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**Existing Stormwater Culvert
Diversion Options Report
Project J, North Sydney
Eastmark Holdings Pty Ltd**

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Appendix A

Utility Providers and Sydney Water Corporation Culvert Details

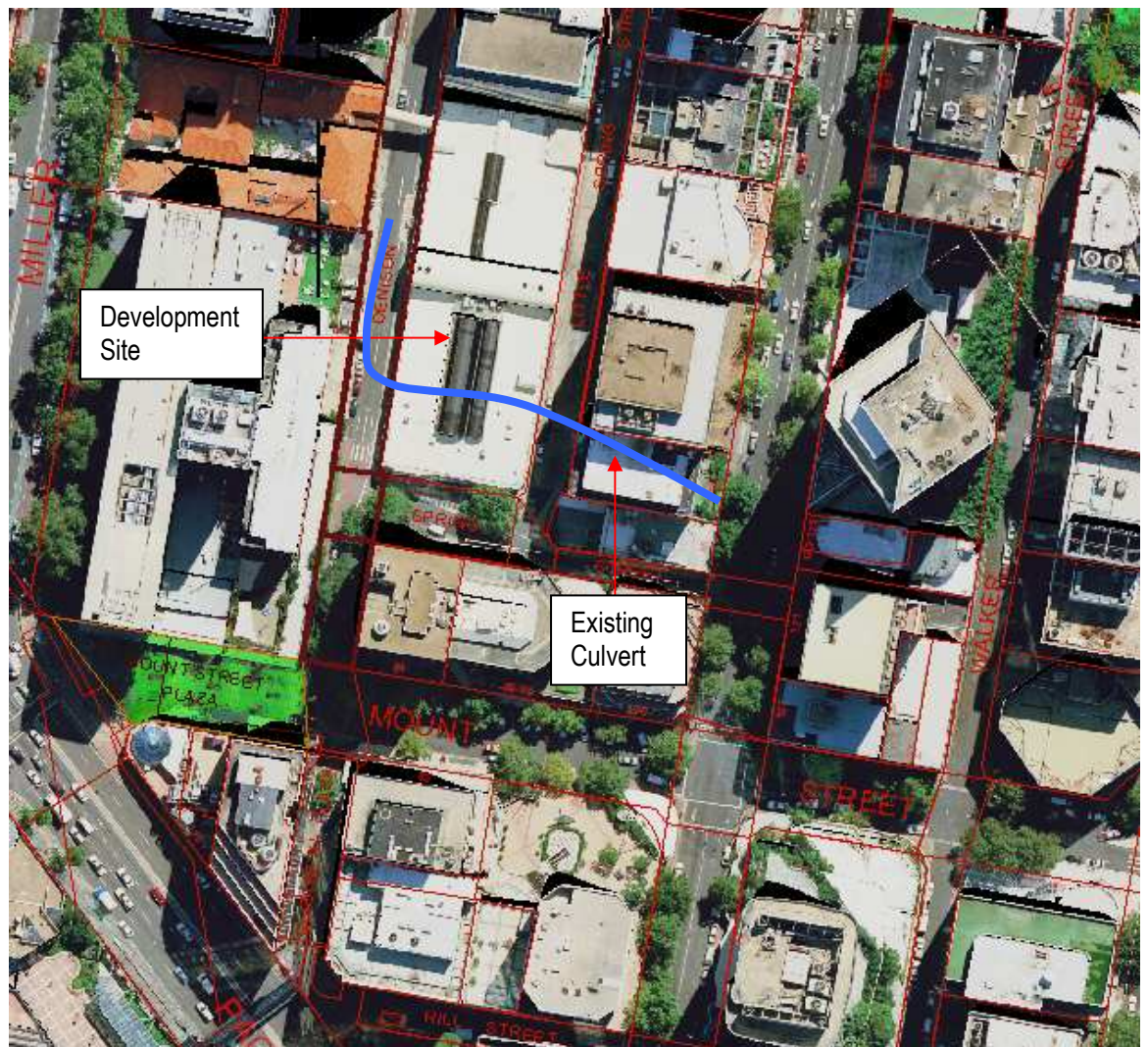
1. Introduction

This report has been provided to outline various options available for Eastmark Holdings Pty Ltd to relocate, divert or adjust an existing stormwater culvert that currently traverses under their proposed future development.

The development is bound by Denison Street, Spring Street and Little Spring Street in North Sydney. This area currently consists of shops and a basement carpark. Below the carpark an existing 1.2m x 1.2m covered concrete culvert crosses under the building from West to East. The culvert is owned by the Sydney Water Corporation.

The culvert location has impacts on the final design layout of the proposed development and the design team will need to assess the implications of the various options proposed.

Detailed analysis and costing have not been undertaken as part of this report.



LOCATION PLAN

2. Existing Utility Locations

Dial before you dig was contacted to obtain information from Utility providers about their assets in the area. The asset owners that were contacted and their contact numbers are provided below.

Verizon Business	(02) 9434 5963
Powertel Ltd, NSW	(02) 8264 3932
Pipe Networks, NSW	(07) 3233 9800
Energy Australia, Northern	(02) 4951 0899
Telstra North Harbour	1800 65 3935
Optus Networks, NSW	1800 50 5777
Agility, North	(02) 4953 5100
Sydney Water	(02) 9350 6744

The major utilities in the area are;

- Water – 200mm, 150mm and 100mm
- Sewer – 225mm
- Storm sewer – 1.2m x 1.2m
- Gas – 150mm high pressure and 75mm low pressure
- Electrical cables
- Communications cables

Plans provided by the asset owners are included in Appendix A.

3. Options Considered

Seven concept options were considered for the development and these are;

- Option 1 - Leave the existing culvert where it is and build around it
- Option 2 – Lower and relocate the existing culvert under the building
- Option 3 - Divert the culvert within the property boundary
- Option 3A - Divert the culvert within the property boundary and re-route through the adjacent property
- Option 4 - Divert the culvert outside the property boundary
- Option 4A - Divert the culvert outside the property boundary and re-route through the adjacent property
- Option 5 – Divert the culvert along Denison Street and Spring Street to Walker Street

These options are shown on Figure 3.1 - Concept Options Plan below.

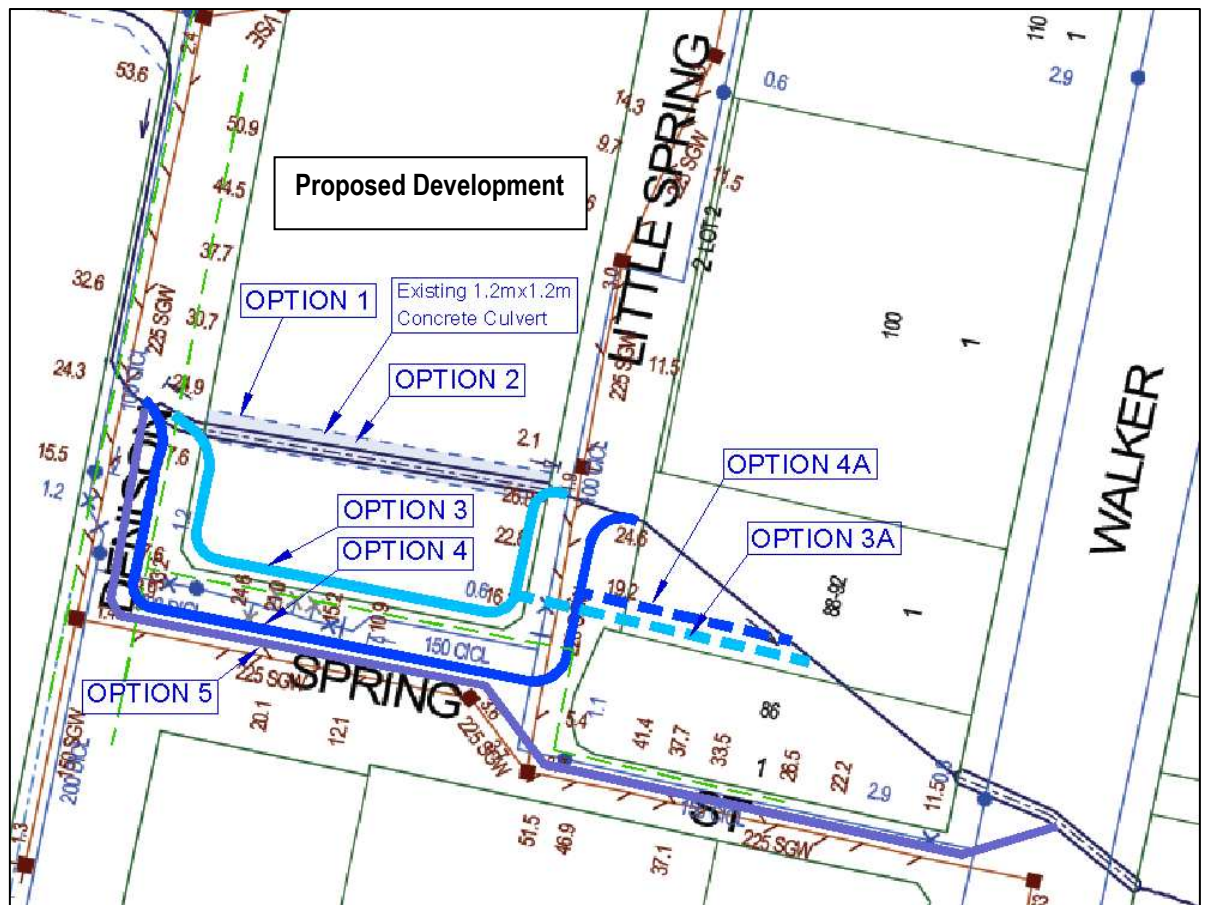


Figure 3.1 CONCEPT OPTIONS PLAN

4. Option Impacts

4.1 Option 1

Option 1 retains the existing culvert in its present location and has the least impact but reduces potential development space. There may also be construction risks and difficulties associated with building near or around the existing culvert and Sydney Water Corporation 'Guidelines for Building Over/Adjacent to Sydney Water Assets' December 2006 should be used to confirm clearances and construction requirements.

Since the existing building will be demolished there should be no impacts from internal existing services. An easement should be retained for the extent of the pipe below the building.

4.2 Option 2

Option 2 considers lowering and relocating the existing culvert beneath the existing building. This would require constructing another culvert adjacent to the existing one at a lower level and then finally connecting each end to the existing structure.

The proposed culvert depth and size would depend on existing connecting invert levels and hydraulic performance. As with Option 1, construction risks and difficulties need to be considered.

Since the existing building will be demolished there should be no impacts from internal existing services. A relocated easement would be required over the new structure.

4.3 Option 3

Option 3 requires the culvert to be diverted along the inside perimeter of the boundary underneath the building. This option would provide for more potential development space and flexibility in construction staging.

The proposed culvert depth and size would depend on existing connecting invert levels and hydraulic performance.

The zone of influence from proposed building structures would have to be considered during the relocation (Sydney Water Corporation guidelines should be adopted). Since the existing building will be demolished there should be no impacts from internal existing services. A relocated easement would be required along the new structure.

4.4 Option 3A

Option 3A is similar to Option 3 except the connection into the existing downstream culvert would be re-routed through the adjacent property (part of the overall proposed development) to avoid construction issues and impacts from the proposed building structure.

There would be some impact from existing services in Little Spring Street. A relocated easement would be required along the new structures.

4.5 Option 4

Option 4 requires the culvert to be diverted outside the development boundary along Denison Street, Spring Street and Little Spring Street. This option provides the ability to construct the culvert independent of the proposed building works. There are impacts from most services. The existing sewer is relatively deep (3.0m – 3.7m) and the water mains should pass over or require slight adjustment when crossing the proposed culvert alignment. There may need to be some adjustments to electrical cables in the area.

The proposed culvert depth and size would depend on existing connecting invert levels and hydraulic performance.

Spring Street is block paved and restoration of any pavement after construction would be relatively inexpensive. Disruption to traffic along Spring Street would be at a minimum due to the wide section available for construction.

4.6 Option 4A

Option 4A is similar to Option 4 except the connection into the existing downstream culvert would be re-routed through the adjacent property (part of the overall proposed development) to avoid construction issues and impacts from the proposed building structure.

There would be some impact from existing services in Little Spring Street. A relocated easement would be required along the new structures.

4.7 Option 5

Option 5 requires the culvert to be diverted outside the development boundary along Denison Street, Spring Street and then to Walker Street. This option provides the ability to construct the culvert independent of the proposed building works. The culvert can be graded to avoid all service clashes but the 225 diameter sewer would require concrete encasement between Little Spring and Walker Streets and sections of the water main along Spring Street would require relocation. All works would have to be confirmed with Sydney Water Corporation.

5. Summary and Conclusions

A matrix summary has been provided to allow a high level of comparison of Options 1 to 5 below in table 5.1.

Table 5.1 – Options Matrix

Option	Construction Risk	Service Adjustments	Hydraulic Performance	Construction Difficulty	Relative Cost	Points Score
1	Low	Low	5	Low	Low	25
2	Low- Medium	Low	4	Medium - High	Medium - High	19
3	Medium - High	Low	3	High	High	15
3A	Medium - High	Low - Medium	4	High	High	16
4	Medium - High	Low - Medium	2	Low - Medium	High	15
4A	Medium - High	Low - Medium	3	Low - Medium	High	16
5	Low - Medium	Low - Medium	5	Low - Medium	Medium -High	20

Detailed costing of each option should be undertaken either by a qualified quantity surveyor or specialist contractor.

The matrix scores are based on;

Low = 5 points, Low – Medium = 4 points, Medium – High = 3 points, High = 2 points and Very High = 1 point.

Hydraulic performance is rated from Highest = 5 to lowest = 1

From the matrix evaluation options 1 and 5 have the highest scores and seem to be the preferred options for this development.

Further investigation is required structurally for all options and hydraulically for all options other than 1 in conjunction with service coordination.

Construction issues relating to building layouts, sequencing and the zone of influence affecting Sydney Water assets should be investigated when considering all options.

Appendix A

Utility Providers and Sydney Water Corporation Culvert Details

Appendix A

Utility Providers

- Optus
- Sydney Water
- Agility
- Telstra
- Verizon Business
- Energy Australia

Sydney Water Corporation Culvert Details