From: Bell, Charlie
Sent: Thursday, September 28, 2023 8:59 AM
To: Rob Smith
Cc: James Cox Samuels, Angela
Subject: RE: Woodsmith Phase 18 Surface Water Drainage Strategy

[OFFICIAL]

Hi Rob

Thank you for your reply. Please see response below from our drainage specialist, confirming no adverse impact on the watercourse.

As part of the Phase 3 strategy, it was shown that the maximum velocity that the watercourse at the outfall of the reinjection pad can take a maximum of 1.6m/s. Within Phase 3 it was shown that the headwall with a stilling basin resulted in the outfall velocity of 0.59m/s into the watercourse which is significantly less than the maximum of 1.6m/s. The proposed works within Phase 18 is to discharge through the same headwall constructed in Phase 3, the new velocity through Phase 18 is 0.65m/s which is still significantly lower than 1.6m/s. This outfall velocity ensures that the existing surface water course can handle the volume and rate of water being discharged into the water course and not cause any adverse impact.

I hope that this provides comfort.

Kind Regard

Charlie

Charlie Bell D

From: Rob Smith <
Sent: Wednesday, September 27, 2023 1:47 PM
To: Bell, Charlie
Cc: James Cox ; Samuels, Angela
Subject: RE: Woodsmith Phase 18 Surface Water Drainage Strategy

[OFFICIAL]

Hi Charlie

Further to our conversation earlier today regarding this, it is my understanding that the proposed reversion to the method used at Phase 3 conditions discharge stage, so far as it relates to discharge from the reinjection pad area, would not have any significant bearing on the overall volume of water potentially requiring management through the surface water control system at the site, or the overall volume eventually discharged into surface water courses. However, for the avoidance of doubt, it would be helpful if this could be confirmed.

On the basis that the above understanding is correct, then I don't anticipate there will be any requirement for the Authority to undertake further consultation, or that there will be any delay in determination of the application by the current deadline.

Kind regards

Rob Smith
Senior Minerals Planner

North York Moors National Park Authority
The Old Vicarage
Bondgate
Helmsley
York
YO62 5BP

Web: www.northyorkmoors.org.uk

From: Samuels, Angela <
Sent: Wednesday, September 27, 2023 9:39 AM
To: Rob Smith >
Cc: James Cox Bell, Charlie <
Subject: Woodsmith Phase 18 Surface Water Drainage Strategy

[OFFICIAL]

Good morning Rob

Further to our submission of the application documents to discharge conditions for Phase 18 works at Woodsmith, I would like to request that the Surface Water Drainage Strategy be replaced with an updated version – attached.

The amendment to the report is very minor (so we feel it is most likely that you would not need to re-consult on the document) but this revision brings the document in line with that which was previously approved for Phase 3. A explanation of the minor change is shown below.

'The reinjection platform catchment area was previously discharged and agreed within Phase 3. Within the original strategy it was agreed that this area will be restricted to a maximum discharge velocity of 1.6m/s into the watercourse rather than an agreed maximum discharge flow rate. The surface water drainage strategy for Phase 18 has been updated to match the previously agreed discharge method of maximum velocity.'

The determination date for the Phase 18 application is Friday 6th October 2023. Are you able to confirm that the replacement of this document will not cause a delay to the determination date please?

If you have any questions, please do not hesitate to contact me.

Thank you and best regards

Angela Samuels
Permitting Coordinator
Woodsmith Project

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Woodsmith Mine - Phase 18 Works

NYMNPA 60 and 79 Surface Water and Wastewater Drainage Schemes

Reference: 1541-ARI-PA-PL-01001

1 | 26 September 2023

Job number

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Document Verification

Project title	Woodsmith Mine - Phase 18 Works
Document title	NYMNPA 60 and 79 Surface Water and Wastewater Drainage Schemes
Job number	
Document ref	1541-ARI-PA-PL-01001
File reference	

Revision	**Date**	**Filename**	1541-ARI-PA-PL-01001_B_IFR_2023-07-26		
Rev B	26 July 2023	**Description**	Draft Issue		
			Prepared by	**Checked by**	**Approved by**
		Name	Aufa Amri	Julia Dutton	Andrew Hornung
		Signature			
Rev 0	8 Aug 2023	**Filename**	1541-ARI-PA-PL-01001_0_PLA_2023-08-08		
		Description	For Planning		
			Prepared by	**Checked by**	**Approved by**
		Name	Aufa Amri	Julia Dutton	Andrew Hornung
		Signature			
Rev 1	26 Sept 2023	**Filename**	1541-ARI-PA-PL-01001_1_PLA_2023-09-12		
		Description	For Planning		
			Prepared by	**Checked by**	**Approved by**
		Name	Aufa Amri	Julia Dutton	Ian Drabble
		Signature			

Issue Document Verification with Document ☑

Contents

Figures

Appendices

1. Introduction

1.1 Overview

This document has been prepared on behalf of Anglo American Plc and details the surface water drainage scheme for the Phase 18 construction activity at Woodsmith Mine (Phase 18 Works). This is required to discharge conditions 60 and 79 of the North York Moors National Park Authority (NYMNPA) planning permission NYM/2014/0676/MEIA, as subsequently varied by NYM/2017/0505/MEIA [1].

This report only details the works required at the Woodsmith Mine site.

The Phase 18 Works comprise of:

- Sinking of the shafts from the top of the Rot Salt to the base of the shafts and associated earthworks.
- Installation and use of saline non-domestic wastewater treatment plant and associated infrastructure.
- Installation and operation of Fin Fan Coolers and associated infrastructure on the shaft platform.
- Installation and use of workshops.
- Installation and operation of tubbing laydown and associated infrastructure.
- Installation and use of pump house at surface water attenuation pond.
- Installation and use of Electrical Ring Main Unit.
- Construction and operation of laydown facility to southern end of site.
- Installation and use of Below Surface Muck Transfer System at MTS Shaft.
- Installation and operation of Fire Water Pumping System.
- Earthworks to landscape bunds.

1.2 Surface water drainage strategy - compliance with conditions

The drainage strategy, calculations and surface water management plan described in the Phase 11 Surface Water Drainage Scheme[2] are still applicable during the Phase 18 works. The location of the Phase 18 scope items are shown on drawing 1000-ARI-PA-18-01000 in Appendix A. The surface water system that will be in use during Phase 18 is shown on the general arrangement drawing 1541-ARI-PA-18-01002 in Appendix B. The changes between Phases 11 and 18 and their potential to impact on the surface water drainage design are outlined below.

- **Sinking of the shafts from the top of the Rot Salt to the base of the shafts and associated earthworks.**

  The sinking of shafts generates material arisings to be placed within Bund F and Bund E. Arisings that are not suitable to stay on site will be stored within the extractive materials store before being removed offsite.

  SW Drainage Impact Assessment: The works described above have an impact on the surface water drainage strategy within the scope item for the construction of landscape bunds, refer to Section 2.1. for further details.

[1] North York Moors National Park Authority planning permission NYM/2014/0676/MEIA and as subsequently varied by NYM/2017/0505/MEIA.

[2] NYMNPA 60 and 79 Surface Water Drainage Scheme, 40-ARI-WS-7100-CI-RP-01007, Rev 0, Arup, July 2019.

- **Installation and use of saline non-domestic wastewater treatment plant and associated infrastructure.**

  The saline non-domestic wastewater treatment plant is to be constructed to treat saline groundwater water ingress through shaft sinking.

  SW Drainage Impact Assessment: The works described above have no impact on the surface water drainage strategy. The treatment plant will be constructed on an area of the existing impermeable construction platform.

  The treatment plant area will sit within a bunded concrete slab with surface water drainage from the area being collected and tested. Following testing surface water will be pumped from the collection facility and either discharged into the site wide surface water drainage network if through testing it is shown to be acceptable for offsite discharge or alternatively treated and tankered off site.

- **Installation and operation of Fin Fan Coolers and associated infrastructure on the shaft platform.**

  The Fin Fan Cooler system is to be constructed adjacent to existing tanks located adjacent to the non-domestic wastewater treatment plant.

  SW Drainage Impact Assessment: The works described above have no impact on the surface water drainage strategy. The fin fan coolers will be constructed on an area of the existing impermeable construction platform and drained to the existing platform perimeter drainage network.

  The fin fan coolers will sit within the existing bunded concrete slab with surface water drainage from the area being collected and tested. Following testing surface water will be pumped from the collection facility and either discharged into the site wide surface water drainage network if through testing it is shown to be acceptable for offsite discharge or alternatively treated and tankered off site.

- **Installation and use of workshops.**

  Construction of new workshops within the existing platform extents.

  SW Drainage Impact Assessment: The works described above have no impact on the surface water drainage strategy. The proposed building will be constructed on an area of the existing impermeable construction platform and drained to the existing platform drainage network.

- **Installation and operation of tubbing laydown and associated infrastructure.**

  An area of the existing platform is to be reorganised to allow for tubbing laydown.

  SW Drainage Impact Assessment: The works described above have no impact on the surface water drainage strategy. The proposed laydown will be established on an area of the existing impermeable construction platform and drained to the existing platform drainage network.

- **Installation and use of pump house at surface water attenuation pond.**

  A new pump station is to be constructed to replace the existing pump at Pond C. The pump station is to pump the attenuated water from Pond C to the surface water treatment facility for silt removal.

  SW Drainage Impact Assessment: The works described above have no impact on the surface water strategy. The proposed pump will continue to pump at the same rate as the existing pumps from Pond C to the surface water treatment facility.

- **Installation and use of Electrical Ring Main Unit.**

  Construction of electrical equipment and ring main unit adjacent to the batteries and main switchroom.

  SW Drainage Impact Assessment: The works described above have no impact on the surface water drainage strategy. The proposed electrical unit will be constructed on an area of the existing impermeable construction platform and drained to the existing platform drainage network.

- **Construction and operation of laydown facility to southern end of site.**

  An area of laydown is to be established within existing platform on the southern end of the site.

  SW Drainage Impact Assessment: The works described above have no impact on the surface water drainage strategy. The proposed works will be constructed on an area of the existing impermeable construction platform and drained into the ditch at less than the previously agreed maximum velocity of 1.6m/s in Phase 3 for the Reinjection Well Platform Drainage Catchment shown in Figure 1.

- **Installation and use of Below Surface Muck Transfer System at MTS Shaft.**

  Installation of a below ground muck transfer system for the MTS Shaft.

  SW Drainage Impact Assessment: The works described above have no impact on the surface water drainage strategy as the proposed works are all below ground.

- **Installation and operation of Fire Water Pumping System.**

  The installation of a surface pumped piped system for fire water.

  SW Drainage Impact Assessment: The works described above have no impact on the surface water drainage strategy. The proposed pipework will be constructed on an area of the existing impermeable construction platform.

- **Earthworks to landscape bunds.**

  Construction of the southern section of Bund F as a continuation to the Bund F footprint included within the Phase 11 works (40-ARI-WS-7100-CI-RP-01007: Phase 11 Woodsmith Mine NYMNPA 60 and 79 Surface Water Drainage Scheme) to be constructed from material arisings from the sinking of the shafts. The construction of the eastern side of the Bund E will also be constructed to accommodate all the material arisings from shaft sinking.

  SW Drainage Impact Assessment: The works described above have an impact on the surface water drainage strategy, refer to Section 2.1 for details.

No other changes between Phases 11 and 18 impact on compliance with the conditions that were described in the Phase 11 report.

2. Phase 18 works

The following works have an impact on the surface water drainage strategy.

2.1 Earthworks to landscape bunds

The construction of the southern section of Bund F is a continuation to the sections of Bund F previously included in the Phase 11 Works submission (40-ARI-WS-7100-CI-RP-01007: Phase 11 Woodsmith Mine NYMNPA 60 and 79 Surface Water Drainage Scheme). The southern section of Bund F will be constructed in accordance with the details previously approved and will also be completed in accordance with the Environmental Permit for "Run-off and basal drainage of bunds' permit number EPR/MB/3399VR and accompanying documents submitted in support of the application for an Environmental Permit.

The eastern section of Bund E is also being constructed to accommodate all the arisings from shaft sinking. The eastern section of Bund E will be constructed in accordance with the details previously approved and will also be completed in accordance with the Environmental Permit for "Run-off and basal drainage of bunds' permit number EPR/MB/3399VR and accompanying documents submitted in support of the application for an Environmental Permit.

The Phase 18 earthworks (as described on drawing 1000-ARI-PA-18-01000) will involve the exposure of unfinished ground in preparation for deposition of materials extracted from the shafts and reforming of some of the permanent and temporary storage bunds on site. To accommodate the collection and attenuation of surface water run-off from these new earthworks, the existing drainage network will be extended, as set out in this document.

The silt mitigation strategy for the surface water run-off approved as part of previous phases, will be applied for the new earthwork areas. The main principle is to minimise the sediment entrainment with measures applied at source. Additional silt fences will be installed around newly disturbed earthworks; check dams will be placed in the new/extended swales and ditches; all run-off from the screening mounds will be attenuated, and sediment particles will be allowed to settle.

Extractive material generated from sinking the shafts will be placed within Bund F and E as shown on the accompanying drawings. Prior to placing the material, a basal drainage system will be provided as defined on drawing 1541-ARI-PA-18-01004 (Woodsmith Mine Site, Construction Phase 18 Basal Drainage General Arrangement).

The basal drainage will be collected and conveyed to the bund perimeter swale which outfalls into Wetland C for Bund F, and additional Ponds E and F for Bund E. The basal drainage system is designed such that, if through on-site testing, the quality of the outfall water is resulting in water quality triggers being breached, the basal drainage system can be isolated prior to outfalling into the bund perimeter swale. Basal drainage can then be collected at defined catchpits for treatment prior to outfall or tankering off site.

On completion of the placement of extractive material within the bund, and prior to the placement of restoration soils (topsoil and subsoil), a surface drainage network will be provided as detailed on drawing 1541-ARI-PA-18-01002 (Woodsmith Mine Site, Phase 18 Drainage General Arrangement). This will be collected and conveyed to the perimeter swale which outfalls into Wetland C for Bund F, and Pond E and F for Bund E.

The restoration soils will be placed in accordance with the Soil Management Plan (40-ARI-WS-7100-CI-PL-01000), that was approved as part of the Phase 11 works.

3. Drainage calculations

Refer to the Phase 11 surface water drainage scheme, report 40-ARI-7100-CI-RP-01007 in relation to the wider drainage strategy. The section below sets out changes to the surface water drainage catchment areas and presents the revised drainage modelling results due to the Phase 18 works.

3.1 Drainage catchment areas

The drainage catchment areas that are affected by the Phase 18 works are as follows:

- **Western bund catchment –** The drained catchment area stays approximately the same during this phase. Therefore, the overall run-off rate from the western catchment stays the same.
- **Northern bund catchment –** The drained catchment area stays approximately the same during this phase. Therefore, the overall run-off rate from the western catchment stays the same.
- **Southern bund catchment** – This is the area for the construction of Bund E; the two attenuation ponds (Pond E and F) were included as part of Phase 17. This catchment area was previously excluded from the gross drained area in previous phases due to no works occurring within the catchment. Due to the works within this phase this catchment area is added to the gross drained area.

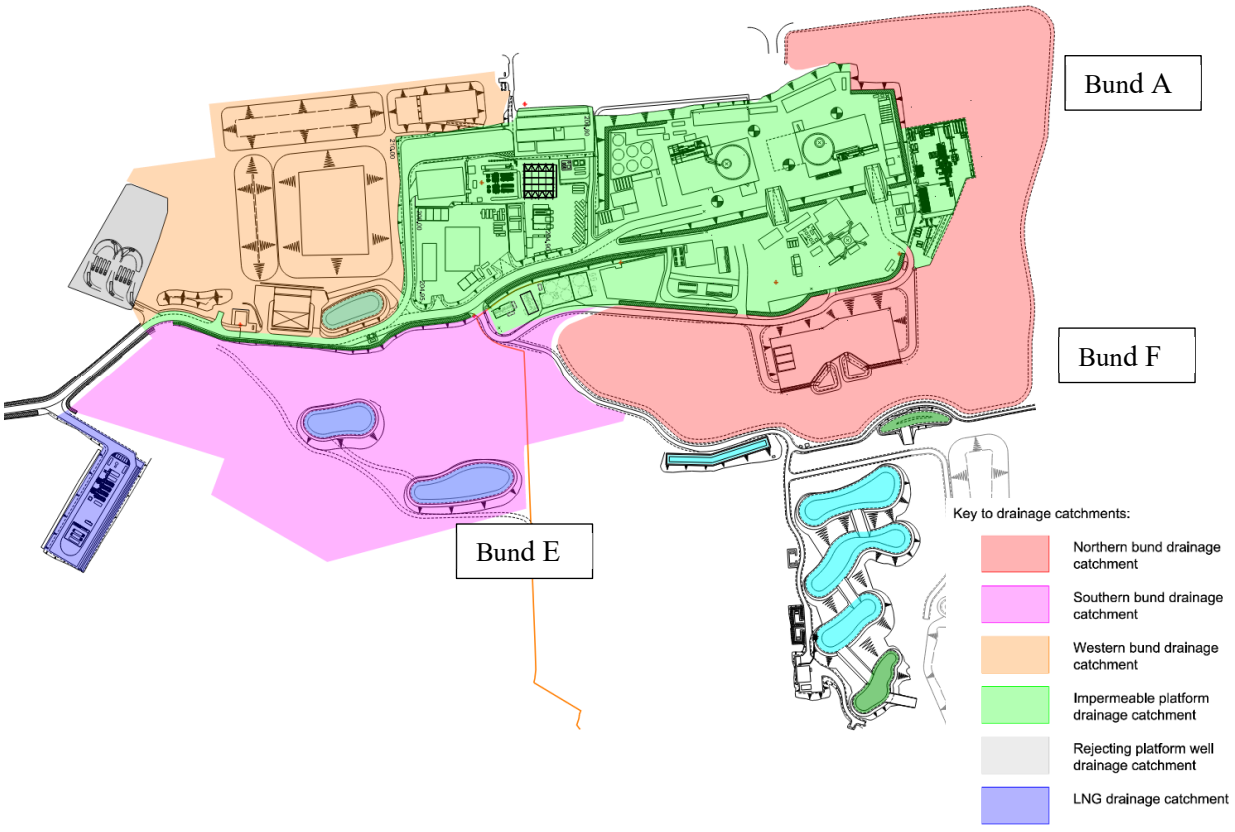


Figure 1 Woodsmith catchment areas

3.2 Calculation methodology

The Phase 18 Works layout for the Woodsmith Mine has been assessed and the required attenuation volumes calculated. The results are shown in Section 3.3 and Appendix C.

The allowable rates of discharge from the ponds have been calculated for the Phase 18 Works based on the QBar greenfield run-off rate for the total contributing area.

For the Phase 18 Works, a 1-in-20-year return period design storm with no climate change allowance has been applied to a MicroDrainage model of the proposed network. Simulations have been undertaken using a range of durations from 15 minutes to seven days to determine the critical duration for each part of the network to ensure no flooding occurs and the attenuation is sufficient.

3.3 Calculation results

The MicroDrainage model outputs in Appendix C demonstrate that the design described in this report meets the requirements set out in the planning conditions. In particular, the discharge rate from the developed areas has been limited to the QBar greenfield run-off rate and the volume of attenuation provided is sufficient to attenuate flows up to the 1-in-20-year return period event. This includes the expected overflow from Pond C when the total capacity of the surface water treatment facility is exceeded.

3.4 Run-off rates

The allowable QBar greenfield run-off rate is 6.5 l/s/ha, based on the Baseline Surface Hydrology report[3].

The flow rate is controlled by flow control devices at the outlets of the attenuation ponds. Table 1 summarises the modelling outputs in Appendix D.

Table 1 Summary of modelled Run-off Rates

Catchments	**Northern drainage catchment**	**Southern drainage catchment**	**Combined northern and southern drainage catchments**	**LNG Platform catchment**	**Refer to:**
	Impermeable platforms Northern landscape bunds	Western landscape bunds Southern landscape bunds			
Gross area drained	26.2 hectares	10.2 hectares	36.4 hectares	0.5 hectares	
Greenfield Run-off Rate (allowable rate of discharge)	6.5 x 26.2 = 170.3 l/s	6.5 x 10.2 = 66.3 l/s	6.5 x 36.4 = 236.6 l/s	6.5 x 0.5 = 3.25 l/s (min 5 l/s)	Baseline Surface Hydrology report
Maximum modelled rate of discharge	N/A See combined discharge rate.	N/A See combined discharge rate.	157 l/s	5 l/s**	Appendix D, critical results by maximum level for Pipes PH3-N-1.039 (Wetland A outfall)

* Where catchments are small and limits of discharge are less than 5l/s (risk of throttle blockage), a minimum of 5l/s is allowed, Reference: DEFRA, Rainfall run-off management for developments.

** This has not changed since the previous phase and therefore the previous calculations remain applicable.

3.4.1 Attenuation pond and wetland sizing

To ensure sufficient surface water attenuation is available to meet the requirement to restrict flows from the site to the green field run-off rate and to ensure sufficient capacity is retained in the ponds to provide sufficient dilution of basal drainage (in accordance the Environmental Permit for "Run-off and basal drainage of bunds" permit number EPR/MB/3399VR and accompanying submission

[3] Baseline Surface Hydrology, Ref LDT/2021/BSH, Revision F, BWB, 11/09/2014

documents) with surface water run-off, the following pond capacities are proposed across the site during the Phase 18 works.

Pond D is no longer required as Ponds E and F are sized to take the drained area of the Bund C and Bund E areas. Therefore within Table 2 it shows that the SW flood attenuation capacity of Pond D is no longer required for Phase 18. Pond D will be removed within a future construction phase but all flow restrictions will be removed during Phase 18 so no attenuation occurs within the pond.

Table 2 Pond and Wetland Capacities

Pond	Construction Phase			Operational Phase (post 1.5 years following construction)		
	Total Capacity (m^3)	SW Flood Attenuation Capacity (m^3)	Permanent Dilution Volume (m^3)	Total Capacity (m^3)	SW Flood Attenuation Capacity (m^3)	Permanent Dilution Volume (m^3)
A	3,700	3,700	0	3,700	3,700	0
B	3,700	3,700	0	3,700	3,700	0
C	2,400	2,070	330	2,400	2,400	0
WA	975	0	975	975	0	975
WC	800	800	0	430	0	430
D	1,300	N/A	N/A	N/A		
E	1,760	1,526	300	300	0	300
F	2,420	2,397	300	300	0	300

3.4.2 Volume of attenuation

A summary of the MicroDrainage modelling results is shown in Table 3 and the modelling outputs are shown in Appendix D.

Table 3 Summary of modelled attenuation volume requirements

	Northern Drainage Catchment	Southern Drainage Catchment	Northern and Southern Catchments Combined	The LNG Platform Catchment	Refer to:
Volume used in MicroDrainage model	10,270 m^3 (*see note below)	3,923m^3	14,193m^3	99 m^3 **	Appendix C, graphs for pipes: • PH3-N-1.036 to 1.038 and PH3-N-29.029 (Ponds A, B, C and WC), • Pipe PH3-N-23.006 (Pond D).
Volume provided by proposed construction phase design	10,270 m^3	4,180m^3	14,450 m^3	180 m^3	Appendix B: Drawing 40-ARI-WS-7100-CI-22-01095 and Table 3.2 above

* In the Microdrainage model the volume stored in the ponds slightly exceeds the volume given in the above table. This is because the ponds utilise some of the additional volume provided in the ponds' freeboard above the spillway levels.

** This has not changed since the previous phase and therefore the previous calculations remain applicable.

In all catchments the attenuation ponds provided in the earthworks design have sufficient storage volumes to attenuate surface water run-off to the allowable rate of discharge.

The storage provided at the main attenuation ponds has been maximised to minimise the risk of sediment discharging into the watercourse. Providing additional storage means that the rate of discharge can be significantly reduced to approximately 60% of the allowable greenfield run-off rate.

There is a very low risk that the surface water treatment facility capacity might be exceeded in the higher storm events. A small volume of excess water would be discharged through the Pond C emergency overflow into the final Wetland A in the critical rainfall duration 1-in-5 year storm event and above (most 1 in 5 year storm events will not cause flow down the emergency overflow).

The treatment facility will remove silt from the water from Pond C and discharge clean water to the wetland prior to outfall. This clean water will dilute any water that discharges over the emergency overflow. The combined discharge rate from Wetland A, which includes the flow from the surface water treatment facility and the emergency overflow from Pond C, is a total of 157 l/s (Refer to Table 3 and Appendix C), which remains below the permitted discharge rate of 236.6 l/s.

4. Conclusions

4.1 Surface water management scheme

There are no changes between Phases 11 and 18 that adversely impact the surface water drainage design. The Phase 11 Surface Water Drainage Scheme[4] is still applicable during Phase 18.

The construction of the additional platform area in Phase 18 does have an interaction with the surface water drainage, but the mitigation proposed minimises the risk to an acceptable level.

This report demonstrates that the Surface Water Drainage design and management during the Phase 18 Works meet the requirements of conditions 60 and 79 of the North York Moors National Park Authority (NYMNPA) planning permission NYM/2014/0676/MEIA, as subsequently varied by NYM/2017/0505/MEIA.

As a result of the Phase 18 works, no new additional Land Drainage Consents will be required.

[4] NYMNPA 60 and 79 Surface Water Drainage Scheme, 40-ARI-WS-7100-CI-RP-01007, Rev 0, Arup, July 2019

Appendix A

Phase 18 - Masterplan

N

B 1416

HV

MTS shaft. Installation and use of Below Surface Muck Transfer System.

Production shaft. Sinking of the shaft from the top of the Rot salt to the base of the shafts.

Service shaft. Sinking of the shaft from the top of the Rot salt to the base of the shaft.

Installation and operation of Fire Water Pumping System.

Installation and use of of Electrical Ring Main Unit.

Installation and use of workshops.

Operation of laydown facility.

Earthworks to Bund F.

Installation and operation of tubbing laydown and associated infrastructure.

Additional laydown area.

Installation and operation of Fin Fan Coolers and associated infrastructure.

Installation and use of saline non domestic waste water treatment plant and associated infrastructure.

Earthworks to Bund E.

Installation and use of pump house.

Non domestic waste water treatment plant outfall.

Non domestic waste water treatment plant outfall pipe.

LNG and generator platform.

Welfare Facility

Working Platform

Concrete batching plant

RS 203.66

SS 203.17

MTS 200.66

203.43 203.22 203.22 203.38 203.6 204.1 200.16 194.90 193.42 194.90 195.00 194.42 200.18 202.95 200.9 203.11 203.32 203.31 202.80 202.57 206.80 204.90 202.30 202.85 206.00 204.95 210.00

0 10 20 30 40 50 100 Metres

Scale 1:2000

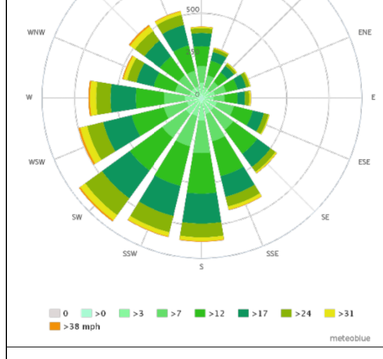
Key:

- Land ownership boundary
- Construction phase security fence / inner site access control fence
- 2.4m high palisade fence
- Topographical survey
- Proposed layout
- 3m high environmental barrier
- Proposed drainage ditch
- Surface water drainage attenuation pond
- Surface water drainage wetland
- Telecommunication mast
- Hydro Boreholes
- Fire Water Pumping System.

Key to utilities:

- HV — Existing Northern Powergrid electrical apparatus

Wind Rose:



REV	DATE	BY	CHKD	APPD
0	26/07/23	AA	JD	AH
	For Planning			
A	29/06/23	KK	JD	CW
	For comments			

AngloAmerican

Anglo American Woodsmith Project Ltd
Resolution House | Lake View | Scarborough | YO11 3ZB | North Yorkshire
T: +44 (0) 1723 470010 | W: uk.angloamerican.com

Drawing Title: Woodsmith Mine Construction Phase 18 Masterplan

SCALE : 1:2000

Job No: 253285

ARUP

DRG No: 1000-ARI-PA-18-01000

REV 0

PIMS CERTIFICATION
DRAWINGS ARE NOT VALID UNLESS THEY CONTAIN A PIMS AUTHORISATION STAMP

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Appendix B

Phase 18 – Drainage Layout

N

Notes:

1. This drawing shows the proposed surface water drainage network for the Phase 18 works.

Key:

- Land Ownership Boundary
- Proposed General Arrangement layout
- Surface water drainage attenuation pond
- Wetland
- Existing watercourses / ditch
- Manhole and carrier pipe
- Swale
- Check dam
- Silt fence
- Ditch
- Ditch with impermeable liner
- Inlet / outlet headwall
- Filter drain
- Earthworks herringbone filter drain
- Non domestic waste water discharge pipe
- Hydro Boreholes

Tributary of Sneaton Thorpe Beck where additional temporary silt control measures are able to be installed.

Pond B
Volume = 3700m³

Wetland WC
Volume = 800m³

Pond C
Volume = 2500m³

For continuation see inset plan

Wetland WA
Volume = 975m³

Piped outfall to be used for emergency use only.

Surface water treatment facility.

Pond A
Volume = 3700m³

Oil interceptors.

Silt removal facility.

Building drainage to temporarily connect to the existing surface water network / drainage ditches.

Oil interceptors.

Over ground piped connection with the silt removal facility. (Final position to be confirmed on site).

Additional temporary silt mitigation is to be installed down stream of this location to manage silt if required.

Pond F
Volume = 2420m³

Pond D

Pond E
Volume = 1760m³

The laydown area is to be drained by a series of filter drains which outfall into the adjacent swale via an oil intercepter.

Tributary of Sneaton Thorpe Beck where additional temporary silt control measures are able to be installed.

Oil interceptor and piped outfall from the laydown area.

Piped outfalls to existing tributary of Sneaton Thorpe Beck from the LNG area.

Oil interceptor

Laydown area.

Inset Plan

Tributary of Sneaton Thorpe Beck where additional temporary silt control measures are able to be installed.

0 10 20 30 40 50 100 Metres
Scale 1:2000

PIMS CERTIFICATION
DRAWINGS ARE NOT VALID UNLESS THEY CONTAIN A PIMS AUTHORISATION STAMP

REV	DATE	BY	CHKD	APPD
0	26/07/23	AA	JD	AH
	For Planning			
A	29/06/23	KK	JD	CW
	For comments			

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Drawing Title: Woodsmith Mine Site
Construction Phase 18
Drainage General Arrangement

SCALE : 1:2000

Job No: 253285

ARUP

DRG No: 1541-ARI-PA-18-01002

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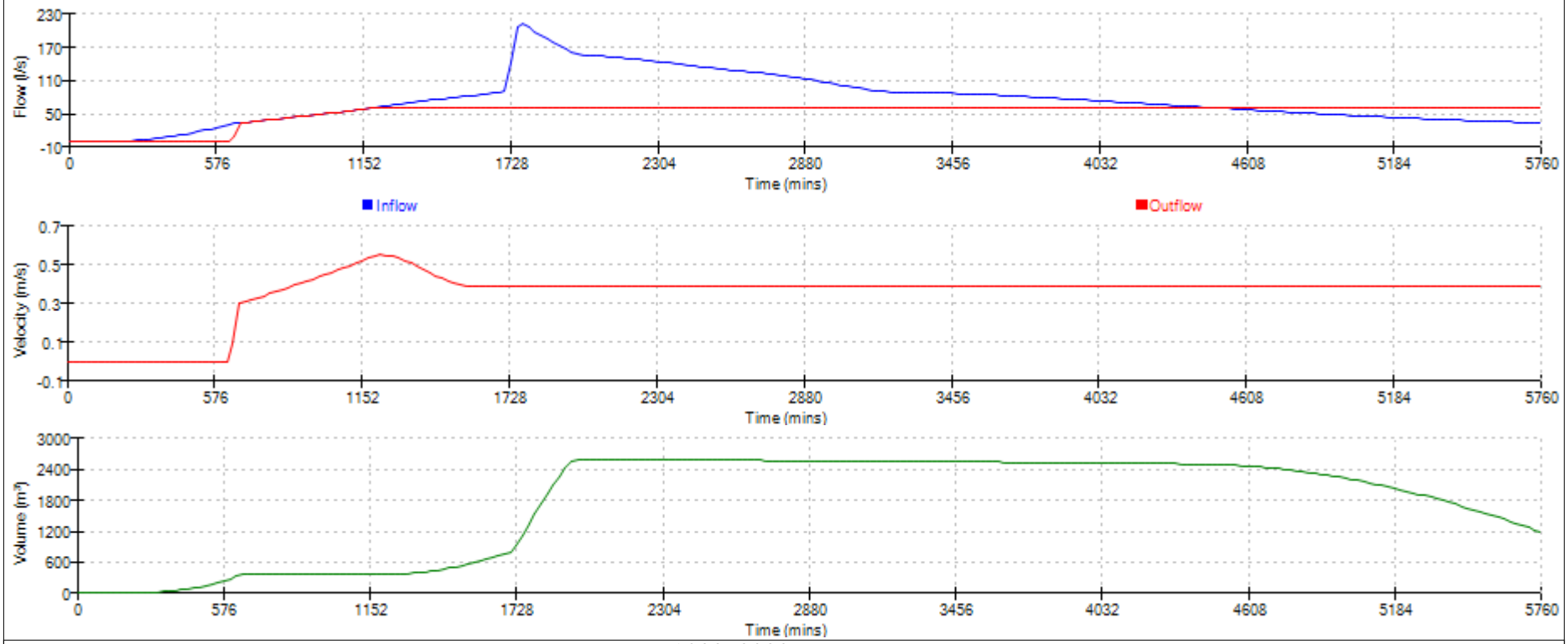
Appendix C

Micro Drainage Model Outputs

Ove Arup & Partners International Ltd		Page 1
The Arup Campus Blyth Gate Solihull B90 8AE		
Date 29/06/2023 16:16 File 20230627 WS-Phase 18.MDX	Designed by Aufa.Amri Checked by	
XP Solutions	Network 2020.1.3	

Graphs for Pipe PH3-N-1.038 US/MH PH3-N-1015 (Combined Networks)
2880 minute 20 year Winter I+0%
Status: FLOOD RISK



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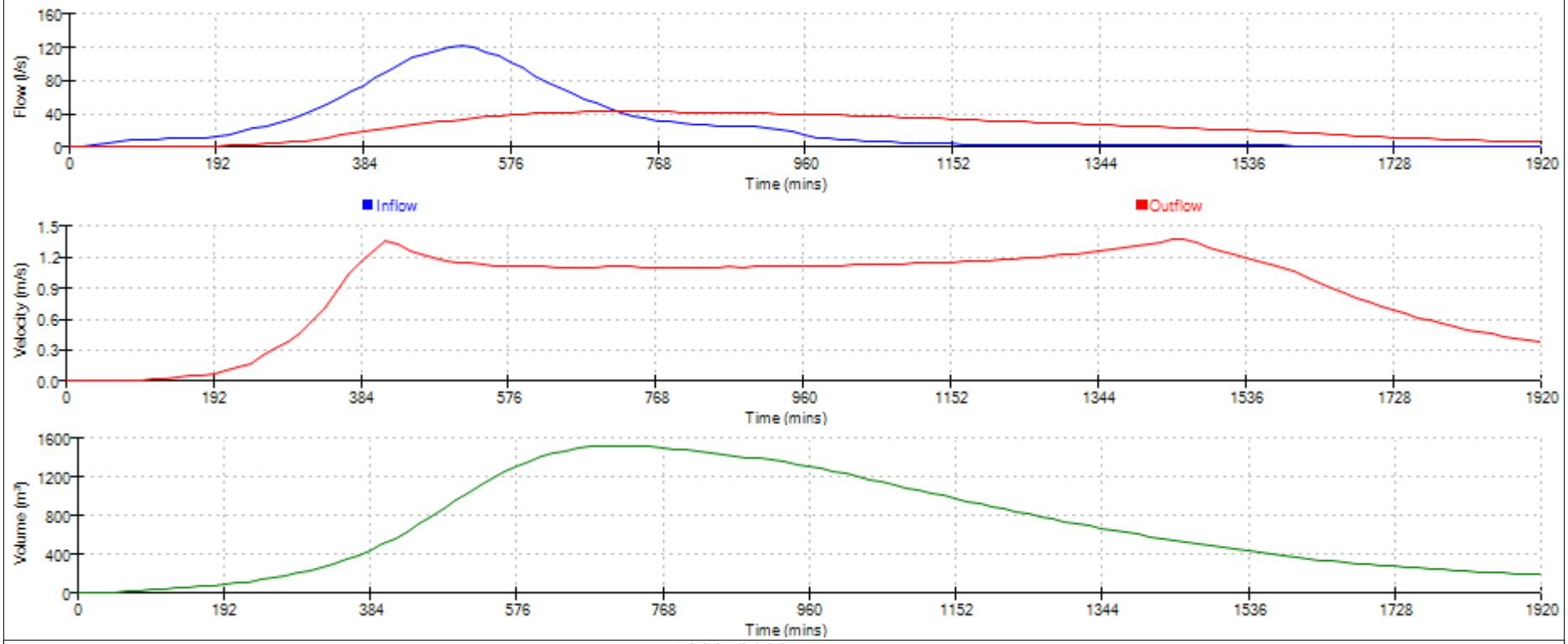
The Arup Campus Blyth Gate Solihull B90 8AE		
Date 29/06/2023 16:18 File 20230627 WS-Phase 18.MDX	Designed by Aufa.Amri Checked by	
XP Solutions	Network 2020.1.3	

Graphs for Pipe PH3-N-24.009 US/MH PH3-N-230 (Combined Networks)
960 minute 20 year Winter I+0%
Status: FLOOD RISK*



Graphs for Pipe PH3-N-24.010 US/MH PH3-N-231 (Combined Networks)
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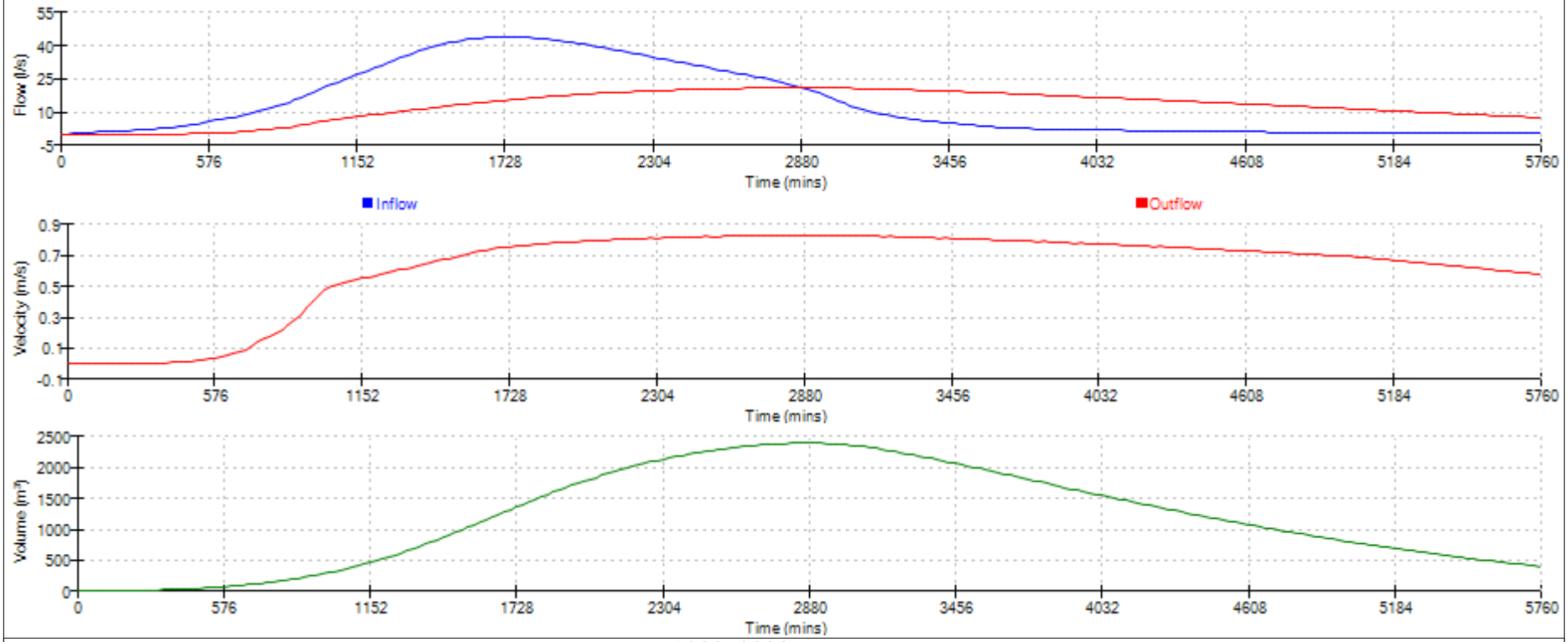
Status: FLOOD



Graphs for Pipe PH3-N-1.039 US/MH PH3-N-1016 (Combined Networks)
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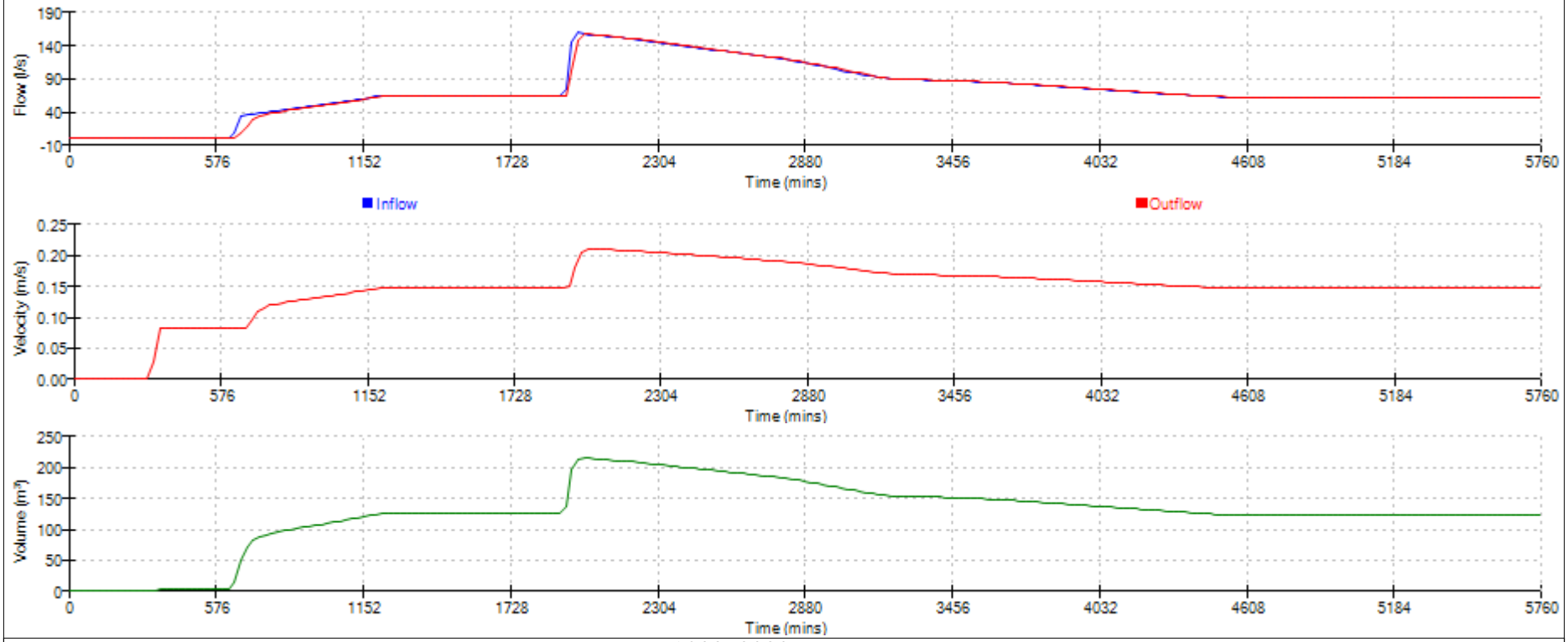
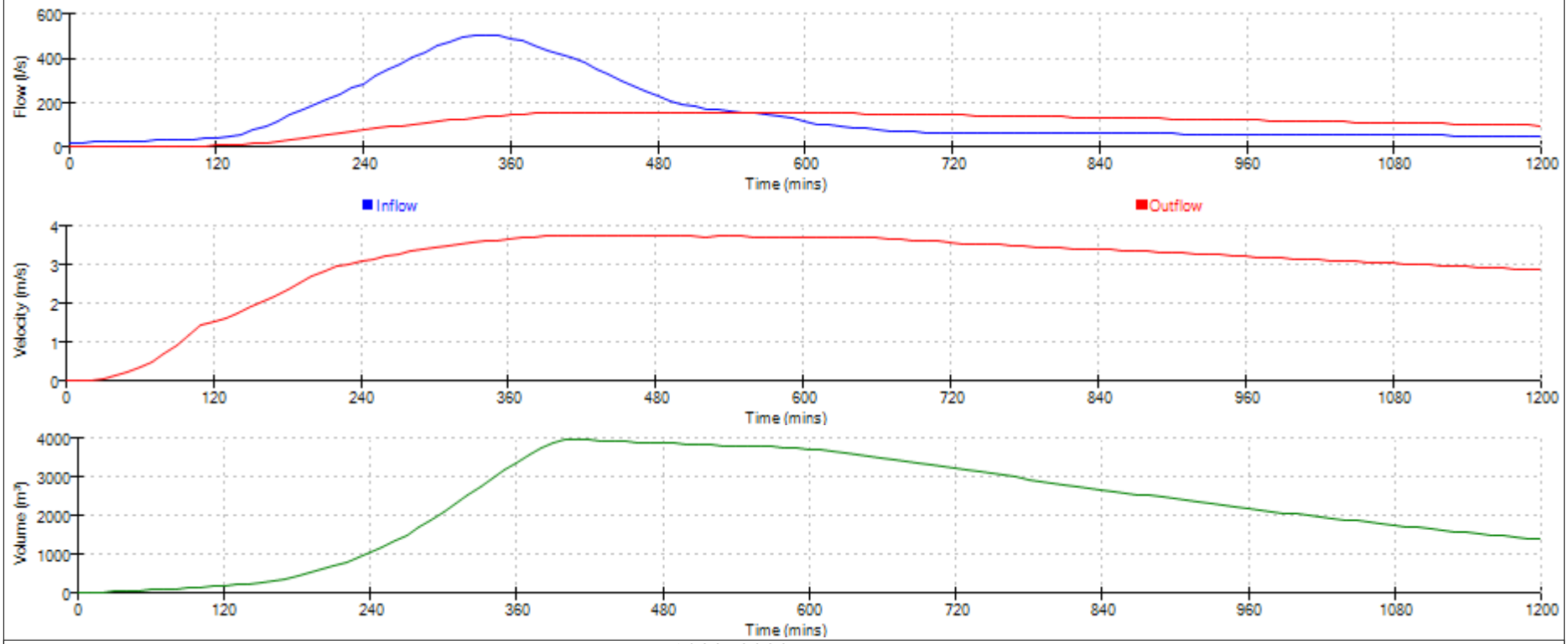
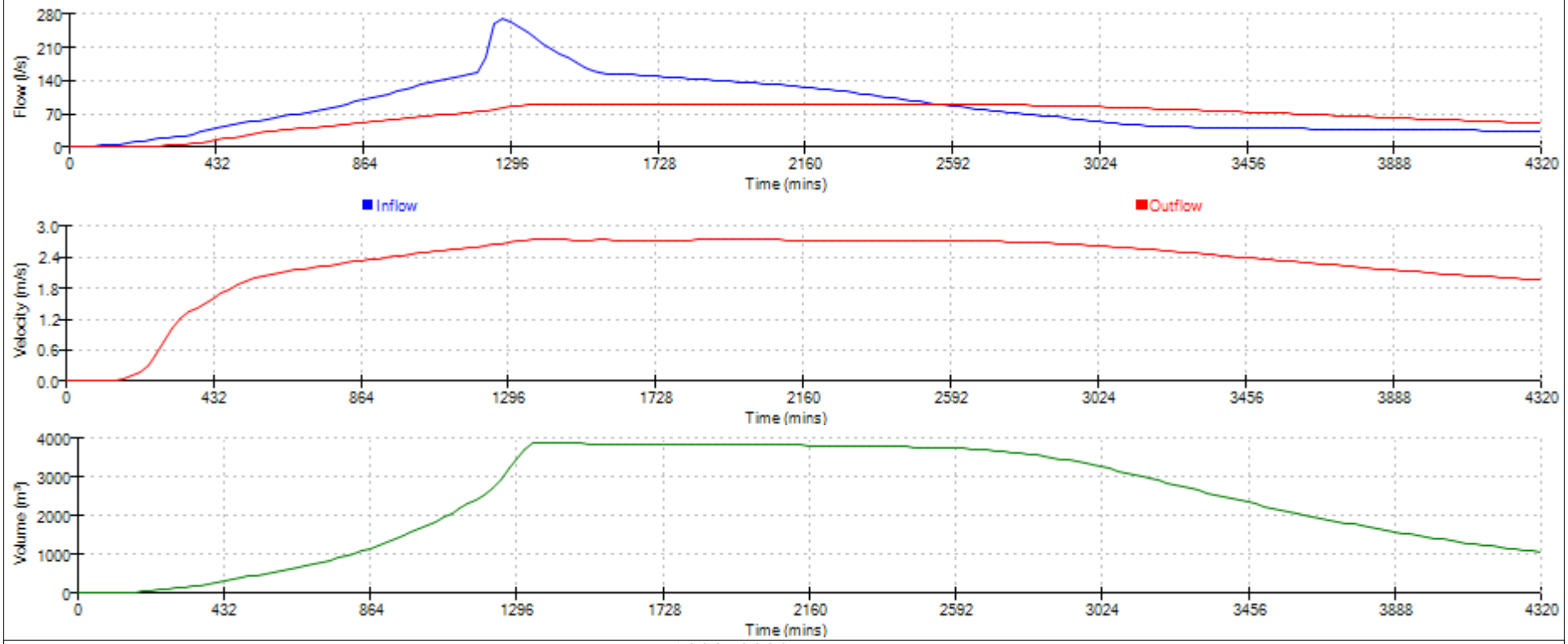


Graphs for Pipe PH3-N-1.036 US/MH PH3-N-1013 (Combined Networks)
600 minute 20 year Winter I+0%
Status: FLOOD RISK



Graphs for Pipe PH3-N-1.037 US/MH PH3-N-1014 (Combined Networks)
2160 minute 20 year Winter I+0%
Status: FLOOD RISK

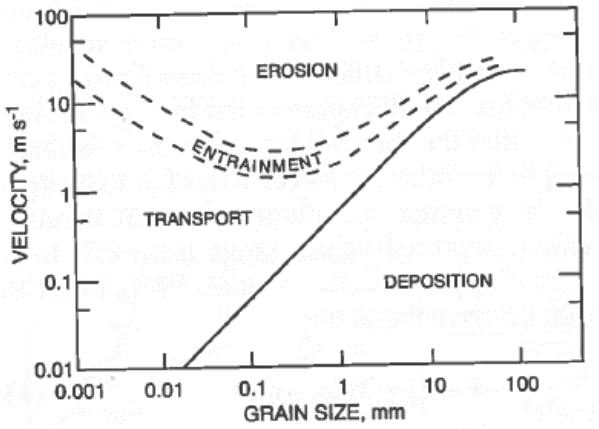


Appendix D

Outfall Velocity Calculations

Determination of a maximum velocity to discharge surface water into Sneaton Thorpe Beck tributaries.

The textbook "Fluvial Forms and Processes, A New Perspective" contains a graph that gives some basic limiting velocities for sediment erosion and entrainment based on various grain sizes.



The graph shows that no grain sizes are entrained into the flow until velocities are greater than 1m/s.

Using Ordnance Survey maps, topographic surveys and contours produced from lidar, Sneaton Thorpe Beck tributaries have an average gradient of approximately 1 in 20.

The tributaries of Sneaton Thorpe Beck are small. The photograph below shows the typical size of the tributaries downstream from the site. The width of the tributaries have been estimated at approximately 1m wide.

Flow monitoring has been undertaken at a number of locations on Sneaton Thorpe Beck. The monitoring data gives typical depths of flow at three monitoring points on the beck over a 4 month period. During rainfall events the depths at these monitoring points increases to about 200mm. The depths of the water in the beck will be dependent on the geometry at any specific location, but the data offers a guide to allow us to undertake some calculations. If we consider that the depth data only covers a 4 month period, we would expect increased depths during higher return period rainfall events.

Using the above information a manning's calculation was undertaken to give an indication of typical velocities in the existing beck during rainfall events:

Manning's "n" has been estimated using (Chow, 1959):
3a. Mountain Streams, no vegetation in channel, banks usually steep, with trees and brush on banks submerged. Bottom: gravels cobbles and few boulders: normal n = 0.040

Slope: 1 in 20
Width of base = 1m
Depth of flow = varies

Manning's Equation

$$V = \frac{R^{2/3} S^{1/2}}{n}$$

V is average velocity (m/s)
R = hydraulic radius (m)
S = energy slope (m/m)
n = Manning's roughness coefficient

Depth of flow (mm)	Velocity (m/s)
100	1.07
200	1.53
300	1.83
400	2.05

This table gives indicative average velocities in the tributary of Sneaton Thorpe Beck downstream of the outfall during rainfall events.

The results suggest velocities ranging from about 1 m/s to 2m/s would be expected during rainfall events. Velocities nearer the upper end of this range would be expected for large storm events such as a 1 in 20year return period event.

In an email from the Environment Agency on the 18th February 2016 contained guidance notes with typical outfall structures that contained limits to the exit velocities. These were 1.2m/s for a typical outfall without a stilling basin and 1.8m/s for outfalls with a stilling basin.

Using the information above, a conservative maximum discharge velocity to set for the outfalls from the site is 1.2m/s for return periods up to the 1 in 20 year return period event.