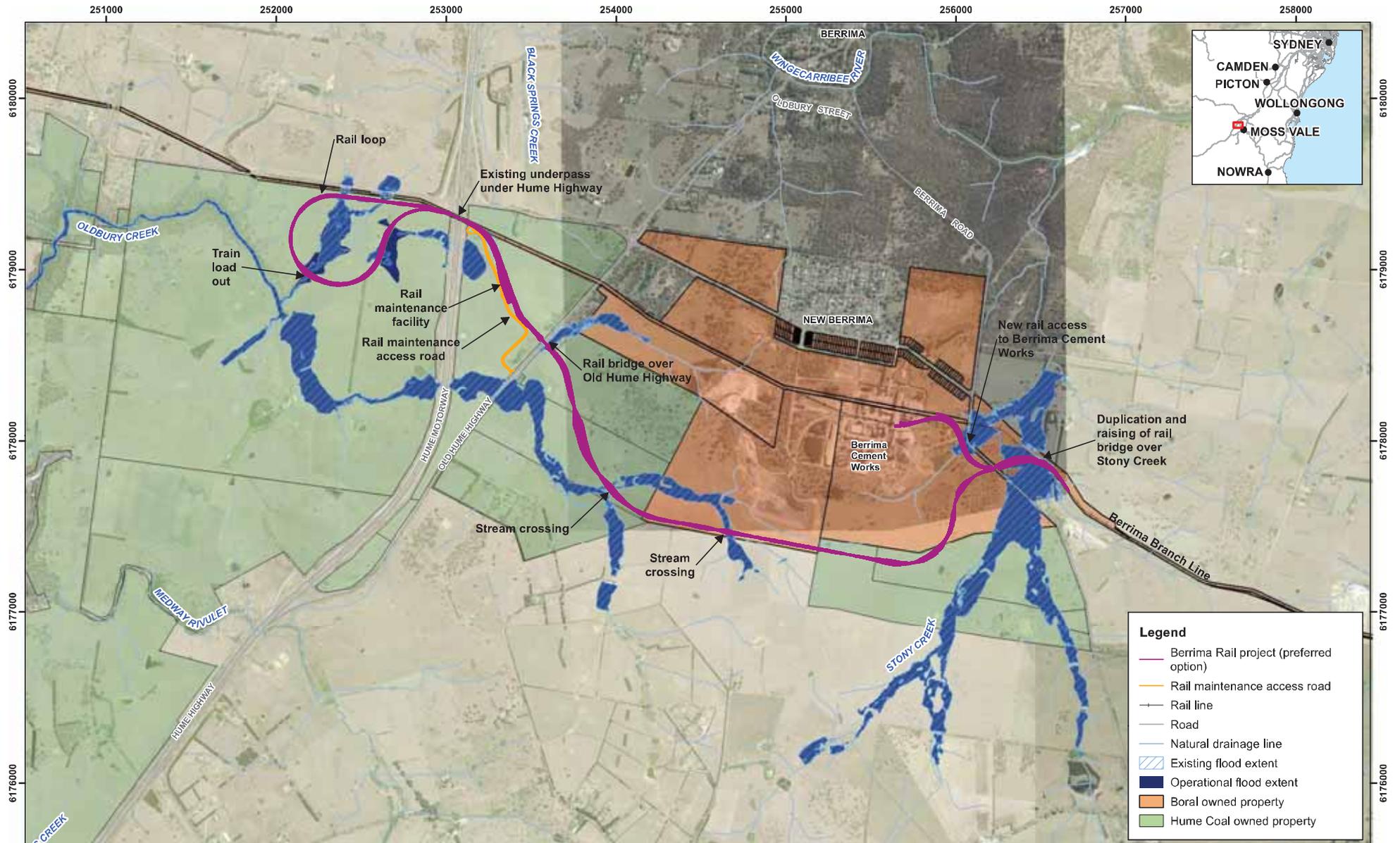


Appendix C

PREFERRED OPTION FLOOD MAPS



Map: 2200569A_GIS_010_A7
 Date: 15/11/2016
 Author: RP
 Approved by: LR



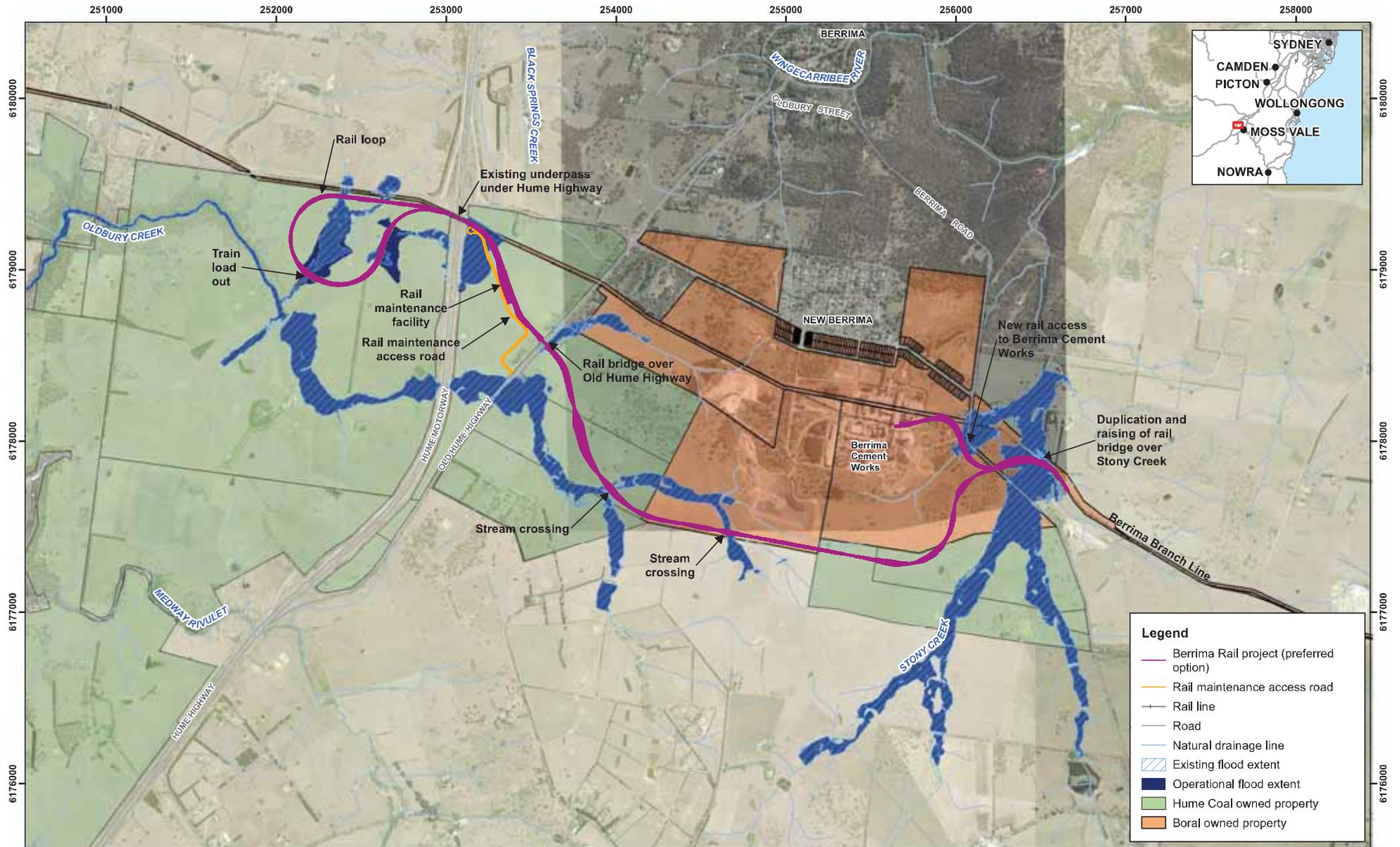
Scale: 1:20,000
 Coordinate system: GDA 1994 MGA Zone 56
 Scale ratio correct when printed at A3

Data source: © Land and Property Information 2015, Hume Coal

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Berrima Rail Project
 Appendix C1
 5 Year ARI flood extent - Operation (Preferred option)



Map: 2200569A_GIS_012_A7
 Date: 15/11/2016
 Author: RP
 Approved by: LR

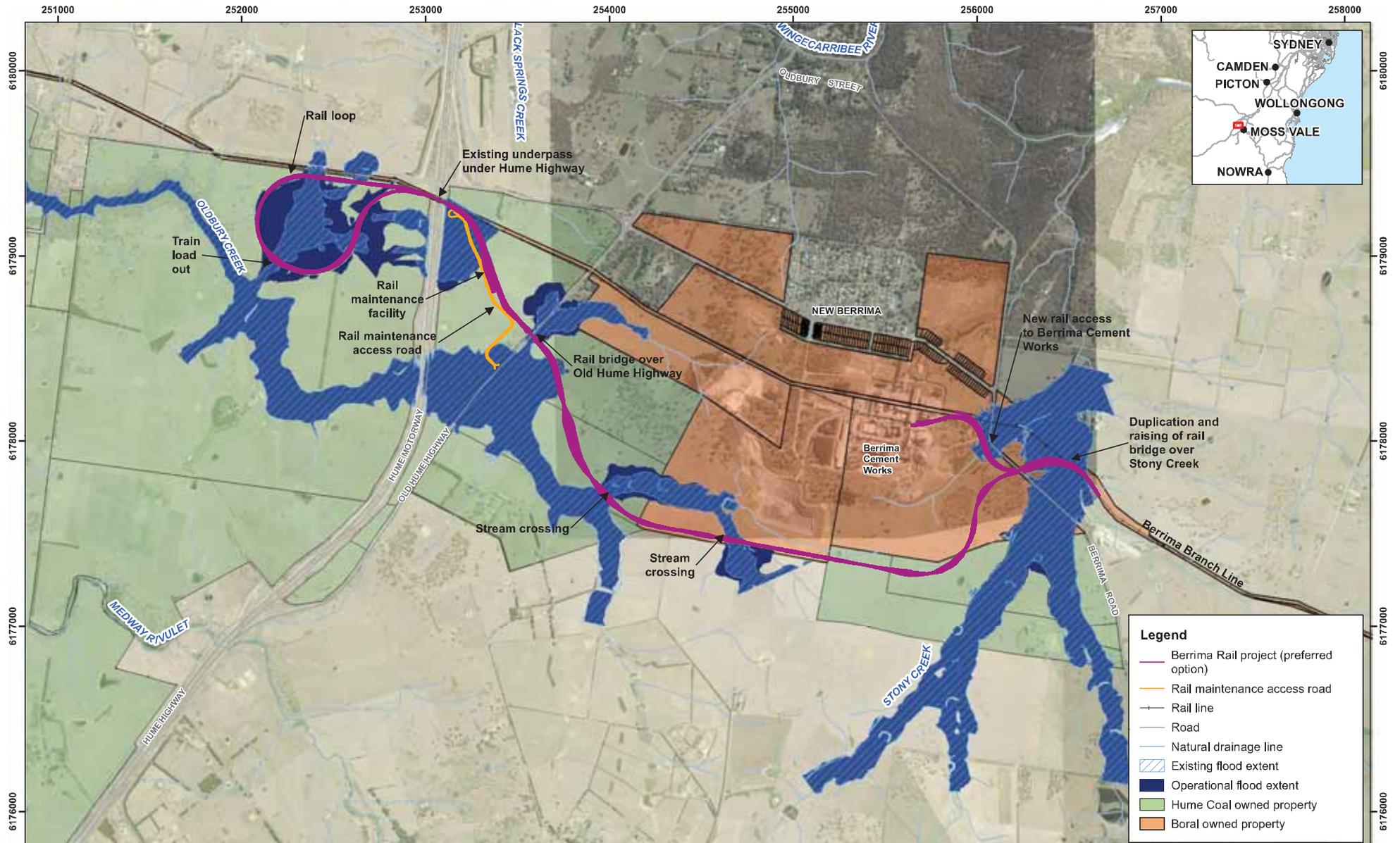


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 1:20,000
 Scale ratio correct when printed at A3

Data source: © Land and Property Information 2015, Hume Coal
 Coordinate system: GDA 1994 MGA Zone 56
 Scale ratio correct when printed at A3



Berrima Rail Project
 Appendix C2
 20 Year ARI flood extent - Operation (Preferred option)



Map: 2200569A_GIS_016_A8
 Date: 15/11/2016
 Author: RP
 Approved by: LR

1:18,520
 Coordinate system: GDA 1994 MGA Zone 56
 Scale ratio correct when printed at A3

Data source: © Land and Property Information 2015, Hume Coal

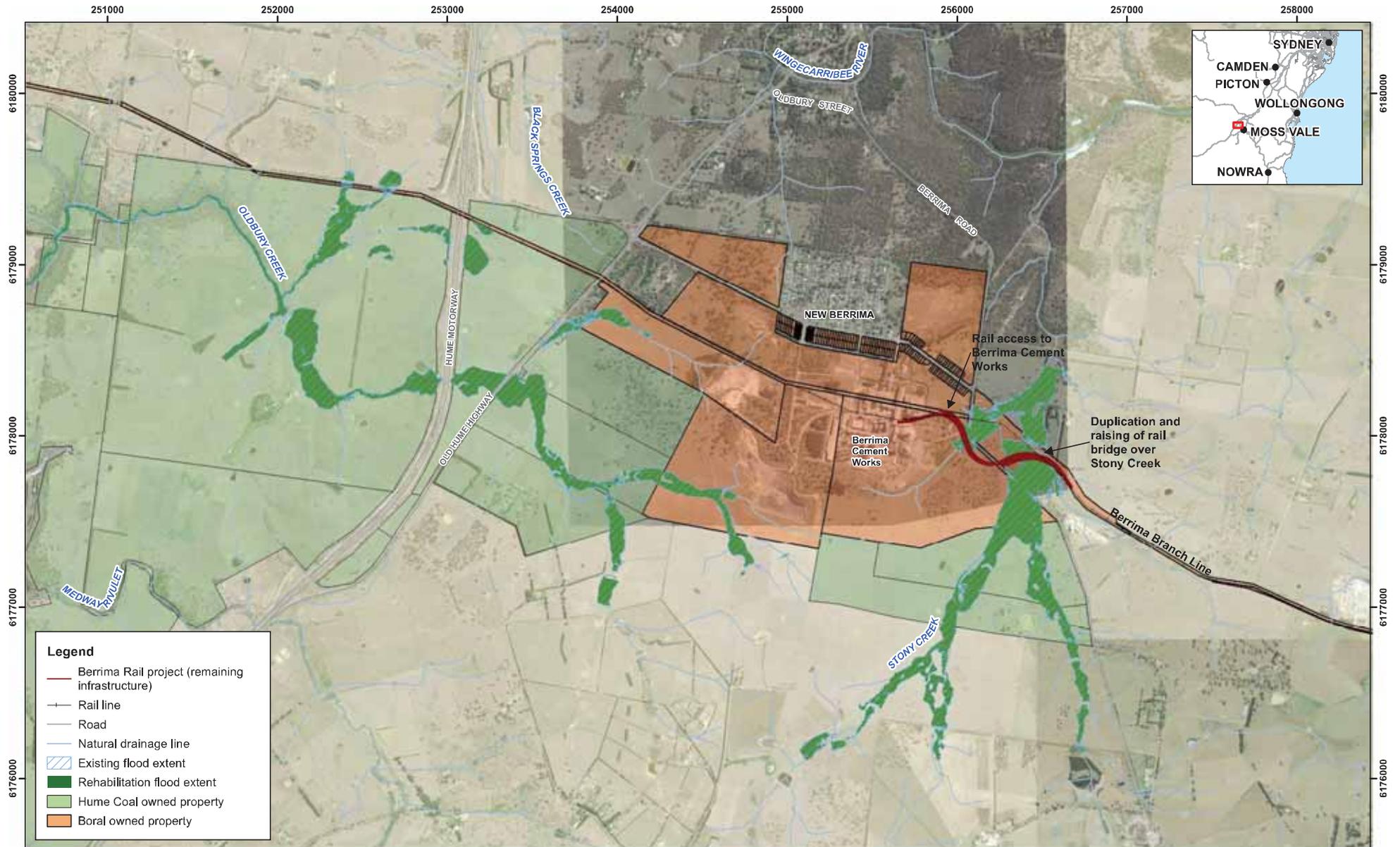
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Berrima Rail Project
 Appendix C3
 PMF flood extent - Operation (Preferred option)

Appendix D

PREFERRED OPTION REHABILITATION FLOOD MAPS



Legend

- Berrima Rail project (remaining infrastructure)
- Rail line
- Road
- Natural drainage line
- Existing flood extent
- Rehabilitation flood extent
- Hume Coal owned property
- Boral owned property

Map: 2200569A_GIS_011_A7	Author: RP		 1:20,000 Coordinate system: GDA 1994 MGA Zone 56 Scale ratio correct when printed at A3
Date: 15/11/2016	Approved by: LR		

Data source: © Land and Property Information 2015, Hume Coal

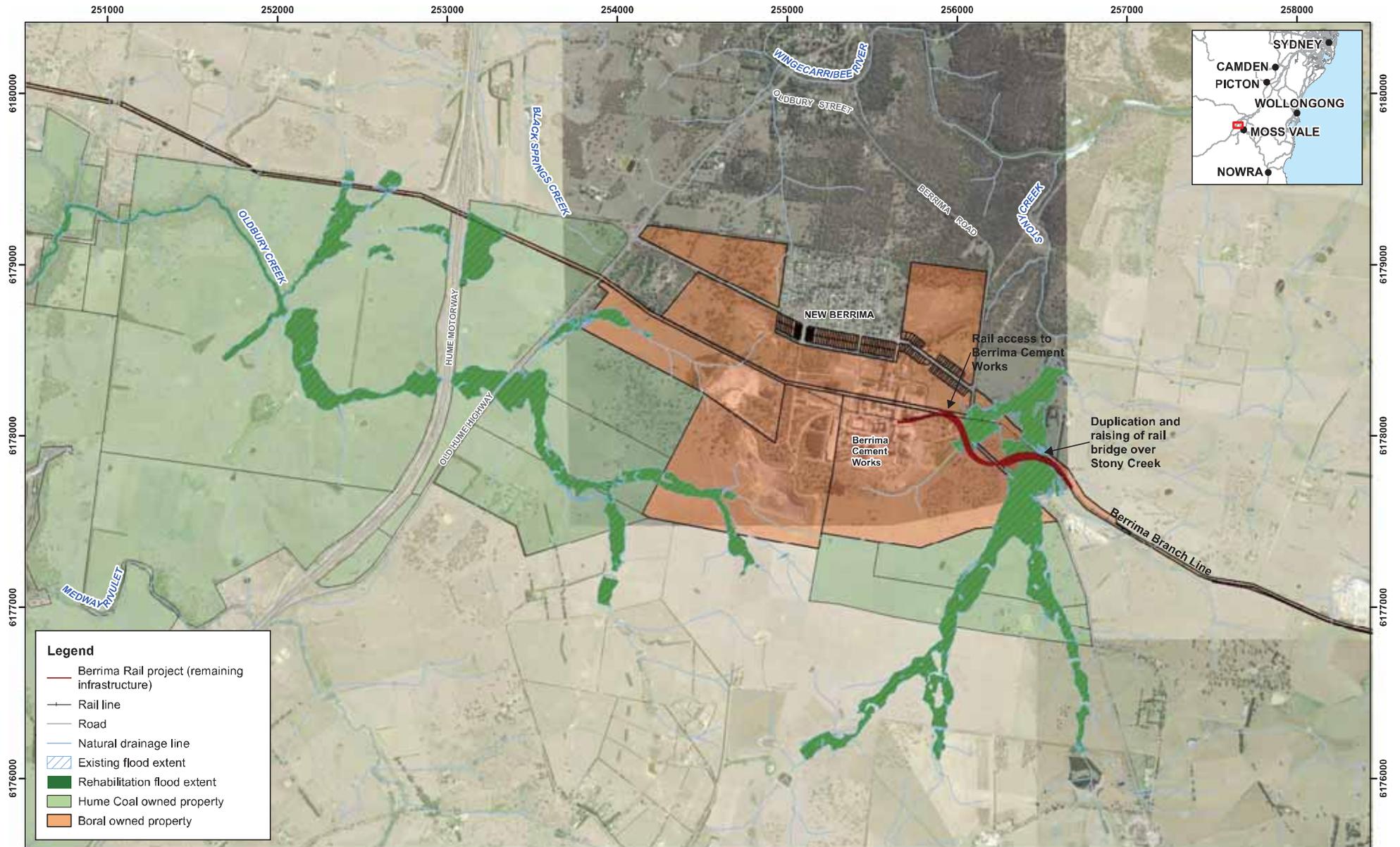
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Hume Coal

Berrima Rail Project
Appendix D1
5 Year ARI flood extent - Rehabilitation (Preferred option)



Map: 2200569A_GIS_013_A7
 Date: 15/11/2016
 Author: RP
 Approved by: LR



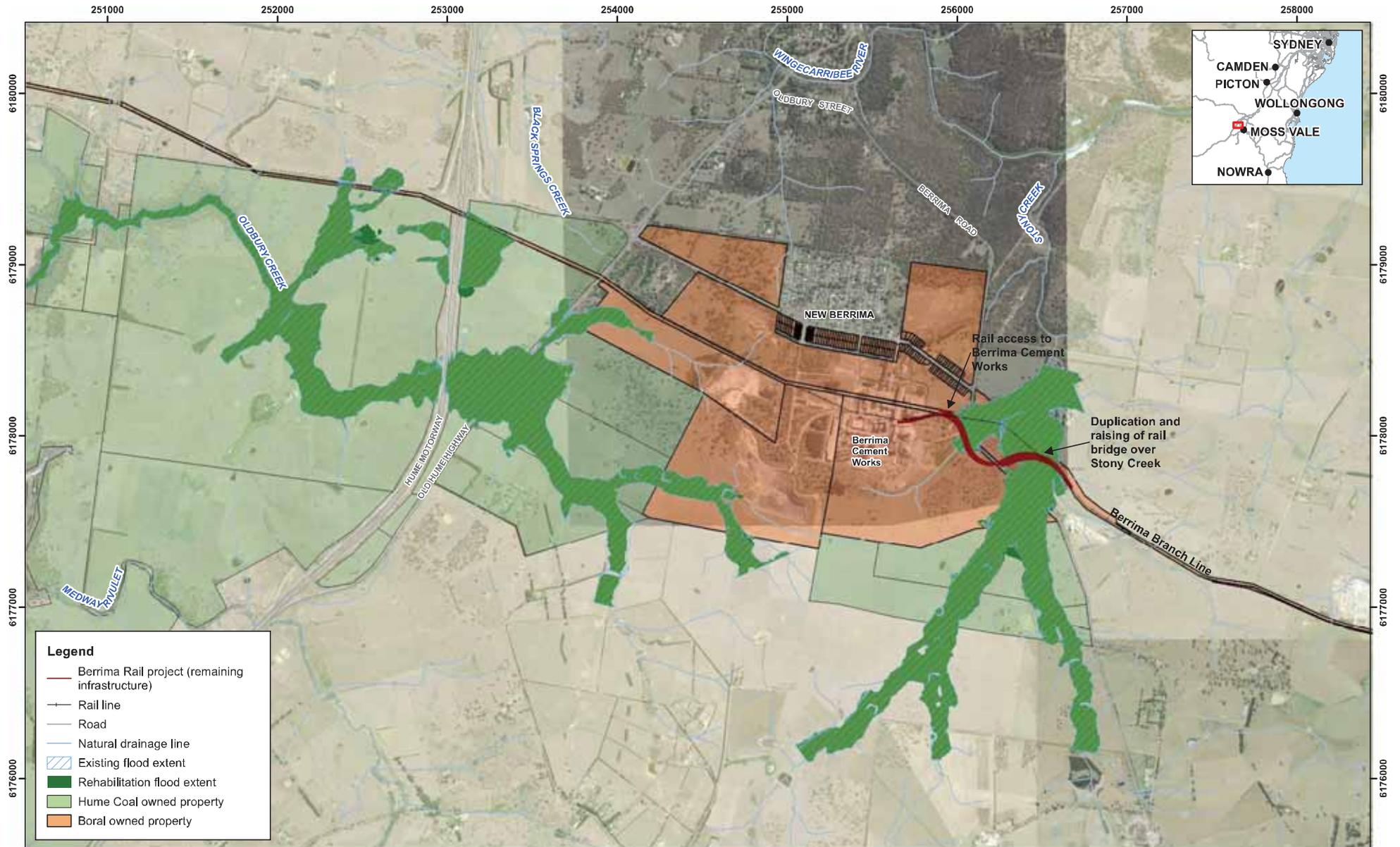
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 Scale ratio correct when printed at A3

Data source: © Land and Property Information 2015, Hume Coal



Berrima Rail Project
 Appendix D2
 20 Year ARI flood extent - Rehabilitation (Preferred option)

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Legend

- Berrima Rail project (remaining infrastructure)
- Rail line
- Road
- Natural drainage line
- Existing flood extent
- Rehabilitation flood extent
- Hume Coal owned property
- Boral owned property

Map: 2200569A_GIS_017_A7	Author: RP		
Date: 15/11/2016	Approved by: LR		
Data source: © Land and Property Information 2015, Hume Coal		Coordinate system: GDA 1994 MGA Zone 56 Scale ratio correct when printed at A3	

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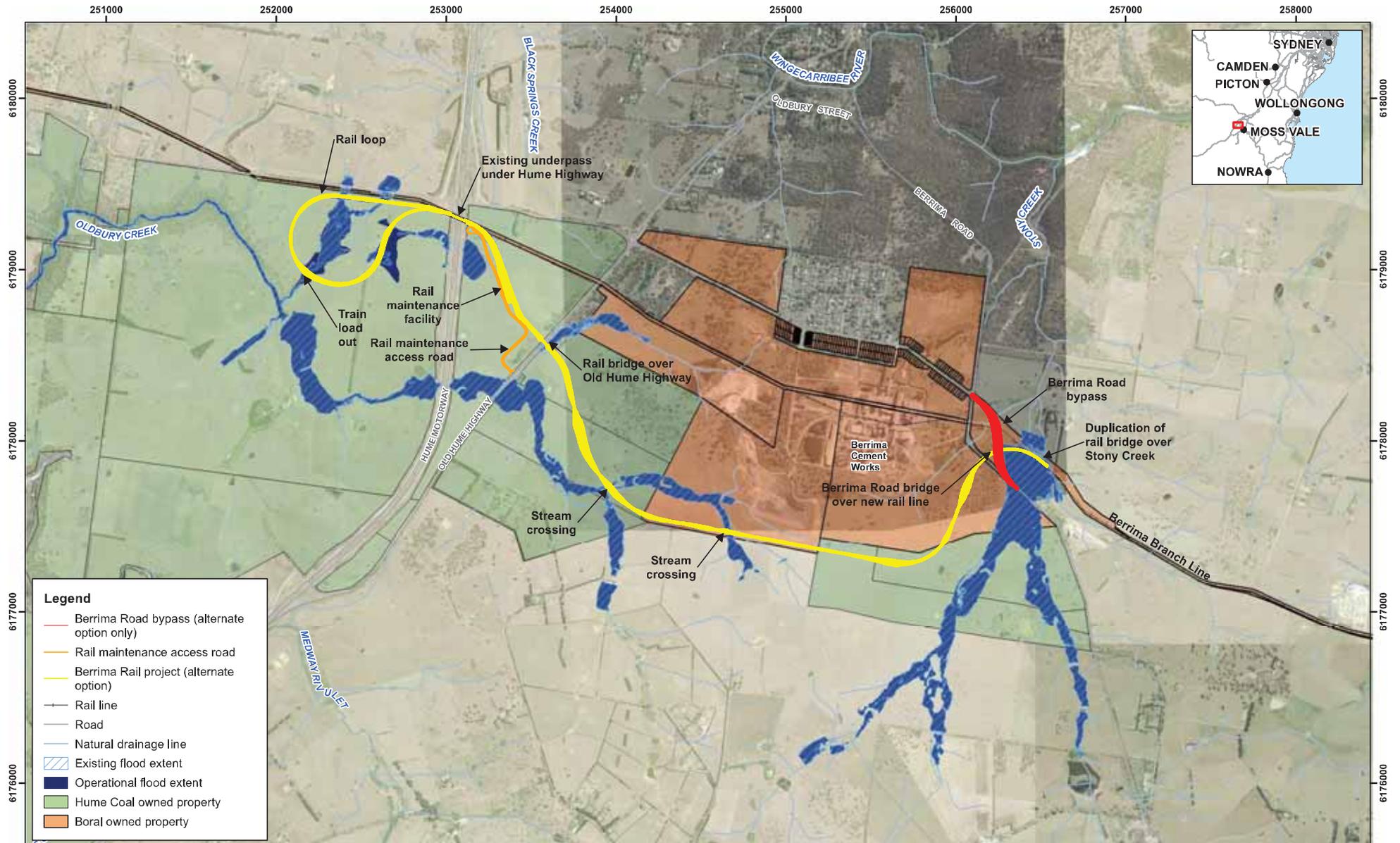


Hume Coal

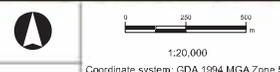
Berrima Rail Project
Appendix D3
PMF flood extent - Rehabilitation (Preferred option)

Appendix E

ALTERNATE OPTION FLOOD MAPS



Map: 2200569A_GIS_002_A7
 Author: RP
 Date: 15/11/2016
 Approved by: LR



Data source: © Land and Property Information 2015, Hume Coal

Coordinate system: GDA 1994 MGA Zone 56
 Scale ratio correct when printed at A3

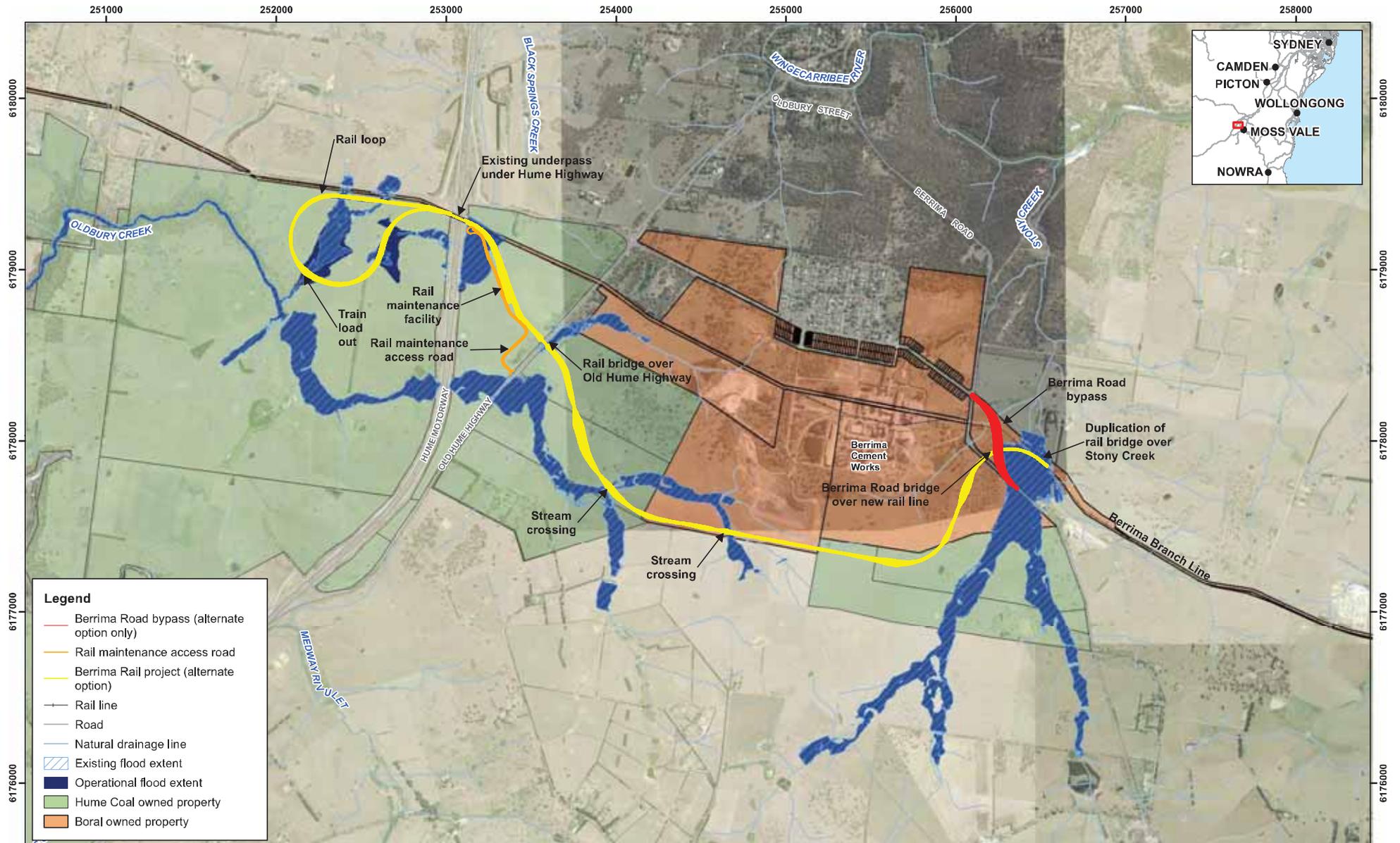
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Hume Coal

Berrima Rail Project
 Appendix E1
 5 year ARI flood extent - Operation (Alternate option)

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Legend

- Berrima Road bypass (alternate option only)
- Rail maintenance access road
- Berrima Rail project (alternate option)
- Rail line
- Road
- Natural drainage line
- Existing flood extent
- Operational flood extent
- Hume Coal owned property
- Boral owned property

Map: 2200569A_GIS_004_A7	Author: RP		
Date: 15/11/2016	Approved by: LR		
Data source: © Land and Property Information 2015, Hume Coal		Coordinate system: GDA 1994 MGA Zone 56 Scale ratio correct when printed at A3	

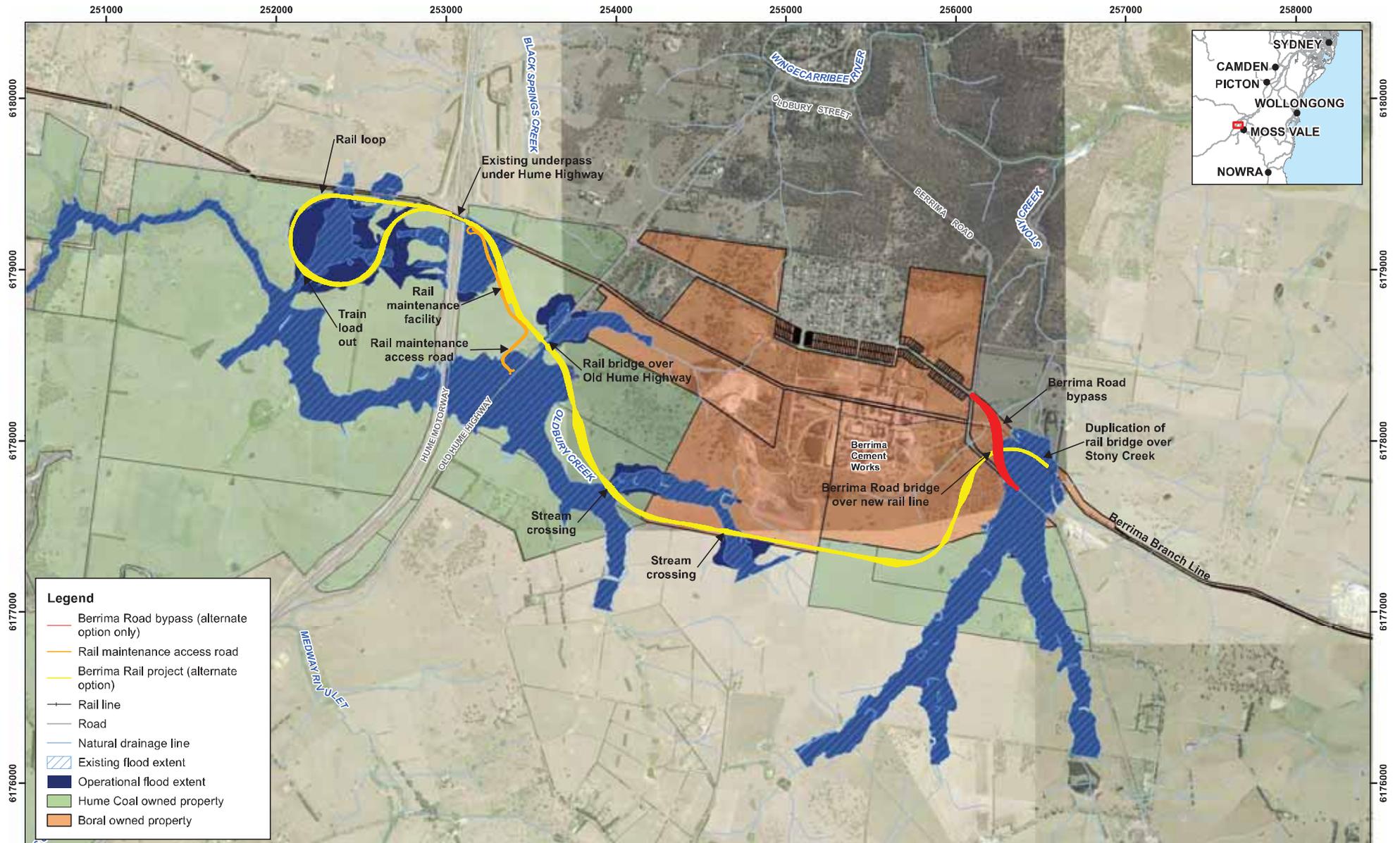
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Hume Coal

Berrima Rail Project
Appendix E2
20 year ARI flood extent - Operation (alternate option)



Legend

- Berrima Road bypass (alternate option only)
- Rail maintenance access road
- Berrima Rail project (alternate option)
- Rail line
- Road
- Natural drainage line
- Existing flood extent
- Operational flood extent
- Hume Coal owned property
- Boral owned property

Map: 2200569A_GIS_008_A6	Author: RP	 1:20,000 Coordinate system: GDA 1994 MGA Zone 56 Scale ratio correct when printed at A3
Date: 15/11/2016	Approved by: LR	

Data source: © Land and Property Information 2015, Hume Coal

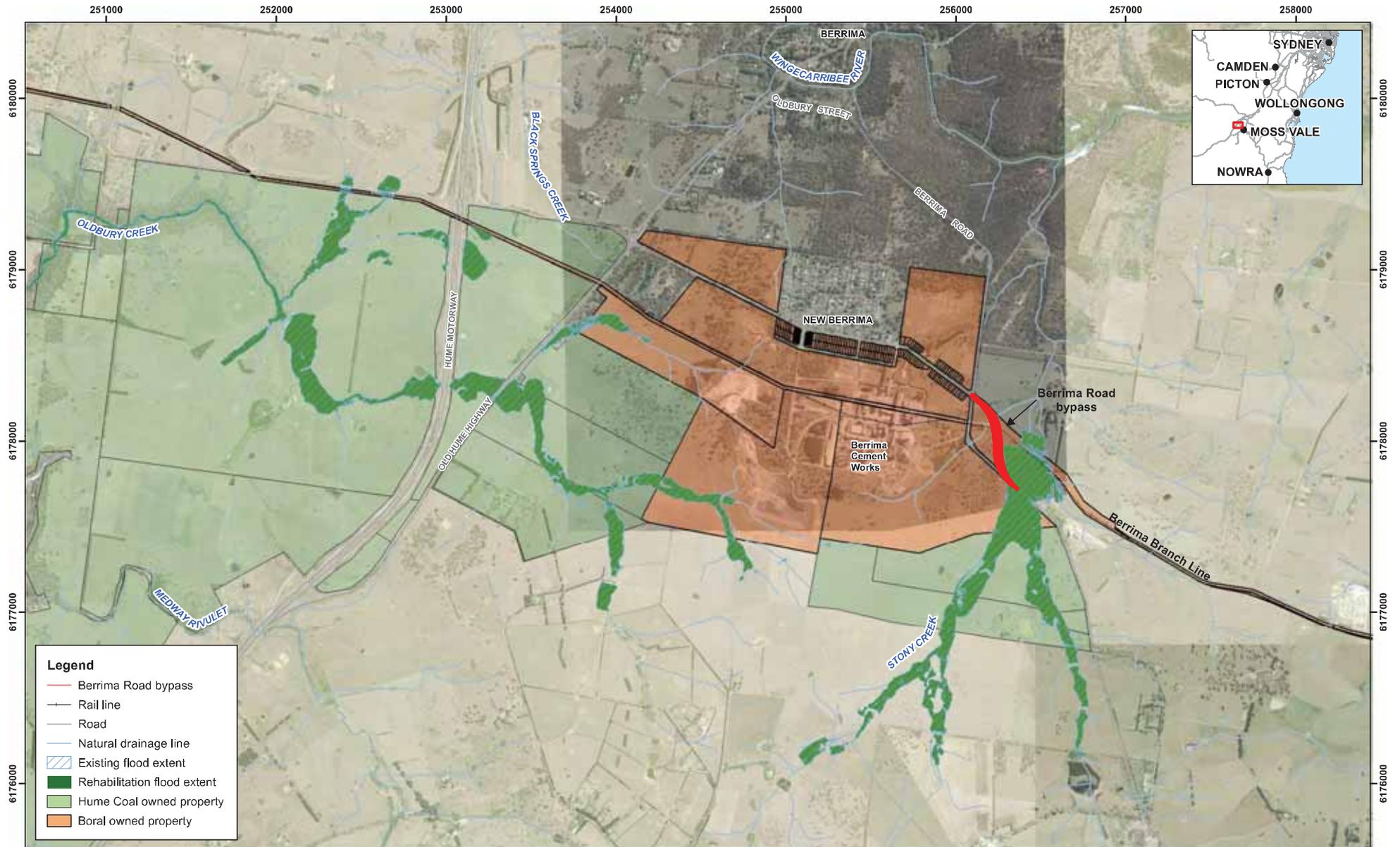
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Berrima Rail Project
Appendix E3
PMF flood extent - Operation (Alternate option)

Appendix F

ALTERNATE OPTION REHABILITATION FLOOD MAPS



- Legend**
- Berrima Road bypass
 - Rail line
 - Road
 - Natural drainage line
 - Existing flood extent
 - Rehabilitation flood extent
 - Hume Coal owned property
 - Boral owned property

Map: 2200569A_GIS_003_A7
 Date: 15/11/2016
 Author: RP
 Approved by: -LR



1:20,000
 Coordinate system: GDA 1994 MGA Zone 56
 Scale ratio correct when printed at A3

Data source: © Land and Property Information 2015, Hume Coal

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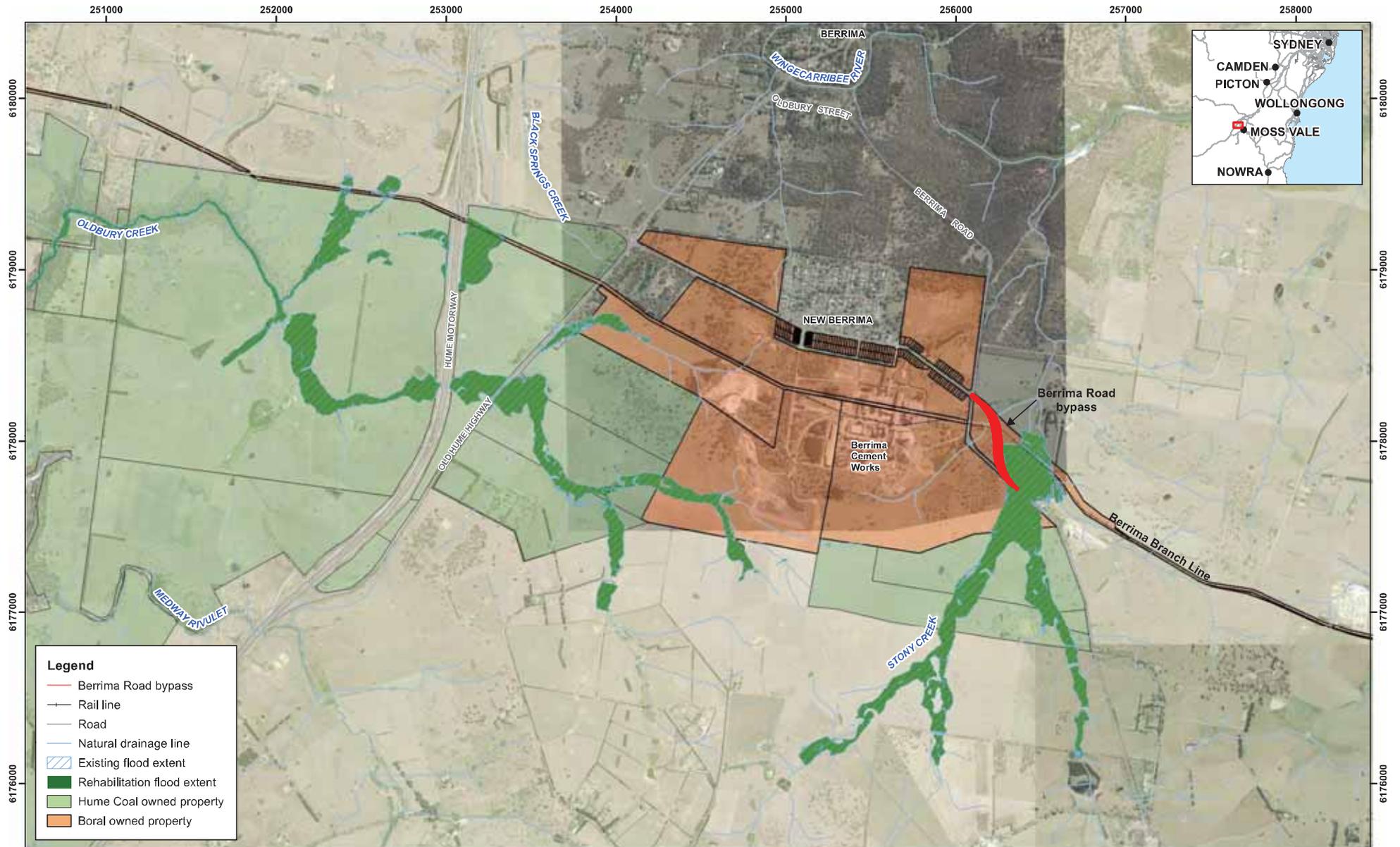


Hume Coal

Berrima Rail Project
 Appendix F1
 5 year ARI flood extent - Rehabilitation (Alternate option)

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- Legend**
- Berrima Road bypass
 - Rail line
 - Road
 - Natural drainage line
 - Existing flood extent
 - Rehabilitation flood extent
 - Hume Coal owned property
 - Boral owned property

Map: 2200569A_GIS_005_A6	Author: RP
Date: 15/11/2016	Approved by: -LR



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1:20,000

Coordinate system: GDA 1994 MGA Zone 56

Scale ratio correct when printed at A3

Data source: © Land and Property Information 2015, Hume Coal

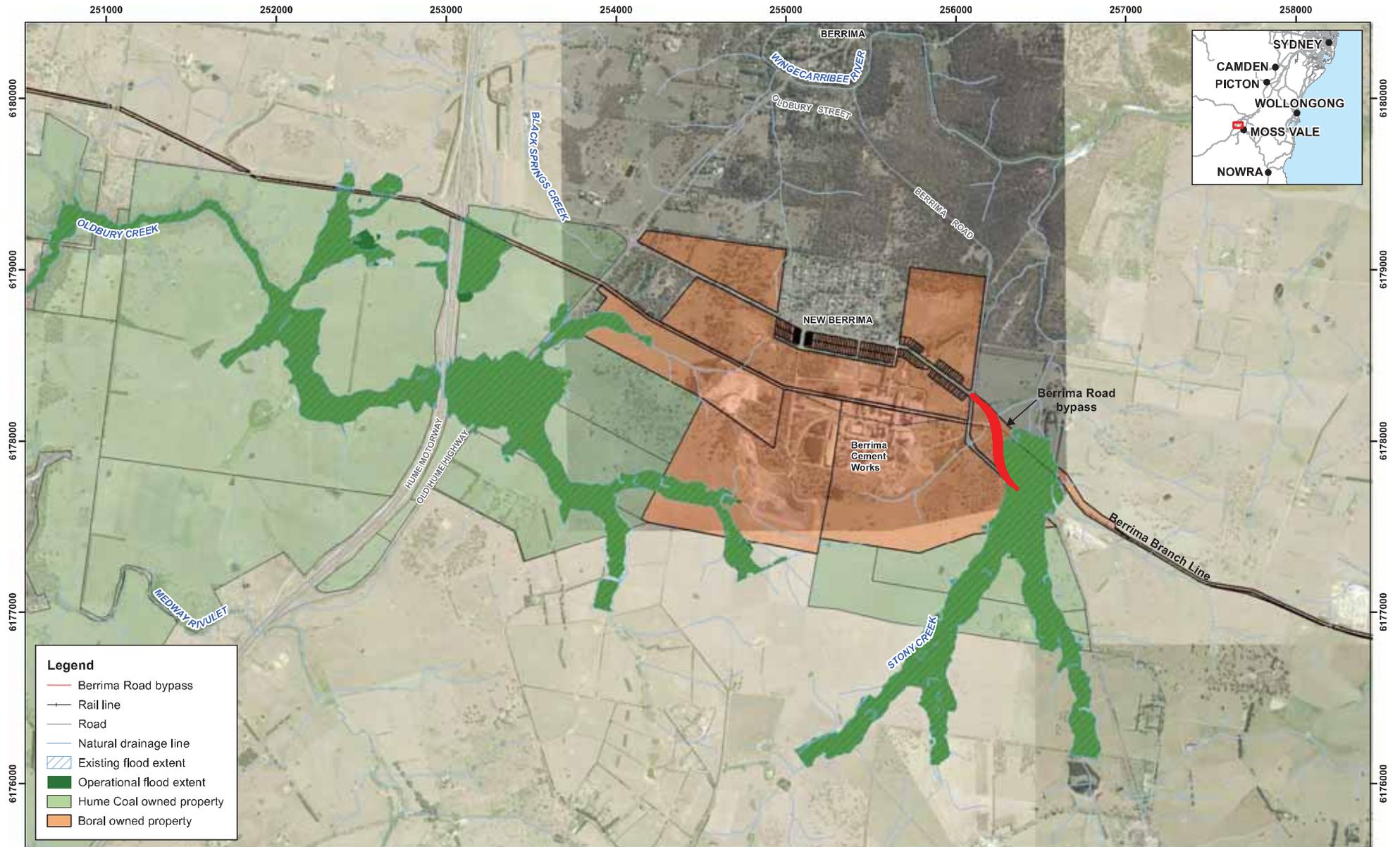
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Hume Coal

Berrima Rail Project
Appendix F2
20 year ARI flood extent - Rehabilitation (Alternate option)

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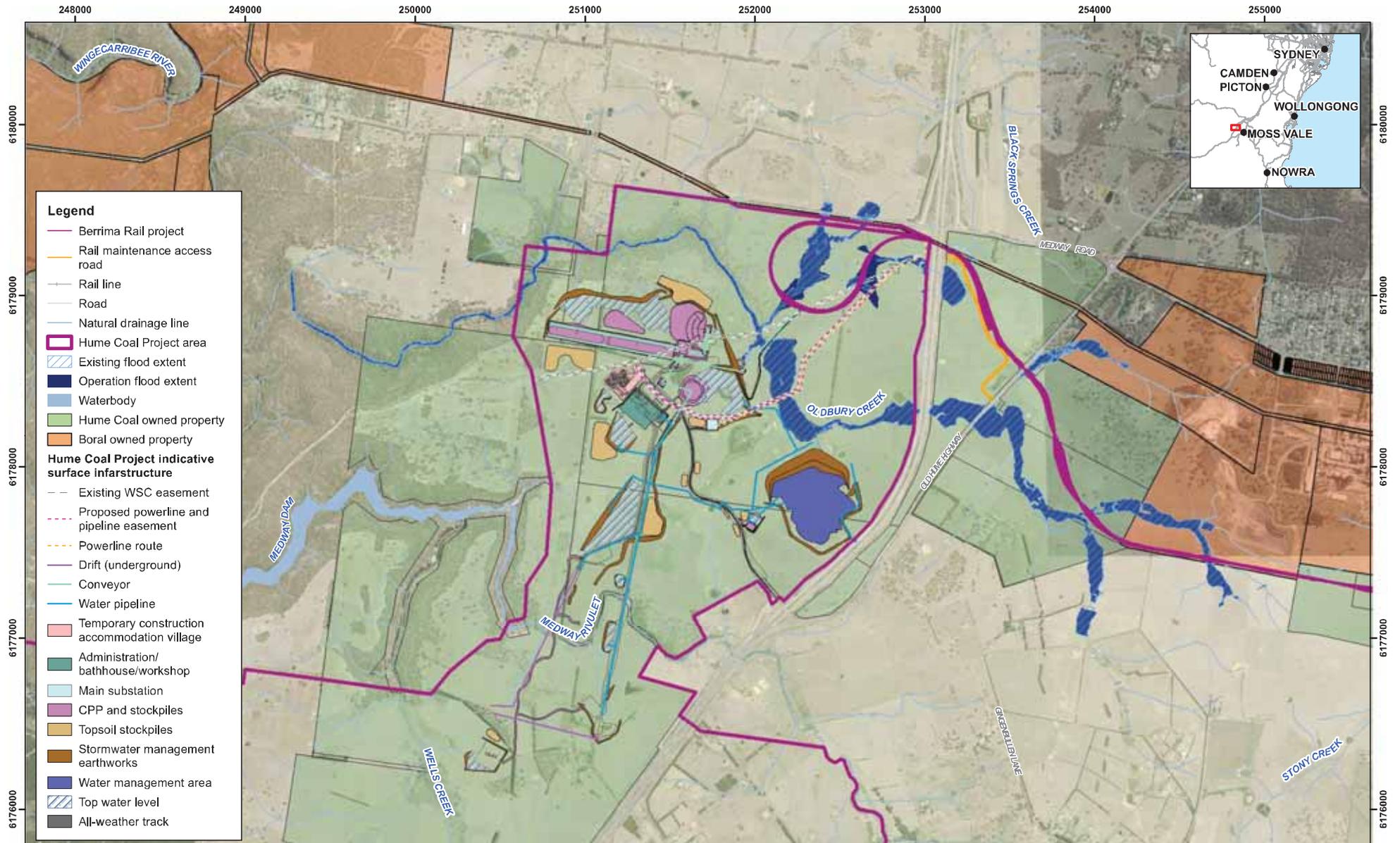
- Legend**
- Berrima Road bypass
 - Rail line
 - Road
 - Natural drainage line
 - Existing flood extent
 - Operational flood extent
 - Hume Coal owned property
 - Boral owned property

Map: 2200569A_GIS_009_A6	Author: RP		
Date: 15/11/2016	Approved by: LR		
Data source: © Land and Property Information 2015, Hume Coal		Coordinate system: GDA 1994 MGA Zone 56 Scale ratio correct when printed at A3	

Berrima Rail Project
Appendix F3
PMF flood extent - Rehabilitation (Alternate option)

Appendix G

CUMULATIVE FLOOD MAPS



- Legend**
- Berrima Rail project
 - Rail maintenance access road
 - Rail line
 - Road
 - Natural drainage line
 - ▭ Hume Coal Project area
 - ▨ Existing flood extent
 - ▨ Operation flood extent
 - ▨ Waterbody
 - ▨ Hume Coal owned property
 - ▨ Boral owned property
- Hume Coal Project indicative surface infrastructure**
- Existing WSC easement
 - - - Proposed powerline and pipeline easement
 - - - Powerline route
 - Drift (underground)
 - Conveyor
 - Water pipeline
 - ▨ Temporary construction accommodation village
 - ▨ Administration/bathhouse/workshop
 - ▨ Main substation
 - ▨ CPP and stockpiles
 - ▨ Topsoil stockpiles
 - ▨ Stormwater management earthworks
 - ▨ Water management area
 - ▨ Top water level
 - ▨ All-weather track

Map: 2200569A_GIS_029_A6
 Date: 15/11/2016
 Author: RP
 Approved by: LR

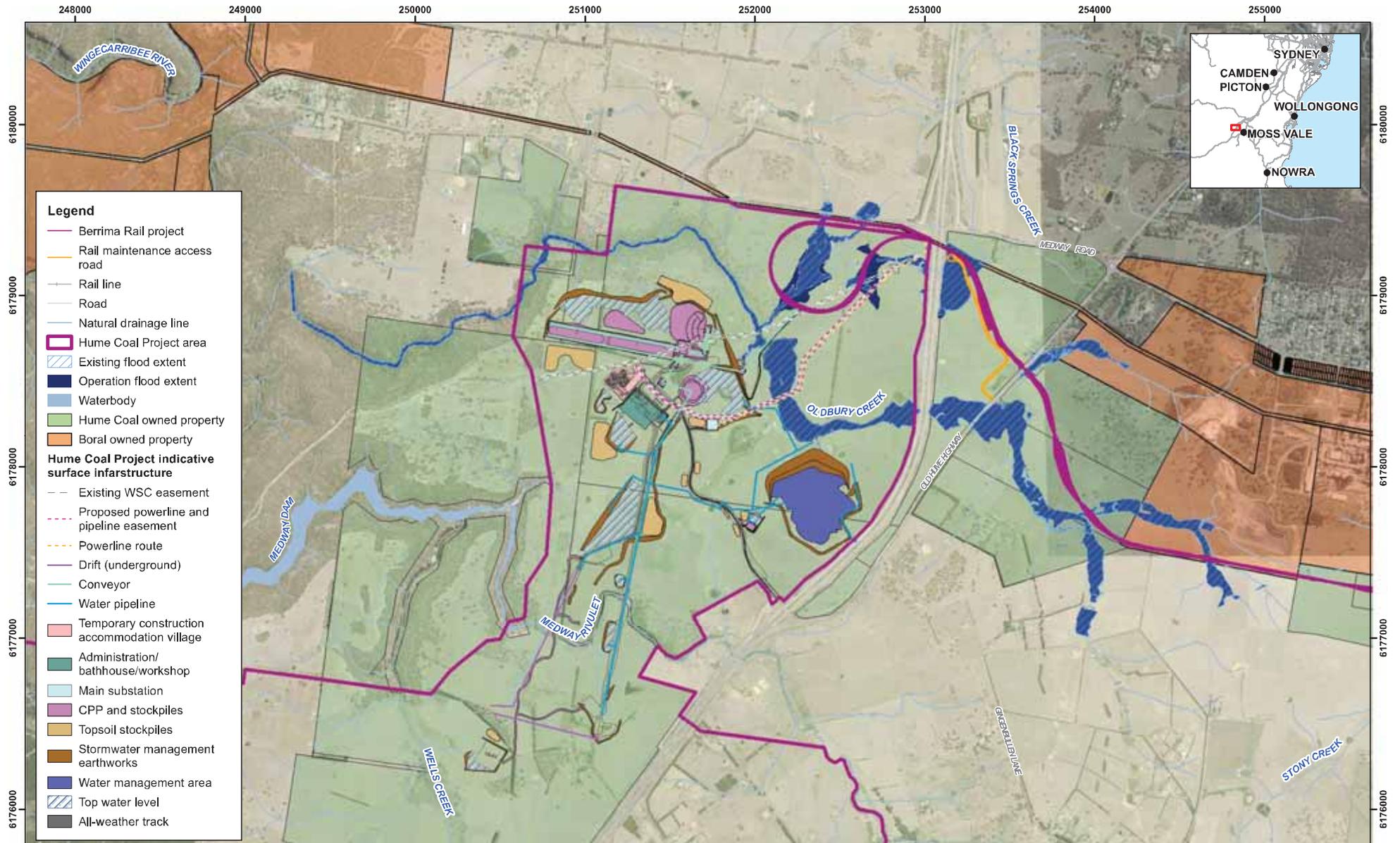


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 Coordinate system: GDA 1994 MGA Zone 56
 Scale ratio correct when printed at A3

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Berrima Rail Project
 Appendix G1
 Cumulative 5 Year ARI flood extent - Operation



Map: 2200569A_GIS_031_A6 Author: RP
 Date: 15/11/2016 Approved by: LR



Data source: © Land and Property Information 2015, Hume Coal

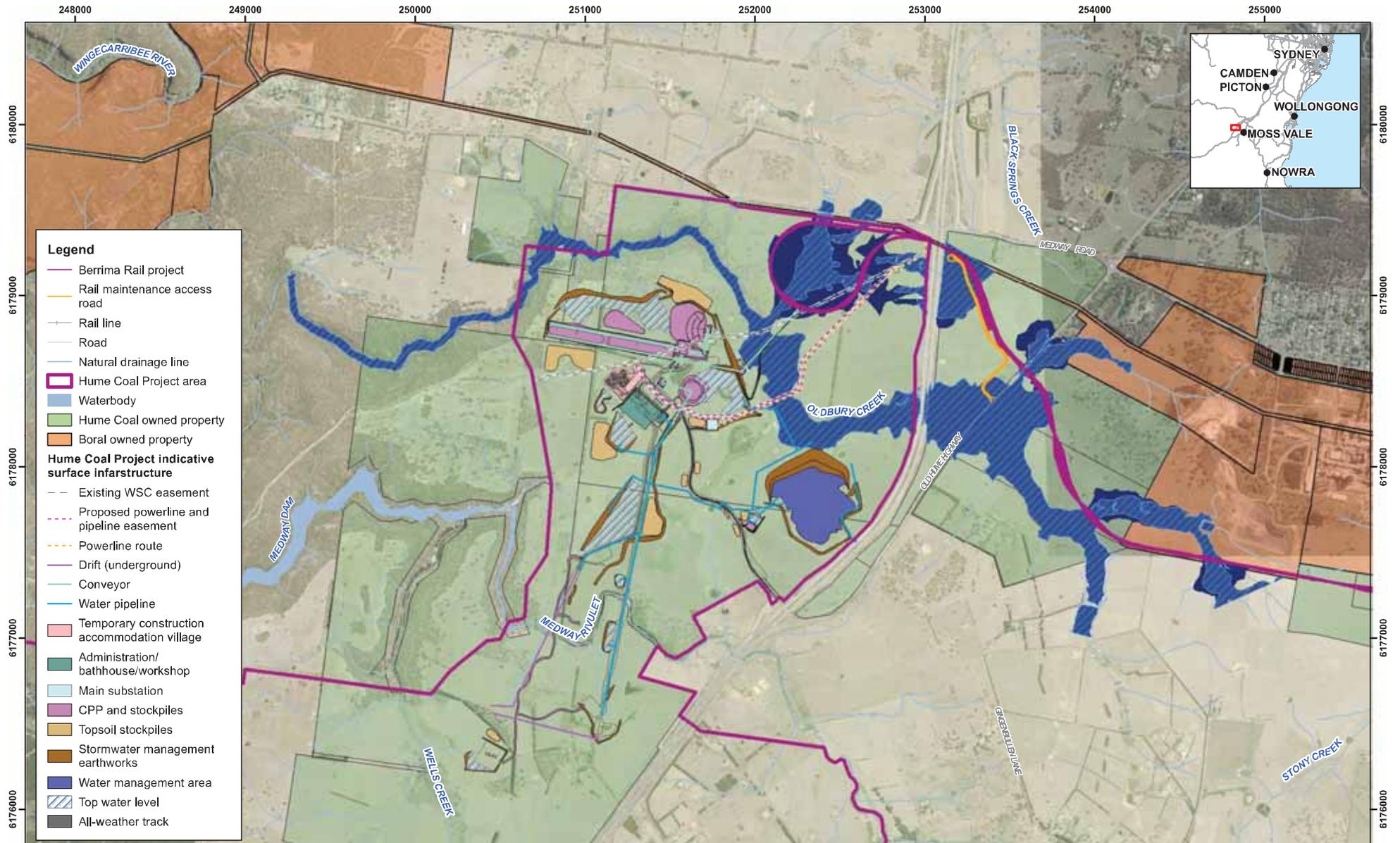
Coordinate system: GDA 1994 MGA Zone 56

Scale ratio correct when printed at A3



Berrima Rail Project
 Appendix G2
 Cumulative 20 Year ARI flood extent - Operation

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- Legend**
- Berrima Rail project
 - Rail maintenance access road
 - Rail line
 - Road
 - Natural drainage line
 - ▭ Hume Coal Project area
 - ▭ Waterbody
 - ▭ Hume Coal owned property
 - ▭ Boral owned property
- Hume Coal Project indicative surface infrastructure**
- - Existing WSC easement
 - - - Proposed powerline and pipeline easement
 - - - Powerline route
 - Drift (underground)
 - Conveyor
 - Water pipeline
 - ▭ Temporary construction accommodation village
 - ▭ Administration/bathhouse/workshop
 - ▭ Main substation
 - ▭ CPP and stockpiles
 - ▭ Topsoil stockpiles
 - ▭ Stormwater management earthworks
 - ▭ Water management area
 - ▭ Top water level
 - ▭ All-weather track

Map: 2200569A_GIS_033_A6
 Date: 15/11/2016
 Author: RP
 Approved by: LR



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 Coordinate system: GDA 1994 MGA Zone 56
 Scale ratio correct when printed at A3

Data source: © Land and Property Information 2015, Hume Coal

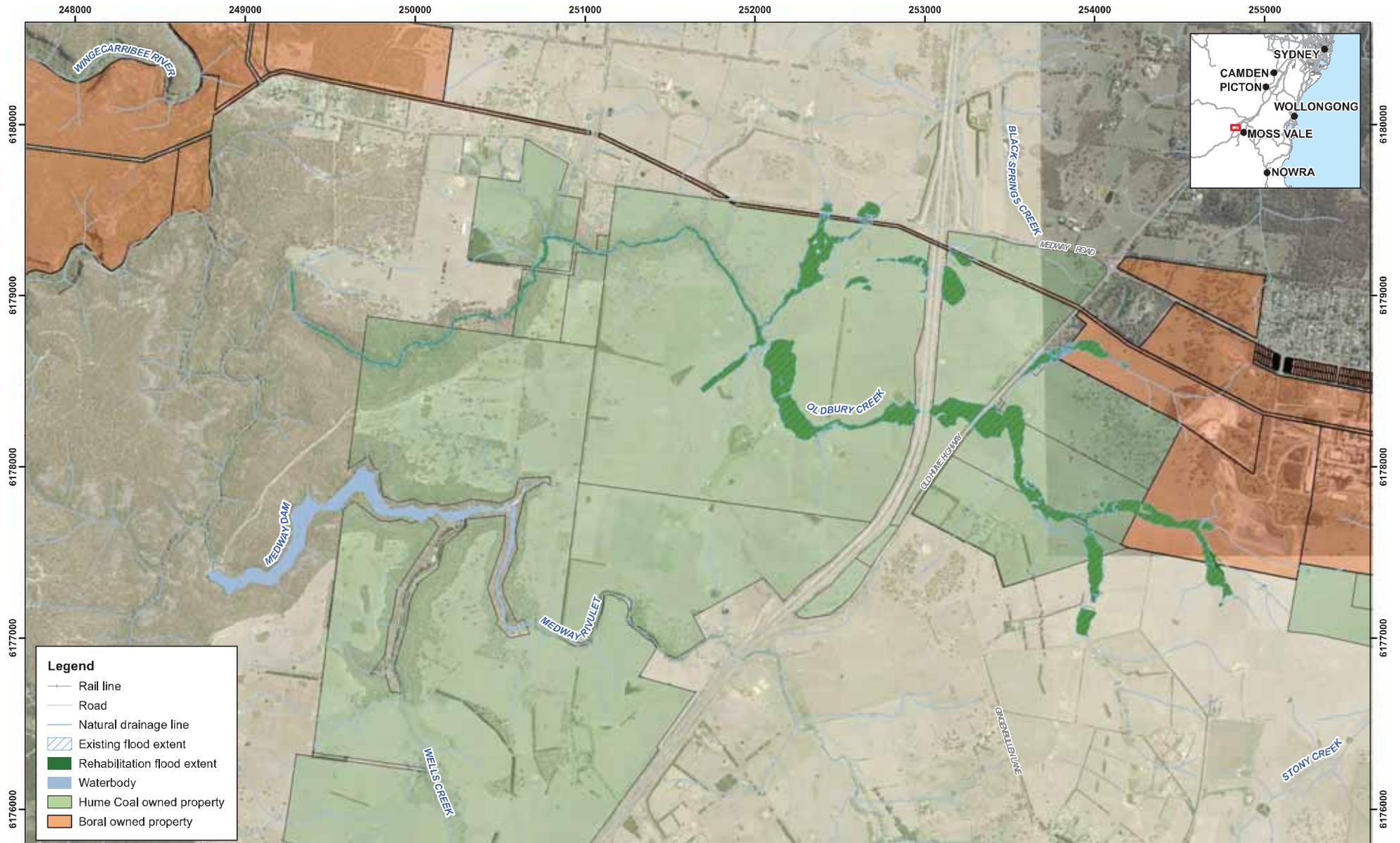
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Berrima Rail Project
 Appendix G3
 Cumulative PMF flood extent - Operation

Appendix H

CUMULATIVE REHABILITATION FLOOD MAPS



Legend

- Rail line
- Road
- Natural drainage line
- Existing flood extent
- Rehabilitation flood extent
- Waterbody
- Hume Coal owned property
- Boral owned property

Map: 2200569A_GIS_030_A6
 Date: 15/11/2016
 Author: RP
 Approved by: LR



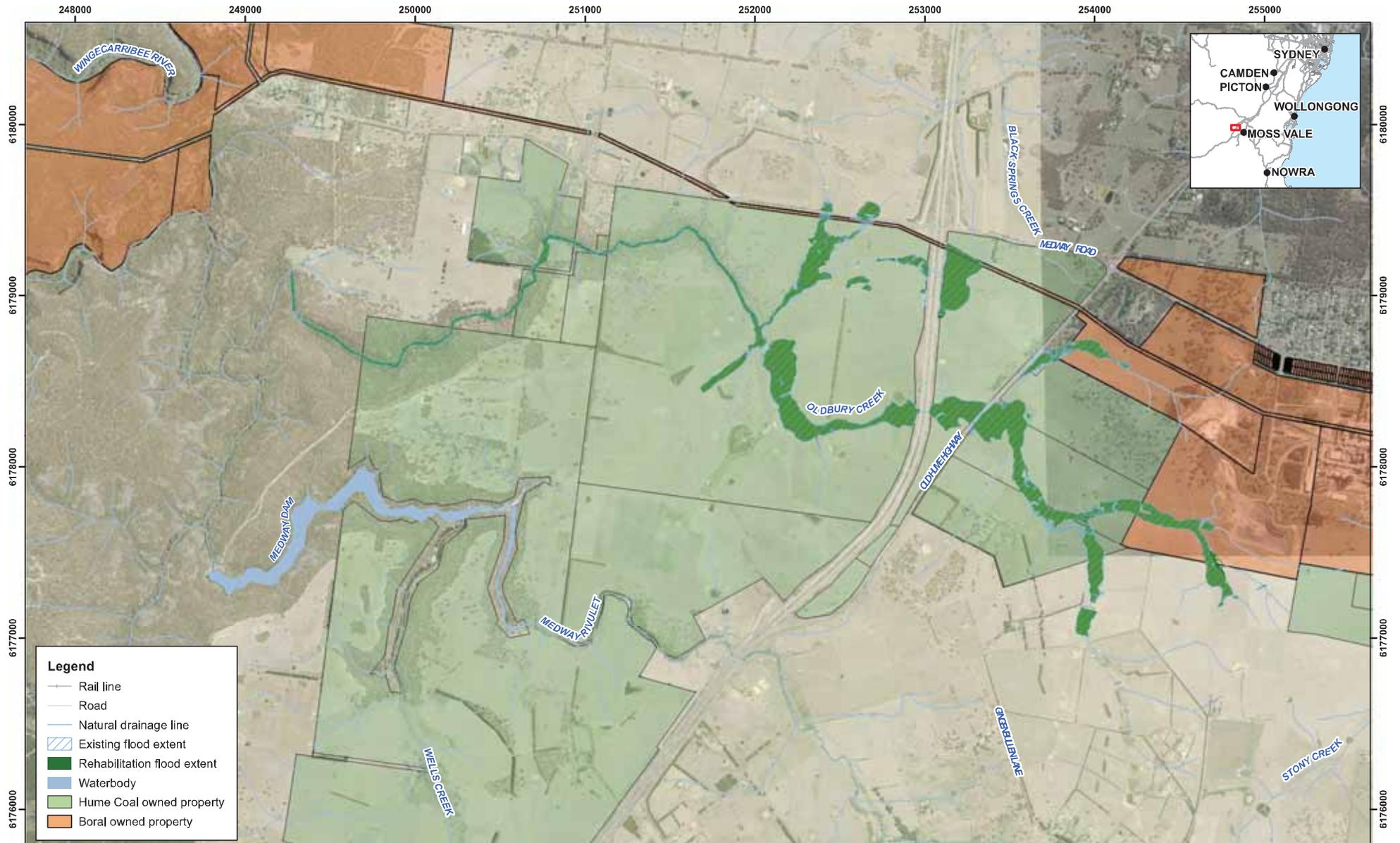
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 Scale ratio correct when printed at A3

Data source: © Land and Property Information 2015, Hume Coal

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Berrima Rail Project
 Appendix H1
 Cumulative 5 year ARI flood extent - Rehabilitation



Legend

- Rail line
- Road
- Natural drainage line
- Existing flood extent
- Rehabilitation flood extent
- Waterbody
- Hume Coal owned property
- Boral owned property

Map: 2200569A_GIS_032_A6
 Date: 15/11/2016
 Author: RP
 Approved by: LR



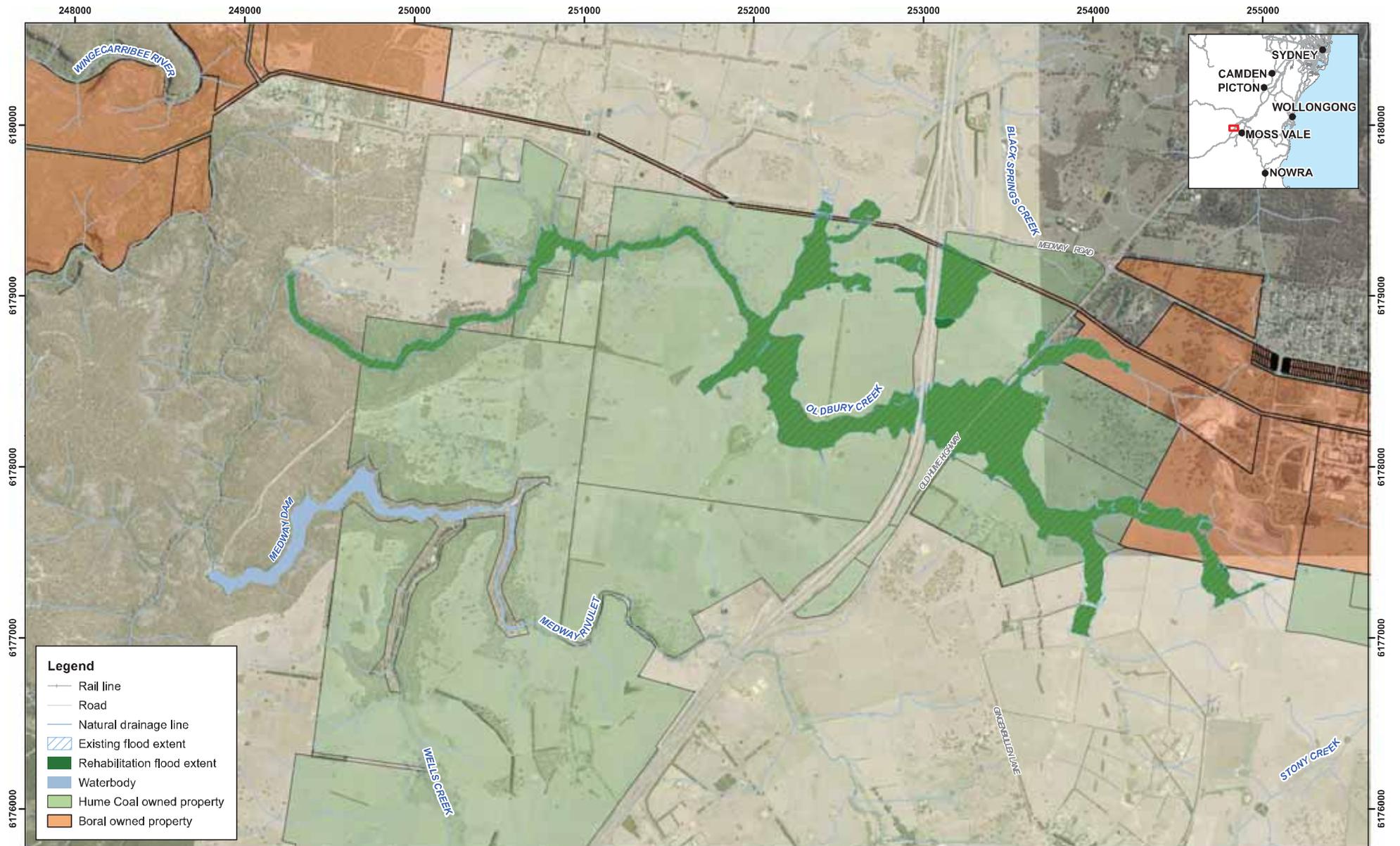
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Data source: © Land and Property Information 2015, Hume Coal

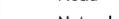
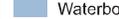
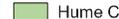


Berrima Rail Project
 Appendix H2
 Cumulative 20 year ARI flood extent - Rehabilitation

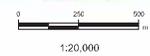
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Legend

-  Rail line
-  Road
-  Natural drainage line
-  Existing flood extent
-  Rehabilitation flood extent
-  Waterbody
-  Hume Coal owned property
-  Boral owned property

Map: 2200569A_GIS_034_A6 Author: RP
 Date: 15/11/2016 Approved by: LR



Data source: © Land and Property Information 2015, Hume Coal

Coordinate system: GDA 1994 MGA Zone 56
 Scale ratio correct when printed at A3



Berrima Rail Project
 Appendix H3
 Cumulative PMF flood extent - Rehabilitation

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Appendix I

**ADJUSTMENT OF NUTRIENT BACKGROUND CONCENTRATIONS IN
SWALES**

A key input parameter in MUSIC treatment nodes is the background pollutant levels, C* (stormflow background pollutant concentration) and C** (baseflow background pollutant levels) values. The default MUSIC background concentrations for TP and TN in swales are set high and are required to be revised to simulate more realistic values.

The C* estimate for total suspended solids (TSS) is obtained by Fletcher (2004) from the particle size at which only 20% removal is achieved. The method and particle distribution figures are provided in Fletcher (2004).

Applying the Fletcher (2004) methodology for TP results in a C* value of 0.18mg/L and an EMC of 0.26mg/L. This is significantly higher than the TP EMC recorded in the Hume Coal project baseline water quality data at 0.14mg/L. Therefore, it was considered reasonable to adjust the C* and C** values to reflect the lower recorded TP concentrations in the watercourses in the project area.

The C* was adjusted by identifying the ratio between the C* and the EMC identified in Fletcher (2004) and the EMC from the project area in the equation below.

$$C_{new}^* = EMC_{from\ baseline\ data} * \frac{C_{fletcher}^*}{EMC_{fletcher}}$$

MUSIC applies the same value for both C* and C** for swales. Therefore, the C*_{new} value was applied for both C* and C**.

The same method was applied for TN and the revised C* and C** for swales for both TP and TN are shown in the table below.

Table 1: Revised C* and C values for swales**

	k	C*	C**
TSS	8000	20	14
TP	6000	0.096 [^]	0.096 [^]
TN	500	0.89 [^]	0.89 [^]

[^]C* and C** values that were revised

By adjusting the C* it is assumed that the background concentration of the swales will not increase because the swales will be properly maintained.

Appendix J

MUSIC MODELLING OUTPUT – CUMULATIVE FREQUENCY PLOTS

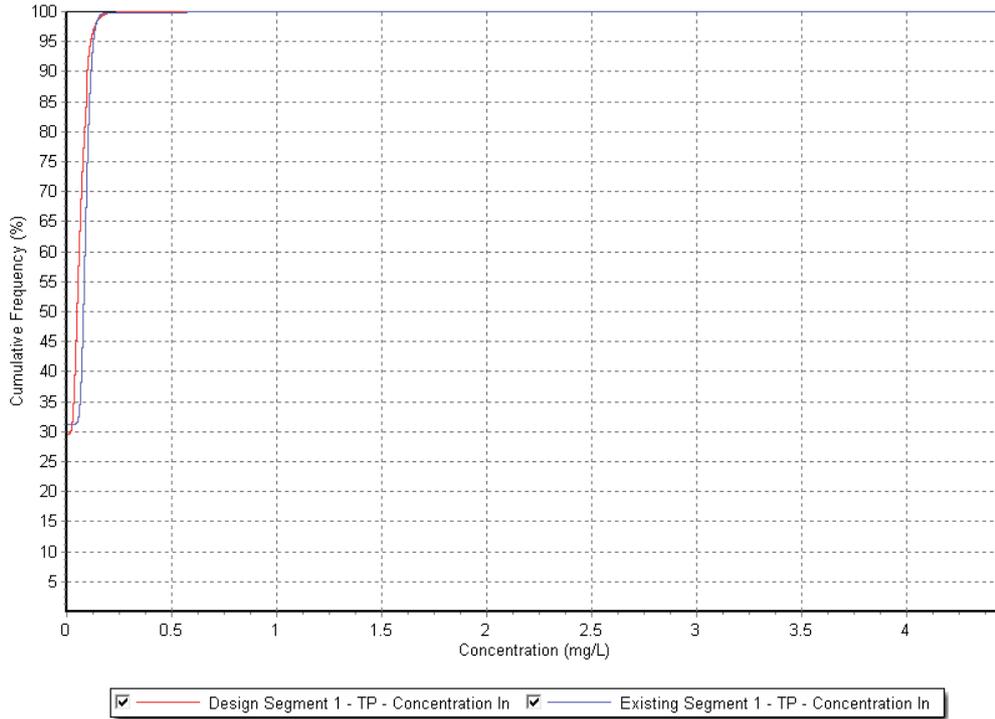


Figure J1: Cumulative Frequency Plots of TP for pre development (existing) and post development (operation) with treatment for Segment 1 of Oldbury Creek preferred and alternate options

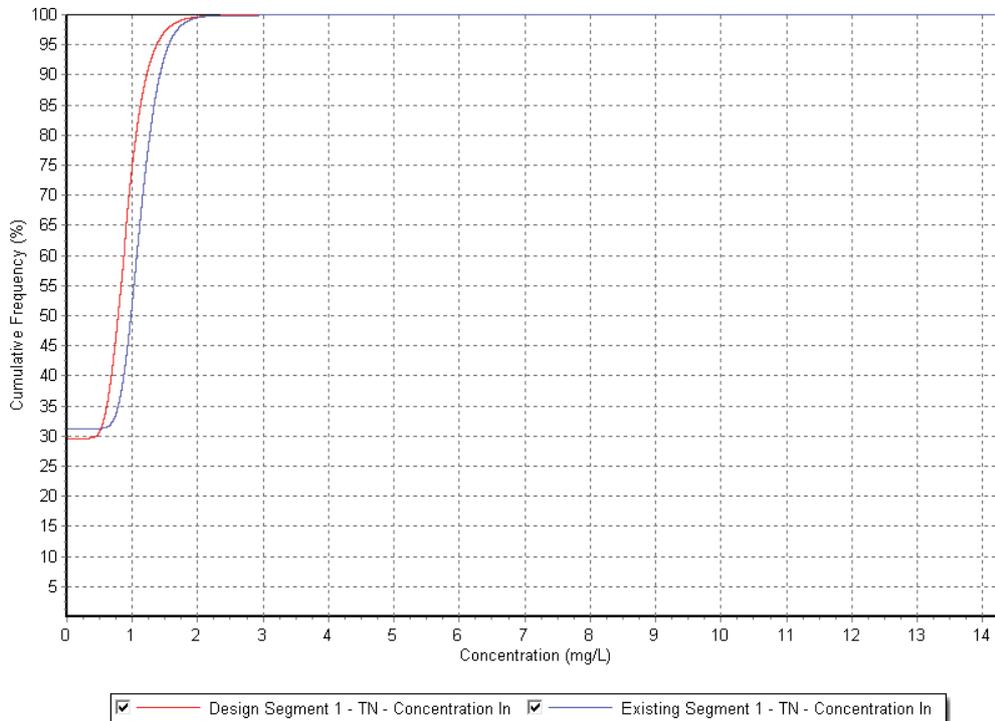


Figure J2: Cumulative Frequency Plots of TN for pre development (existing) and post development (operation) with treatment for Segment 1 of Oldbury Creek preferred and alternate options

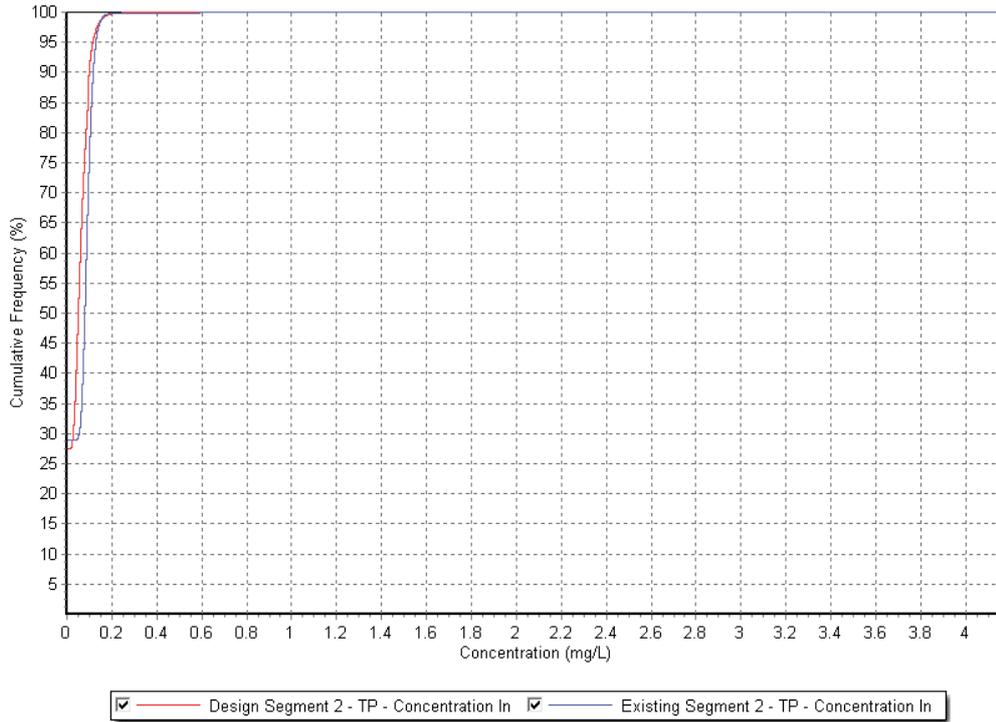


Figure J3: Cumulative Frequency Plots of TP for pre development (existing) and post development (operation) with treatment for Segment 2 of Oldbury Creek preferred and alternate options

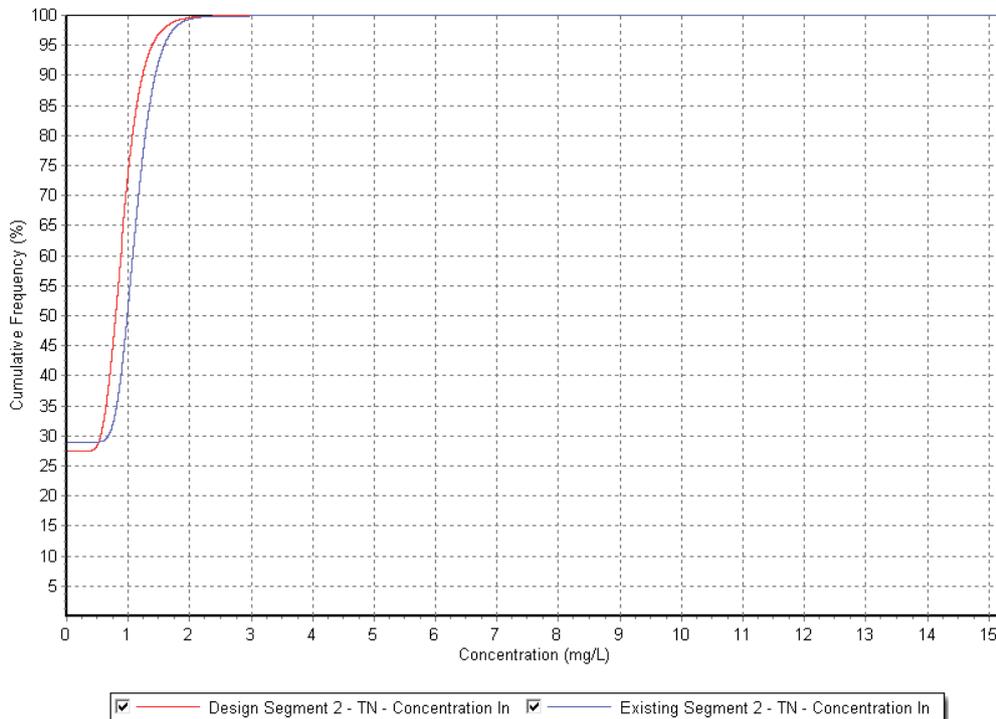


Figure J4: Cumulative Frequency Plots of TN for pre development (existing) and post development (operation) with treatment for Segment 2 of Oldbury Creek preferred and alternate options

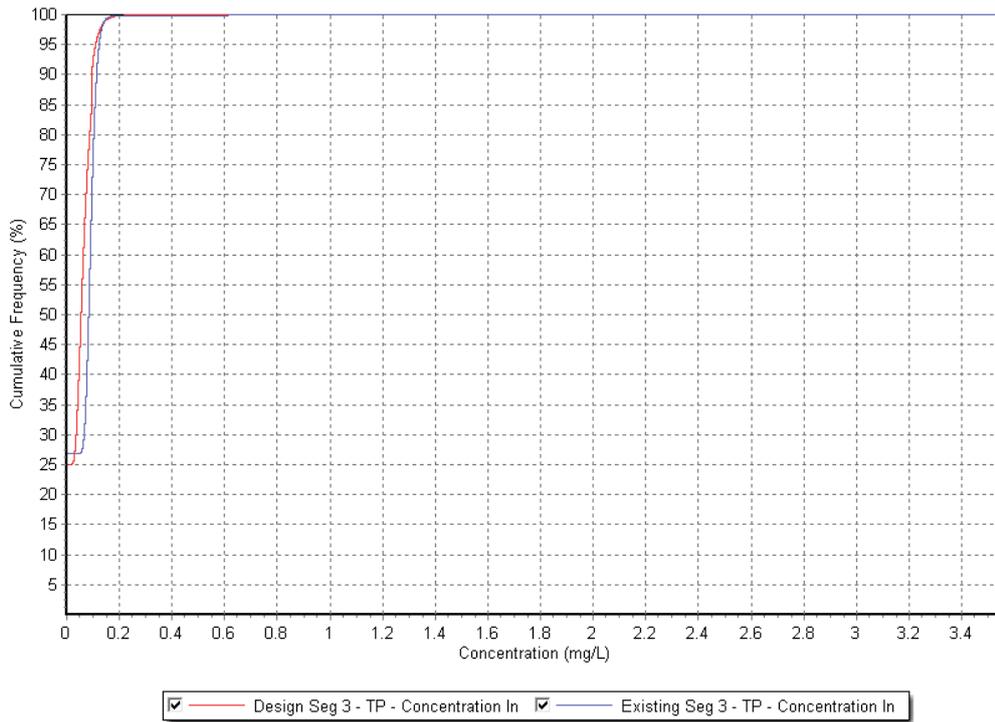


Figure J5: Cumulative Frequency Plots of TP for pre development (existing) and post development (operation) with treatment for Segment 3 of Oldbury Creek preferred and alternate options

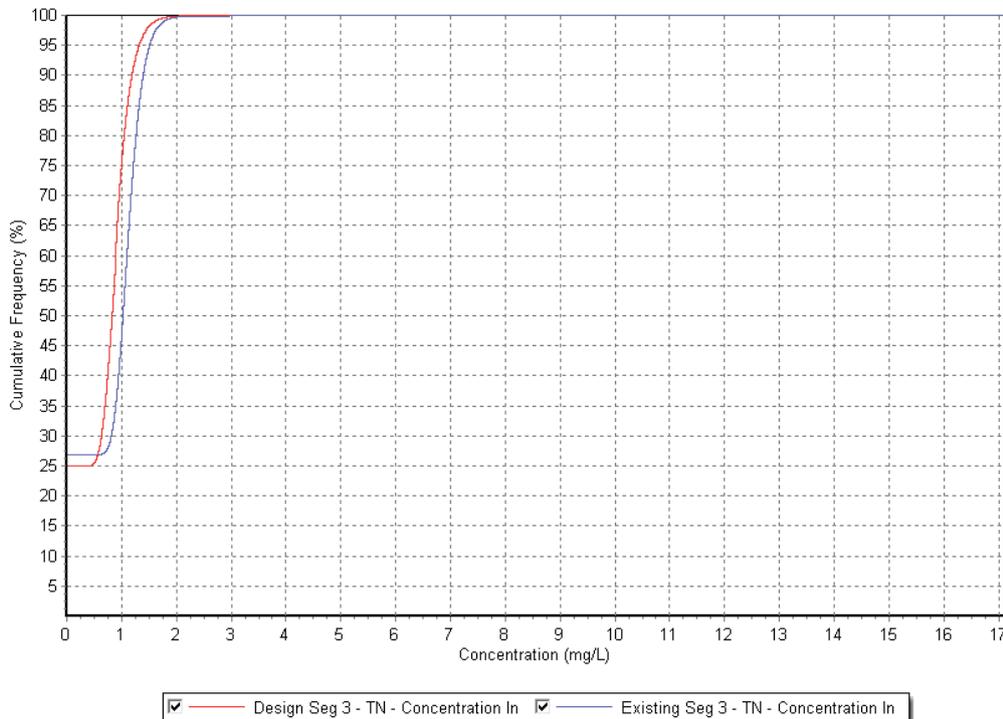


Figure J6: Cumulative Frequency Plots of TN for pre development (existing) and post development (operation) with treatment for Segment 3 of Oldbury Creek preferred and alternate options

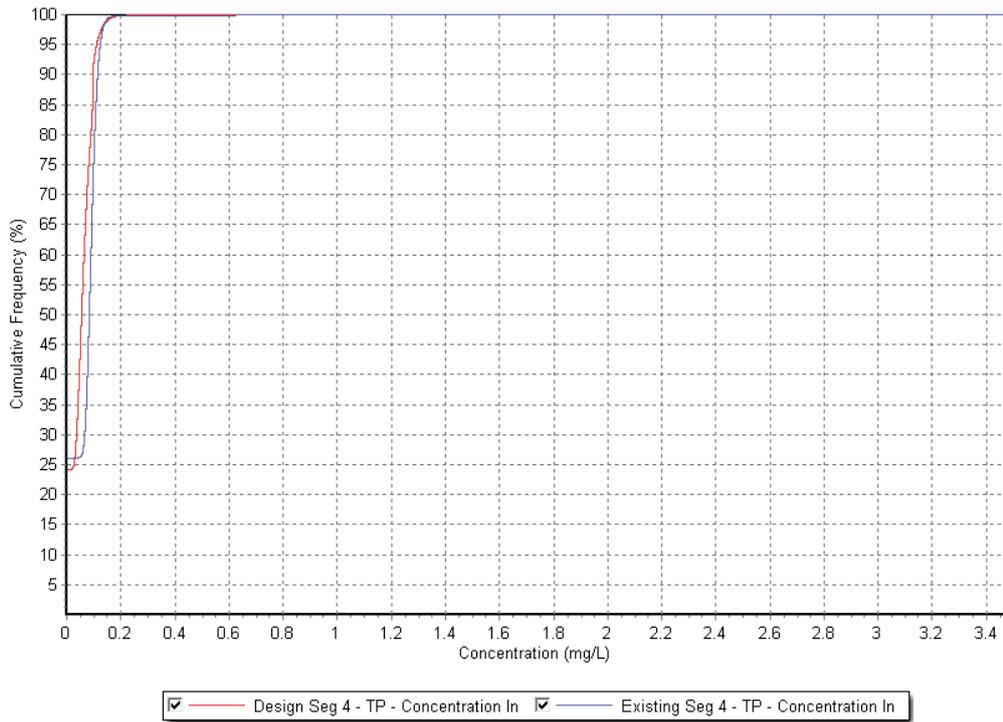


Figure J7: Cumulative Frequency Plots of TP for pre development (existing) and post development (operation) with treatment for Segment 4 of Oldbury Creek preferred and alternate options

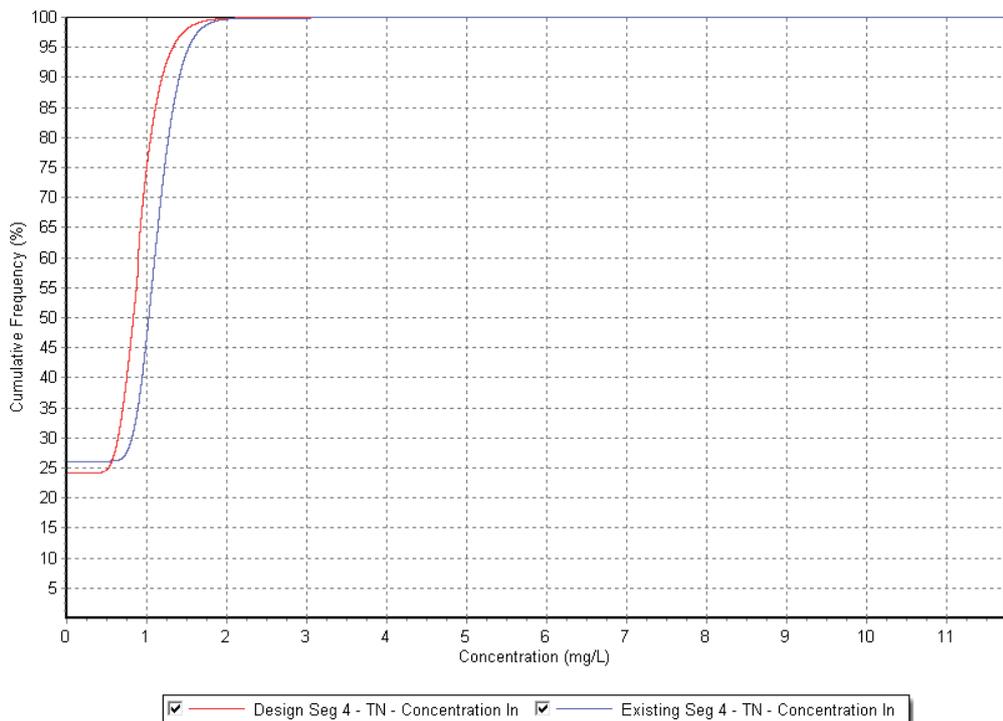


Figure J8: Cumulative Frequency Plots of TN for pre development (existing) and post development (operation) with treatment for Segment 4 of Oldbury Creek preferred and alternate options

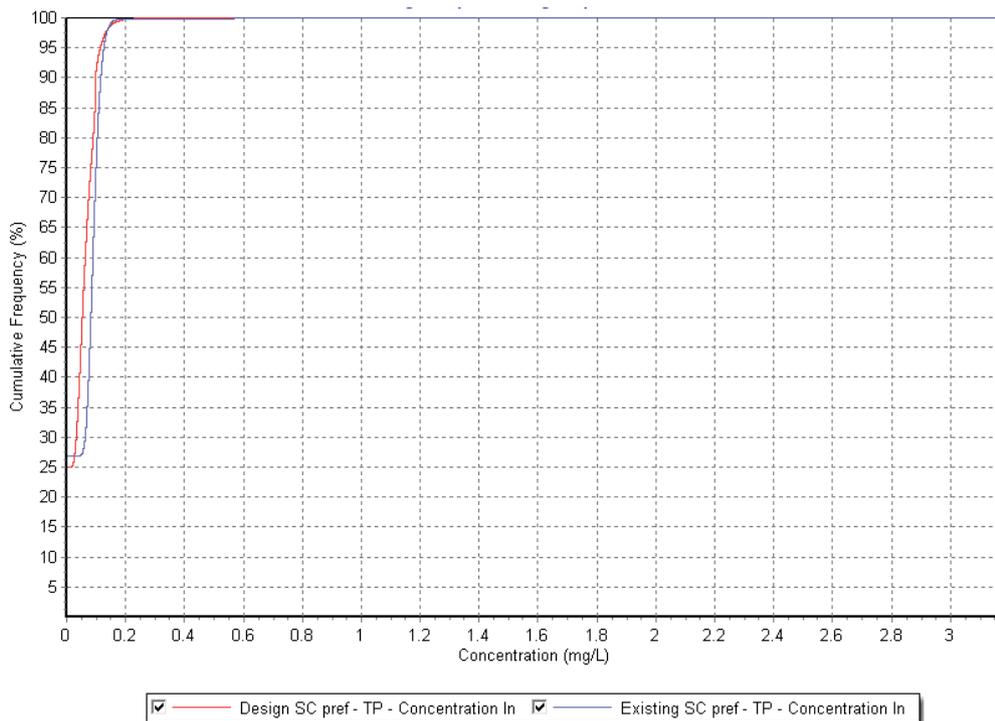


Figure J9: Cumulative Frequency Plots of TP for pre development (existing) and post development (operation) with treatment for Stony Creek preferred option

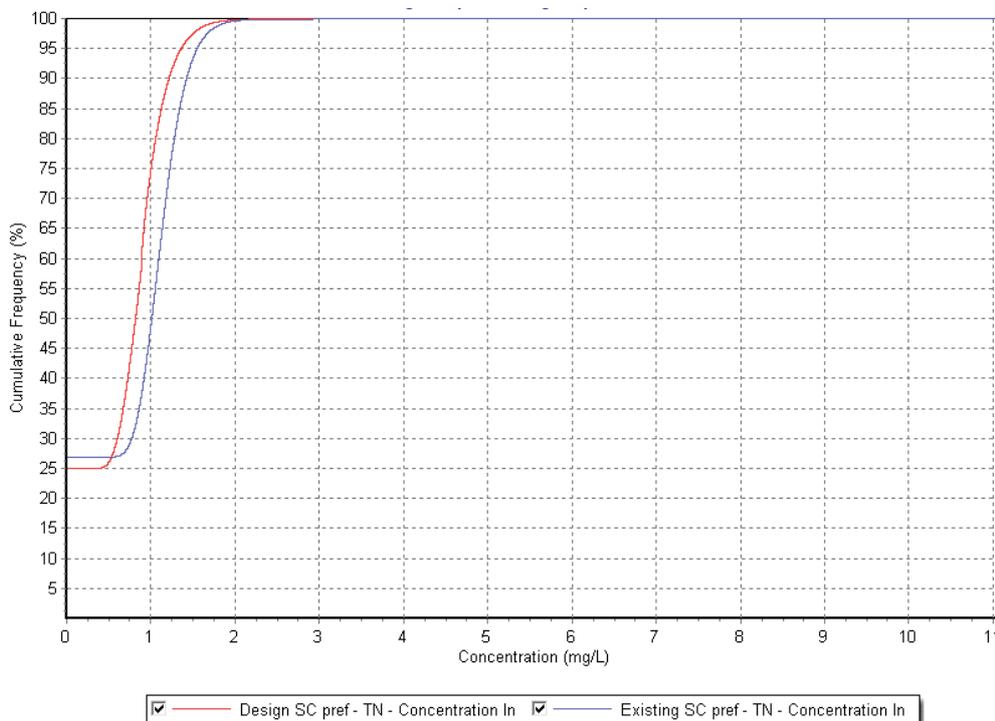


Figure J10: Cumulative Frequency Plots of TN for pre development (existing) and post development (operation) with treatment for Stony Creek preferred option

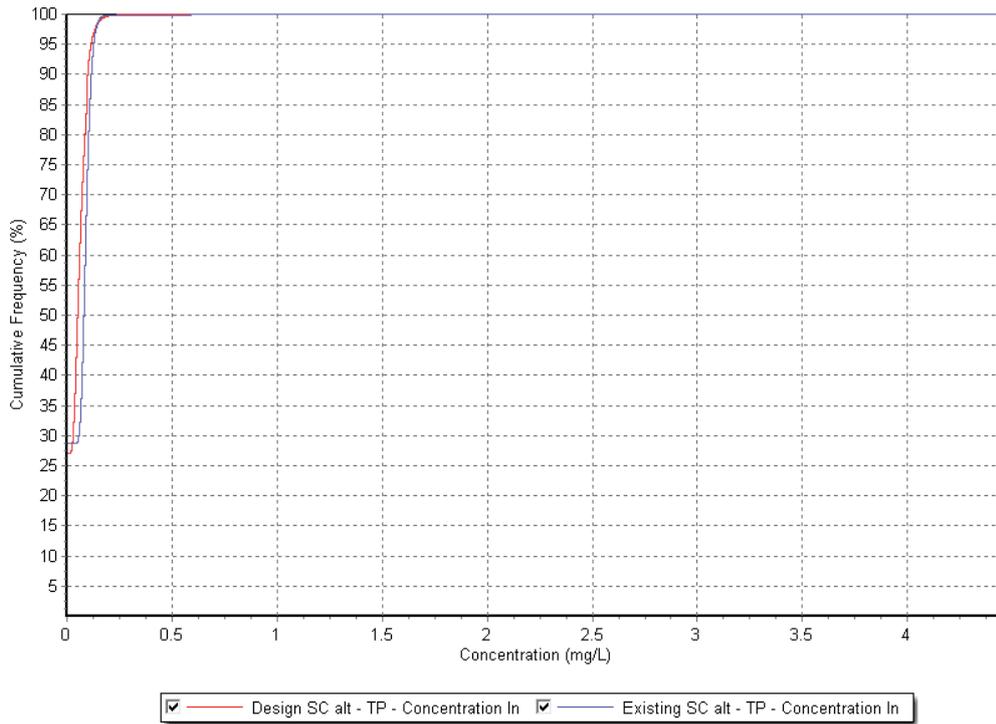


Figure J11: Cumulative Frequency Plots of TP for pre development (existing) and post development (operation) with treatment for Stony Creek alternate option

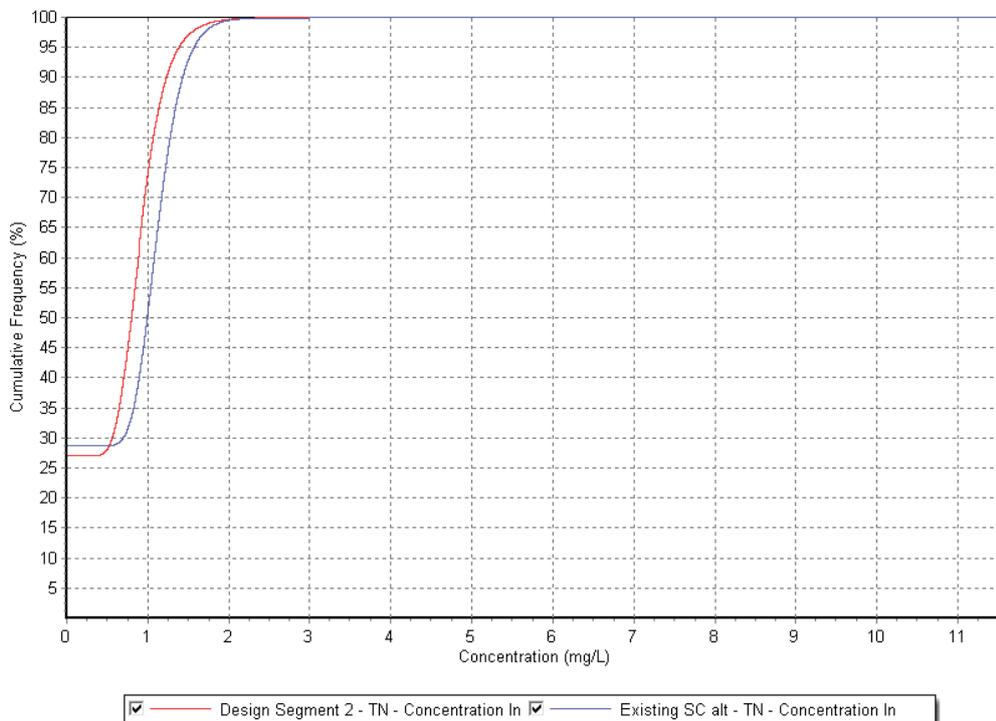


Figure J12: Cumulative Frequency Plots of TN for pre development (existing) and post development (operation) with treatment for Stony Creek alternate option

