



Victorian Planning Authority

Sunbury Sth Lancefield Rd ICP
Design and Costings

November 2019

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Appendices

Appendix A – Current Drawings

Part 1

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Part 2

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Part 3

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Appendix B – Design Costing Reference Sheet

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Appendix C – Cost Plans

Appendix D – LR-BR-01 Options

Appendix E – Past Reports

Appendix F – Utility Correspondence

Appendix G – Chainages and Lengths of South Sunbury Projects

Appendix H – Chainages and Lengths of Lancefield Road - Road Projects

1. Introduction

1.1 Introduction

GHD were engaged by the Victorian Planning Authority (VPA) to prepare a report to inform the preparation of the Infrastructure Costing Plan (ICP) for the Sunbury South and Lancefield Road Precinct Structure Plans (PSP 1074 and PSP 1075).

Further to this report, GHD has updated the detailed design drawings and cost plans provided by the VPA with revised quantities based on updated design amendments and direction from the VPA, as detailed in RFQ D/18/2421 and subsequent variations. GHD notes that not all drawings and quantities calculations and have been updated, only those that have been changed as a result of the design amendments completed. GHD also note that other consultants have prepared similar cost plans for the previous designs, however previous costings are to be considered superseded. Quantities and rates expressed in previous costings are not to be referred to or referenced unless directed by the VPA.

Many of the assumptions formulated throughout this project by other consultants have been reviewed by GHD and the VPA. Where appropriate, these assumptions have been adopted and have been expressed in this report.

Other consultancies have prepared reports detailing aspects that also assist with the ICP refer Appendix E. The report considered to be the initial design investigation for this project was produced by Aurecon titled 'Infrastructure Design and Costings (Grade Separations and Harpers Creek Crossing)'. A succeeding report titled 'Memo Sunbury South and Lancefield Road PSP-Infrastructure Cost Estimates' produced by WSP dated 28 April 2017 has been built upon by GHD and forms the basis of this report. This report is considered to hold the most pertinent information and should be the first point of reference.

When reviewing this report, it is advised that the cost plans be read in conjunction with the Functional Design drawings.

1.2 Design Development

The Sunbury South and Lancefield Road Precinct Structure Plans (PSP 1074 and PSP 1075) can be considered the origin point of this project. Prepared by the VPA in consultation with Hume City Council and with the assistance of relevant government agencies, service authorities and major stakeholders. The PSPs are a long-term plan for urban development, describing how the land is expected to be developed, and how and where services are planned to support development.

Following the formulation of PSP 1074 and PSP 1075, Aurecon were engaged in 2015 to prepare a concept drawing package, associated cost estimates and report for five grade separations and/or bridges associated with the PSPs. This design package references a study completed by GTA Consultants which established road widths and conceptual road alignments.

Further to Aurecon's involvement with the project, Parsons Brinckerhoff were later engaged in 2016 to further develop the work completed by Aurecon and undertake an infrastructure design study of the same PSP areas. High level, 2-dimensional concept designs were developed for numerous road and intersection projects using elements of the previous designs completed by GTA, Aurecon and Hume City Council as a base.

The desired lane arrangement for each intersection was provided by the VPA. The road alignments used were drawn from those established by GTA, Aurecon, Hume City Council and from those identified in the Future Urban Structure Plan as supplied by the VPA. In some cases the alignments were adjusted slightly to conform to the basis of design as established by VicRoads, Hume City Council and the VPA.

Aurecon has also provided a geotechnical report in 2016, refer Appendix FE that further guided the confirmation of road alignments. The works involved a desktop study and subsequent on site geotechnical assessment of a range of options for two potential road crossings of Jacksons Creek in Sunbury. This geotechnical report also guided the assumption relating to rock in the cost estimates, first generated by Aquenta. This allowance is further explained in the Geotechnical section of this report, refer section 6 and cost assumptions.

1.3 Scope and limitations

This report has been prepared by GHD for Victorian Planning Authority and may only be used and relied on by Victorian Planning Authority as advice for the infrastructure items to be funded under the Sunbury South PSP and Lancefield Road PSP Infrastructure Contributions Plan.

GHD otherwise disclaims responsibility to any person other than Victorian Planning Authority arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared

GHD has prepared the preliminary cost estimate set out in attached document to this report ("Cost Estimate") using information reasonably available to the GHD employee(s) who prepared this report; and based on assumptions and judgments made by GHD (refer to section 5).

The Cost Estimate has been prepared for the purpose of understanding high level costs associated with the development and must not be used for any other purpose.

The Cost Estimate is a preliminary estimate only. Actual prices, costs and other variables may be different to those used to prepare the Cost Estimate and may change. Unless as otherwise specified in this report, no detailed quotation has been obtained for actions identified in this report. GHD does not represent, warrant or guarantee that the works can or will be undertaken at a cost which is the same or less than the Cost Estimate.

Where estimates of potential costs are provided with an indicated level of confidence, notwithstanding the conservatism of the level of confidence selected as the planning level, there remains a chance that the cost will be greater than the planning estimate, and any funding would not be adequate. The confidence level considered to be most appropriate for planning purposes will vary depending on the conservatism of the user and the nature of the project. The user should therefore select appropriate confidence levels to suit their particular risk profile.

2. VPA supplied information

Table 1 below is a summary of information provided by the VPA including drawings, reports and other sources of information that has informed GHD during this project. GHD has also been provided additional information verbally, via email and through directions in meetings that has been utilised in the preparation of the plans and cost detail.

Table 1 Summary of VPA Information

Description	Author	Date
PSP 1074 Sunbury South High Level Utility Servicing Assessment	Jacobs	27 November 2014
Sunbury South and Lancefield Road PSP (PSP 1074 and 1075) Infrastructure Design and Costings (Grade Separations and Harpers Creek Crossing) Draft Report	Aurecon	10 June 2015
Geotechnical Investigation Report For Jackson's Creek Road Crossing (Northern and Southern Line)	Aurecon	8 March 2016
Sunbury South Precinct Structure Plan	Victorian Planning Authority	November 2016
Lancefield Road Precinct Structure Plan	Victorian Planning Authority	November 2016
1074&1075 Sunbury South & Lancefield Road Precinct Structure Plan Background Report	Victorian Planning Authority	November 2016
Sunbury South and Lancefield Road Precinct Structure Plans (PSP's) – Infrastructure Design Study Design Report	Parsons Brinckerhoff	15 December 2016
Sunbury/Diggers Rest Growth Corridor Plan	Growth Area Authority	
Sunbury South and Lancefield Road PSP Infrastructure Design Study Drawings	Parsons Brinckerhoff	
Memo, Sunbury South and Lancefield Road PSP – Infrastructure cost estimates	WSP	28 April 2017
Amendment C207 to Hume Planning Scheme Submission to the Sunbury South PSP	Taylor	25 May 2017
Sunbury South and Lancefield Road PSP 1075 – Jacksons Creek crossing – Western bridge launch point interface investigation	WSP	15 September 2017
Hume Planning Scheme Amendments C207 and C208 Sunbury South and Lancefield Road Precinct Structure Plans Permit Application Numbers P18858, P18854, P18855	Planning Panels Victoria	15 December 2017

3. Relevant drawings

Table 2 is a summary of the final concept design drawings that provides relevant detail for all infrastructure items captured; refer Appendix A for drawings.

The naming convention for the drawing titles is explained below:

Component	Explanation	Comment
LR	Lancefield Road	
SS	Sunbury South	
IN (IT)	Intersection	IT updated to IN as requested by VPA for latest revision
BR (BD)	Bridge	BD updated to BR as requested by VPA for latest revision
RD	Roads	

Table 2 Drawing Index

Drawing number	Scope item	Designer
CIV-0100	Title Sheet	GHD
CIV-0101	Drawing Index	GHD
CIV-0201	Sections	PB
CIV-0202	Sections	PB
CIV-0203	Sections	GHD
CIV-0204	Sections	GHD
CIV-0205	Sections	PB
CIV-0300	Vehicle Swept Path SS-RD-07	GHD
CIV-0400	Long Sections	GHD
CIV-0401	Long Sections	GHD
CIV-0501	Lancefield Road PSP	GHD
CIV-0502	Sunbury South PSP	GHD
CIV-1000	LR-RD-01	GHD
CIV-1001	LR-RD-01	GHD
CIV-1002	LR-RD-01	GHD
CIV-1004	LR-RD-01	PB
CIV-1006	LR-RD-01	PB
CIV-1020	LR-RD-02	GHD
CIV-1021	LR-RD-02	GHD

Drawing number	Scope item	Designer
CIV-1022	LR-RD-02	GHD
CIV-1023	LR-RD-02	GHD
CIV-1030	LR-RD-03/LR-RD-04	GHD
CIV-1032	LR-RD-03	GHD
CIV-1033	LR-RD-04	GHD
CIV-1100	SS-RD-02	GHD
CIV-1101	SS-RD-02	GHD
CIV-1102	SS-RD-02	GHD
CIV-1103	SS-RD-02	GHD
CIV-1104	SS-RD-02	GHD
CIV-1110	SS-RD-01	GHD
CIV-1111	SS-RD-01	GHD
CIV-1112	SS-RD-01	GHD
CIV-1120	SS-RD-03	GHD
CIV-1121	SS-RD-03	GHD
CIV-1122	SS-RD-03	GHD
CIV-1130	SS-RD-04	GHD
CIV-1131	SS-RD-04	GHD
CIV-1132	SS-RD-04	GHD
CIV-1133	SS-RD-04	GHD
CIV-1134	SS-RD-04	GHD
CIV-1135	SS-RD-04	GHD
CIV-1136	SS-RD-04	GHD
CIV-1140	SS-RD-05	GHD
CIV-1141	SS-RD-05	GHD
CIV-1142	SS-RD-05	GHD
CIV-1143	SS-RD-05	GHD
CIV-1151	SS-RD-06	GHD
CIV-1160	SS-RD-07	GHD
CIV-1161	SS-RD-07	PB
CIV-1162	SS-RD-07	GHD
CIV-1163	SS-RD-07	GHD
CIV-1164	SS-RD-07	GHD
CIV-1170	SS-RD-08	GHD
CIV-1171	SS-RD-08	GHD
CIV-1172	SS-RD-08	GHD
CIV-1173	SS-RD-08	GHD

Drawing number	Scope item	Designer
CIV-1501	LR-IT1	PB
CIV-1502	LR-IN-01	GHD
CIV-1503	LR-IT3	PB
CIV-1504	LR-IT4	PB
CIV-1601	SS-IN-01	GHD
CIV-1602	SS-IN-02	GHD
CIV-1603	SS-IN-03	GHD
CIV-1604	SS-IN-04	GHD
STR-0102	SS-BD1 (LONG)	PB
STR-0103	SS-BD1 (LONG)	PB
STR-0401	LR-BR-01	GHD
STR-0402	LR-BR-01	GHD
STR-0403	LR-BR-01	GHD
CIV -2015	Retaining Wall Detail	GHD

4. GHD design changes scope

4.1 Background

GHD has undertaken design alterations based on a prescribed scope of works seeking amendments to the existing Sunbury South and Lancefield Road PSP's road layout and cost estimates. The scope included:

- Review of previous concept design and costing advice as background information
- Preparation of concept design plans for each nominated project based on amendments requested by the VPA

A summary of GHD's scope is outlined in Table 3 below.

Table 3 Scope items

Item	Description	Project
1	Split existing roadway SS-RD-04 from SS-IN-03 to SS-BR-01 update drawings	SS-RD-04-1
2	Split existing roadway SS-RD-04 from SS-BR-01 to SS-IN-10 update drawings	SS-RD-04-2
3	Split existing roadway SS-RD-04 from SS-IN-10 to SS-BR-03 update drawings	SS-RD-04-3
4	Split existing roadway SS-RD-04 from SS-BR-03 to SS-IN-09 update drawings	SS-RD-04-4
5	Split existing roadway SS-RD-04 from SS-IN-09 to SS-IN-05 update drawings	SS-RD-04-5
6	Amend road alignment to match into revised SS-IN-010	SS-RD-06
7	Amend intersection alignment to accommodate SS-BR-04 and SS-RD-04-2	SS-IN-09
8	Realign intersection	SS-IN-10
9	Design new intersection with Lancefield Road section (40.4m) and Connector Road Residential (25m)	SS-IN-12
10	Consult with relevant service authorities to ascertain existing infrastructure, implementation requirements for relocation preparation of site layout plan and updating cost plan which includes bridge road and asset relocations	SS-BR-04
11	Update the existing bridge alignment plans with the preferred option and to avoid encroaching within the BCS Conservation Area	LR-BR-01
12	Provide higher amenity bridge option design, visualisations and cost plan in consultation with VPA	LR-BR-01
13	Divide LD-RD-02 from LR-IN-05 to LR-BR-01	LR-RD-02-01
14	Divide LD-RD-02 from LR-BR-01 to LR-BR-03	LR-RD-02-02
15	Divide LD-RD-02 from LR-BR-03 to LR-IN-04	LR-RD-02-03
16	Prepare design and cost plan for a new roundabout intersection to accommodate low floor bus.	SS-IN-13
17	Upgrade existing Stockwell Drive, T intersection with St Ronans Court, 25m road cross section, no intersection with Raes Road and provide cost plan	LR-RD-04

Item	Description	Project
18	Update cost plan to reflect reduction in scope where new intersection SS-IN-13 has been designed.	SS-RD-07
19	Preparation of design for new 3 way roundabout intersection for Stockwell Drive and Balbethan Drive	LR-IN-06
20	Preparation of design for new 4 way intersection (3 lanes attributed to Sunbury South) at Moore Road/Old Vineyard Road/Vineyard Road	SS-IN-07
21	Modify Sunbury Road to match new cross section (new interim configuration MRPA Drawing CIV-0101)	SS-IN-01
22	Modify Sunbury Road to match new cross section (new interim configuration MRPA Drawing CIV-0101). Design of intersection has been amended to align with gazetted FUS	SS-IN-02
23	Modify Sunbury Road to match new cross section (new interim configuration MRPA Drawing CIV-0101). Change in location of intersection. New location for signalised intersection is the existing roundabout. South western leg has been modified to be 34m connector Boulevard	SS-IN-03
24	Modify Sunbury Road to match new cross section (new interim configuration MRPA Drawing CIV-0101)	SS-IN-04
25	SS-RD-05 modified to show start of road at tie in at Buckland Way continuing to SS-IN-09 (chainage 600).	SS-RD-05
26	Realign road segment SS-RD-04-01 to match new intersection point to the north east	SS-RD-04-01
27	Bridge approaches separated from road segments	LR-RD-02-01b LR-RD-02-02a LR-RD-02-03a LR-RD-02-03b
28	Costing between SS-IN-09 and SS-BR-04 create at the request of Hume City Council	SS-RD-04-04
29	Design and costing for southern extent Buckland Way included	SS-RD-05
30	Intersection design at Watsons Road and Crinnion Road included	SS-IN-15
31	Intersection design amended to suit gazetted FUS Northern connector leg of intersection to be redesigned to remove left turn slip lane. Lane has been redesigned to a shared through and left stand-up lane.	SS-IN-01
32	Review design of intersection and create associated costing	SS-IN-11
33	Eastern leg redesigned to remove dedicated left turn and have shared left and through lane instead. Designed to suit gazetted FUS	LR-IN-02

4.2 SS-BR-04 Bendigo rail line bridge

SS-BR-04 is a rail bridge over the connector street SS-RD-04 in the Sunbury South PSP area. The previous design of the bridge was undertaken by Aurecon and further design consideration and costing was completed by Parsons Brinckerhoff and Aquenta respectively.

GHD's scope included a review of the concept and its impact on the services that will require relocation to facilitate the works. GHD has liaised with service authorities whose assets will be impacted by the construction, refer 4.2.1 to 4.2.4 below, and has updated the previous cost plan with service relocation advice received from the Authorities.

GHD has updated previous drawings showing an indicative cross section detail of the structure.

4.2.1 Western water

Western Water (WW)'s DN225 DICL sewer rising main transfers wastewater from Diggers Rest to the Sunbury South sewer pump station (SPS). The alignment is predominately along the eastern boundary of the railway reserve. The asset is offset approximately 6.0m within the reserve, however does vary along the alignment. The depth ranges from 1.2m to 2.5m.

Relocation would need to follow WW's Standard Works and Land Development processes, as prescribed within its Land Development Manual. This process requires applying to WW seeking conditions for relocation, an accredited consultant undertaking detailed design and an accredited contractor completing the works. The developer and its consultant will need to seek WW and VicTrack endorsement for relocation works. Based on the response from WW, VicTrack approval process for access within the rail reserve would be more exhaustive than WW's approvals process.

The Diggers Rest SPS will be ultimately upgraded. WW are undergoing concept design for the SPS and rising main upgrades, which could result in the rising main being upgraded to DN375. Western Water would need to confirm timing of these works which are dependent on growth rates. The current expectations are that the upgrade will be required within 5-10 years.

Preliminary discussions with WW has identified the preferred option, based on the limited information available, would be to directionally drill under the new road. WW has estimated costs associated with the works will be in the order of \$300,000.

4.2.2 Telstra

Telstra has advised the proposed rail bridge works will potentially affect a number of direct buried assets, these include a major interstate (60F) fibre optic cable on the west of the rail reserve and 2 copper cables on the eastern side.

Telstra has advised no easements would be required as any cable installations will be completed as per the Telecommunication Act 1997, which enable Telstra to issue land access notices to landholders informing them of the installation.

The time for Telstra to undertake the works would be in the order of 6 months from project start to completion.

The existing services are not wholly contained within the rail corridor and were direct buried when installed. Telstra has advised its preferred option would be to relocate their assets by attaching them to the underside of the new rail overpass. A new fibre optic line would need to be installed between existing FAPS (joints) which are located approximately 3km apart from Diggers Rest train station and Wanginu Park in Sunbury.

Telstra estimate the costs associated with design and construction of the relocation will be in the order of \$300,000-\$400,000. Refer Appendix F for correspondence record.

Telstra has advised that it can undertake a detailed design impact study which allows a full appraisal of Telstra's requirements.

4.2.3 VicTrack

VicTrack has advised that the stakeholders listed below may be involved in the development of the design and construction process for bridge SS-BR 04.

- Transport for Victoria (TfV)
- Department of Economic Development, Jobs, Transport and Resources (DEDJTR)
- VicTrack
- Public Transport Victoria (PTV)
- Metro Trains Melbourne (MTM)

Table 4 summarises the action items that may be required in the development of the design and construction process as well as which authorities require consultation should these actions be required.

Table 4 Action items and authority consultation

Stage	Authority
Designation of future rail requirements to be included in design	TfV
Clearance to sell land under rail corridor	DEDJTR, VicTrack
Purchase of land	VicTrack
Concept design approval and design review	TfV, PTV, MTM, VicTrack
Rail corridor access for works	PTV, MTM
Working around VicTrack communications assets	VicTrack
Staging of construction and occupation	MTM

VicTrack has advised the bridge design must comply with AS5100 Bridge Code and be certified by an independent engineer.

TfV will need to provide advice during the design process to ensure future expansion of the rail network is considered/incorporated. This includes any provisions for duplication of tracks that may be required as part of the future rail network.

Due to the number of stakeholders that are essential to the design and approvals for the construction of SS-BR-04, VicTrack was unable to provide an estimate of fees that would be required for the design and construction of the bridge.

4.2.4 APA gas

APA has advised the proposed rail bridge works will have an impact on the existing Deer Park and Sunbury pipeline PL122. The pipeline is a 150mm diameter high pressure transmission gas line which is operated by APA in accordance with AS2885 Pipelines – Gas and liquid petroleum.

In accordance with AS 2885, a Safety Management Study was completed by the VPA and APA to identify risk and how they need to be managed for the implementation of the Sunbury PSP.

Following the SMS study and subsequent conversations with APA regarding the relocation of the pipeline to facilitate the construction of SS-BR-04, APA provided 2 options.

1. Pipeline to remain within its existing easement and lowered under the proposed roadway.

2. Re-route the pipeline around SS-BR-04 structure.

Based on the limited information available, installation within the current easement, option 1, is favoured by APA. The lowered pipe would likely be offset from the existing pipeline but still within the existing easement. This is APA's preferred solution as no further land acquisition is likely to be required outside of the existing easement.

If the pipeline remains within the existing easement then no amended licence agreement would be required. Pipe abandonment would need to be addressed through acceptance of a decommissioning plan by the Department.

Following receipt of the option noted above, a meeting was held on 29 June 2018 between APA Gas, VPA and GHD to further understand the project requirements, risks and potential costs. Attendees from APA included representatives from their commercial and planning groups. During the meeting APA advised that for them to provide an indicative cost plan for the works VPA would need to enter into a formal Agreement with APA. The purpose of this agreement is for VPA to engage APA to develop concept design upon which a cost plan could be produced. A program and fee estimate associated with the development of the concept design and cost plan could not be provided by APA at that meeting.

GHD has further investigated APA's preferred option of lowering the transmission pipeline within the current easement and note the pipeline could be laid by either open cut, horizontal directional drilling or pipe jacking. All methods would most likely require installation of a stopple bypass to allow continuous flow of gas to occur throughout the works. Construction techniques would need to be discussed with VicTrack and other service authorities whose assets may be impacted to ascertain the preferred methodology. The Concept Design would be reviewed via the Safety Management Study process as specified in AS2885.

During preliminary discussions with APA a preference for horizontal direction drilling (HDD) was nominated, to minimise excavation and impacts on the surrounding environment. GHD has further investigated the HDD option and prepared a preliminary specification for the works as outlined below.

- a trajectory radius of 1000 D = 168.3 m
- use a high strength steel for this radius as the bending stress will be relatively high for low strength
- 12 degree entry and exit angle
- Current pipe cover 0.75 m, under road we need minimum 1.2 m
- A depth margin of 2 m
- The depth of the HDD below current surface levels will be approximately 10.3 m

Noting the above assumptions, the overall HDD span will be about 132 m from entry to exit.

The existing exclusion zone for the in-service pipeline could be about 5 m, therefore the new HDD pipeline would be offset 5m from the existing. Allowance for another 10 m for horizontal dog-leg piping to meet the existing alignment is required resulting in a total new pipeline section length of approximately 142 m.

The temporary stopple bypass pipeline will be 154 m along x 5 m offset or total length of 164 m.

Subsequently the VPA was provided a cost estimate from APA for the transmission pipeline relocation works which has been inserted in the overall cost plan, the works have been estimated at \$4,400,000. Refer Appendix F for correspondence record.

4.3 Bridge Option at Jacksons Creek crossing LR-BR-01

GHD were asked to provide a number of high level options which looked at alternative bridge styles for LR-BR-01 crossing Jacksons Creek. Three (3) options were reviewed as preliminary structures for the Jackson's Creek crossing.

Option 1 the original base case was a Super-T span bridge, with 35m spans. The bridge piers and headstock were a revised design from the original base case, with a head stock which was tapered for a more refined profile. The piers were design to be tapering from the base of the headstock to ground level, allowing for a refined side profile. The Super-T depth is approximately 2.0m, with a headstock depth of approx. 2.6m. Both Option 1 and Option 2 are able to use precast concrete piers, which will allow for some efficiencies on site in the construction program, for cost and also quality, due to the higher quality of concrete due to the controlled conditions with casting off site.

Option 2 proposed was a Steel Girder bridge, with 60m maximum spans. The design of the piers and headstock is the same as the Super-T design, with tapering headstock and piers to present a refined profile with shadow lines which lighten the structure. The proposed overall depth of the steel girders is 3.0m, and a headstock depth of approx. 2.6m.

Option 3 was a Concrete Box Girder design, which is able to span approx. 60m also. Due to the design of the box girder and it's depth of 2.8m, a different pier type is required. This pier design does not use a headstock, and is also required to be cast on site. The overall design of the Box Girder allows for a recessed shadow line which gives box girder bridges a lighter appearance than steel girder bridges, which reveal the side profile of the girders due to the design.

VPA feedback from presentation of the three options was that the preference was to allow for a greater span to limit the impact upon the creek line and water course given the cultural significance of the area, Option 2 or Option 3 were preferred. Option 2 the steel box girder, provided the better financial option and has been included in the overall costing.

For further detail, refer to Appendix D.

5. Cost summary

GHD has prepared the cost plans with revised quantities based on updated design amendments and direction from the VPA. All previous costing calculations are to be considered outdated and superseded. Reasonable and verifiable assumptions have been carried forward from previous consultants.

A summary of the overall development costs is captured in Table 5 below. Individual projects including intersection, road and bridge cost sheets have been attached in Appendix C

Table 5 Overall development costs

Sunbury South			
ROADS SEGMENTS			
	Construction Costs (excl GST)	Other Project Costs (excl GST)	Total (excl GST)
SS-RD-04-01	\$10,949,199	\$4,516,545	\$15,465,744
SS-RD-04-02	\$4,527,811	\$1,867,722	\$6,395,533
SS-RD-04-03	\$8,759,628	\$3,613,346	\$12,372,974
SS-RD-04-04	\$2,492,584	\$1,028,191	\$3,520,774
SS-RD-04-05	\$14,489,127	\$5,976,765	\$20,465,892
SS-RD-05	\$4,535,832	\$1,871,031	\$6,406,863
SS-RD-06	\$3,208,842	\$1,323,647	\$4,532,489
SS-RD-07	\$6,117,147	\$2,523,323	\$8,640,470
SS-RD-08	\$3,014,581	\$1,243,515	\$4,258,096
SS-RD-09	\$2,657,454	\$1,096,200	\$3,753,653
SUB-TOTAL	\$60,752,204	\$25,060,284	\$85,812,488
INTERSECTIONS			
SS-IN-01	\$6,273,935	\$2,587,998	\$8,861,934
SS-IN-02	\$6,531,799	\$2,694,367	\$9,226,167
SS-IN-03	\$5,742,658	\$2,368,846	\$8,111,504
SS-IN-04	\$5,528,075	\$2,280,331	\$7,808,405
SS- IN-05	\$3,719,015	\$1,534,094	\$5,253,109
SS- IN-07	\$3,942,497	\$1,626,280	\$5,568,777
SS- IN-08	\$3,943,164	\$1,626,555	\$5,569,719
SS- IN-09	\$6,551,132	\$2,702,342	\$9,253,474
SS-IN-10	\$4,160,255	\$1,716,105	\$5,876,361
SS-IN-11	\$879,420	\$362,761	\$1,242,180
SS-IN-12	\$3,517,523	\$1,450,978	\$4,968,501
SS-IN-13	\$1,222,531	\$504,294	\$1,726,824
SS-IN-14	\$1,222,531	\$504,294	\$1,726,824
SS-IN-15	\$667,213	\$275,225	\$942,438
SUB-TOTAL	\$53,901,747	\$22,234,471	\$76,136,217

Sunbury South			
BRIDGES			
SS-BR-01	\$28,152,339	\$13,583,504	\$41,735,843
SS-BR-02	\$2,053,541	\$929,227	\$2,982,768
SS-BR-03	\$326,647	\$147,808	\$474,454
SS-BR-04	\$10,718,143	\$6,564,863	\$17,283,005
SUB-TOTAL	\$41,250,670	\$21,225,401	\$62,476,070
Lancefield Road			
ROAD SEGMENTS			
LR-RD-02-01B	\$4,104,012	\$1,692,905	\$5,796,917
LR-RD-02-02A	\$17,722,503	\$7,310,532	\$25,033,035
LR-RD-02-03A	\$4,581,171	\$1,889,733	\$6,470,905
LR-RD-02-03B	\$4,198,353	\$1,731,821	\$5,930,174
LR-RD-03	\$2,003,767	\$826,554	\$2,830,321
LR-RD-04	\$2,658,038	\$1,096,441	\$3,754,478
SUB-TOTAL	\$35,267,845	\$14,547,986	\$49,815,830
INTERSECTIONS			
LR- IN-01	\$4,803,402	\$1,981,403	\$6,784,805
LR- IN-02	\$5,001,509	\$2,063,122	\$7,064,631
LR- IN-03	\$4,577,602	\$1,888,261	\$6,465,864
LR- IN-04	\$4,769,255	\$1,967,318	\$6,736,573
LR- IN-06	\$367,720	\$151,684	\$519,404
SUB-TOTAL	\$19,519,488	\$8,051,789	\$27,571,277
BRIDGES			
LR-BR-01	\$68,672,887	\$35,194,854	\$103,867,741
LR-BR-02	\$5,094,836	\$3,120,587	\$8,215,424
LR-BR-03	\$4,891,094	\$2,995,795	\$7,886,889
SUB-TOTAL	\$78,658,817	\$41,311,237	\$119,970,054
TOTAL	\$289,350,770	\$132,431,167	\$421,781,937

5.1 Cost assumptions

The following assumptions have been taken into consideration within each high-level cost estimate:

- The cost estimates assume a traditional lump sum competitively tendered procurement method
- The cost estimates are based on carrying out the works during normal working hours
- The cost estimates assume road works outside the alignments for each option are excluded
- Cost template was supplied by the VPA
- Road pavement profile has been assumed to be 685mm deep to reflect Hume City Council Trunk Collector Street detail, refer Hume Standard Drawing SD06. Due to the limited geotechnical information, this pavement depth also reflects an insitu subgrade CBR value of 2%
- Earthwork volumes for pedestrian footpaths or similar have been added to the cut and fill values. The bulk cut and fill quantities allowed in the estimate will need to be tested and revised subsequent to further analysis and design
- Where batters have been designed the calculated cut and fill values have been added to the volumes used in the cost estimates
- Extra over allowance rate for rock excavation is based on the assumption of the possibility of rock being encountered everywhere. The assumption based off the geotechnical reports that indicate that rock should be breakable through normal excavation means, however production rates would be slower. GHD has applied this extra over allowance to 50% of the excavated area based upon discussion with VPA and Hume Council
- Preliminary vertical road design was completed on roads SS-RD-04, SS-RD-05, SS-RD-06, LR-RD-02-02, LR-RD-02-03 and LR-RD-03 only, using previous design inputs from GTA, Aurecon and WSP
- Earthworks quantities for GHD designed elements were calculated using a 3D model created for roads SS-RD-04, SS-RD-05, SS-RD-06, LR-RD-02-02, LR-RD-02-03 and LR-RD-03. Cut and fill volumes were calculated using 3d design software (12d Model) by comparing two elevation surfaces: the design surface (vertical geometry, including road cross sections and batter interfaces) and existing surface (constructed from LIDAR data provided by VPA)
- Cut and fill quantities are based upon insitu volumes, no bulking factors have been applied to excavated soil quantities.
- Bridge cost estimates exclude all civil and retaining wall works associated with the approaches unless noted otherwise. These works have been included in the adjacent road cost estimates.
- GHD has made no allowance for contaminated material.
- Street lighting poles 12m high with luminaries placed every 50m along roads to one side, unless noted otherwise
- An allowance for traffic signals has been made based on type and size of intersection at locations
- Rates used in the cost estimates are based on recent project data and benchmarked rates for concept cost estimates for projects of a similar nature in the Melbourne region

- Cost estimates are based on the information provided to GHD and knowledge of similar projects. The costs used for calculations have been validated via an external third party.
- All structural rates are high level allowances based on concept drawings. Adjustments to structural rates upon further structural design developments are anticipated
- The cost review assumes that a structured cost planning / value engineering process will be followed throughout the design process and that the project will be appropriately documented prior to tender
- No flood modelling have been incorporated into the costing allowance for culverts that appear in the cost sheets
- The Harpers Creek crossing SS-BR-03 is a culvert. GHD has maintained the size assumed by Aurecon in its previous report and adopted a 2.4m span precast concrete inverted culvert on a concrete base.
- LR-BR-03 consists of a bridge over existing rail, LIDAR data advises that the current rail level is approximately 5-6m below the adjacent land. Therefore GHD has made minimal allowance for fill to the bridge approach to meet the required 5.75m clearance stipulated by Transport for Victoria.
- Road design has been completed using AutoCAD software, the software has also been utilised to derive road lengths which have been measured along the road centre line from intersection to intersection, intersection to bridge structure and precinct boundary to intersection as applicable. Road project lengths and chainages are detailed in Appendix G for South Sunbury and Appendix H for Lancefield Road.
- Intersection extents are defined at the earliest point where a road layout differs from the typical road layout, such as the start of a turn lane.
- Retaining walls details are based on the soil nail retaining wall detail prepared by WSP in their Memo Sunbury South and Lancefield Road PSP – Infrastructure cost estimates, dated 28 April 2017.
- Habitat compensation fees were provided by the VPA following receipt of advice from DELWP.
- Along road alignments, batters have been substituted for retaining wall when batter widths exceed 20m perpendicular to the edge of pavement works. Further design refinement and value engineering will be required to identify the optimal design.
- All other assumptions have been noted in the cost estimates for each option

6. Geotechnical

Aurecon was previously by the VPA to produce a geotechnical report for the purpose of assessing a range of alignment options for two potential road crossings of Jacksons Creek in Sunbury, for the development of Sunbury South and Lancefield Road Precinct Structure Plans (PSP).

The final report is presented as two components, firstly a desktop used by the VPA to aid in selection of the most appropriate alignment options followed by a geotechnical investigation highlighting geotechnical findings, recommendation for bridge foundations and a discussion of constructability issues.

In the desktop study, based on geology of the site, and the previously report generated by GTA consultants, the following preferred alignment options were recommended:

- PSP Sunbury South – Option D and E
- PSP Lancefield Road – Option B

Following the confirmation of the listed alignments by the VPA, the geotechnical site assessment was conducted. The report provides a number of recommendations regarding each proposed alignment. Refer to Appendix E for the geotechnical report.

The geotechnical report states that *“excavation for the road construction will encounter rock with varying degrees of weathering from extremely weathered to moderately weathered condition.”*

An assumption has been made in the Aquenta Report based on the possibility of rock being encountered everywhere and the limited geotechnical information available, an extra over allowance of 30% of the excavated area was applied by Aquenta.

Subsequent discussions with the VPA and Hume City Council resulted in an extra over allowance of 50% being adopted for rock excavation in this report.

7. Design assumptions

The following design standards and reference documents (versions current as of July 2018) have been used in this investigation:

- Austroads Guide to Road Design (AGRD) and corresponding VicRoads supplements
- Engineering Design and Construction Manual (VPA April 2011)
- VicRoads Standard Specification for Roadworks and Bridgeworks.
- Growth Area
- Road Network Planning – Guidance and Policy Principles (VicRoads – working document)

The design speeds adopted are outlined in Table 6 below

Table 6 Adopted design speeds

Road type	Posted speed limit	Design speed	Reference
Connector Boulevard	60 km/h	60 km/h	Growth Area Road Network Planning – Guidance and Policy Principles
Connector Street	60 km/h	60 km/h	Growth Area Road Network Planning – Guidance and Policy Principles
Arterial (primary)	60 km/h	60 km/h	Growth Area Road Network Planning – Guidance and Policy Principles

Horizontal geometry design inputs are outlined in Table 7 below

Table 7 Horizontal geometry design inputs

Criteria	Value	Comment	Reference
Minimum radius for adverse cross fall	60 km/h = 200 m 80 km/h = 500 m	Urban Side friction factor = 0.17 Urban Side friction factor = 0.13	VicRoads Supplement to AGRD, Part 3, Table V7.2
Minimum radius for horizontal curves with superelevation	60 km/h = 98 m 80 km/h = 240 m	Desirable min. friction factor	AGRD, Part 3, Table 7.5
Minimum horizontal curve length	60 km/h = 100 m 80 km/h = 180 m		AGRD, Part 3, Table 7.6
Merge taper length	100 m (60 km/h) 130 m (80 km/h)		AGRD Part 3 Table 9.8

The design vehicles for intersections have not been changed from PB's early assumptions of the following, based on Austroads Design Vehicles and Turning Path Templates Guide:

- Arterial/ Arterial - Prime mover and semi-trailer (19 m)
- Arterial/Collector (Connector) - Single unit truck/bus (12.5 m)
- Collector/Collector (Connector/Connector) - Single unit truck/bus (12.5 m)

Intersection turn lane lengths have been adopted from table 4.1 within the Growth Area Road Network Planning – Guidelines & Policy Principles, as outlined in Table 8 below.

Table 8 Intersection turn lengths

Road type	Turn lane	Assumed volumes	Total turn land length (incl taper)
Primary Arterial	Left	400 veh/hr	100m (incl 25m taper)
	Single Right	200 veh/hr	200m (incl 25m taper)
	Double Right	400 veh/hr	170m (incl 55m taper)
Secondary Arterial	Left	400 veh/hr	100m (incl 20m taper)
	Right	200 veh/hr	200m (incl 20m taper)
Connector Street	Left	500 veh/hr	100m (incl 15m taper)
	Right	500 veh/hr	100m (incl 30m taper)

Vertical geometry adopted in the design is outlined in Table 9 below.

Table 9 Vertical geometry

Vertical geometry limits	Value	Comment	Reference
Minimum k value for a crest curve	60 km/h = 11.8 80 km/h = 29.3	Desirable minimum value for a 2.0s reaction time (2.5s is not available for these speeds)	AGRD, Part 3, Table 8.7
Minimum k value for a sag curve	60 km/h = 10 80 km/h = 17	Other Urban and Rural Roads without street lighting	AGRD, Part 3, Figure 8.7
Minimum longitudinal grade	1%	Desirable minimum value for drainage purposes	AGRD, Part 3, Table 8.5
Maximum longitudinal grade	60 km/h = 7-9% 80 km/h = 5-7%	Rolling Terrain	AGRD Part 3 Table 8.3

The geometry for road batters listed below has been reproduced from previously generated road cross-sections. The batter slope may not be applicable along all roads due to soil conditions on site. The grades will need to be reviewed following receipt of further detailed site specific geotechnical information.

- Fill batters – 6:1
- Cut batters – 3:1