

## 5.2 Indicative Cost Budget Assessment Results

The most influential criteria from the above relates to the indicative cost budget with an overall weighting of 45%. Note that as discussed previously these cost budgets were prepared for comparison between the options only and do not represent the final out turn cost, particularly as they do not include overhead, profit and contingencies.

During the workshop it was noted that potential works to the Ausgrid 132kV infrastructure (which had not been clarified in any detail) were having a substantial influence on the overall costs. Due to the high degree of uncertainty around the works required to the 132kV oil filled transmission lines and the likelihood that the infrastructure would in reality be designed to avoid them, these were excluded from the cost comparison exercise. This was with the exception of Option 5 which would most likely require significant relocation of the 132kV cables in Burrows Road as it runs parallel to them, rather than crossing transversely.

In addition Land Acquisition (LA) and Easement Acquisition (EA) costs were refined to identify the influence on the final estimate figures. The Workshop agreed whether land acquisition or an easement should be assumed for each property based on the scope of impact and current site use.

The indicative cost budget assessment within the MCA was performed using the highlighted values shown below in MCA Analysis Results

As shown in Table 10 and 11, Option 1 was the highest ranked by the MCA, scoring .

[REDACTED] Option 1 holds minimum risk with respect to LA requirements and 132kV alterations due to its alignment and is favourable from that perspective.

Option 6 requires minimum EA requirements and also offers the least risk from a 132kV perspective on the basis that the 132kV lines already interface with the existing channel.

**Table 12 Indicative Cost Budgets Values adopted for MCA analysis (adopted values in Yellow) – note that these are used for the MCA only and do not represent out turn cost and do not include overheads, profit and contingencies – direct costs only**

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## 5.3 MCA Analysis Results

As shown in Table 10 and 11, Option 1 was the highest ranked by the MCA, scoring highest in all five assessment criteria with an overall weighted score of 89.66%.

However, as discussed in Section 3 the feasibility of Option 1 has not been confirmed, with the capacity of the Sheas Creek open channel to accommodate additional inflow without further amplification requiring substantial additional investigation before being confirmed. If the capacity does not exist, then this Option would revert to Option 2, which ranked 5<sup>th</sup> in the MCA analysis.

It was concluded in the Workshop that while Option 1 presents a clearly preferred solution (scoring more than 20% higher than all others), if ultimately proven to be feasible, in the absence of the required level of hydraulic analysis this option cannot be adopted as the basis for the Business Case at this stage.

# ATTACHMENT B

As such, it was decided to maintain Option 1 as part of the assessment with the aim of including within future investigations, while reverting to the second ranked option within the MCA analysis for adoption as the Preferred Option – that is, Option 6.

While not differentiated from the remaining options by as significant margin as Option 1, Option 6 was still scored a minimum of 10% higher than the next ranked option. The initial cost budget applied to Option 6

Upon review of the MCA analysis results and further discussion of the appropriateness of Option 6 for taking forward as the preferred solution, it was agreed that this option was preferred, with the following benefits being noted in addition to the outcomes of the MCA process:

- The alignment through Sydney Park Oval allows flexibility for further development before settling on the final alignment.
- Widening the existing open channel allows minimum disturbance to the existing Ausgrid 132kV oil filled Transmission cables at the crossings of Euston Road and Burrows Road. Based on early discussions with Ausgrid and utility tracing works undertaken by City of Sydney, it is possible that only localised protection measures may be required where an interface between the proposed works and the 132kV cables occurs.
- Option 6 has the shortest length of micro-tunnelling. The risk for micro-tunnelling and unforeseen ground conditions consequentially becomes more manageable. Where clashes in Sydney Park Oval occur this would be directly accessible via open cut construction methods with minimum utility diversions, adjacent property disruption and significant traffic management and associated delay costs.
- It is likely that permanent land acquisition would not be required to facilitate the works. Widening of existing easements would however be required for the channel extension works between Euston Road and Burrows Road.
- Option 6 has minimum reliance on the programming of parallel construction projects such as Ashmore Precinct development and WestConnex.



## 6 Preferred Option

### 6.1 Preferred Option Design Development

A number of areas for development of the Option 6 design prior to finalising the cost estimate were identified at the Workshop, these include the following as discussed in the following Sections:

- Utilities interfaces
- Upstream connection point and detail
- Alignment through Sydney Park
- Downstream open channel adjustments

The developed design of the preferred option is presented in Appendix C.

#### 6.1.1 Utilities Interfaces

Following the Workshop, AAJV have had preliminary discussions with Ausgrid regarding the implications of Option 6 construction on the existing 132kV oil filled cables. Whilst no formal advice was provided, it was noted that the design solution would require zero disturbance of the 132kV assets where micro-tunnelling works in Mitchell Road would traverse the existing 132kV asset.

In addition preliminary advice suggests that widening of the existing Euston Road and Burrows Road bridges may be achieved through adopting stringent construction methods and protecting the 132kV assets.

Further site inspections and servicing tracing has also provided better understanding of the interface of the 132kV cables with the existing open channel crossings and therefore opportunity for augmentation. Site inspections have identified that one set of the cables (3 feeders) at Burrows Road are housed in a galvanised service bridge to the east of Burrows Road which would require temporary propping and extension to facilitate the channel widening works. This services bridge is shown in Figure 22.



Figure 22 Burrows Road East Services Bridge

# ATTACHMENT B

City of Sydney has commissioned pot holing works to be undertaken within Burrows Road and Euston Road to further understand the constraints of the utilities in these areas. Due to time constraints AAJV have not received the results of the pot holing works for this study, however the results of the utility tracing works have been made available and provide a better understanding of the other services interfaces in these locations.

The services layouts obtained from the tracing are shown in Figures 23, 24 and 25.

The tracing indicates that the other set of Ausgrid 132kV Transmission feeders to the west of Burrows Road pass under the existing channel. From the tracing it appears that transmission lines transition in depth from 1.2m to 2.5m under road level to 0.5m under the channel bed.

This indicates that there may be opportunity to widen the existing channel over the existing feeders without disturbing them.

Other services crossings are a combination of crossings below and above the existing open channel. Based on this information allowance has been made within the cost estimate for the appropriate protection or relocation.

A similar situation was found at Euston Road, with widening either requiring support of the services which pass over the existing channel or to avoid conflict with the services that pass below the existing channel.

These interfaces and proposed scope of work are discussed further in Section 6.2.2.

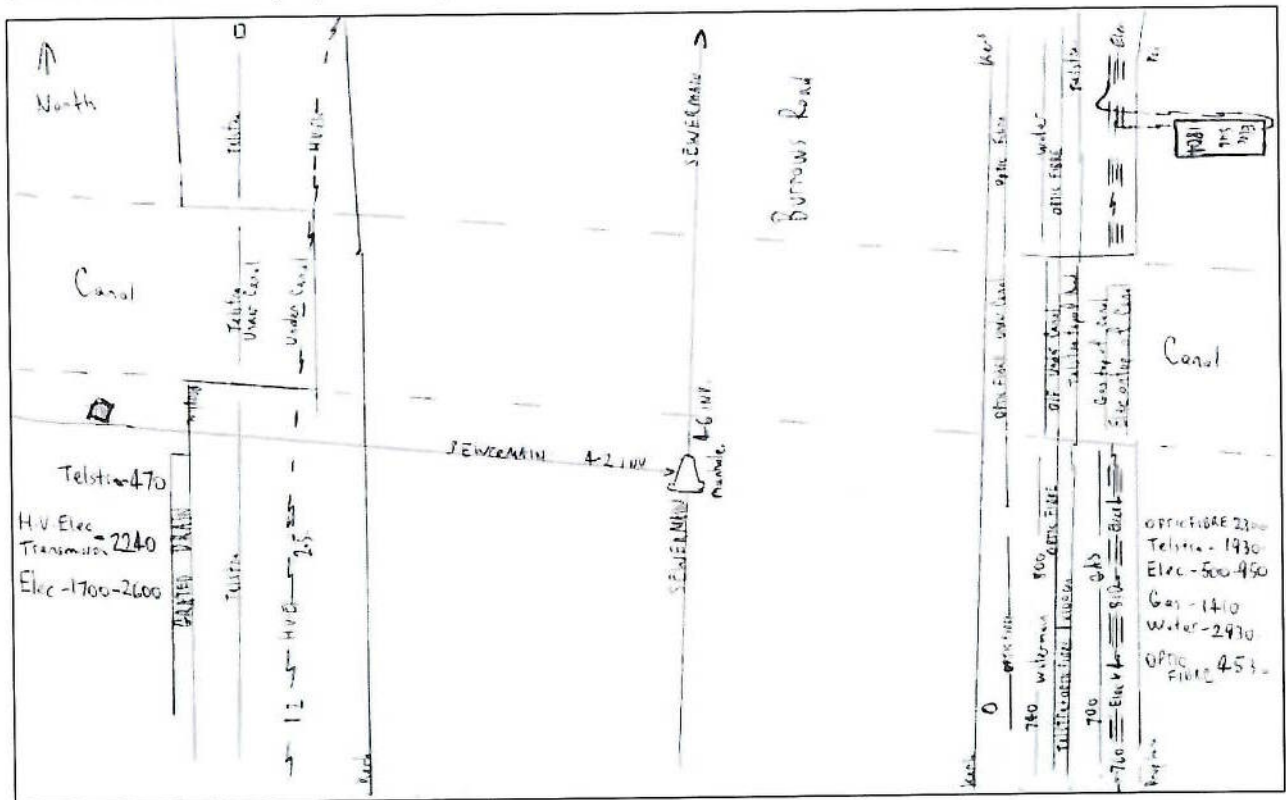


Figure 23 Plan layout of utilities crossing Burrows Road





## 6.1.2 Upstream Connection

The upstream connection of Option 6 into the existing trunk culverts and the Ashmore Precinct will require a complicated detail and substantial works as open cut within operational roads.

Due to the existing culverts being at approximately the same level as the proposed culvert, micro tunnelling would not be a viable solution in this location. As such open cut works is assumed through to Mitchell Road.

Due to space constraints and the alignment of proposed lots within the Ashmore Precinct, it is assumed that the additional capacity between the Ashmore Precinct boundary and Mitchell Road would be achieved by constructing a new larger culvert over the alignment of one of the existing culverts as shown in Figure 26.

Within Mitchell Road it is assumed that an in-situ reinforced concrete structure would be required to connect the amplified culvert with the existing trunk culvert and then to the micro-tunnelling launch pit part way along Mitchell Road.

A detailed hydraulic model of the existing and proposed trunk drainage lines would need to be developed to confirm the capacity is achieved and to understand the implications of the bifurcation structures on hydraulic performance.

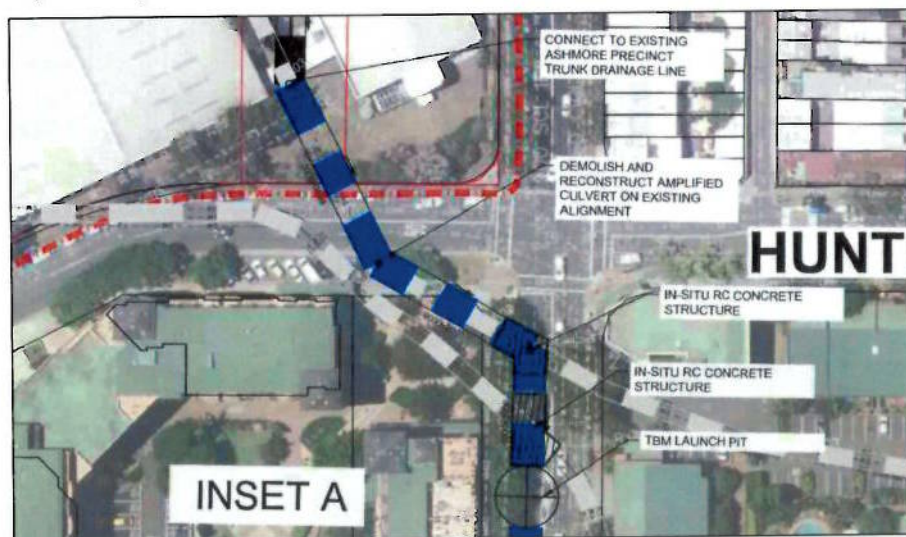


Figure 26 Upstream connection detail requires a detailed hydraulic assessment

## 6.1.3 Alignment through Sydney Park

It was agreed in the Workshop that AAJV would review the alignment of Option 6 to align parallel with Sydney Park Road. This was to minimise the impact on the existing Oval, to tunnel through a section where the depth of landfilling is potentially less and to reduce the overall length of micro tunnelling.

The developed alignment through Sydney Park is presented in Figure 27.



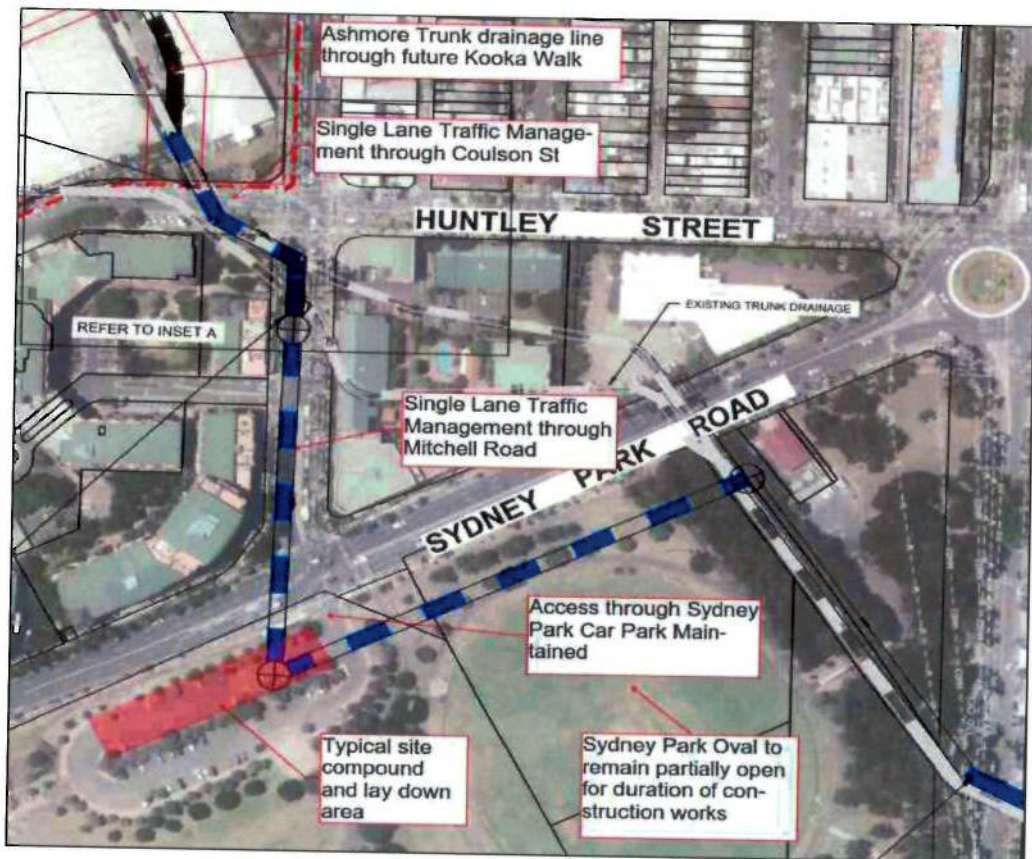


Figure 27 Final Option 6 revised alignment

#### 6.1.4 Downstream Open Channel Adjustments

The widening of the open channel downstream of Sydney Park would generally be achieved through widening of one side of the existing open channel, similar to the works that have previously been undertaken to the section through Sydney Park. This adjustment is presented in the sketches within Appendix D.

The section immediately upstream of Burrows Road is currently culverted, however as details of the existing culvert are not available, it has been assumed that the structural capacity of the existing culverts is not sufficient to allow widening immediately adjacent. As such, it has been assumed that the existing culverts will be removed and replaced with a new culvert arrangement to provide the required hydraulic capacity.

#### 6.2 Cost Estimate

The developed cost estimate for the Preferred Option is summarised in Table 13 below, with the detailed cost schedule including detailed assumptions attached in Appendix D.

Further details of the key assumptions applied to the cost estimate are discussed in the following Sections.

Table 13 Cost Estimate

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### 6.2.1 Utility Diversion/Enabling Works

Utility enabling/diversion works represent a key risk for construction of the preferred option. For the purposes of informing the cost estimate, dial before you dig information has been used to identify potential clashes other than at Burrows Road and Euston Road where more detailed utility tracing has been made available.

For the works within Coulson Street and Mitchell Road, AAJV have assumed that for works transverse to the utility crossings, temporary utility relocation works would be required in advance of open cut operations. In addition, local utility diversion works would be required to facilitate the construction of 12m diameter launch/receptor pits for the micro-tunnelling works.

It has been assumed that approximately 50m of temporary relocation of in-ground services would be required at Coulson Street (Gas, Comms, 11kV, 33kV Water & Sewer) and Mitchell Road (Water & Gas) to facilitate the open cut sections of work. In addition, 150m of permanent relocation of 11kV and Comms have been allowed for in Mitchell Road.



AAJV have adopted the information derived from the utility tracing works in Burrows Road and Euston Road to provide a likely estimate of works in this area.

The 132kV cables have been assumed to be protected during the works with full time Ausgrid supervision and safe construction methods. Adjustment to the galvanised service bridge to the east of Burrows Road has been priced including temporary propping and replacement.

The Southern Cross Optic Fibre cable has been assumed to be relocated to facilitate the works. In the absence of any information on the extents of these works a lump sum figure has been derived based on the works undertaken for previous projects.

It has been assumed that approximately 50m of temporary relocation of in-ground services would be required at Euston Road (11kV, Water, Gas & Fibre Optic) and Burrows Road (Gas, Water & Fibre Optic cables) to facilitate the open cut sections of work. Protection works to existing fibre optic and gas mains in Burrows Road have also been included.

## 6.2.2 Bridge Structure Modifications

There are three bridges which will require modification between Euston Road and the Alexandra Canal:

- At Euston Road;
- At Burrows Road; and
- Within the private property downstream of Burrows Road.

It has been assumed that all three bridges will be partially demolished and reconstructed with a reinforced concrete piled bridge with concrete deck to facilitate the widening of the existing channel in these areas.

The extent of works at Euston Road will need to be coordinated with WestConnex who are widening the road. The cost estimate currently allows for widening the structure for the existing road width only.

A more cost effective solution may be to install twin/triple box culverts to replace the existing bridge however the Ausgrid requirement for zero disruption to the 132kV transmission lines would be difficult to demonstrate at this stage of the project.

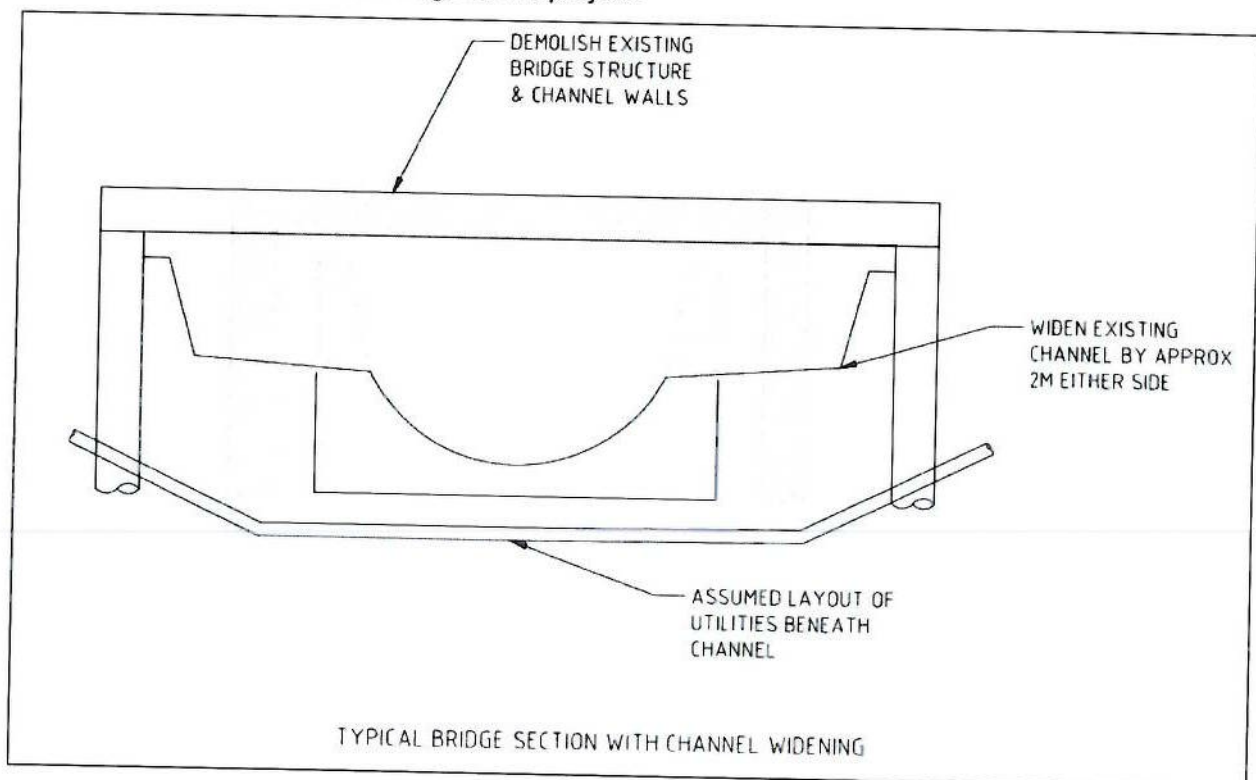


Figure 28 Sketch demonstrating assumed methodology for bridge reconstruction and channel widening works

## 6.2.3 Land and Easement Acquisition

Easement Acquisition rates have been excluded from the cost estimate at this stage as these values will be provided by Sydney Water's property team. The easement areas presented in Table 14 should be allowed for in this exercise.

**Table 14 Lot Numbers and Easement Acquisition Areas**

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## 7 Conclusion and Next Steps

Based on this study, Option 6 has been identified as the preferred alignment for the purpose of cost estimation and further development to inform a business case for future works.

It is noted that Option 1 was the highest scoring option within the MCA analysis, however due to the substantial uncertainty regarding the suitability of the hydraulic performance of this option it was agreed to not adopt this as the preferred option at this stage. However, further analysis should be undertaken as part of next steps to confirm whether this option can be feasible as if so it would result in substantial cost savings compared with Option 6.

The level of development of Option 6 within this study is preliminary and further work will be required during subsequent design development to confirm assumptions and refine the proposals. Specifically, the following areas need to be investigated in further detail for the next design phases to ensure a sustainable and cost effective design solution is achieved.

- Further utility tracing and pot holing works need to be undertaken to assess the extent of the major and minor utility diversion works required;
- Further liaison with Ausgrid is required to better understand the scope of works associated with the 132kV feeders in Mitchell Road, Euston Road and Burrows Road;
- Further consultation is required with other utility authorities to better define the scope of diversion and protection of their assets required;
- A detailed hydraulic assessment of the proposed infrastructure and in particular of the two bifurcation structures within Mitchell Road needs to be undertaken;
- Detailed geotechnical investigation and micro-tunnelling feasibility review is required before this construction methodology can be confirmed;
- Detailed traffic modelling to understand the impact on the works and the scope of traffic management required;
- WestConnex project interface review to assess impacts/opportunities for works – e.g. bridge widening works in Euston Road & 132kV Ausgrid relocation works in Euston Road. Furthermore, there is a need to ensure that the bridge widening works take account of the potential open channel widening if WestConnex proceeds in advance of the culvert works;
- Flood modelling is required to assess impacts on flooding throughout the Alexandra Canal catchment;
- Sediment mobilisation study will be required for the Alexandra Canal; and
- Contamination assessments and environmental impact assessments will also be required as part of the planning for the future trunk drain.

# APPENDIX A

## Options Sketches





**NOTES:**

- 1) A 6M WIDE X 2M DEEP CULVERT HAS BEEN MODELLED TO ALLOW FLEXIBILITY IN FINAL DESIGN. COSTING ESTIMATE BASED ON TRIPPLE 1800Ø PIPES - REFER TO MAIN BODY REPORT
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- 3) DRAWINGS TO BE READ IN CONJUNCTION WITH REPORT AAJV-0416-P01 "ASHMORE PRECINCT FLOOD MITIGATION - TRUNK DRAINAGE OPTIONS REVIEW"

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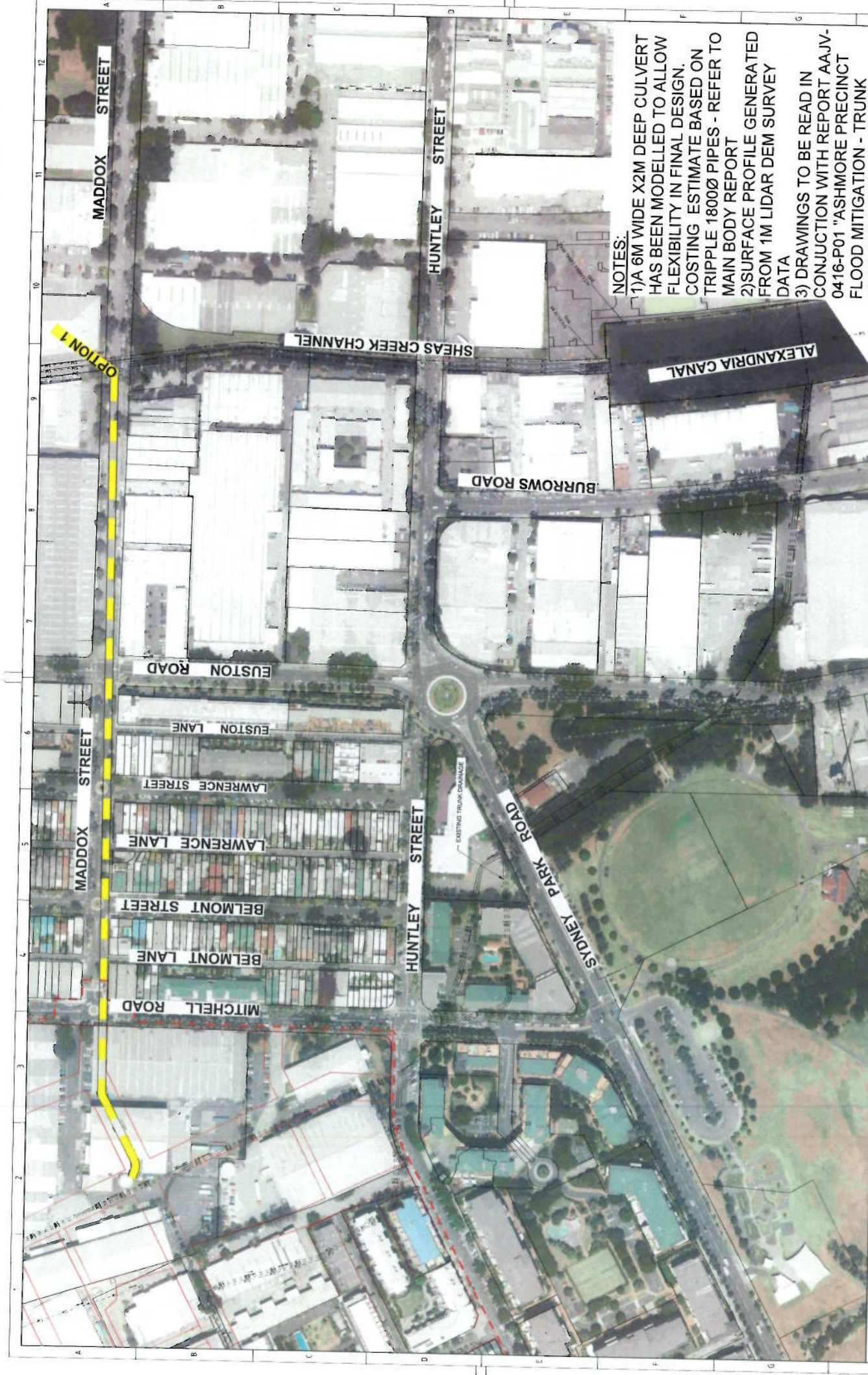
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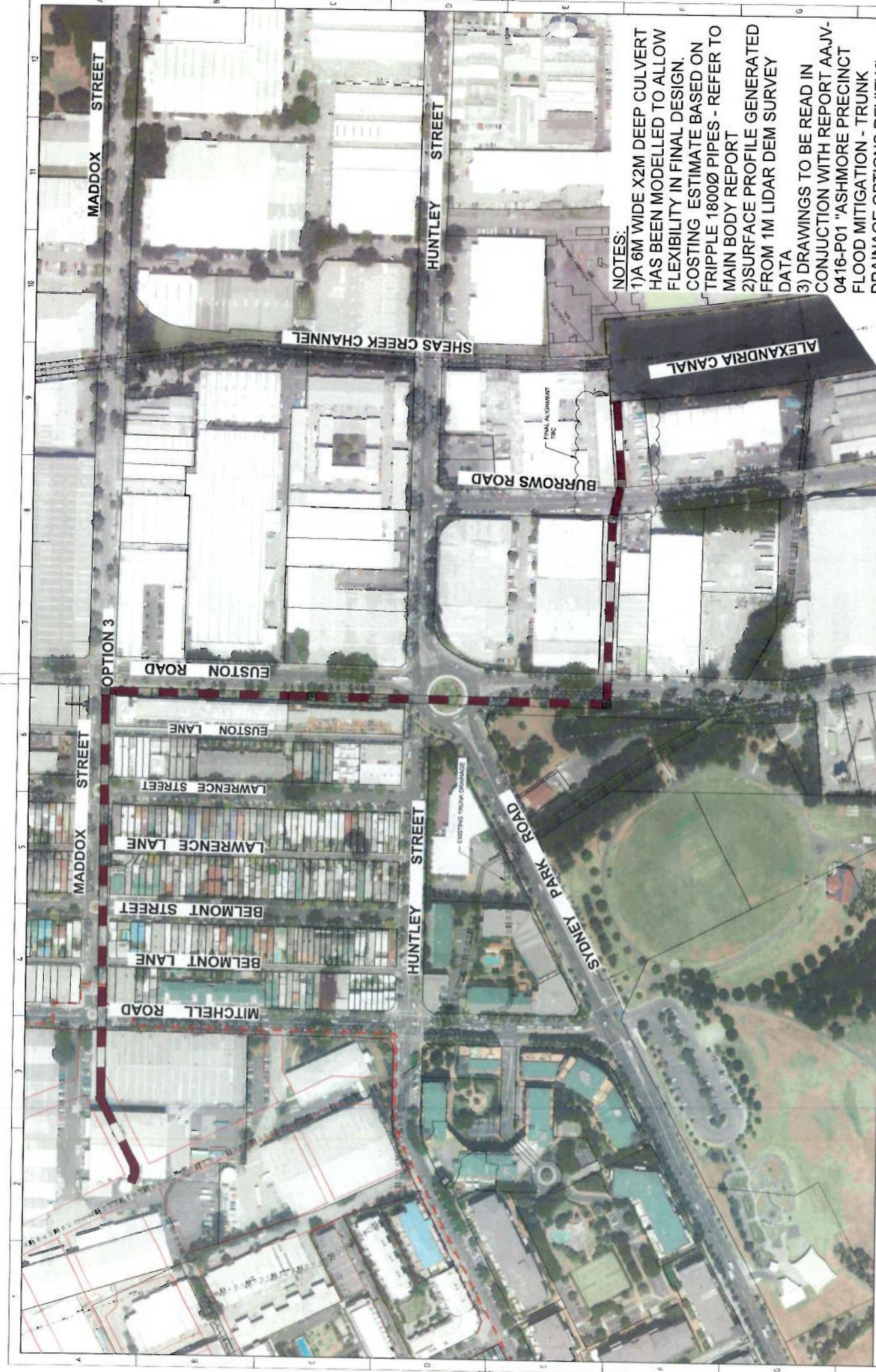
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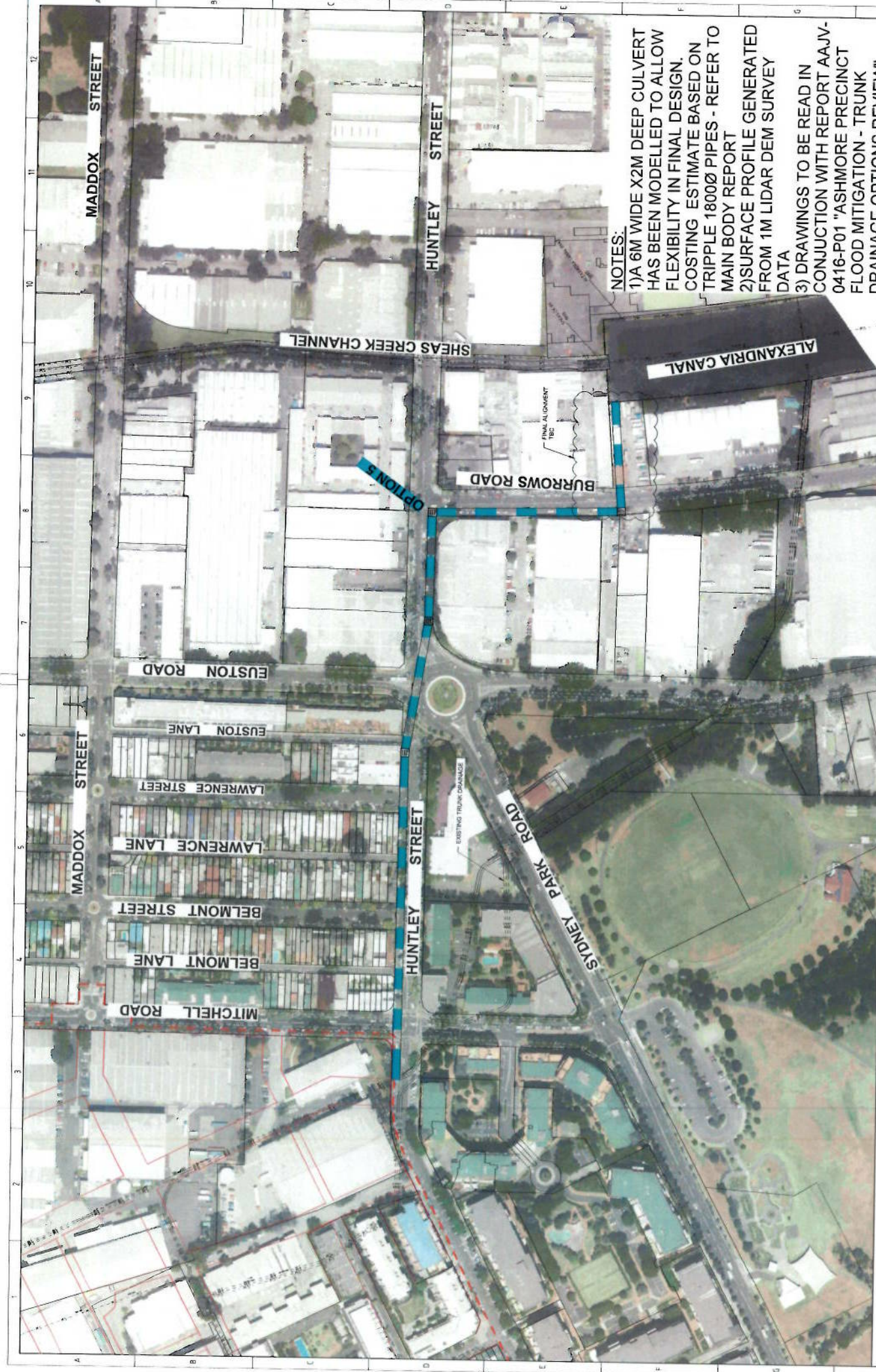
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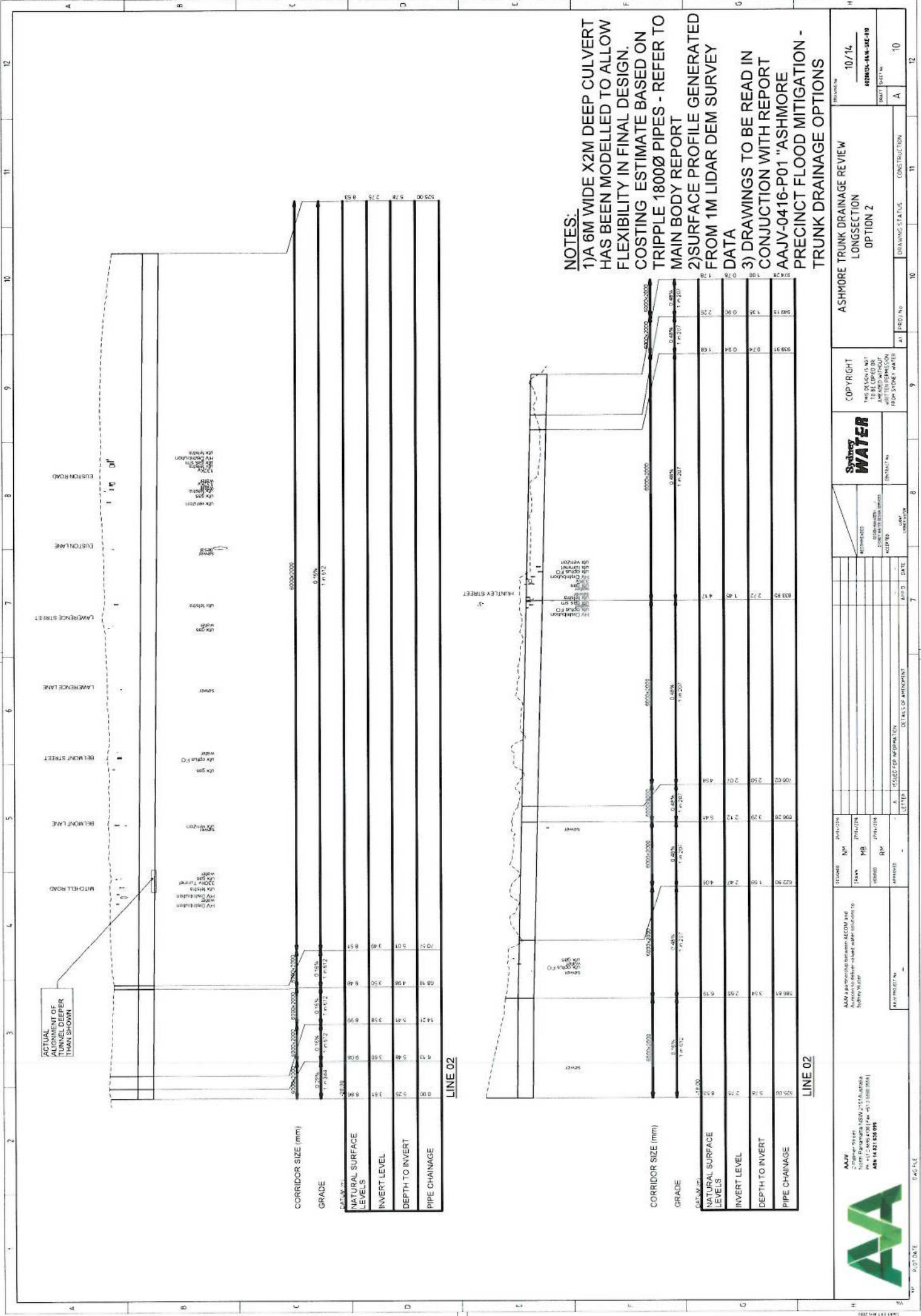
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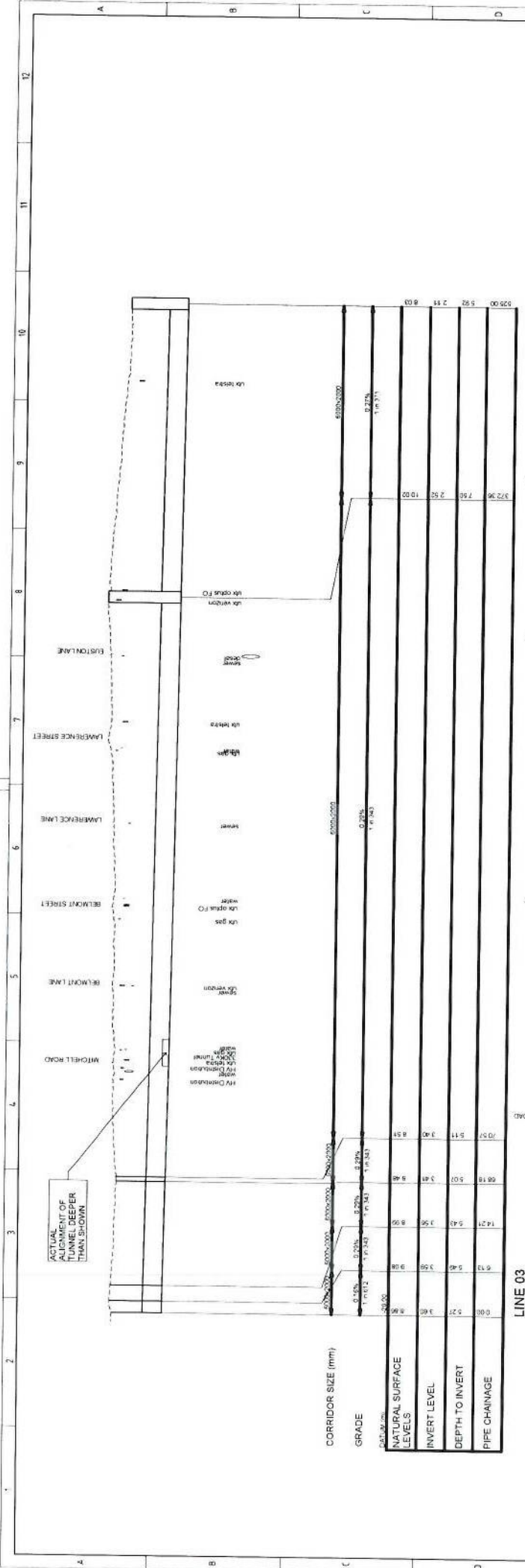
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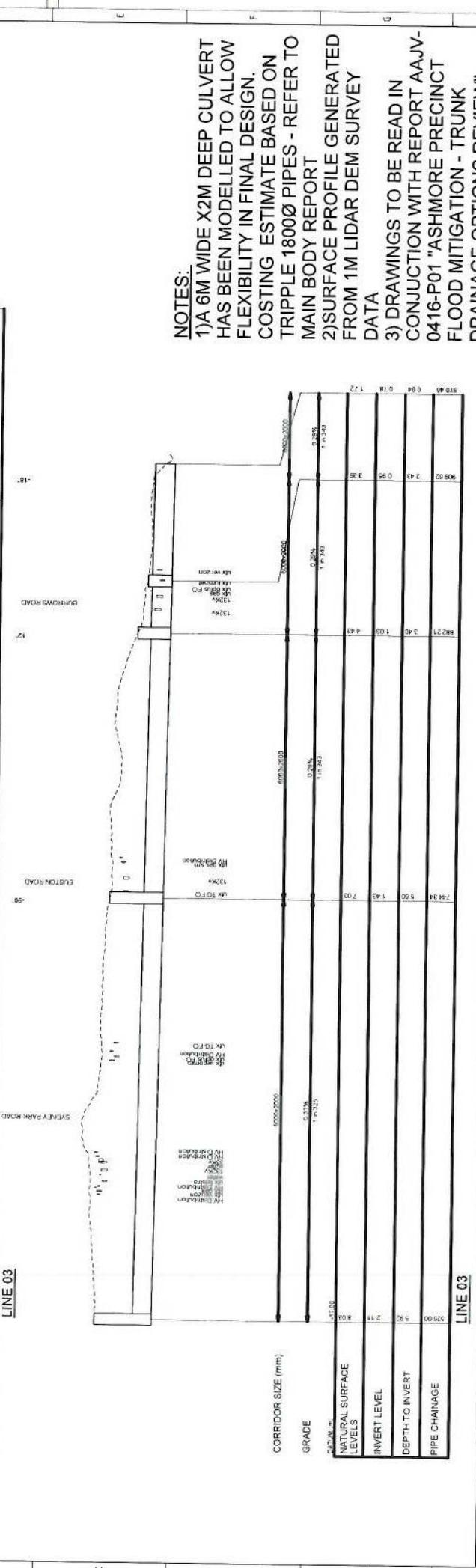
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**CORRIDOR SIZE (mm)**

GRADE	0+00	0+10	0+20	0+30	0+40	0+50	0+60	0+70	0+80	0+90	0+95	0+99
NATURAL SURFACE LEVELS	5.96	5.96	5.96	5.96	5.96	5.96	5.96	5.96	5.96	5.96	5.96	5.96
INVERT LEVEL	3.66	3.66	3.66	3.66	3.66	3.66	3.66	3.66	3.66	3.66	3.66	3.66
DEPTH TO INVERT	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30
PIPE CHAINAGE	0.00	14.21	28.42	42.63	56.84	71.05	85.26	99.47	113.68	127.89	142.10	156.31



**CORRIDOR SIZE (mm)**

GRADE	0+00	0+10	0+20	0+30	0+40	0+50	0+60	0+70	0+80	0+90	0+95	0+99
NATURAL SURFACE LEVELS	5.96	5.96	5.96	5.96	5.96	5.96	5.96	5.96	5.96	5.96	5.96	5.96
INVERT LEVEL	3.66	3.66	3.66	3.66	3.66	3.66	3.66	3.66	3.66	3.66	3.66	3.66
DEPTH TO INVERT	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30
PIPE CHAINAGE	0.00	14.21	28.42	42.63	56.84	71.05	85.26	99.47	113.68	127.89	142.10	156.31

**NOTES:**  
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 3) DRAWINGS TO BE READ IN CONJUNCTION WITH REPORT AAJV-0416-P01 "ASHMORE PRECINCT FLOOD MITIGATION - TRUNK DRAINAGE OPTIONS REVIEW"

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**AA**

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PROJECT No: 2016/014  
 SHEET No: 11/14  
 DRAWING STATUS: CONSTRUCTION

DATE: 11/14  
 DRAWING No: A  
 PROJECT No: 11

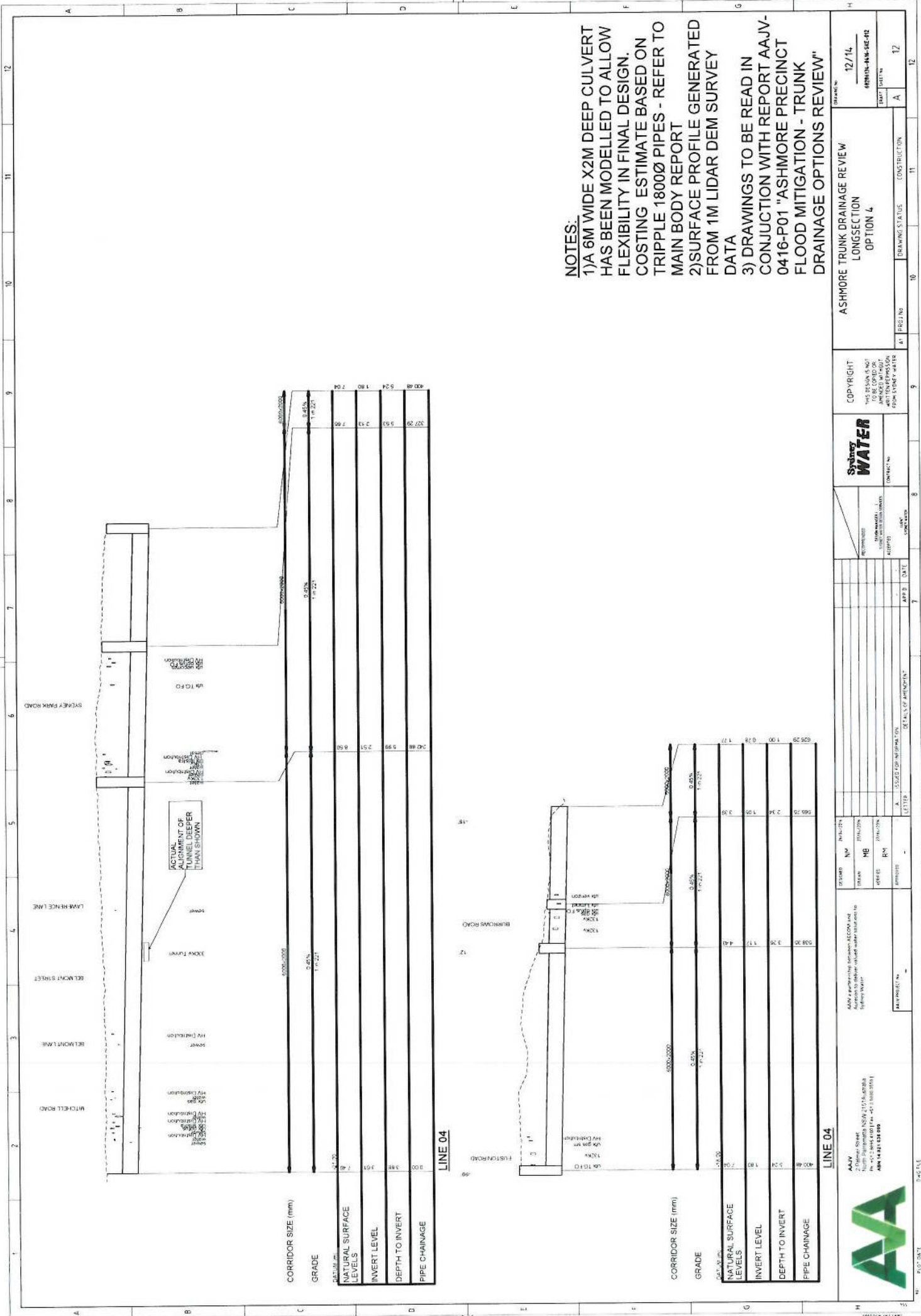
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 OPTION 3

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APPROVED FOR CONSTRUCTION

DATE: 11/14  
 DATE: 11/14  
 DATE: 11/14





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**LINE 04**

STATION	GRADE	NATURAL SURFACE LEVELS	INVERT LEVEL	DEPTH TO INVERT	PIPE CHAINAGE
800.00	7.48	5.93	3.88	3.88	0.00
805.00	7.48	5.93	3.88	3.88	10.00
810.00	7.48	5.93	3.88	3.88	20.00
815.00	7.48	5.93	3.88	3.88	30.00
820.00	7.48	5.93	3.88	3.88	40.00
825.00	7.48	5.93	3.88	3.88	50.00
830.00	7.48	5.93	3.88	3.88	60.00
835.00	7.48	5.93	3.88	3.88	70.00
840.00	7.48	5.93	3.88	3.88	80.00
845.00	7.48	5.93	3.88	3.88	90.00
850.00	7.48	5.93	3.88	3.88	100.00
855.00	7.48	5.93	3.88	3.88	110.00
860.00	7.48	5.93	3.88	3.88	120.00
865.00	7.48	5.93	3.88	3.88	130.00
870.00	7.48	5.93	3.88	3.88	140.00
875.00	7.48	5.93	3.88	3.88	150.00
880.00	7.48	5.93	3.88	3.88	160.00
885.00	7.48	5.93	3.88	3.88	170.00
890.00	7.48	5.93	3.88	3.88	180.00
895.00	7.48	5.93	3.88	3.88	190.00
900.00	7.48	5.93	3.88	3.88	200.00

**LINE 04**

STATION	GRADE	NATURAL SURFACE LEVELS	INVERT LEVEL	DEPTH TO INVERT	PIPE CHAINAGE
800.00	7.02	5.22	3.20	3.20	0.00
805.00	7.02	5.22	3.20	3.20	10.00
810.00	7.02	5.22	3.20	3.20	20.00
815.00	7.02	5.22	3.20	3.20	30.00
820.00	7.02	5.22	3.20	3.20	40.00
825.00	7.02	5.22	3.20	3.20	50.00
830.00	7.02	5.22	3.20	3.20	60.00
835.00	7.02	5.22	3.20	3.20	70.00
840.00	7.02	5.22	3.20	3.20	80.00
845.00	7.02	5.22	3.20	3.20	90.00
850.00	7.02	5.22	3.20	3.20	100.00
855.00	7.02	5.22	3.20	3.20	110.00
860.00	7.02	5.22	3.20	3.20	120.00
865.00	7.02	5.22	3.20	3.20	130.00
870.00	7.02	5.22	3.20	3.20	140.00
875.00	7.02	5.22	3.20	3.20	150.00
880.00	7.02	5.22	3.20	3.20	160.00
885.00	7.02	5.22	3.20	3.20	170.00
890.00	7.02	5.22	3.20	3.20	180.00
895.00	7.02	5.22	3.20	3.20	190.00
900.00	7.02	5.22	3.20	3.20	200.00

**AAJV**  
 21/12/2018  
 AAJV PROJECT NO. 14.024.000  
 AAJV PROJECT NO. 14.024.000

**AAJV** is a partnership between AECOM and Sydney Water  
 21/12/2018  
 AAJV PROJECT NO. 14.024.000  
 AAJV PROJECT NO. 14.024.000

**DESIGNED BY** MB  
**CHECKED BY** RM  
**APPROVED BY** MB

**REVISIONS**

NO.	DESCRIPTION	DATE
1	ISSUED FOR INFORMATION	
2	FOR CONSTRUCTION	

**DETAILS OF ATTACHMENT**

NO.	DESCRIPTION	DATE
1	ISSUED FOR INFORMATION	
2	FOR CONSTRUCTION	

**PROJECT INFORMATION**

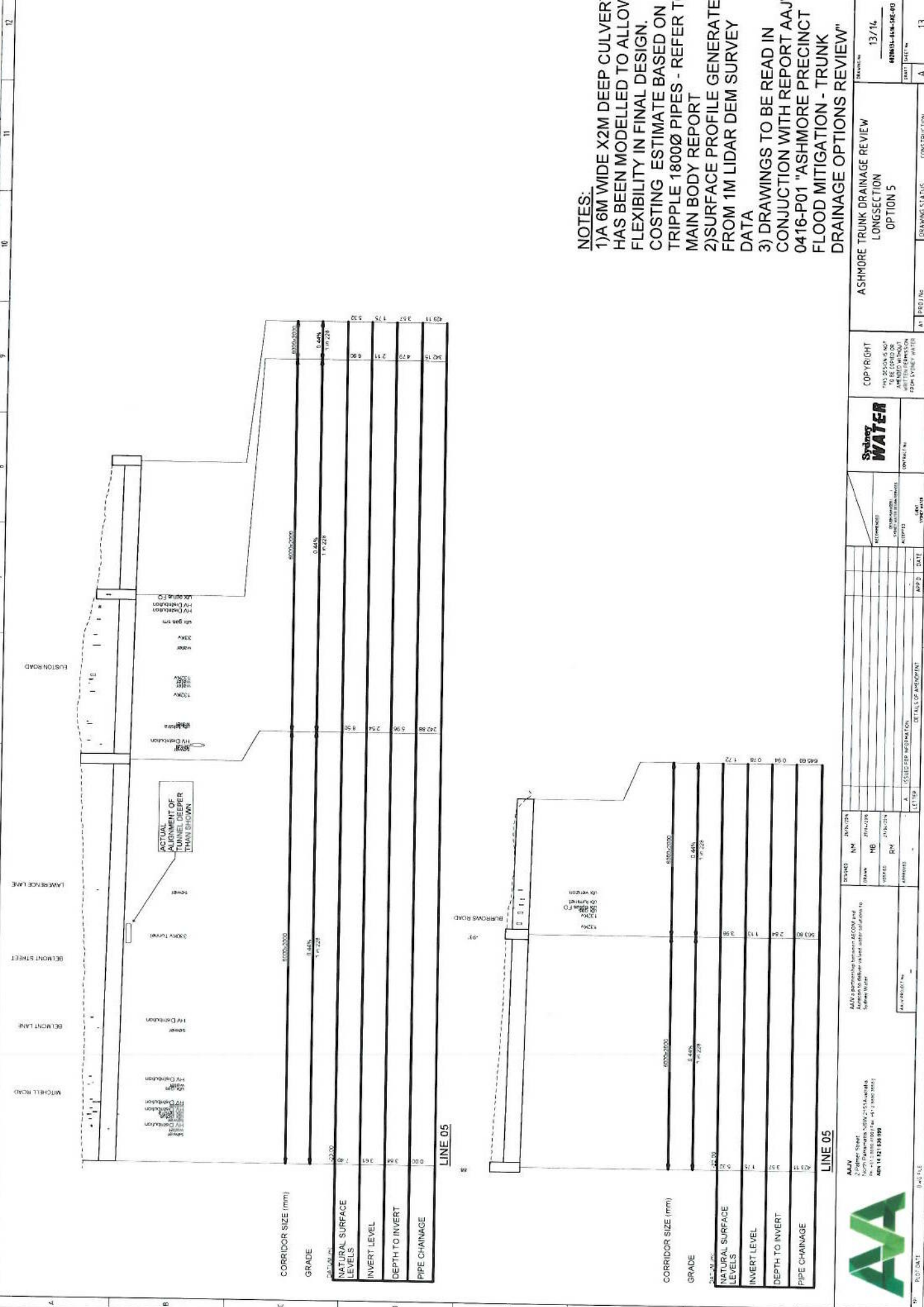
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14.024.000	A	CONSTRUCTION	

**DATE** 12/14  
**REVISIONS** 12/14  
**DATE** 12/14

**AAJV PROJECT NO. 14.024.000**







**LINE 05**

CORRIDOR SIZE (mm)	420
GRADE	0.44%
NATURAL SURFACE LEVELS	1.77228
INVERT LEVEL	0.90
DEPTH TO INVERT	2.11
PIPE CHAINAGE	420.11

**LINE 05**

CORRIDOR SIZE (mm)	420
GRADE	0.44%
NATURAL SURFACE LEVELS	1.77228
INVERT LEVEL	0.94
DEPTH TO INVERT	2.11
PIPE CHAINAGE	420.11

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 1500 Pyramont Street  
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 Auckland  
 PH 09 421 638 090

REVISED	BY	DATE	DESCRIPTION

DATE	
BY	
CHECKED	
APPROVED	

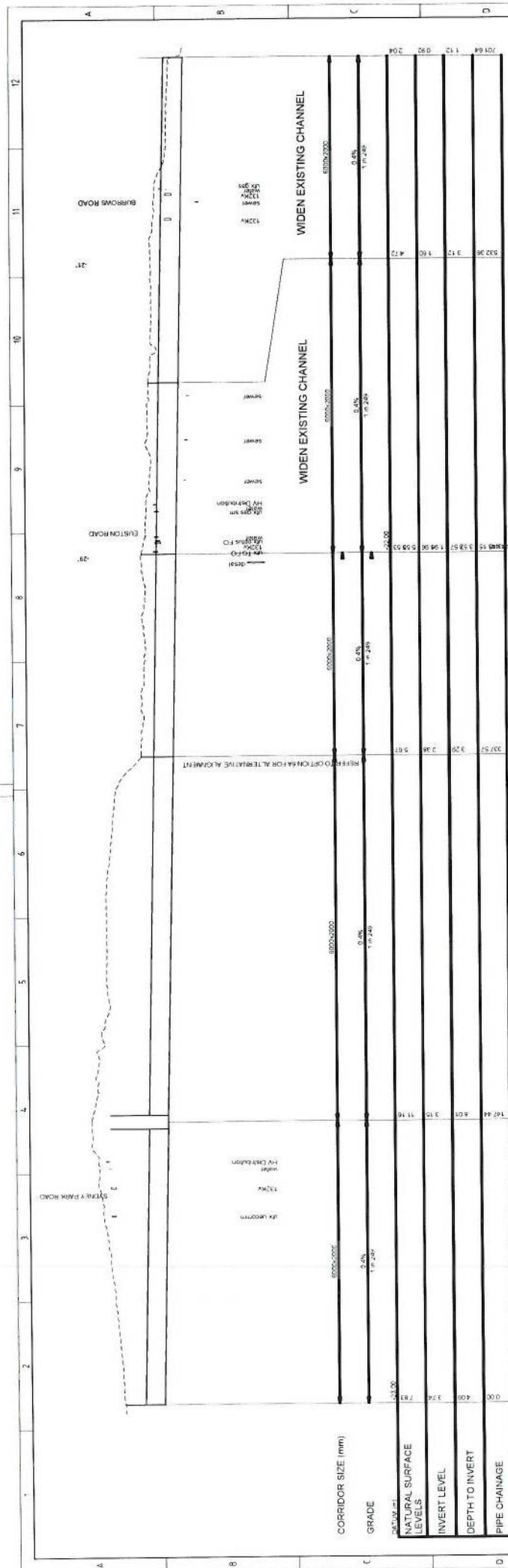
**Sydney WATER**

CONTRACT NO. 13/14

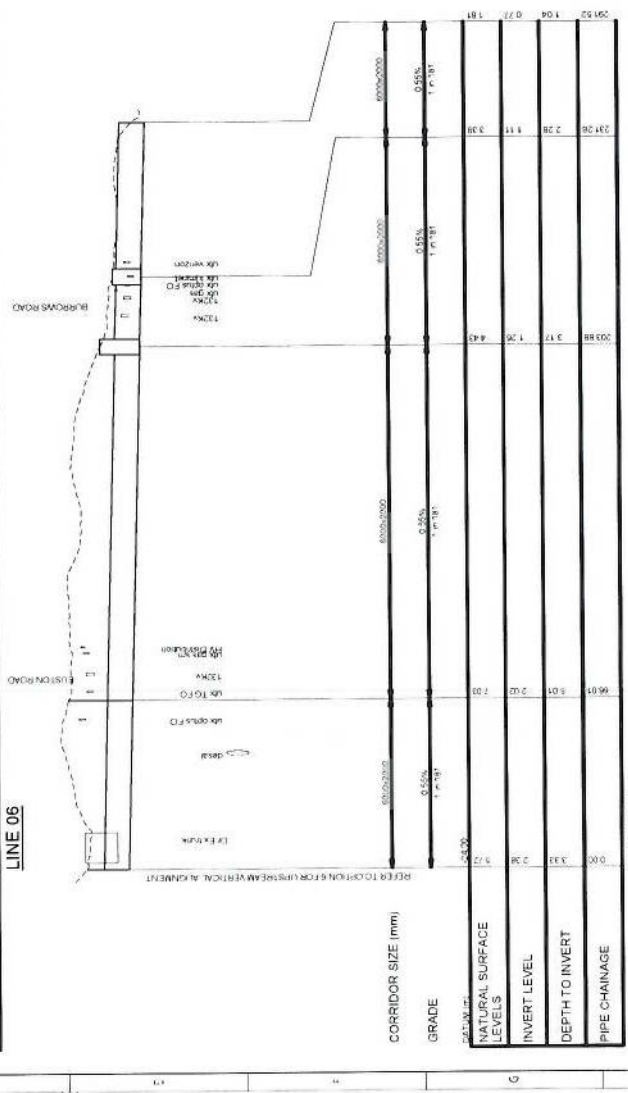
ASHMORE TRUNK DRAINAGE REVIEW  
 LONGSECTION  
 OPTION 5

DRAWING NO.	13/14
PROJECT CODE	0416-P01-04-SEC-10
PROJECT NO.	
PROJECT NAME	
PROJECT LOCATION	
PROJECT DATE	
PROJECT AUTHOR	
PROJECT CHECKER	
PROJECT APPROVER	
PROJECT REVIEWER	
PROJECT SIGNATURE	





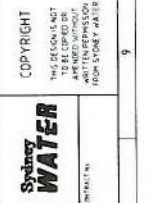
LINE 06



LINE 06A

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	AAJV 2 Eagle Street Ashmore NSW 2161 (544 4444) PO BOX 108 (02) 94 44 44 (1 800 004) FAX 02 94 44 44 44 WWW.AAJV.COM.AU	AAJV PROJECT NO AAJV-0416-P01	AAJV PROJECT NAME ASHMORE PRECINCT FLOOD MITIGATION - TRUNK DRAINAGE OPTIONS REVIEW	AAJV PROJECT LOCATION ASHMORE PRECINCT	AAJV PROJECT DATE 14/14
	AAJV PROJECT NUMBER AAJV-0416-P01	AAJV PROJECT DESCRIPTION ASHMORE TRUNK DRAINAGE REVIEW LONGSECTION OPTION 6 & 6A	AAJV PROJECT STATUS CONSTRUCTION	AAJV PROJECT SHEET NO A	AAJV PROJECT SHEET TOTAL 14
AAJV PROJECT NUMBER AAJV-0416-P01	AAJV PROJECT DESCRIPTION ASHMORE TRUNK DRAINAGE REVIEW LONGSECTION OPTION 6 & 6A	AAJV PROJECT STATUS CONSTRUCTION	AAJV PROJECT SHEET NO A	AAJV PROJECT SHEET TOTAL 14	AAJV PROJECT DATE 14/14



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REVISION	NO.	DATE	DESCRIPTION

DESIGNED BY	
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DATE	

SCALE	
UNIT	
PROJECTION	
COORDINATE SYSTEM	

AAJV PROJECT NUMBER  
 AAJV-0416-P01

AAJV PROJECT DESCRIPTION  
 ASHMORE TRUNK DRAINAGE REVIEW LONGSECTION OPTION 6 & 6A

AAJV PROJECT STATUS  
 CONSTRUCTION

AAJV PROJECT SHEET NO  
 A

AAJV PROJECT SHEET TOTAL  
 14



# **APPENDIX B**

## **Workshop Agenda & Minutes**



# ATTACHMENT B

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## Workshop Meeting Agenda 02/05/2016

Project	<b>Ashmore Precinct Flood Mitigation Trunk Drainage Options Review Workshop</b>	Project Number	<b>AAJV0416</b>
Attendees	Martin Boran (MB) Rob Mason (RM) – Workshop Chair William Hammond (WH) Nathan Mitchell (NM)		AAJV AAJV AAJV AAJV
	Peter Shields (PS) Shah Alam (SA) Dee Mardon (DM) Kim Woodbury (KW) Richard Clark (RC) Amarnath Reddy (AR) Nicholas Male-Perkins(NMP)	Company	City of Sydney (CoS) City of Sydney (CoS) City of Sydney (CoS) City of Sydney (CoS) City of Sydney (CoS) City of Sydney (CoS) City of Sydney (CoS)
	Fernando Ortega (FO) Mura Muralitharan (MM) Matthew Lewis (ML)		Sydney Water (SW) Sydney Water (SW) Sydney Water (SW)
Subject	<b>Ashmore Trunk Drainage Options Workshop</b>		

Item No	Agenda ITEM	Time	Notes
<b>1.0 Introduction and Welcome (9 to 9:15)</b>			
1.1	Introductions		Tea/Coffee orders will be taken
1.2	Safety Note		
<b>2.0 Purpose and agenda (9:15 to 9:30)</b>			
2.1	Outline of the workshop purpose and discussion of agenda		
2.2	Background to Project, aims & Objectives		
<b>3.0 Project Context and Debriefing on the Technical Briefing Paper (9:30 to 10:15)</b>			
3.1	Discussion on Hydrology and Hydraulics		
3.2	Discussion on Utilities		
3.3	Parallel Projects		
3.4	Construction Methods		
3.5	Discussion on Constraints by area		
<b>4.0 MCA Process (10:15 to 10:45)</b>			
4.1	Process Overview & Objectives		

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4.2	Criteria selection & weighting		
<b>15 Min Tea/Coffee Break</b>			
4.3	Review of results and moderation		
<b>5.0 Options Summary and Scoring (11:00 to 12:30)</b>			
5.1	Option 1		
5.2	Option 2		
5.3	Option 3		
5.4	Option 4		
5.5	Option 5		
5.6	Option 6		
5.7	Option 6a		
<b>30 Min Break for Lunch (Provided)</b>			
<b>6.0 Review of Results (1:00 to 2:00)</b>			
6.1	Discussion on Results		
6.2	Sensitivity analysis		
6.3	Conclusions and single option identification		
<b>7.0 Single Option Development (2:00 to 3:00)</b>			
7.1	Identify possible enhancements to the preferred option		
7.1	Methodology to further develop budget estimate		
7.2	Agree way forward		
<b>8.0 Close</b>			
8.1	AOB		
8.2	Close		



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## Options Workshop Meeting Minutes

<b>Assignment Number</b>			AAJV0416	<b>Meeting Date</b>	2/05/16
<b>Assignment Name</b>			Ashmore Trunk Drainage Options Review	<b>Recorded by</b>	Martin Boran
<b>Meeting / Subject</b>			<b>Options Workshop</b>	<b>Total pages</b>	9 Pages
<b>Present</b>	<b>Apology</b>	<b>Copy</b>	<b>Name</b>	<b>Organisation</b>	<b>Contact details</b>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Martin Boran (MB)	AAJV	<a href="mailto:Martin.boran@aecom.com">Martin.boran@aecom.com</a>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Rob Mason (RM)	AAJV	<a href="mailto:Rob.mason@aecom.com">Rob.mason@aecom.com</a>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Nathan Mitchell (NM)	AAJV	<a href="mailto:Nathan.mitchell@aecom.com">Nathan.mitchell@aecom.com</a>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	William Hammond (WH)	AAJV	<a href="mailto:William.hammond@aecom.com">William.hammond@aecom.com</a>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Peter Shields (PS)	CoS	<a href="mailto:PShields@cityofsydney.nsw.gov.au">PShields@cityofsydney.nsw.gov.au</a>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Mura Muralitharan (MM)	CoS	<a href="mailto:S.MURALITHARAN@sydneywater.com.au">S.MURALITHARAN@sydneywater.com.au</a>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Shah Alam (SA)	CoS	<a href="mailto:SAlam@cityofsydney.nsw.gov.au">SAlam@cityofsydney.nsw.gov.au</a>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Dee Mardon (DM)	CoS	<a href="mailto:DMardon@cityofsydney.nsw.gov.au">DMardon@cityofsydney.nsw.gov.au</a>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Matthew Lewis (ML)	SW	<a href="mailto:MATTHEW.LEWIS@sydneywater.com.au">MATTHEW.LEWIS@sydneywater.com.au</a>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Fernando Ortega (FO)	SW	<a href="mailto:ff.ORTEGA@sydneywater.com.au">ff.ORTEGA@sydneywater.com.au</a>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Kim Woodbury (KW)	CoS	<a href="mailto:kwoodbury@cityofsydney.nsw.gov.au">kwoodbury@cityofsydney.nsw.gov.au</a>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Richard Clark (RC)	CoS	<a href="mailto:RClark@cityofsydney.nsw.gov.au">RClark@cityofsydney.nsw.gov.au</a>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Amarnath Reddy(AR)	CoS	<a href="mailto:AReddy@cityofsydney.nsw.gov.au">AReddy@cityofsydney.nsw.gov.au</a>

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## Options Workshop Meeting Minutes

Item	Topic	Action By	Action Due
<b>1.0</b>	<b>Introduction and Welcome</b>		
1.1	Introductions by all parties	Note	N/A
<b>2.0</b>	<b>Purpose and agenda</b>		
2.1	<p>RM discussed the purpose of the workshop was to achieve a single option through the MCA process. This option would then be explored and refined in more detail to increase the level of cost certainty.</p> <p>Specifically from the project brief the purpose is described as:</p> <ul style="list-style-type: none"> <li>The purpose of the workshop is to the review trunk stormwater amplification options and identify one preferred option to be considered in a greater level of detail.</li> <li>The information derived from the works will be used to give confidence that the project can achieve the program benefits and outcomes within the program budget, as well as inform an initiation business case and Council report.</li> </ul> <p>Definition of purpose was agreed.</p>	Note	N/A
2.2	The overall context of the project was discussed and the purpose was identified as providing sufficient research and suitable cost estimate to facilitate a business case for implementation of a trunk drainage system.	Note	N/A
<b>3.0</b>	<b>Project Context and Debriefing on the Technical Briefing Paper</b>		
3.1.0	RM outlined the hydraulic & hydrologic context of the site, referencing the high level calculations undertaken by AAJV to date as shown in the technical briefing paper.	Note	N/A
3.1.1	It was noted that the works to date were not based on a flood model, thus it is likely that the results could be considered as conservative estimates to facilitate optioneering.	Note	N/A
3.1.2	<p>The existing drainage is estimated to have approximately 5 year ARI capacity within the existing culverts and open channel downstream of Euston Road.</p> <p>The open channel through Sydney Park has been previously widened and raised and is estimated to have approximately 50 year ARI capacity.</p>	Note	N/A
3.1.3	RM noted that the triple 1800Ø pipe bore or 4.4x1.8m culverts would be required to facilitate the estimated 21.5m <sup>3</sup> /s of flow. Noted that the high level cost estimates were based on triple 1800Ø pipes.	Note	N/A



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## Options Workshop Meeting Minutes

3.1.4	<p>Local hydraulic modelling in HEC RAS indicates that the widening of the Sheas Creek open channel as part of the Green Square Trunk Drain works increases the capacity from approximately 70 m<sup>3</sup>/s to 100 m<sup>3</sup>/s to 100 m<sup>3</sup>/s to 160 m<sup>3</sup>/s (depending on the assumed freeboard).</p> <p>ML noted that the performance of the Green Square Trunk Drain (particularly around Joynton Avenue) is very sensitive to tailwater levels and that it is unlikely that additional flow could be discharged to the Sheas Creek Open Channel without adverse impact on the hydraulic performance. It is likely that changes to the flood level in Alexandria Canal will also be reflected in Joynton Ave</p> <p>It was agreed that further detailed flood modelling is required as part of future stages of work to confirm if additional discharge can be added to the Sheas Creek open channel without adverse offsite impact.</p>	Note	N/A
3.2.0	<p>MB discussed the various key constraints from a utility perspective – HV Elec, Gas, Water, Sewer &amp; Fibre Optic</p>	Note	N/A
3.2.1	<p>It was noted that the utilities shown in the drainage long sections were located at indicative depths based on average DBYD values or at typical depths.</p>	Note	N/A
3.2.2	<p>Critical electrical infrastructure includes:</p> <ul style="list-style-type: none"> <li>• 330kV Transgrid tunnel (greater than 10m depth)</li> <li>• 132kV Ausgrid infrastructure in Burrows Road, Euston Road, Sydney Park Road and Mitchell Road</li> <li>• 11kV Ausgrid infrastructure in Sydney Park Road</li> </ul> <p>MB noted that there was a cable gantry to the east of Burrows Road at the intersection of the existing channel which appeared to facilitate one set of 132kV cables. The other set of 132kV cables within Burrows Road are believed to be at lower depths and possibly under the channel, however this has not been confirmed with Ausgrid.</p>	AAJV to chase further details of 132kV crossings in Burrows Road	13/05/2016
3.2.3	<p>DM noted that CoS are planning to undertake pot holing works in the next 2 weeks. DM to forward the result of the pot holing works on Burrows Road.</p> <p>Potholing to focus on the existing open channel crossing location. Tracing to be provided in advance of pot holing to allow design to be developed.</p> <p>AAJV to review the results and comment on suitability in final report.</p> <p><i>Post meeting note: Potholing information not available</i></p>	DM	Tracing by 11/05/2016 Pot holing by 17/05/2016

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## Options Workshop Meeting Minutes

	<i>until 26/5/16. Tracing information received on the 10/05/2016 from CoS.</i>		
3.2.4	Critical optical fibres include the Southern Cross cable in Huntley Street and Burrows Road and local fibres in Maddox Street, Sydney Park Road and Mitchell Road.	Note	N/A
3.2.5	Critical sewer infrastructure includes rising mains in Huntley Street, and gravity sewers parallel to the Sheas Creek open channel, in Huntley Street and crossing Maddox Street at several points.	Note	N/A
3.2.6	Critical water infrastructure includes a 900 diameter main in Mitchell Road and Huntley Street and a 500 diameter main in Euston Road.	Note	N/A
3.2.7	A new gas main is proposed within the Ashmore precinct. This should be considered when defining the interfaces with the existing infrastructure and locations for launching pits.	Note	N/A
3.3	<p>The interface with Westconnex and Ashmore precinct were discussed to understand the opportunities and constraints with both projects.</p> <p>It is likely that Westconnex works will not be able to provide much benefit to this scheme in terms of coordination of works. The general consensus was to ignore Westconnex as an opportunity and consider as a potential constraint.</p> <p>The timing in Ashmore (Goodman site) &amp; upstream trunk drainage is likely to cause a significant program risk to this project with a high degree of reliance on the Goodman site being developed in time.</p>	Note	N/A
3.4.0	<p>MB outlined the proposed construction method noting the high risk with Micro Tunnelling in water charged, sandy silt material. It was noted that the Green Square Trunk Drain project has experienced some issues also, however the general consensus was that Micro Tunneling would be the preferred option due to the significant open cut depths.</p> <p>The experience on Green Square has been that even allowing for the difficult ground conditions, Micro Tunnelling has generally been more cost efficient than open cut methods.</p>	Note	N/A
3.4.1	<p>MB relayed that the industry guidance received suggested that a maximum interval of 100m be used between launch and receptor pits to mitigate settlement.</p> <p>MM noted that larger spacing have been used on Green Square.</p>	Note	N/A
3.4.2	It was noted that upfront utility relocations would be required to facilitate the 12m diameter launch pits.	Note	N/A



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## Options Workshop Meeting Minutes

3.4.3	It was noted that open cut construction methods would be more feasible where cover is less than 3m.	Note	N/A
3.5	It was noted that there are key areas common to all options which have constraints primarily the options which discharge to Alexandria Canal via Burrows Road.	Note	N/A
<b>4.0</b>	<b>MCA Process</b>		
4.1.0	RM explained the MCA process and analysis criteria were reviewed collectively as a group.	Note	N/A
4.2.0	A list of 10 criteria (as per technical briefing paper) was presented on the screen which was agreed to be reduced to 5 number as follows: <ul style="list-style-type: none"> <li>• Constructability</li> <li>• Public disturbance</li> <li>• High Level Cost Estimate</li> <li>• 3<sup>rd</sup> Party utility/approvals/risk</li> <li>• Ground conditions</li> </ul>	Note	N/A
4.2.1	The workshop split into groups of 2-3 people and each group allocated an appropriate percentage weighting for the 5 criteria. The results were averaged and provided on screen for discussion.	Note	N/A
4.3.0	Minor adjustments were made but in general all parties were happy to proceed with the weighting as follows: <ul style="list-style-type: none"> <li>• Constructability – 20%</li> <li>• Public disturbance -10%</li> <li>• High Level Cost Estimate-45%</li> <li>• 3<sup>rd</sup> Party utility/approvals/risk-15%</li> <li>• Ground conditions-10%</li> </ul>	Note	N/A
<b>5.0</b>	<b>Options Summary and Scoring</b>		
5.1	Each of the options from 1-6 were discussed in detail by all parties. It was noted that Option 6a was not feasible due to a clash with the existing storm water channel in Sydney Park.	Note	N/A
5.2	Key points discussed for each option follow.		
5.2.1	<b>Option 1</b> <ul style="list-style-type: none"> <li>• It was noted that the start point is currently an operating site which may introduce complexities and risk for timing regarding building clearance</li> <li>• The layout currently includes works within the Ashmore Precinct which has been allowed for as part of the Precinct drainage works. A contribution from the developer would be sought for the works within private property.</li> <li>• Expected that the construction along Maddox Street would require a full road closure</li> <li>• The alignment is typically 6m deep meaning that open trenching is likely to be cost prohibitive and Micro Tunnelling is assumed for the full length</li> </ul>	Note	N/A

# ATTACHMENT B



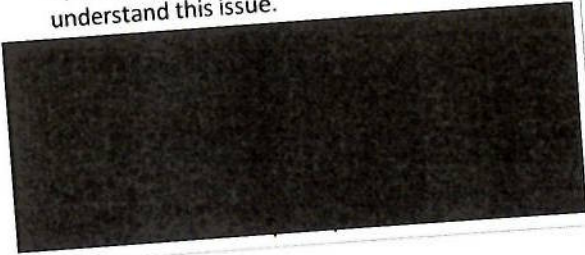

## Options Workshop Meeting Minutes

	<ul style="list-style-type: none"> <li>• Costs within the Ashmore Precinct in terms of potential savings for northern tie-ins and potential early works if in advance of lot development need to be considered</li> <li>• Further investigation would be necessary to determine the hydraulic viability of interfacing directly with the Shea's Creek channel - notably the effect on the GSTD upstream</li> <li>• Noted that an additional cost would be required for localised works in the vicinity of Sheas creek and Moddox St bridge</li> </ul>		
5.2.2	<p><b>Option 2</b></p> <ul style="list-style-type: none"> <li>• Construction methodology and risk are key considerations based on the Green Square experience (poor ground conditions and limited details of existing buildings available)</li> </ul>  <ul style="list-style-type: none"> <li>• Assumed that the current Huntley Street bridge works would not facilitate further widening without additional services adjustments and structural works</li> </ul>	Note	N/A
5.2.3	<p><b>Option 3</b></p> <ul style="list-style-type: none"> <li>• It was agreed to assume that Westconnex widening and associated services relocations will have occurred prior to the trunk drain works on Euston Road</li> <li>• Noted that the Westconnex works on Euston Road transition to an RMS project at some point north of Sydney Park Road</li> <li>• Alternative to run down Lawrence Street if Westconnex interface on Euston Road is prohibitive</li> <li>• Constructability of the bend from Maddox Street into Euston Road is likely to require substantial disruption to this intersection</li> <li>• Burrows Road services conflicts are a significant constraint as proposed culvert has limited cover by this point – pot holing is required to fully understand this issue.</li> <li>• Lot acquisition requirements were reviewed and agreed as follows;             <ul style="list-style-type: none"> <li>○ Lot between Euston Road and Burrows Road – full acquisition</li> <li>○ Public Works lot between Burrows Road and the canal – easement (as no building demolition required)</li> </ul> </li> </ul>	Note	N/A






## Options Workshop Meeting Minutes

		Note	N/A
5.2.4	<p><b>Option 4</b></p> <ul style="list-style-type: none"> <li>Huntley Street contains a very high density of services which may make locating caissons for Micro tunnelling difficult without substantial relocations</li> <li>There is very little traffic on Huntley Street which makes this option attractive from this perspective</li> <li>South of Huntley Street, the alignment could be moved out of Euston Road and into Sydney Park to avoid conflicts with Westconnex</li> <li>Burrows Road services conflicts are a significant constraint as proposed culvert has limited cover by this point – pot holing is required to fully understand this issue.</li> </ul> 		
5.2.5	<p><b>Option 5</b></p> <ul style="list-style-type: none"> <li>Issues are similar to Option 4</li> <li>Burrows Road services conflicts are a significant constraint as proposed culvert has limited cover by this point – pot holing is required to fully understand this issue. This option potential most challenging as running parallel to services at shallow depth</li> </ul> 	Note	N/A
5.2.6	<p><b>Option 6</b></p> <ul style="list-style-type: none"> <li>Scope of work for Option 6 needs to extend back into the Ashmore Precinct (northern side of Coulson Street)</li> <li>The potential to only upgrade the downstream open channel section to remove this capacity constraint was discussed, however it is expected to not be hydraulically controlling the capacity of the existing culverts as the depth only increases slightly when overbank spill occurs</li> <li>Alignment through Sydney Park should be maintained as close to Sydney Park Road as possible to minimise length through former landfill</li> <li>Constructability of launch pit and mixing chamber for existing culverts in Mitchell Road to be considered as part of design development</li> <li>Review of constructability downstream of Euston</li> </ul>	Note	N/A

# ATTACHMENT B



## Options Workshop Meeting Minutes

	<p>Road indicates that this could be achieved without significant disruption to the existing businesses.</p> <ul style="list-style-type: none"> <li>It was agreed that the alignment would be unlikely to affect the existing water re-cycling structure at the channel east of Sydney Park.</li> </ul> 		
5.3	<p>The workshop split into groups of 2-3 people and each group estimated a score between 1 to 5 for each of the criteria against options 1-6. The results were averaged and provided on screen for discussion.</p>	Note	N/A
5.4	<p>The Land acquisition and Easement acquisition costs were updated based on a discussion of the likely requirements for each option (as noted above).</p> <p>It was identified that the 132kV and land costs were most influential to the cost and as such were itemised separately to review the most likely cost estimate.</p> <p>The results were ranked on a 1-5 basis.</p>	Note	N/A
<b>6.0</b>	<b>Review of Results</b>		
6.1	<p>The Results were displayed on screen which ranked Option 6 as the most favourable option behind Option 1.</p> <p>It was noted that Option 1 would only be feasible if there were no adverse impacts to the performance of the Sheas Creek Channel which is considered unlikely at this stage.</p> <p>In the absence of understanding of the feasibility of Option 1, Option 6 was agreed to be taken forward.</p>	Note	N/A
6.2	<p>ML noted that need to be very clear in the report about why Option 1 was considered and is later ignored – being that it does represent a good option, however has a potential critical flaw in advance of additional hydraulic investigations. As such, with this uncertainty, it is not reasonable to adopt this as the basis of determining a likely project cost.</p> <p>However, this option should be included as part of future more detailed analysis and as such is retained within the assessment.</p>	Note	N/A
6.2	<p>PS had concerns over the order of preference for the 3<sup>rd</sup> (Option 3) and 4<sup>th</sup> (Option 4) options in the event of Options 1 &amp; 2 not being achievable.</p> <p><i>Post meeting note: A sensitivity analysis on the influence of cost has shown that Option 4 would rank higher than that of Option 3 – refer to report</i></p> <p>The end result was consistent with Option 6 showing to be the most feasible option.</p>	Note	N/A



# ATTACHMENT B



## Options Workshop Meeting Minutes

6.3	RM noted that the spread of scoring against the cost criteria was potentially resulting in greater variance in the assessment than there is variance in cost between the options. A sensitivity analysis was undertaken to review the impacts of a more closely applied scoring on cost (2 to 4 rather than 1 to 5) which did not alter the preferred option	Note	N/A
<b>7.0</b>	<b>Single Option Development</b>		
7.1	<p>It was discussed that the following key elements need to be considered as part of the Single Option development:</p> <ol style="list-style-type: none"> <li>1) Greater level of understanding required around the 132kV cables and their location with reference to the existing channel in Burrows Road</li> <li>2) Further liaison with Ausgrid required to understand the influence with the 132kV cable in Mitchell Road and the works associated with Westconnex</li> <li>3) CoS to provide the result of the tracing and pot holing works in Burrows Road as soon as this becomes available.</li> </ol> <p><i>Post meeting note: Potholing information not available until 26/5/16 – thus not included in the final report. Tracing information received on the 10/05/2016 from CoS.</i></p> <ol style="list-style-type: none"> <li>4) AAJV to review the current alignment for Option 6 with the view to remaining parallel to Sydney Park Road if possible</li> <li>5) Potential inclusion of a GPT (subject to further discussion)</li> <li>6) Contamination implications to be considered</li> <li>7) Confirmation that easements for downstream channel widening is appropriate</li> <li>8) Alignment to be extended at the northern end towards Coulson Street and layout of works in Mitchell Road to be considered in more detail</li> <li>9) Mark-up percentages to be provided by AAJV in advance for agreement</li> <li>10) AAJV to provide a detailed budget estimate to facilitate the business case</li> </ol>	<p>AAJV</p> <p>AAJV</p> <p>CoS</p> <p>AAJV</p> <p>AAJV/SW</p> <p>Note SW</p> <p>AAJV</p> <p>AAJV</p> <p>AAJV</p>	<p>Before 13/05/16</p> <p>Before 13/05/16</p> <p>Before 13/05/16</p> <p>Before 13/05/16</p> <p>Before 13/05/16</p> <p>Before 13/05/16</p> <p>Before 17/05/16</p> <p>Before 20/05/16</p>
7.2	It was agreed that AAJV would include the information from the CoS potholing in Burrows Road if it becomes available in time. This information will inform the cost estimate for the scheme	Note	N/A
<b>8.0</b>	<b>Close</b>		
	No other business		



## Multi-Criteria Scores

Criteria	OPTION 1						OPTION 2						OPTION 3						OPTION 4						OPTION 5						OPTION 6						OPTION 6a																	
	OPTION 1						OPTION 2						OPTION 3						OPTION 4						OPTION 5						OPTION 6						OPTION 6a																	
<b>C1</b> Constructability (5 = easy to construct, 1 = difficult to construct)	4						2						2						1						1						3						3						X											
<b>C2</b> Public disturbance (5 = minimum disturbance, 1 = maximum disturbance)	3						3						3						2						2						3						3						X											
<b>C3</b> High Level Cost Estimate (pre-determined)																																																	X					
<b>C4</b> 3rd Party utility impact/approvals/risk (5 = least impact, 1 = most impact)	4						1						1						1						1						3						3						X											
<b>C5</b> Ground conditions (5 = most favourable conditions, 1 = least favourable conditions)	4						3						2						1						1						3						3						X											





## Multi-Criteria Scores

f x x x x x

Criteria	OPTION 1	OPTION 2	OPTION 3	OPTION 4	OPTION 5	OPTION 6	OPTION 6a
<b>C1</b> Constructability (5 = easy to construct, 1 = difficult to construct)	4	1	2	2	1	3	X
<b>C2</b> Public disturbance (5 = minimum disturbance, 1 = maximum disturbance)	<del>3</del>	1	1	2	1	3	X
<b>C3</b> High Level Cost Estimate (pre-determined)	<del>3</del>						X
<b>C4</b> 3rd Party utility impact/approvals/risk (5 = least impact, 1 = most impact)	4	2	1	2	1	3	X
<b>C5</b> Ground conditions (5 = most favourable conditions, 1 = least favourable conditions)	4	1	3	3	3	1	X



# ATTACHMENT B

## Multi-Criteria Scores

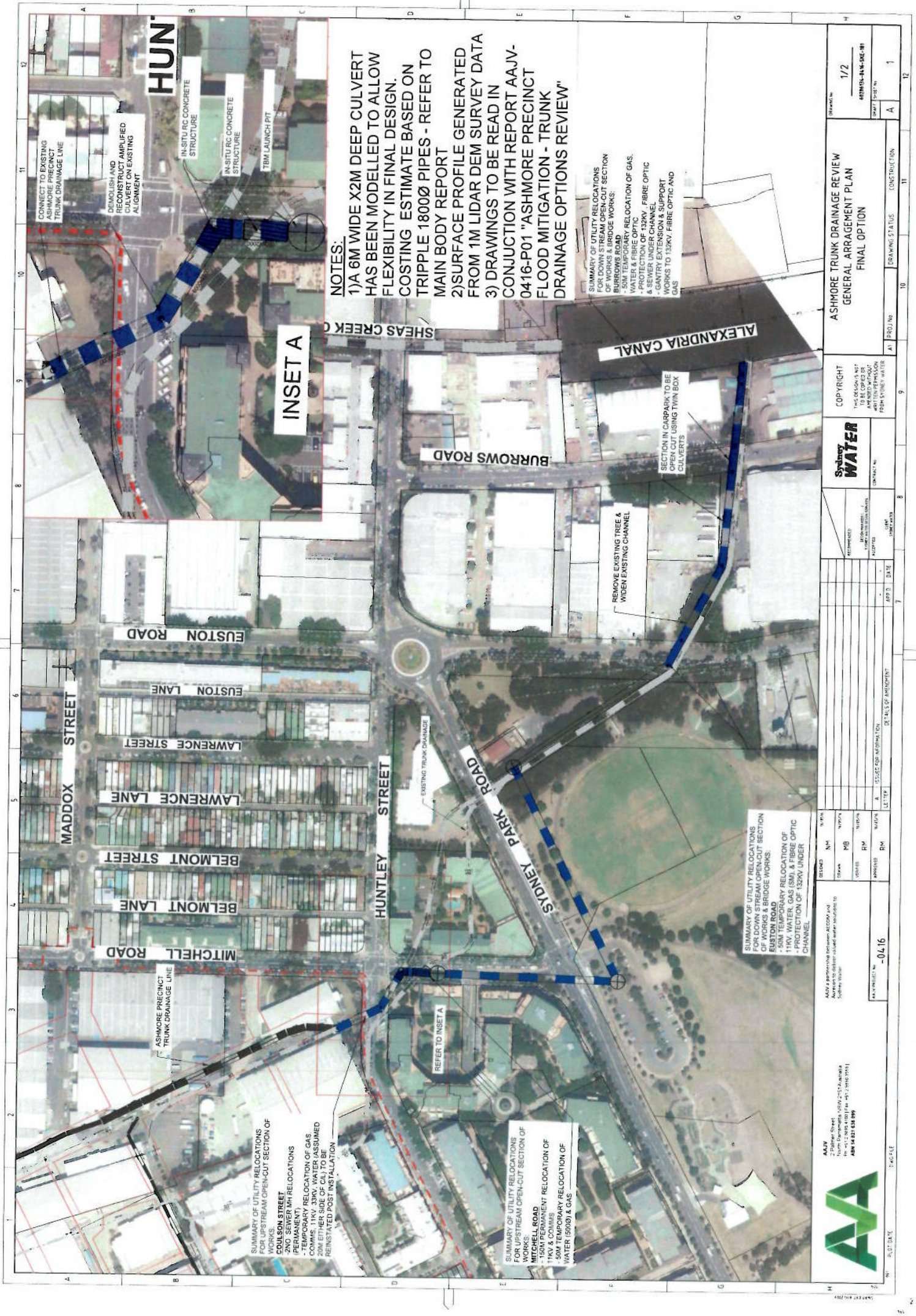
Criteria	OPTION 1	OPTION 2	OPTION 3	OPTION 4	OPTION 5	OPTION 6	OPTION 6a
<b>C1</b> Constructability (5 = easy to construct, 1 = difficult to construct)	5	2	3	3	3	3	<del>3</del>
<b>C2</b> Public disturbance (5 = minimum disturbance, 1 = maximum disturbance)	5	4	2	<del>3</del> 3	<del>4</del> 4	3	<del>3</del>
<b>C3</b> High Level Cost Estimate (pre-determined)							<del>3</del>
<b>C4</b> 3rd Party utility impact/approvals/risk (5 = least impact, 1 = most impact)	4	<del>4</del> 4	<del>1</del> 1	1	1	<del>3</del> 3	<del>3</del>
<b>C5</b> Ground conditions (5 = most favourable conditions, 1 = least favourable conditions)	4	1	4	4	4	1	<del>3</del>



# **APPENDIX C**

## **Developed Preferred Option Sketches**





**INSET A**

**NOTES:**

- 1) A 6M WIDE X 2M DEEP CULVERT HAS BEEN MODELLED TO ALLOW FLEXIBILITY IN FINAL DESIGN. COSTING ESTIMATE BASED ON TRIPPLE 1800Ø PIPES - REFER TO MAIN BODY REPORT
- 2) SURFACE PROFILE GENERATED FROM 1M LIDAR DEM SURVEY DATA
- 3) DRAWINGS TO BE READ IN CONJUNCTION WITH REPORT AAJV-0416-P01 "ASHMORE PRECINCT FLOOD MITIGATION - TRUNK DRAINAGE OPTIONS REVIEW"

**SUMMARY OF UTILITY RELOCATIONS FOR DOWN STREAM OPEN-CUT SECTION OF BURROWS ROAD:**

- 50M TEMPORARY RELOCATION OF GAS, WATER & FIBRE OPTIC
- PROTECTION OF 0.33KV, FIBRE OPTIC & SEWER UNDER CHANNEL
- CANTYRY EXTENSION & SUPPORT WORKS TO 125KV, FIBRE OPTIC AND GAS

**SUMMARY OF UTILITY RELOCATIONS FOR DOWN STREAM OPEN-CUT SECTION OF SYDNEY PARK ROAD:**

- 50M TEMPORARY RELOCATION OF 11KV, WATER, GAS (SM) & FIBRE OPTIC
- PROTECTION OF 0.33KV UNDER CHANNEL

**SUMMARY OF UTILITY RELOCATIONS FOR UPSTREAM OPEN-CUT SECTION OF COLLESON STREET:**

- 11KV PERMANENT RELOCATION OF GAS
- TEMPORARY RELOCATION OF GAS COMING 11KV 33KV WATER (ASSUMED 20M EITHER SIDE OF CL) TO BE REINSTATED POST INSTALLATION

**SUMMARY OF UTILITY RELOCATIONS FOR UPSTREAM OPEN-CUT SECTION OF MITCHELL ROAD:**

- 11KV PERMANENT RELOCATION OF GAS
- 50M TEMPORARY RELOCATION OF WATER (500Ø) & GAS

**CONNECT TO EXISTING ASHMORE PRECINCT TRUNK DRAINAGE LINE**

**DEMOLISH AND RECONSTRUCT AMPLIFIED CULVERT ON EXISTING ALIGNMENT**

**IN-SITU RC CONCRETE STRUCTURE**

**IN-SITU RC CONCRETE STRUCTURE**

**TBM LAUNCH PIT**

**REMOVE EXISTING TREE & WIDEN EXISTING CHANNEL**

**SECTION IN CARPARK TO BE OPEN CUT USING TWIN BOX CULVERTS**



**AAJV**  
 Ashmore Trunk Drainage Review  
 Ashmore Precinct Flood Mitigation  
 Ashmore Trunk Drainage Review  
 Ashmore Precinct Flood Mitigation  
 Ashmore Trunk Drainage Review  
 Ashmore Precinct Flood Mitigation

**AA PROJECT -04-16**

REVISED	NO	DATE	BY	CHKD	DATE	BY	CHKD

**SYDNEY WATER**

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**ASHMORE TRUNK DRAINAGE REVIEW  
 GENERAL ARRANGEMENT PLAN  
 FINAL OPTION**

**SCALE**  
 1/2

**DATE**  
 08/01/24

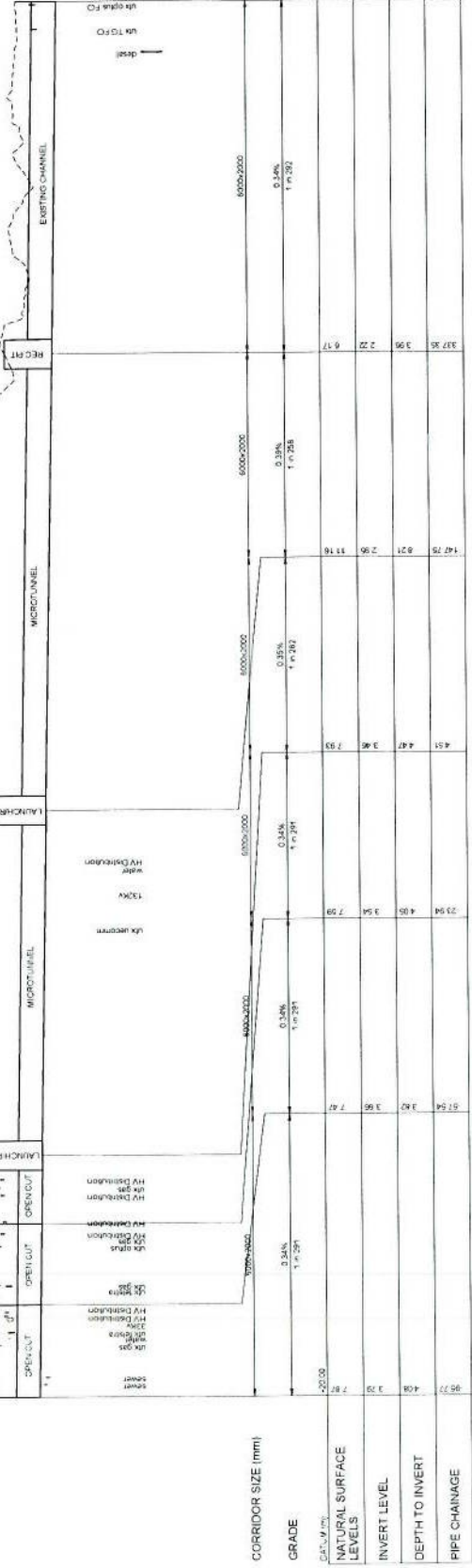
**PROJECT NO.**  
 0416-P01

**CONSTRUCTION**  
 1



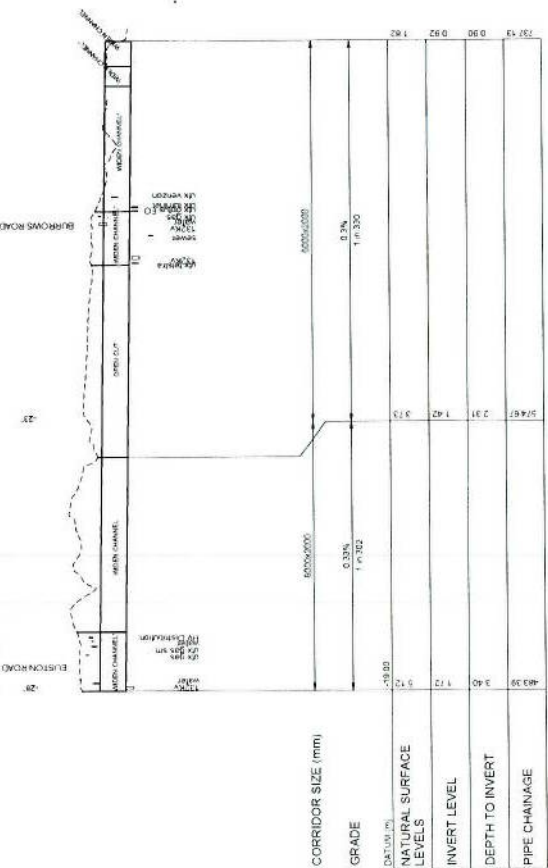
**NOTES:**

- 1) A 6M WIDE X 2M DEEP CULVERT HAS BEEN MODELLED TO ALLOW FLEXIBILITY IN FINAL DESIGN. COSTING ESTIMATE BASED ON TRIPPLE 1800Ø PIPES - REFER TO MAIN BODY REPORT
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- 3) DRAWINGS TO BE READ IN CONJUNCTION WITH REPORT AAJV-0416-P01 "ASHMORE PRECINCT FLOOD MITIGATION - TRUNK DRAINAGE OPTIONS REVIEW"



**LINE 06**

STATION	GRADE (m)	PIPE CHAINAGE	DEPTH TO INVERT	INVERT LEVEL	NATURAL SURFACE LEVELS
0+00	0.34%	1 in 200	4.08	3.20	7.82
0+20	0.34%	1 in 200	3.96	3.08	7.42
0+40	0.34%	1 in 200	3.84	2.96	7.02
0+60	0.34%	1 in 200	3.72	2.84	6.62
0+80	0.34%	1 in 200	3.60	2.72	6.22
1+00	0.34%	1 in 200	3.48	2.60	5.82
1+20	0.34%	1 in 200	3.36	2.48	5.42
1+40	0.34%	1 in 200	3.24	2.36	5.02
1+60	0.34%	1 in 200	3.12	2.24	4.62
1+80	0.34%	1 in 200	3.00	2.12	4.22
2+00	0.34%	1 in 200	2.88	2.00	3.82
2+20	0.34%	1 in 200	2.76	1.88	3.42
2+40	0.34%	1 in 200	2.64	1.76	3.02
2+60	0.34%	1 in 200	2.52	1.64	2.62
2+80	0.34%	1 in 200	2.40	1.52	2.22
3+00	0.34%	1 in 200	2.28	1.40	1.82
3+20	0.34%	1 in 200	2.16	1.28	1.42
3+40	0.34%	1 in 200	2.04	1.16	1.02
3+60	0.34%	1 in 200	1.92	1.04	0.62
3+80	0.34%	1 in 200	1.80	0.92	0.22
4+00	0.34%	1 in 200	1.68	0.80	-0.18
4+20	0.34%	1 in 200	1.56	0.68	-0.58
4+40	0.34%	1 in 200	1.44	0.56	-0.98
4+60	0.34%	1 in 200	1.32	0.44	-1.38
4+80	0.34%	1 in 200	1.20	0.32	-1.78
5+00	0.34%	1 in 200	1.08	0.20	-2.18
5+20	0.34%	1 in 200	0.96	0.08	-2.58
5+40	0.34%	1 in 200	0.84	-0.04	-2.98
5+60	0.34%	1 in 200	0.72	-0.16	-3.38
5+80	0.34%	1 in 200	0.60	-0.28	-3.78
6+00	0.34%	1 in 200	0.48	-0.40	-4.18
6+20	0.34%	1 in 200	0.36	-0.52	-4.58
6+40	0.34%	1 in 200	0.24	-0.64	-4.98
6+60	0.34%	1 in 200	0.12	-0.76	-5.38
6+80	0.34%	1 in 200	0.00	-0.88	-5.78
7+00	0.34%	1 in 200	-0.12	-1.00	-6.18
7+20	0.34%	1 in 200	-0.24	-1.12	-6.58
7+40	0.34%	1 in 200	-0.36	-1.24	-6.98
7+60	0.34%	1 in 200	-0.48	-1.36	-7.38
7+80	0.34%	1 in 200	-0.60	-1.48	-7.78
8+00	0.34%	1 in 200	-0.72	-1.60	-8.18
8+20	0.34%	1 in 200	-0.84	-1.72	-8.58
8+40	0.34%	1 in 200	-0.96	-1.84	-8.98
8+60	0.34%	1 in 200	-1.08	-1.96	-9.38
8+80	0.34%	1 in 200	-1.20	-2.08	-9.78
9+00	0.34%	1 in 200	-1.32	-2.20	-10.18
9+20	0.34%	1 in 200	-1.44	-2.32	-10.58
9+40	0.34%	1 in 200	-1.56	-2.44	-10.98
9+60	0.34%	1 in 200	-1.68	-2.56	-11.38
9+80	0.34%	1 in 200	-1.80	-2.68	-11.78
10+00	0.34%	1 in 200	-1.92	-2.80	-12.18
10+20	0.34%	1 in 200	-2.04	-2.92	-12.58
10+40	0.34%	1 in 200	-2.16	-3.04	-12.98
10+60	0.34%	1 in 200	-2.28	-3.16	-13.38
10+80	0.34%	1 in 200	-2.40	-3.28	-13.78
11+00	0.34%	1 in 200	-2.52	-3.40	-14.18
11+20	0.34%	1 in 200	-2.64	-3.52	-14.58
11+40	0.34%	1 in 200	-2.76	-3.64	-14.98
11+60	0.34%	1 in 200	-2.88	-3.76	-15.38
11+80	0.34%	1 in 200	-3.00	-3.88	-15.78
12+00	0.34%	1 in 200	-3.12	-4.00	-16.18



**LINE 06**

STATION	GRADE (m)	PIPE CHAINAGE	DEPTH TO INVERT	INVERT LEVEL	NATURAL SURFACE LEVELS
0+00	0.3%	1 in 300	3.40	2.52	9.12
0+20	0.3%	1 in 300	3.28	2.40	8.72
0+40	0.3%	1 in 300	3.16	2.28	8.32
0+60	0.3%	1 in 300	3.04	2.16	7.92
0+80	0.3%	1 in 300	2.92	2.04	7.52
1+00	0.3%	1 in 300	2.80	1.92	7.12
1+20	0.3%	1 in 300	2.68	1.80	6.72
1+40	0.3%	1 in 300	2.56	1.68	6.32
1+60	0.3%	1 in 300	2.44	1.56	5.92
1+80	0.3%	1 in 300	2.32	1.44	5.52
2+00	0.3%	1 in 300	2.20	1.32	5.12
2+20	0.3%	1 in 300	2.08	1.20	4.72
2+40	0.3%	1 in 300	1.96	1.08	4.32
2+60	0.3%	1 in 300	1.84	0.96	3.92
2+80	0.3%	1 in 300	1.72	0.84	3.52
3+00	0.3%	1 in 300	1.60	0.72	3.12
3+20	0.3%	1 in 300	1.48	0.60	2.72
3+40	0.3%	1 in 300	1.36	0.48	2.32
3+60	0.3%	1 in 300	1.24	0.36	1.92
3+80	0.3%	1 in 300	1.12	0.24	1.52
4+00	0.3%	1 in 300	1.00	0.12	1.12
4+20	0.3%	1 in 300	0.88	0.00	0.72
4+40	0.3%	1 in 300	0.76	-0.12	0.32
4+60	0.3%	1 in 300	0.64	-0.24	-0.08
4+80	0.3%	1 in 300	0.52	-0.36	-0.48
5+00	0.3%	1 in 300	0.40	-0.48	-0.88
5+20	0.3%	1 in 300	0.28	-0.60	-1.28
5+40	0.3%	1 in 300	0.16	-0.72	-1.68
5+60	0.3%	1 in 300	0.04	-0.84	-2.08
5+80	0.3%	1 in 300	-0.08	-0.96	-2.48
6+00	0.3%	1 in 300	-0.20	-1.08	-2.88
6+20	0.3%	1 in 300	-0.32	-1.20	-3.28
6+40	0.3%	1 in 300	-0.44	-1.32	-3.68
6+60	0.3%	1 in 300	-0.56	-1.44	-4.08
6+80	0.3%	1 in 300	-0.68	-1.56	-4.48
7+00	0.3%	1 in 300	-0.80	-1.68	-4.88
7+20	0.3%	1 in 300	-0.92	-1.80	-5.28
7+40	0.3%	1 in 300	-1.04	-1.92	-5.68
7+60	0.3%	1 in 300	-1.16	-2.04	-6.08
7+80	0.3%	1 in 300	-1.28	-2.16	-6.48
8+00	0.3%	1 in 300	-1.40	-2.28	-6.88
8+20	0.3%	1 in 300	-1.52	-2.40	-7.28
8+40	0.3%	1 in 300	-1.64	-2.52	-7.68
8+60	0.3%	1 in 300	-1.76	-2.64	-8.08
8+80	0.3%	1 in 300	-1.88	-2.76	-8.48
9+00	0.3%	1 in 300	-2.00	-2.88	-8.88
9+20	0.3%	1 in 300	-2.12	-3.00	-9.28
9+40	0.3%	1 in 300	-2.24	-3.12	-9.68
9+60	0.3%	1 in 300	-2.36	-3.24	-10.08
9+80	0.3%	1 in 300	-2.48	-3.36	-10.48
10+00	0.3%	1 in 300	-2.60	-3.48	-10.88
10+20	0.3%	1 in 300	-2.72	-3.60	-11.28
10+40	0.3%	1 in 300	-2.84	-3.72	-11.68
10+60	0.3%	1 in 300	-2.96	-3.84	-12.08
10+80	0.3%	1 in 300	-3.08	-3.96	-12.48
11+00	0.3%	1 in 300	-3.20	-4.08	-12.88
11+20	0.3%	1 in 300	-3.32	-4.20	-13.28
11+40	0.3%	1 in 300	-3.44	-4.32	-13.68
11+60	0.3%	1 in 300	-3.56	-4.44	-14.08
11+80	0.3%	1 in 300	-3.68	-4.56	-14.48
12+00	0.3%	1 in 300	-3.80	-4.68	-14.88

TYPICAL BRIDGE SECTION WITH CHANNEL WIDENING

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ADVISE PARTNERSHIP BETWEEN AECOM AND SYDNEY WATER FOR INITIAL WATER OCCUPATION  
Sydney Water  
A8814 21 030 09

DATE: 02/02  
REVISION: A8814 21 030 09  
DRAWN: A  
CHECKED: A  
APPROVED: A

**ASHMORE TRUNK DRAINAGE REVIEW  
LONGSECTION  
FINAL OPTION 6**

PROJECT: A8814 21 030 09  
CONTRACT NO: A8814 21 030 09

DATE: 02/02  
DRAWING STATUS: CONSTRUCTION

PROJECT NO: A8814 21 030 09  
DRAWING NO: 2

TYPICAL BRIDGE SECTION WITH CHANNEL WIDENING



# APPENDIX D

## Cost Estimate Report

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