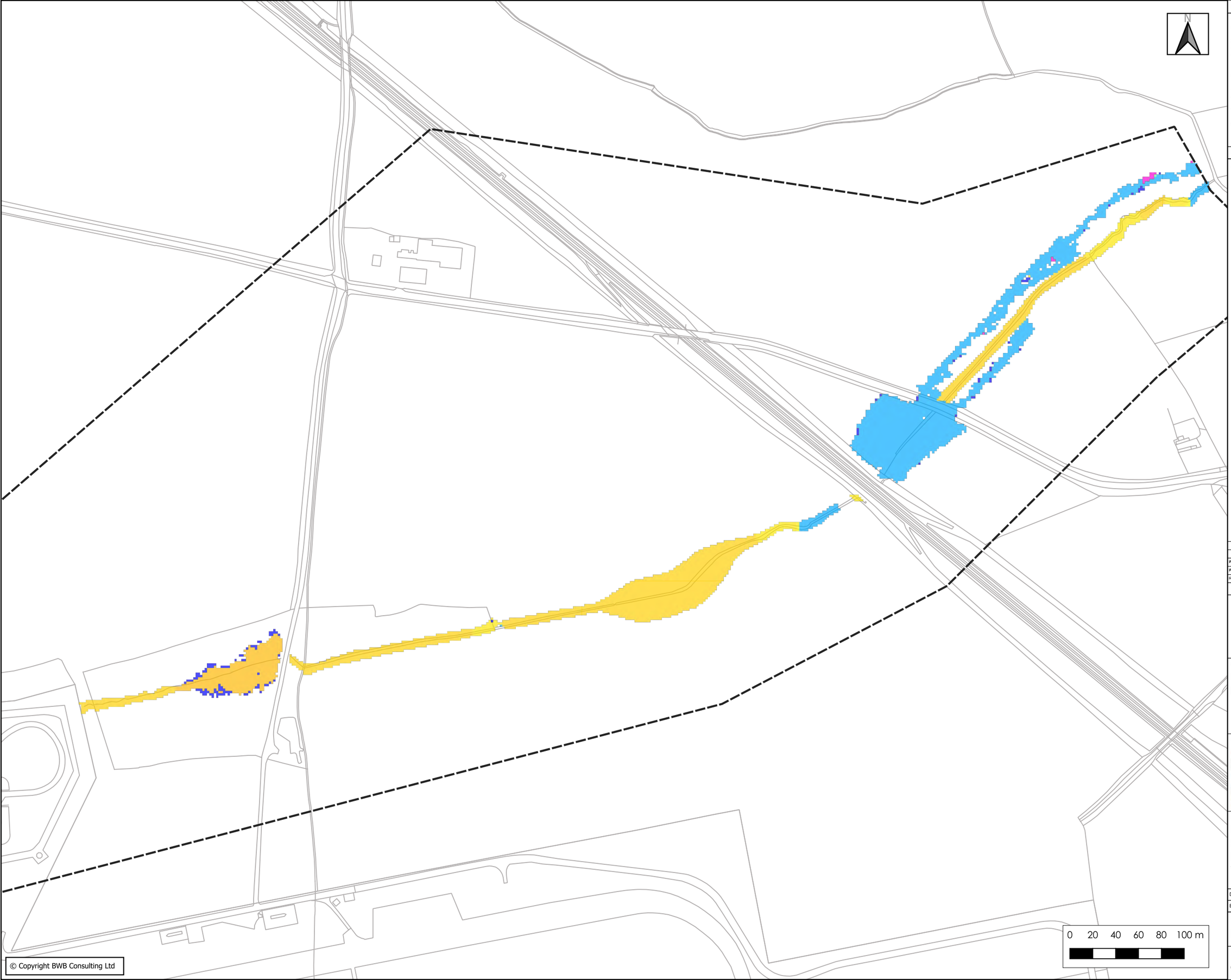
Drawn:	[redacted]				
BWB Ref:	NTH2479	Date:	27.03.23	Scale@A3:	1:3,000

Drawing Status

PRELIMINARY

Project - Originator - Zone - Level - Type - Role - Number	Status	Rev
OXSRFI-BWB-ZZ-XX-D-W-1233	S2	P03

Appendix 8: Sensitivity Testing



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3. All dimensions in millimetres unless noted otherwise. All levels in metres unless noted otherwise.

4. Any discrepancies noted on site are to be reported to the engineer immediately.

5. Model not yet peer reviewed.

6. Contains OS data © Licence no. 100019980

Key

- Model Domain
- Former Wet Areas Now Dry
- Former Dry Areas Now Wet

Change in Modelled Peak Flood Level (m)

- <= -0.125
- -0.125 - -0.100
- -0.100 - -0.075
- -0.075 - -0.050
- -0.050 - -0.025
- -0.025 - -0.01
- -0.01 - 0.01 (No Change)
- 0.01 - 0.025
- 0.025 - 0.050
- 0.050 - 0.075
- 0.075 - 0.100
- 0.100 - 0.125
- > 0.125

Rev	Date	Details of issues/ revision	Drw	Rev
P02	28.08.25	UPDATED HYDROLOGY AND SOFTWARE	MN	SR
P01	27.03.23	PRELIMINARY ISSUE	MPB	MB

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Client

Oxfordshire Railfreight Limited

Project Title

OxSRFI
OXFORDSHIRE
STRATEGIC RAIL FREIGHT INTERCHANGE

Drawing Title

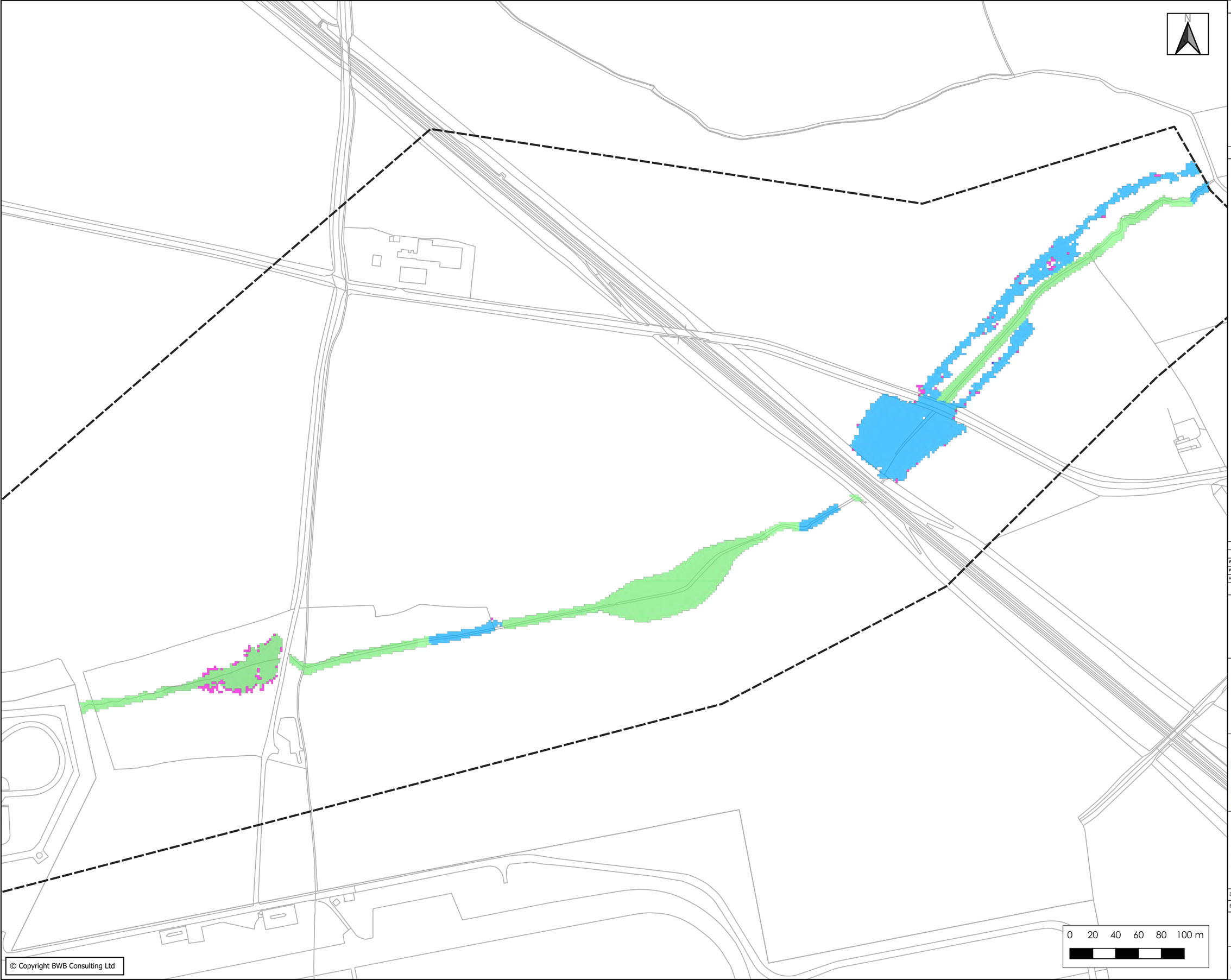
Post-Development Sensitivity: Increased Roughness (20%) 1 in 100-Year

Drawn:	[redacted]				
BWB Ref:	NTH2479	Date:	27.03.23	Scale@A3:	1:3,000

Drawing Status

PRELIMINARY

Project - Originator - Zone - Level - Type - Role - Number	Status	Rev
OXSRFI-BWB-ZZ-XX-D-W-1240	S2	P02



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Notes

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2. This drawing is to be read in conjunction with all relevant architects, engineers and specialists drawings and specifications.

3. All dimensions in millimetres unless noted otherwise. All levels in metres unless noted otherwise.

4. Any discrepancies noted on site are to be reported to the engineer immediately.

5. Model not yet peer reviewed.

6. Contains OS data © Licence no. 100019980

Key

- Model Domain
- Former Wet Areas Now Dry
- Former Dry Areas Now Wet

Change in Modelled Peak Flood Level (m)

- <= -0.125
- -0.125 - -0.100
- -0.100 - -0.075
- -0.075 - -0.050
- -0.050 - -0.025
- -0.025 - -0.01
- -0.01 - 0.01 (No Change)
- 0.01 - 0.025
- 0.025 - 0.050
- 0.050 - 0.075
- 0.075 - 0.100
- 0.100 - 0.125
- > 0.125

Rev	Date	Details of issues/ revision	Drw	Rev
P02	28.08.25	UPDATED HYDROLOGY AND SOFTWARE	MN	SR
P01	27.03.23	PRELIMINARY ISSUE	MPB	MB

Issues & Revisions

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■ Birmingham | 0121 233 3322
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□ Nottingham | 0115 924 1100
www.bwbconsulting.com

Client

Oxfordshire Railfreight Limited

Project Title

OxSRFI
OXFORDSHIRE
STRATEGIC RAIL FREIGHT INTERCHANGE

Drawing Title

Post-Development Sensitivity: Decreased Roughness (20%) 1 in 100-Year

Drawn:	[redacted]				
BWB Ref:	NTH2479	Date:	27.03.23	Scale@A3:	1:3,000

Drawing Status

PRELIMINARY

Project - Originator - Zone - Level - Type - Role - Number	Status	Rev
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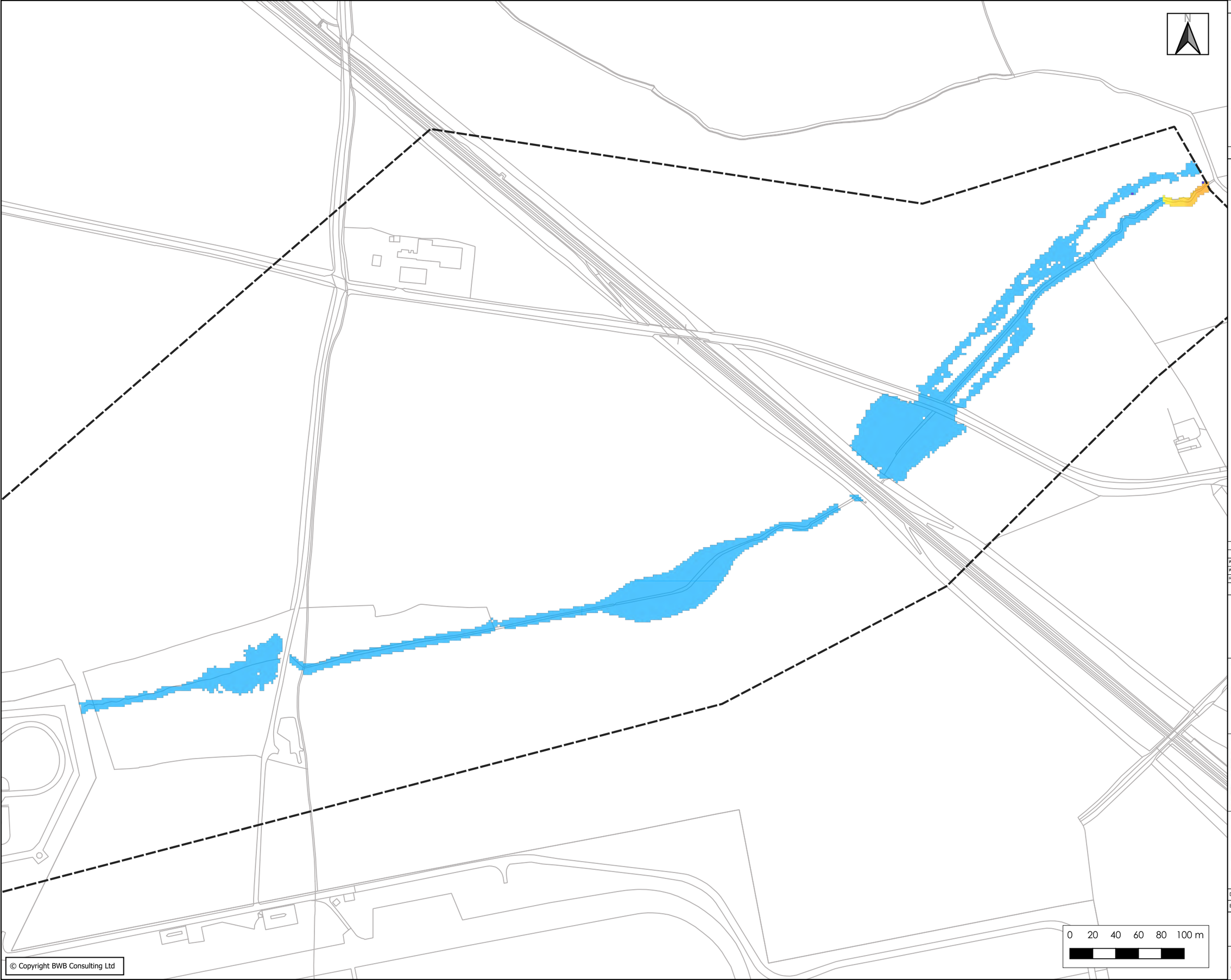

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6. Contains OS data © Licence no. 100019980

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- Former Dry Areas Now Wet

Change in Modelled Peak Flood Level (m)

- <= -0.125
- -0.125 - -0.100
- -0.100 - -0.075
- -0.075 - -0.050
- -0.050 - -0.025
- -0.025 - -0.01
- -0.01 - 0.01 (No Change)
- 0.01 - 0.025
- 0.025 - 0.050
- 0.050 - 0.075
- 0.075 - 0.100
- 0.100 - 0.125
- > 0.125

Rev	Date	Details of issues/ revision	Drw	Rev
P02	28.06.25	UPDATED HYDROLOGY AND SOFTWARE	MN	SR
P01	27.03.23	PRELIMINARY ISSUE	MPB	MB

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Client

Oxfordshire Railfreight Limited

Project Title

OxSRFI OXFORDSHIRE STRATEGIC RAIL FREIGHT INTERCHANGE

Drawing Title

Post-Development Sensitivity: Increased Downstream Boundary (20%) 1 in 100-Year

Drawn:	[redacted]				
BWB Ref:	NTH2479	Date:	27.03.23	Scale@A3:	1:3,000

Drawing Status

PRELIMINARY

Project - Originator - Zone - Level - Type - Role - Number	Status	Rev
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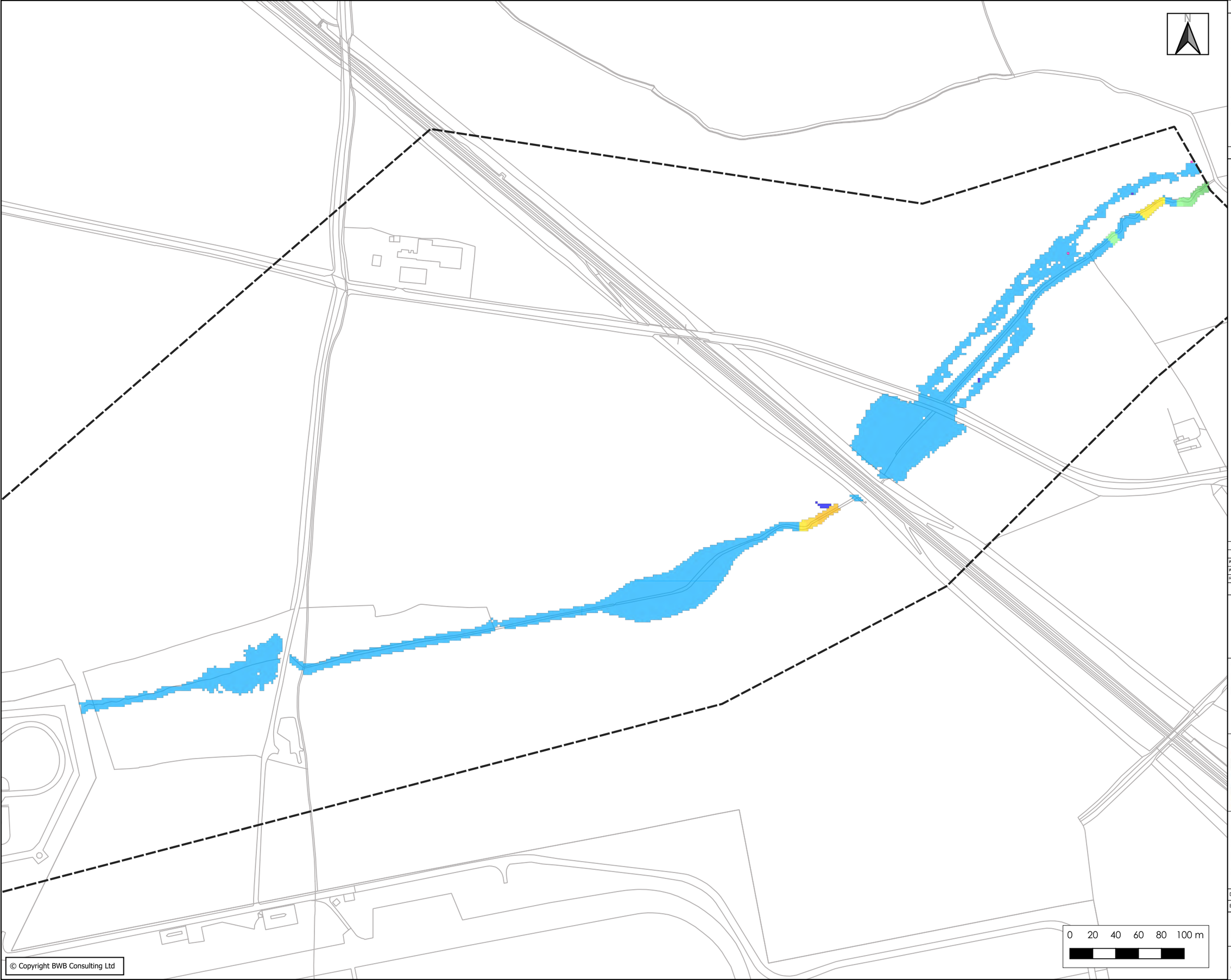

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Change in Modelled Peak Flood Level (m)

- <= -0.125
- -0.125 - -0.100
- -0.100 - -0.075
- -0.075 - -0.050
- -0.050 - -0.025
- -0.025 - -0.01
- -0.01 - 0.01 (No Change)
- 0.01 - 0.025
- 0.025 - 0.050
- 0.050 - 0.075
- 0.075 - 0.100
- 0.100 - 0.125
- > 0.125

Rev	Date	Details of issues/ revision	Drw	Rev
P02	28.08.25	UPDATED HYDROLOGY AND SOFTWARE	MN	SR
P01	27.03.23	PRELIMINARY ISSUE	MPB	MB

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Client

Oxfordshire Railfreight Limited

Project Title

OxSRFI
OXFORDSHIRE
STRATEGIC RAIL FREIGHT INTERCHANGE

Drawing Title

Post-Development Sensitivity: Decreased Downstream Boundary (20%) 1 in 100-Year

Drawn:	[redacted]				
BWB Ref:	NTH2479	Date:	27.03.23	Scale@A3:	1:3,000

Drawing Status

PRELIMINARY

Project - Originator - Zone - Level - Type - Role - Number	Status	Rev
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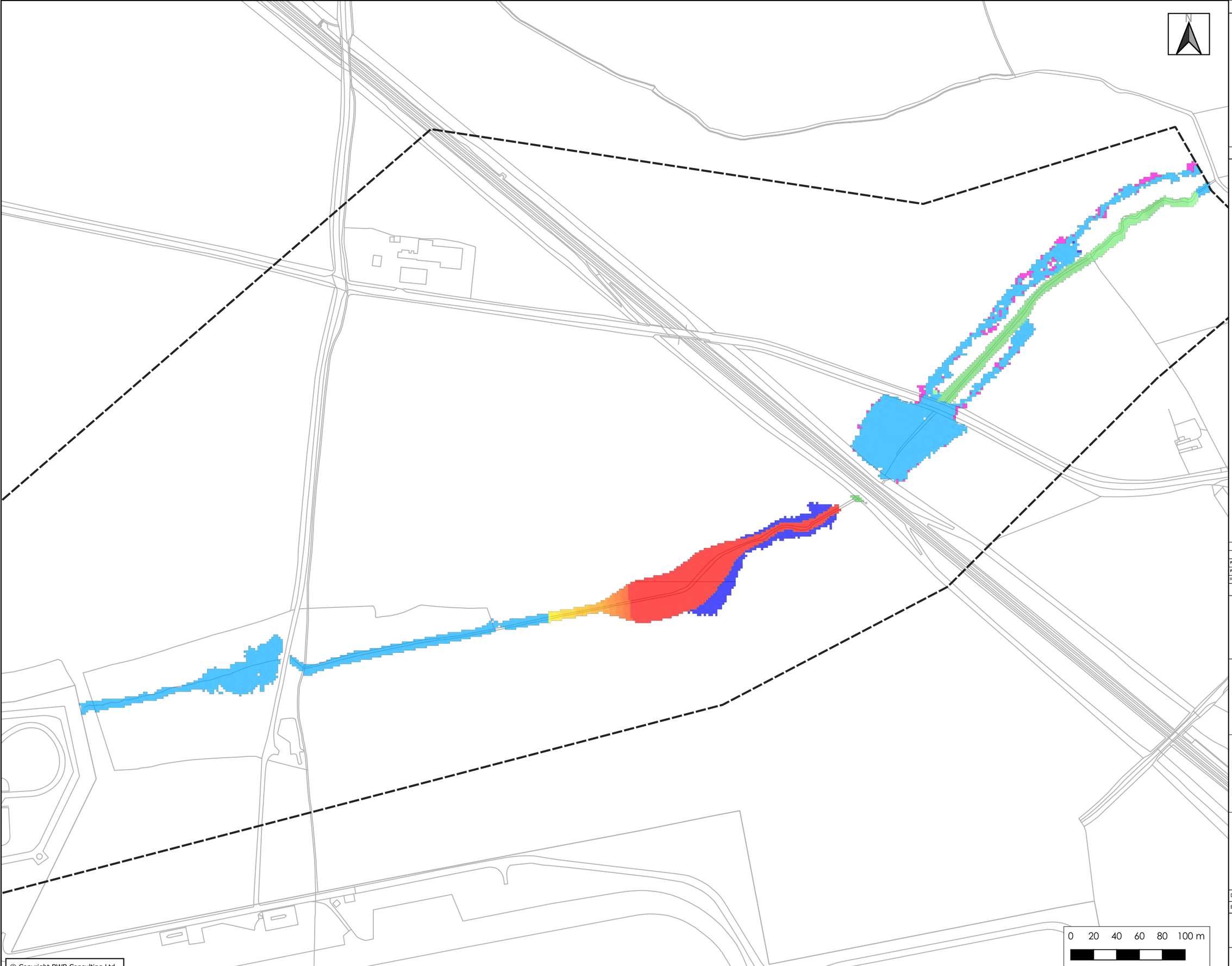

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Notes

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- <= -0.125
- -0.125 - -0.100
- -0.100 - -0.075
- -0.075 - -0.050
- -0.050 - -0.025
- -0.025 - -0.01
- -0.01 - 0.01 (No Change)
- 0.01 - 0.025
- 0.025 - 0.050
- 0.050 - 0.075
- 0.075 - 0.100
- 0.100 - 0.125
- > 0.125

Rev	Date	Details of issues/ revision	Drw	Rev
P02	28.07.25	UPDATED HYDROLOGY AND SOFTWARE	MN	SR
P01	27.03.23	PRELIMINARY ISSUE	MPB	MB

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Client

Oxfordshire Railfreight Limited

Project Title

OxSRFI
OXFORDSHIRE
STRATEGIC RAIL FREIGHT INTERCHANGE

Drawing Title

Post-Development Sensitivity: Proposed Culvert Blockage (75%) 1 in 100-Year

Drawn:	[redacted]				
BWB Ref:	NTH2479	Date:	27.03.23	Scale@A3:	1:3,000

Drawing Status

PRELIMINARY

Project - Originator - Zone - Level - Type - Role - Number	Status	Rev
OXSRFI-BWB-ZZ-XX-D-W-1248	S2	P02

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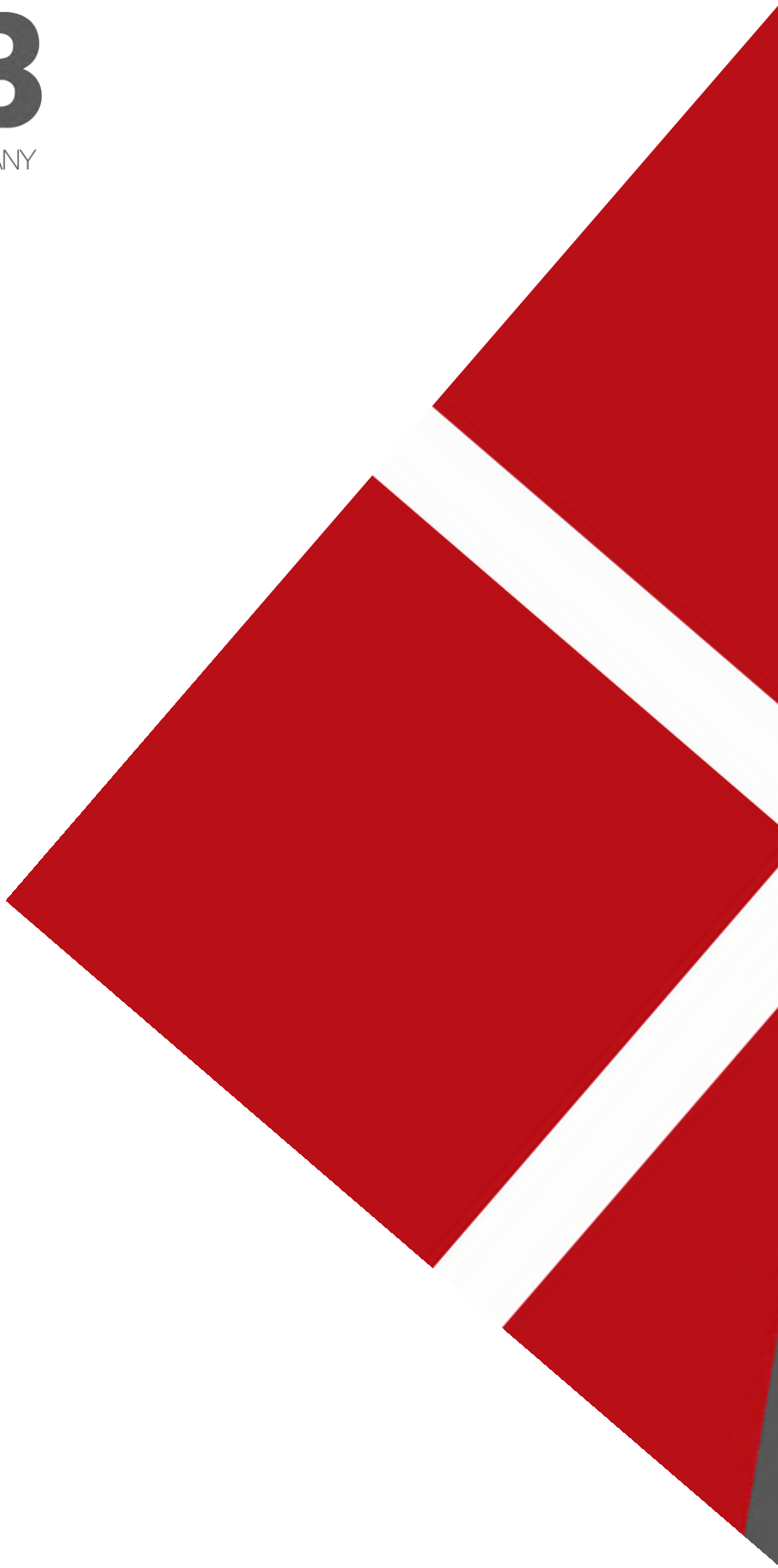

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Appendix 4: ~~Hydraulic Modelling Reports~~

~~Appendix 5:~~ Thames Water Sewer Plans

Asset location search

Property Searches

Engineering Services Consultancy Limited
Griffin House
19Ludgate Hill
BIRMINGHAM
B3 1DW

Search address supplied OX27 7PH

Your reference Q-CPC-Ardley

Our reference ALS/ALS Standard/2018_3817907

Search date 19 June 2018

Keeping you up-to-date

Knowledge of features below the surface is essential in every development. The benefits of this not only include ensuring due diligence and avoiding risk, but also being able to ascertain the feasibility for any commercial or residential project.

An asset location search provides information on the location of known Thames Water clean and/or wastewater assets, including details of pipe sizes, direction of flow and depth. Please note that information on cover and invert levels will only be provided where the data is available.

Thames Water Utilities Ltd
Property Searches, PO Box 3189, Slough SL1 4WW
DX 151280 Slough 13

searches@thameswater.co.uk
www.thameswater-propertysearches.co.uk

0845 070 9148

searchcode

Asset location search

Property Searches

Search address supplied: OX27 7PH

Dear Sir / Madam

An Asset Location Search is recommended when undertaking a site development. It is essential to obtain information on the size and location of clean water and sewerage assets to safeguard against expensive damage and allow cost-effective service design.

The following records were searched in compiling this report: - the map of public sewers & the map of waterworks. Thames Water Utilities Ltd (TWUL) holds all of these.

This searchprovides maps showing the position, size of Thames Water assets close to the proposed development and also manhole cover and invert levels, where available.

Please note that none of the charges made for this report relate to the provision of Ordnance Survey mapping information. The replies contained in this letter are given following inspection of the public service records available to this company. No responsibility can be accepted for any error or omission in the replies.

You should be aware that the information contained on these plans is current only on the day that the plans are issued. The plans should only be used for the duration of the work that is being carried out at the present time. Under no circumstances should this data be copied or transmitted to parties other than those for whom the current work is being carried out.

Thames Water do update these service plans on a regular basis and failure to observe the above conditions could lead to damage arising to new or diverted services at a later date.

Contact Us

If you have any further queries regarding this enquiry please feel free to contact a member of the team on 0845 070 9148, or use the address below:

Thames Water Utilities Ltd
Property Searches
PO Box 3189
Slough
SL1 4WW

Email: searches@thameswater.co.uk
Web: www.thameswater-propertysearches.co.uk

Waste Water Services

Please provide a copy extract from the public sewer map.

The following quartiles have been printed as they fall within Thames' sewerage area:

SP5226SW
SP5226NW
SP5226SE
SP5226NE
SP5326NW

Enclosed is a map showing the approximate lines of our sewers. Our plans do not show sewer connections from individual properties or any sewers not owned by Thames Water unless specifically annotated otherwise. Records such as "private" pipework are in some cases available from the Building Control Department of the relevant Local Authority.

Where the Local Authority does not hold such plans it might be advisable to consult the property deeds for the site or contact neighbouring landowners.

This report relates only to sewerage apparatus of Thames Water Utilities Ltd, it does not disclose details of cables and or communications equipment that may be running through or around such apparatus.

The sewer level information contained in this response represents all of the level data available in our existing records. Should you require any further Information, please refer to the relevant section within the 'Further Contacts' page found later in this document.

The following quartiles have not been printed as they contain no assets:

SP5225NW
SP5225NE
SP5325NW
SP5326SW

For your guidance:

- The Company is not generally responsible for rivers, watercourses, ponds, culverts or highway drains. If any of these are shown on the copy extract they are shown for information only.
- Any private sewers or lateral drains which are indicated on the extract of the public sewer map as being subject to an agreement under Section 104 of the Water Industry Act 1991 are not an ‘as constructed’ record. It is recommended these details be checked with the developer.

Clean Water Services

Please provide a copy extract from the public water main map.

The following quartiles have been printed as they fall within Thames' water area:

SP5225NW
SP5225NE
SP5325NW

Enclosed is a map showing the approximate positions of our water mains and associated apparatus. Please note that records are not kept of the positions of individual domestic supplies.

For your information, there will be a pressure of at least 10m head at the outside stop valve. If you would like to know the static pressure, please contact our Customer Centre on 0800 316 9800. The Customer Centre can also arrange for a full flow and pressure test to be carried out for a fee.

The following quartiles have not been printed as they contain no assets:

SP5226SW
SP5226NW
SP5226SE
SP5226NE
SP5326SW
SP5326NW

For your guidance:

- Assets other than vested water mains may be shown on the plan, for information only.
- If an extract of the public water main record is enclosed, this will show known public water mains in the vicinity of the property. It should be possible to estimate the likely length and route of any private water supply pipe connecting the property to the public water network.

Payment for this Search

A charge will be added to your suppliers account.

Further contacts:

Waste Water queries

Should you require verification of the invert levels of public sewers, by site measurement, you will need to approach the relevant Thames Water Area Network Office for permission to lift the appropriate covers. This permission will usually involve you completing a TWOSA form. For further information please contact our Customer Centre on Tel: 0845 920 0800. Alternatively, a survey can be arranged, for a fee, through our Customer Centre on the above number.

If you have any questions regarding sewer connections, budget estimates, diversions, building over issues or any other questions regarding operational issues please direct them to our service desk. Which can be contacted by writing to:

Developer Services (Waste Water)
Thames Water
Clearwater Court
Vastern Road
Reading
RG1 8DB

Tel: 0800 009 3921
Email: developer.services@thameswater.co.uk

Clean Water queries

Should you require any advice concerning clean water operational issues or clean water connections, please contact:

Developer Services (Clean Water)
Thames Water
Clearwater Court
Vastern Road
Reading
RG1 8DB

Tel: 0800 009 3921
Email: developer.services@thameswater.co.uk

Asset Location Search Sewer Map - ALS/ALS Standard/2018_3817907	SP5226SW



The width of the displayed area is 500m and the centre of the map is located at OS coordinates 452250,226250

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.

Based on the Ordnance Survey Map with the Sanction of the controller of H.M. Stationery Office, License no. 100019345 Crown Copyright Reserved.

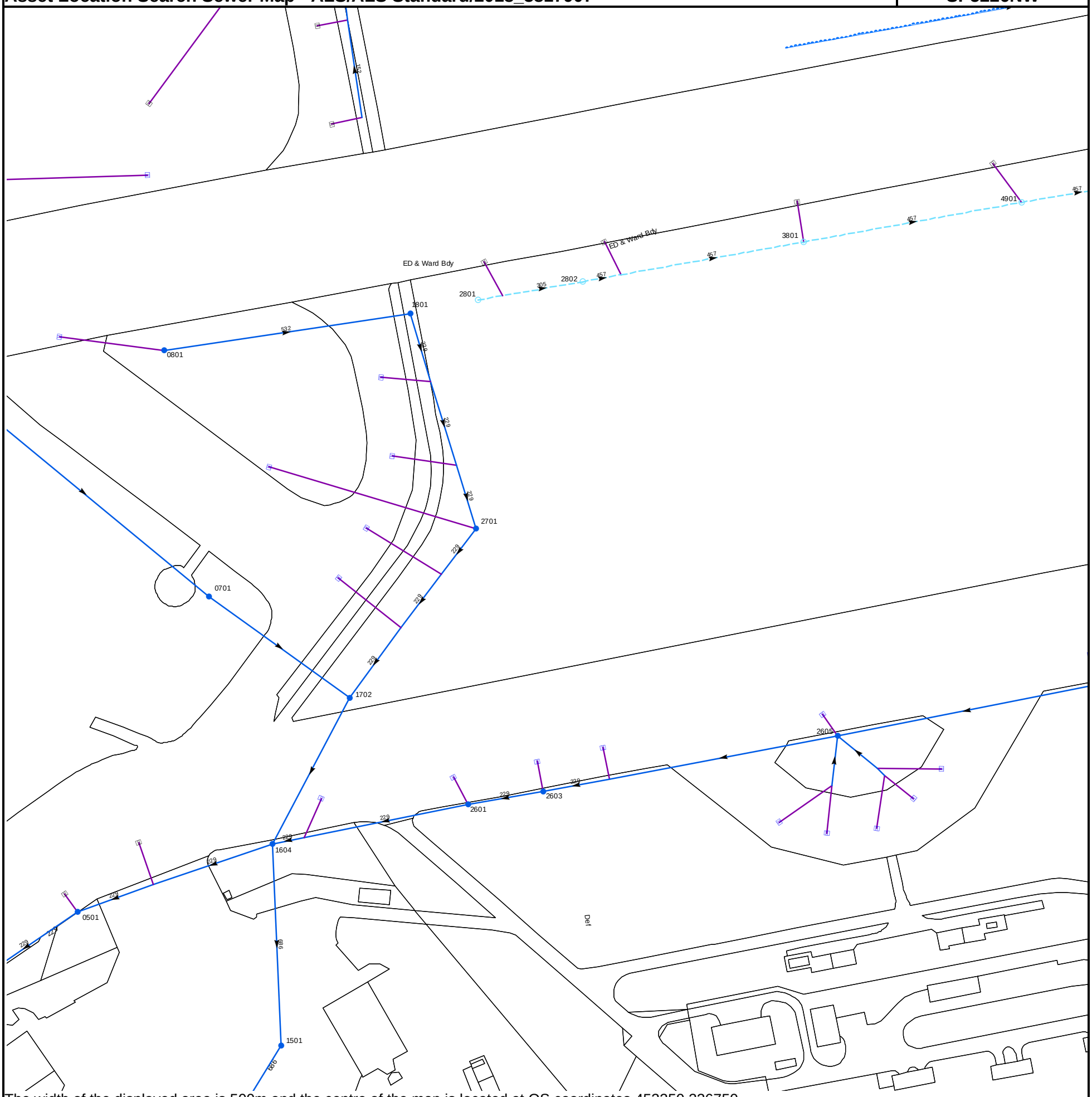
NB. Levels quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates that no survey information is available

Manhole Reference	Manhole Cover Level	Manhole Invert Level
1301	n/a	n/a
1201	n/a	n/a
4401	n/a	n/a
5404	n/a	n/a
0402	n/a	n/a
0401	n/a	n/a

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.

Asset Location Search Sewer Map - ALS/ALS Standard/2018_3817907

SP5226NW



The width of the displayed area is 500m and the centre of the map is located at OS coordinates 452250,226750

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.

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NB. Levels quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates that no survey information is available

Manhole Reference	Manhole Cover Level	Manhole Invert Level
1702	n/a	n/a
1801	n/a	n/a
2601	n/a	n/a
2701	n/a	n/a
2801	n/a	n/a
2603	n/a	n/a
2802	n/a	n/a
3801	n/a	n/a
2605	n/a	n/a
4901	n/a	n/a
0501	n/a	n/a
0801	n/a	n/a
0701	n/a	n/a
1604	n/a	n/a
1501	n/a	n/a

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.

Asset Location Search Sewer Map - ALS/ALS Standard/2018_3817907	SP5226SE



The width of the displayed area is 500m and the centre of the map is located at OS coordinates 452750,226250

The width of the displayed area is 500m and the centre of the map is located at OS coordinates 452750,226250

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.

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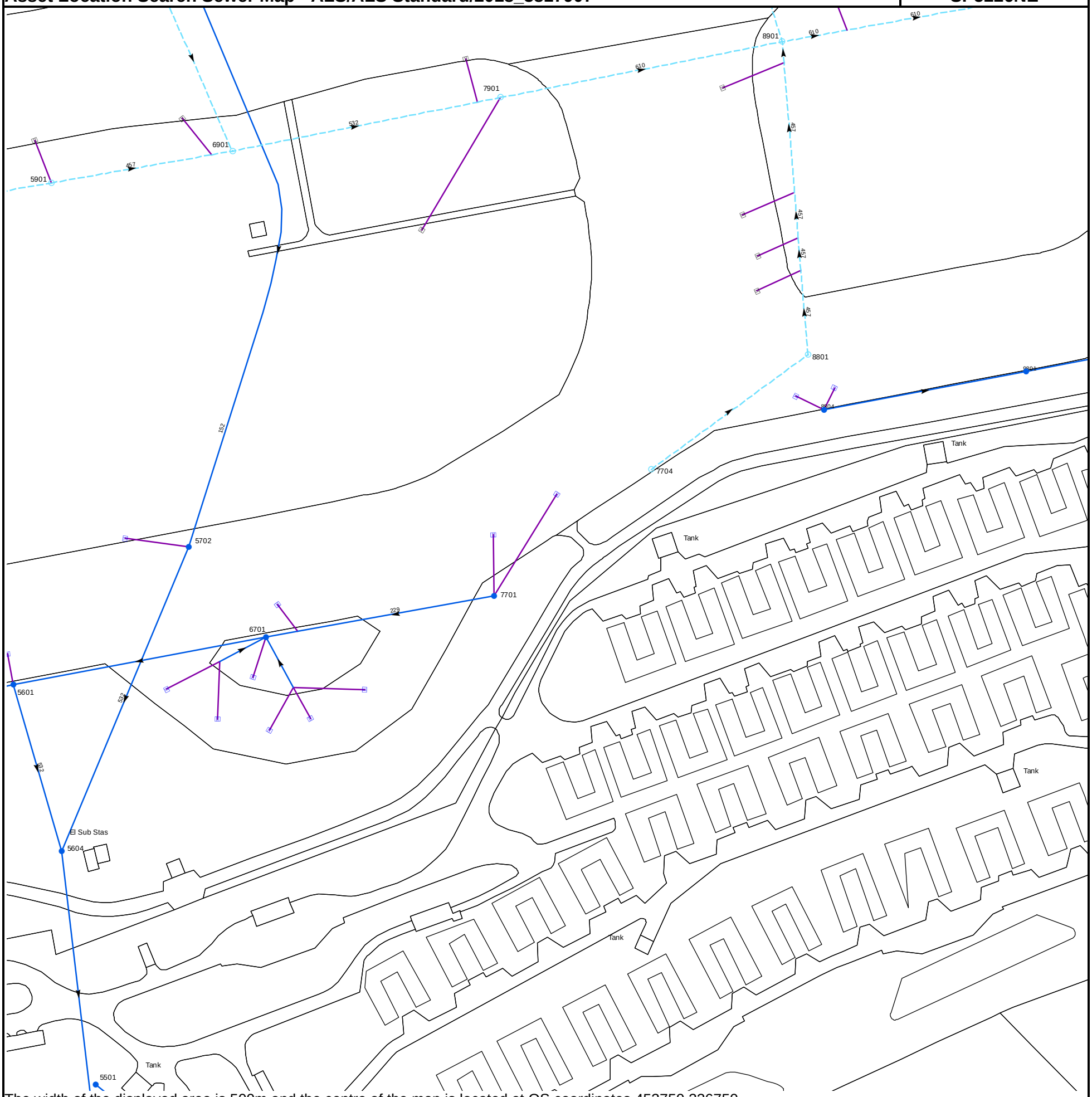
NB. Levels quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates that no survey information is available

Manhole Reference	Manhole Cover Level	Manhole Invert Level
5407	n/a	n/a
5403	n/a	n/a
5406	n/a	n/a
5405	n/a	n/a
5409	n/a	n/a

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.

Asset Location Search Sewer Map - ALS/ALS Standard/2018_3817907 | SP5226NE



The width of the displayed area is 500m and the centre of the map is located at OS coordinates 452750,226750

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NB. Levels quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates that no survey information is available

Manhole Reference	Manhole Cover Level	Manhole Invert Level
7901	n/a	n/a
7704	n/a	n/a
8901	n/a	n/a
8801	n/a	n/a
8804	n/a	n/a
9801	n/a	n/a
5601	n/a	n/a
5901	n/a	n/a
5604	n/a	n/a
5501	n/a	n/a
5702	n/a	n/a
6901	n/a	n/a
6701	n/a	n/a
7701	n/a	n/a

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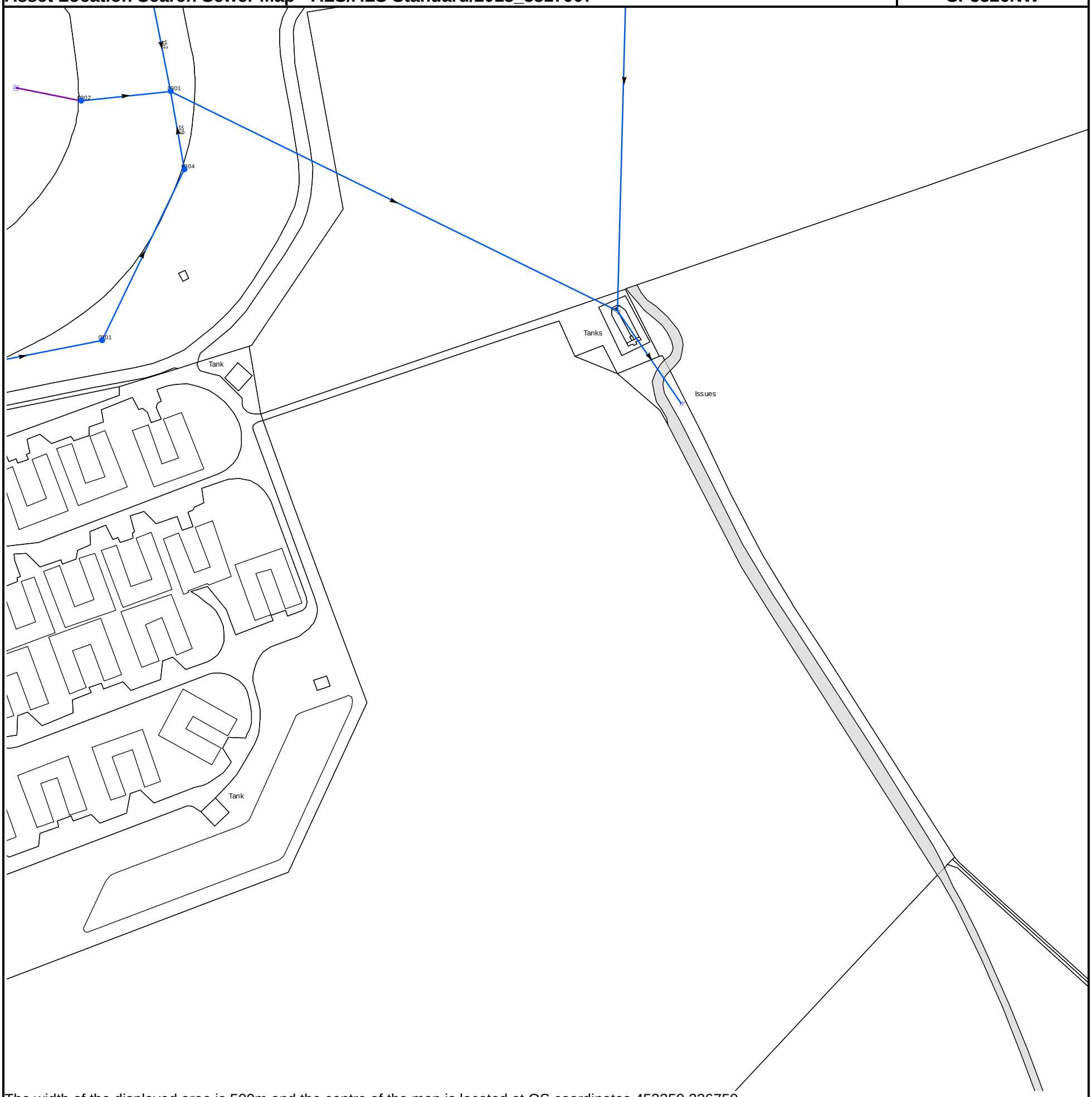
Asset Location Search Sewer Map - ALS/ALS Standard/2018_3817907	SP5326NW



The width of the displayed area is 500m and the centre of the map is located at OS coordinates 453250,226750

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NB. Levels quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates that no survey information is available

Manhole Reference	Manhole Cover Level	Manhole Invert Level
0801	n/a	n/a
0901	n/a	n/a
0904	n/a	n/a
0902	n/a	n/a

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.

Based on the Ordnance Survey Map with the sanction of the Controller of H.M Stationary Office License Number 10019345

ALS/ALS Standard/2018_3817907



0 45 90 180 270 360
Meters

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified before any works are undertaken. Crown copyright Reserved

Scale: 1:7165
Width: 2001m
Printed By: [redacted]
Print Date: 19/06/2018
Map Centre: 452819,226164
Grid Reference: SP5226SE

Comments:

ALS Sewer Map Key

Public Sewer Types (Operated & Maintained by Thames Water)

Foul: A sewer designed to convey waste water from domestic and industrial sources to a treatment works.

Surface Water: A sewer designed to convey surface water (e.g. rain water from roofs, yards and car parks) to rivers or watercourses.

Combined: A sewer designed to convey both waste water and surface water from domestic and industrial sources to a treatment works.

- Trunk Surface Water
- Trunk Foul
- Storm Relief
- Trunk Combined
- Vent Pipe
- Bio-solids (Sludge)
- Proposed Thames Surface Water Sewer
- Proposed Thames Water Foul Sewer
- Gallery
- Foul Rising Main
- Surface Water Rising Main
- Combined Rising Main
- Sludge Rising Main
- Proposed Thames Water Rising Main
- Vacuum

Sewer Fittings

A feature in a sewer that does not affect the flow in the pipe. Example: a vent is a fitting as the function of a vent is to release excess gas.

- Air Valve
- Dam Chase
- Fitting
- Meter
- Vent Column

Operational Controls

A feature in a sewer that changes or diverts the flow in the sewer. Example: A hydrobrake limits the flow passing downstream.

- Control Valve
- Drop Pipe
- Ancillary
- Weir

End Items

End symbols appear at the start or end of a sewer pipe. Examples: an Undefined End at the start of a sewer indicates that Thames Water has no knowledge of the position of the sewer upstream of that symbol, Outfall on a surface water sewer indicates that the pipe discharges into a stream or river.

- Outfall
- Undefined End
- Inlet

Other Symbols

Symbols used on maps which do not fall under other general categories

- Public/Private Pumping Station
- Change of characteristic indicator (C.O.C.I.)
- Invert Level
- Summit

Areas

Lines denoting areas of underground surveys, etc.

- Agreement
- Operational Site
- Chamber
- Tunnel
- Conduit Bridge

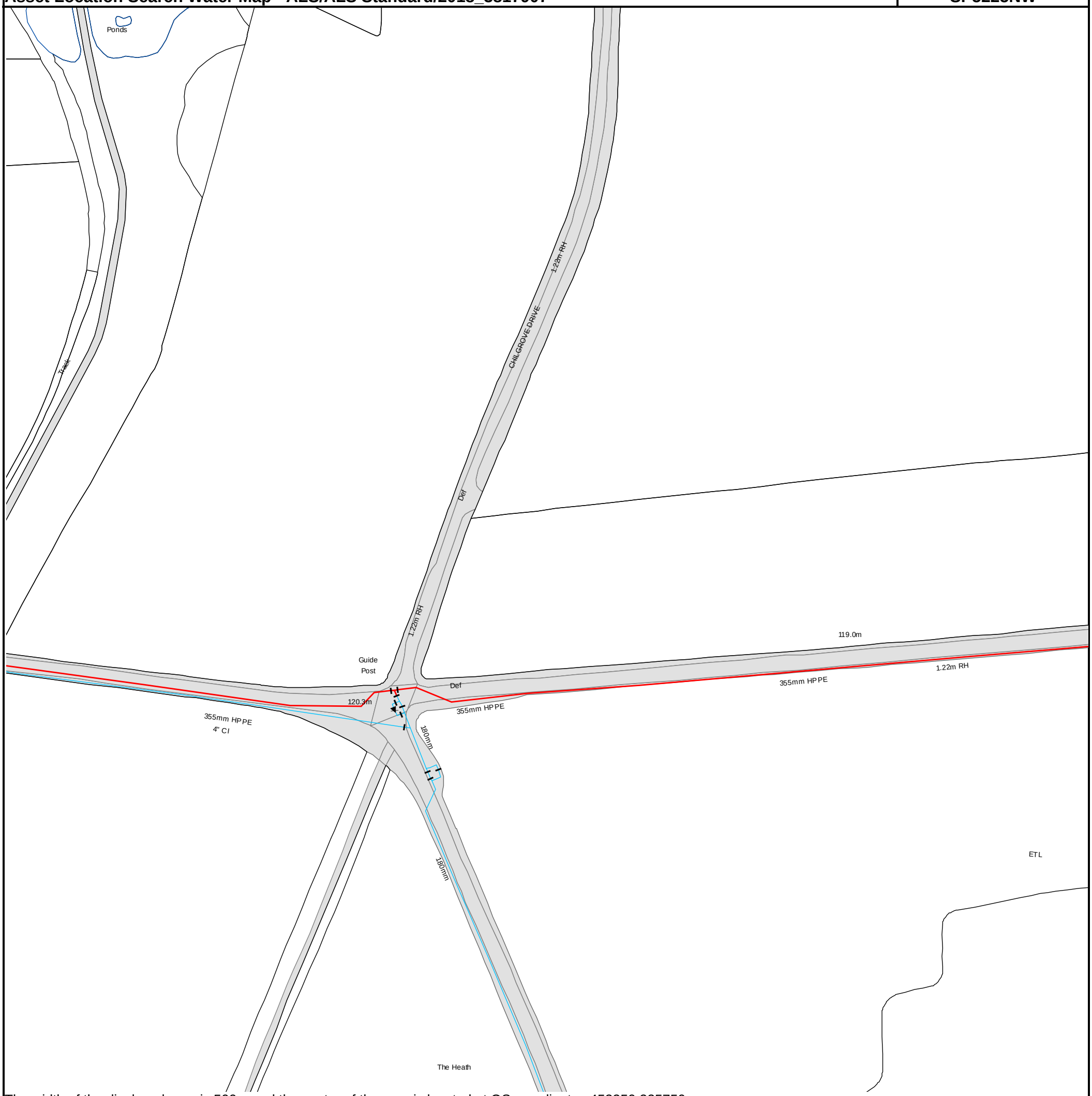
Other Sewer Types (Not Operated or Maintained by Thames Water)

- Foul Sewer
- Surface Water Sewer
- Combined Sewer
- Gulley
- Culverted Watercourse
- Proposed
- Abandoned Sewer

Notes:

1) All levels associated with the plans are to Ordnance Datum Newlyn.
2) All measurements on the plans are metric.
3) Arrows (on gravity fed sewers) or flecks (on rising mains) indicate direction of flow.
4) Most private pipes are not shown on our plans, as in the past, this information has not been recorded.
5) 'na' or '0' on a manhole level indicates that data is unavailable.
6) The text appearing alongside a sewer line indicates the internal diameter of the pipe in milimetres. Text next to a manhole indicates the manhole reference number and should not be taken as a measurement. If you are unsure about any text or symbology present on the plan, please contact a member of Property Insight on 0845 070 9148.

Asset Location Search Water Map - ALS/ALS Standard/2018_3817907	SP5225NW



The width of the displayed area is 500m and the centre of the map is located at OS coordinates 452250,225750

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.

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Asset Location Search Water Map - ALS/ALS Standard/2018_3817907	SP5225NE



The width of the displayed area is 500m and the centre of the map is located at OS coordinates 452750,225750

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.

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Asset Location Search Water Map - ALS/ALS Standard/2018_3817907	SP5325NW



The width of the displayed area is 500m and the centre of the map is located at OS coordinates 453250,225750

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.

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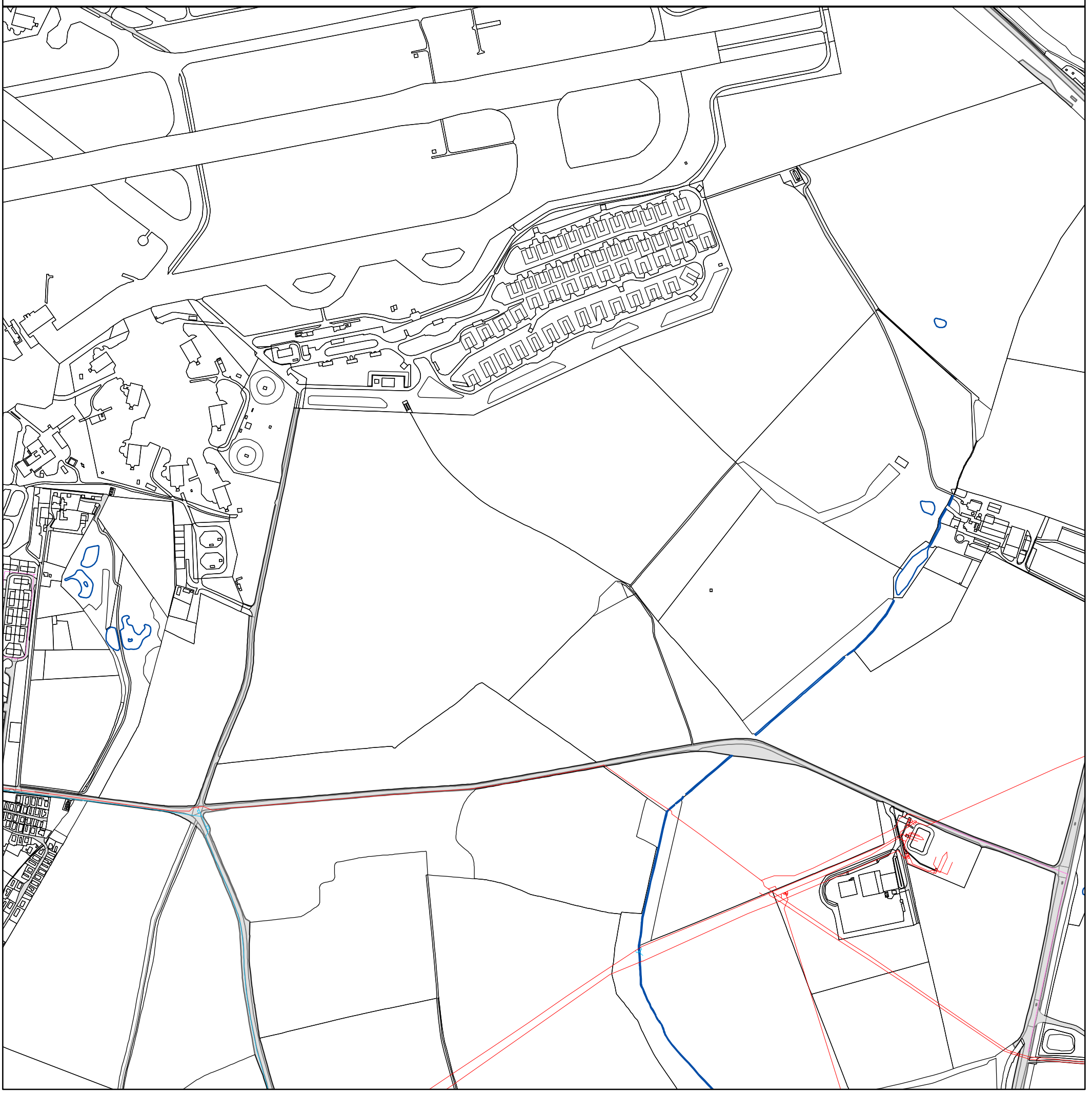
ALS/ALS Standard/2018_3817907



0 45 90 180 270 360
Meters

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified before any works are undertaken. Crown copyright Reserved

Scale: 1:7165
Width: 2001m
Printed By: [redacted]
Print Date: 19/06/2018
Map Centre: 452819,226164
Grid Reference: SP5226SE

Comments:

ALS Water Map Key

Water Pipes (Operated & Maintained by Thames Water)

4"

Distribution Main: The most common pipe shown on water maps. With few exceptions, domestic connections are only made to distribution mains.

16"

Trunk Main: A main carrying water from a source of supply to a treatment plant or reservoir, or from one treatment plant or reservoir to another. Also a main transferring water in bulk to smaller water mains used for supplying individual customers.

3" SUPPLY

Supply Main: A supply main indicates that the water main is used as a supply for a single property or group of properties.

3" FIRE

Fire Main: Where a pipe is used as a fire supply, the word FIRE will be displayed along the pipe.

3" METERED

Metered Pipe: A metered main indicates that the pipe in question supplies water for a single property or group of properties and that quantity of water passing through the pipe is metered even though there may be no meter symbol shown.

Transmission Tunnel: A very large diameter water pipe. Most tunnels are buried very deep underground. These pipes are not expected to affect the structural integrity of buildings shown on the map provided.

Proposed Main: A main that is still in the planning stages or in the process of being laid. More details of the proposed main and its reference number are generally included near the main.

Valves

- General Purpose Valve
- Air Valve
- Pressure Control Valve
- Customer Valve

Hydrants

- Single Hydrant

Meters

- Meter

End Items

Symbol indicating what happens at the end of a water main.

- Blank Flange
- Capped End
- Emptying Pit
- Undefined End
- Manifold
- Customer Supply
- Fire Supply

Operational Sites

- Booster Station
- Other
- Other (Proposed)
- Pumping Station
- Service Reservoir
- Shaft Inspection
- Treatment Works
- Unknown
- Water Tower

Other Symbols

- Data Logger

PIPE DIAMETER	DEPTH BELOW GROUND
Up to 300mm (12")	900mm (3')
300mm - 600mm (12" - 24")	1100mm (3' 8")
600mm and bigger (24" plus)	1200mm (4')

Other Water Pipes (Not Operated or Maintained by Thames Water)

Other Water Company Main: Occasionally other water company water pipes may overlap the border of our clean water coverage area. These mains are denoted in purple and in most cases have the owner of the pipe displayed along them.

Private Main: Indiates that the water main in question is not owned by Thames Water. These mains normally have text associated with them indicating the diameter and owner of the pipe.

Terms and Conditions

All sales are made in accordance with Thames Water Utilities Limited (TWUL) standard terms and conditions unless previously agreed in writing.

1. All goods remain in the property of Thames Water Utilities Ltd until full payment is received.
2. Provision of service will be in accordance with all legal requirements and published TWUL policies.
3. All invoices are strictly due for payment 14 days from due date of the invoice. Any other terms must be accepted/agreed in writing prior to provision of goods or service, or will be held to be invalid.
4. Thames Water does not accept post-dated cheques-any cheques received will be processed for payment on date of receipt.
5. In case of dispute TWUL`s terms and conditions shall apply.
6. Penalty interest may be invoked by TWUL in the event of unjustifiable payment delay. Interest charges will be in line with UK Statute Law 'The Late Payment of Commercial Debts (Interest) Act 1998'.
7. Interest will be charged in line with current Court Interest Charges, if legal action is taken.
8. A charge may be made at the discretion of the company for increased administration costs.

A copy of Thames Water's standard terms and conditions are available from the Commercial Billing Team (cashoperations@thameswater.co.uk).

We publish several Codes of Practice including a guaranteed standards scheme. You can obtain copies of these leaflets by calling us on 0800 316 9800

If you are unhappy with our service you can speak to your original goods or customer service provider. If you are not satisfied with the response, your complaint will be reviewed by the Customer Services Director. You can write to her at: Thames Water Utilities Ltd. PO Box 492, Swindon, SN38 8TU.

If the Goods or Services covered by this invoice falls under the regulation of the 1991 Water Industry Act, and you remain dissatisfied you can refer your complaint to Consumer Council for Water on 0121 345 1000 or write to them at Consumer Council for Water, 1st Floor, Victoria Square House, Victoria Square, Birmingham, B2 4AJ.



Search Code

IMPORTANT CONSUMER PROTECTION INFORMATION

This search has been produced by Thames Water Property Searches, Clearwater Court, Vastern Road, Reading RG1 8DB, which is registered with the Property Codes Compliance Board (PCCB) as a subscriber to the Search Code. The PCCB independently monitors how registered search firms maintain compliance with the Code.

The Search Code:

- provides protection for homebuyers, sellers, estate agents, conveyancers and mortgage lenders who rely on the information included in property search reports undertaken by subscribers on residential and commercial property within the United Kingdom
- sets out minimum standards which firms compiling and selling search reports have to meet
- promotes the best practise and quality standards within the industry for the benefit of consumers and property professionals
- enables consumers and property professionals to have confidence in firms which subscribe to the code, their products and services.

By giving you this information, the search firm is confirming that they keep to the principles of the Code. This provides important protection for you.

The Code's core principles

Firms which subscribe to the Search Code will:

- display the Search Code logo prominently on their search reports
- act with integrity and carry out work with due skill, care and diligence
- at all times maintain adequate and appropriate insurance to protect consumers
- conduct business in an honest, fair and professional manner
- handle complaints speedily and fairly
- ensure that products and services comply with industry registration rules and standards and relevant laws
- monitor their compliance with the Code

Complaints

If you have a query or complaint about your search, you should raise it directly with the search firm, and if appropriate ask for any complaint to be considered under their formal internal complaints procedure. If you remain dissatisfied with the firm's final response, after your complaint has been formally considered, or if the firm has exceeded the response timescales, you may refer your complaint for consideration under The Property Ombudsman scheme (TPOs). The Ombudsman can award compensation of up to £5,000 to you if he finds that you have suffered actual loss as a result of your search provider failing to keep to the Code.

Please note that all queries or complaints regarding your search should be directed to your search provider in the first instance, not to TPOs or to the PCCB.

TPOs Contact Details

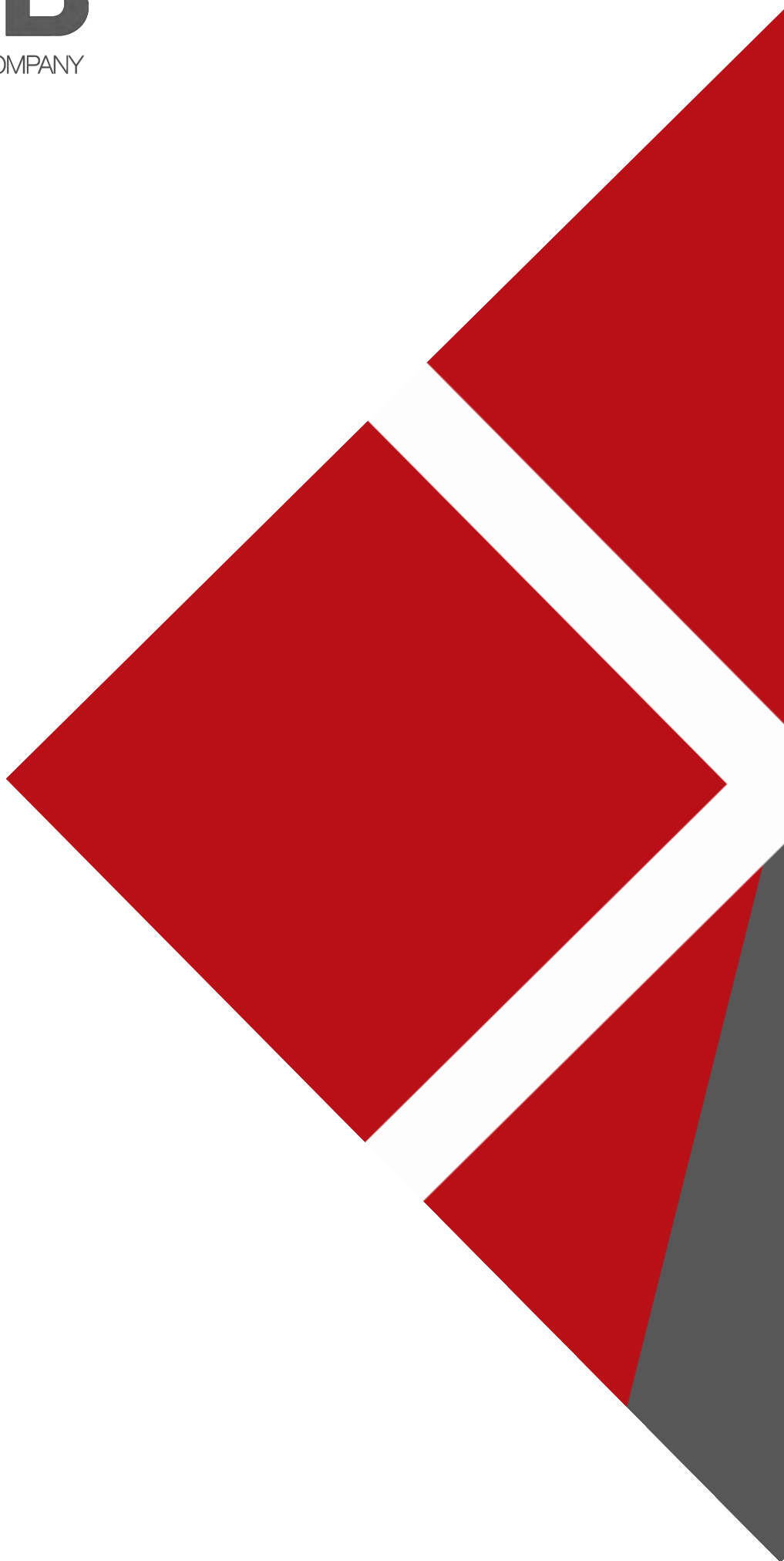
The Property Ombudsman scheme
Milford House
43-55 Milford Street
Salisbury
Wiltshire SP1 2BP
Tel: 01722 333306
Fax: 01722 332296
Email: admin@tpos.co.uk

You can get more information about the PCCB from www.propertycodes.org.uk

PLEASE ASK YOUR SEARCH PROVIDER IF YOU WOULD LIKE A COPY OF THE SEARCH CODE

BWB

A CAF GROUP COMPANY



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