This report has been requested by Hall & Wilcox on behalf of the Victorian Planning Authority and accordingly is subject to legal professional privilege

Victorian Planning Authority

Amendment C243 to the Hume Planning Scheme Review of Documentation relevant to the ICP

October 2020

Table of contents

Table index

Appendices

1. Introduction

1.1 Background

The VPA is the Planning Authority for Amendment C243 to the Hume Planning Scheme..

Amendment C243 makes changes to the Hume Planning Scheme to incorporate the final Sunbury South and Lancefield Road Infrastructure Contributions Plan (ICP). This ICP will replace the incorporated 'interim' ICP with an updated ICP and apply it to land affected by the Sunbury South Precinct Structure Plan (Sunbury South PSP) and Lancefield Road Precinct Structure Plan (Lancefield Road PSP) (together, the PSPs).

Amendment C243 incorporates a supplementary levy ICP which will be applied to the area of the PSPs by the proposed Schedule 1 to Clause 45.11 (ICO1)

The supplementary levy is required on the basis that the standard levy is insufficient to fully cover transport construction costs. The standard levy is a per hectare rate for infrastructure contributions for residential and commercial land, which are fixed by the Ministerial Direction on the Preparation and Content of Infrastructure Contributions Plans (1 July 2018) (Ministerial Direction) pursuant to Section 46GJ of the Planning and Environment Act 1987 (Vic) (PE Act).

2. Expert Witness Statement

2.1 Name and Address

Mark Whalen, FIE Aust.,

Civil Engineer

GHD Pty Ltd, 180 Lonsdale Street, Melbourne, Victoria, 3000.

2.2 Qualifications and experience

I am a civil engineer holding a Batchelor of Engineering (Civil), 1973, from the University of Melbourne and have 47 years' experience as a civil engineer.

I am a Fellow of the Institution of Engineers and a past president of the Association of Land Development Engineers.

My Curriculum Vitae is appended.

2.3 Profile and expertise

My career has largely been associated with major infrastructure and greenfield and brownfield land development projects. I have specialised experience in the production of engineering standards and costings, having undertaken assignments for both State and Federal Authorities.

For over 25 years I managed GHD's urban development, transportation and property groups and have been actively involved in the development of substantial urban developments in Melbourne.

2.4 Instructions

I have been instructed by Hall & Wilcox, Lawyers by correspondence dated 10th September 2020 to undertake the following work:

a. Review the exhibited ICP and background documents as relevant to your expertise

b. Review the submissions made to the VPA in respect of the Amendment; and

c. Prepare an expert witness statement addressing:

   i. Whether the costings of infrastructure items in the ICP are reasonable

   ii. The matters raised in relation to costings of infrastructure items in the submissions; and

   iii. The design and costings of Option 1 prepared by your firm

d. Participate in the expert witness conclave as required and attend the Panel hearing to give evidence

I have been further instructed by Hall & Wilcox, Lawyers by correspondence dated 16th October 2020 to undertake the following additional investigations:

Report by Mr Mark Breuer

We attach an expert witness report dated 8 October 2020 prepared by Mr Mark Breuer of Spiire Australia Pty Ltd in relation to the bridge crossings referred to in the Sunbury South and Lancefield Road ICP. The report has been filed on behalf of Villawood Properties for the purpose of the Panel hearing in this matter.

In his report, Mr Breuer proposes alternative options for the location and design of the northern bridge crossing of Jacksons Creek (LR-BR-01). As part of your report, you are requested to consider and comment on the costings considerations of the bridges contemplated by these alternative options.

Report by Mr Henry Turnbull

We also attach an expert witness report dated October prepared by Mr Henry Turnbull of Traffix in relation to his traffic engineering assessments of the Amendment. This report has been filed on behalf of Moremac Property Group for the purpose of the Panel hearing in this matter.

At section 7 of his report, Mr Turnbull provides his traffic engineering opinion regarding the Lancefield Road/Sunningdale Avenue 'interim' signalised intersection (LR-IN-01). At section 8.4, he discusses his design opinion regarding both of the bridge plans in the GHD ICP Infrastructure Design and Costings Report dated November 2019. You are requested to consider and comment on these sections of Mr Turnbull's report.

2.5 Assessment based on documents

The following documents have been provided by Hall & Wilcox, Lawyers to assist in the assessment and preparation of this report.

a. VPA Sunbury South and Lancefield Road, Infrastructure Contributions Plan, April 2020

b. Three expert witness reports dealing with aspects of the ICP Amendment have been reviewed:

   i. Expert Witness Report prepared by Mark Breuer titled

      Sunbury South and Lancefield Road Infrastructure Contributions Plan Jacksons Creek Bridge Crossing (SS-BR-01 & LR-BR-01) – Alternate Solutions and Probable Costs

      8 October 2020

   ii. ICP Transport Projects Cost Estimate Review prepared by Stephen Watters titled

      Expert Witness Report Sunbury South and Lancefield Road ICP

      14 October 2020

   iii. Traffic Engineering Evidence prepared by Henry Turnbull and titled

      Sunbury South and Lancefield Road ICP Amendment C243 to the Hume Planning Scheme

      October 2020

c. A Summary of Submissions – Community

Further relevant documents reviewed were:

VPA Benchmark Infrastructure Report, 11 April 2019

DELWP Infrastructure Contribution Guidelines November 2019

2.6 Preparation of this report

I have been assisted by Luke Morrison, a senior engineer in GHD's Civil and Urban Infrastructure group who was involved with the development of the GHD Design and Costings report.

2.7 Anomalies & Exclusions

I have made the inquiries I believe are necessary to form my opinion and I am not aware of any anomalies or exclusions which would alter my opinions regarding the matters I have been requested to address.

2.8 Practice Note Declaration

I have made all the enquiries that I believe are desirable and appropriate and no matters of signi ficance which Iregard as relevant have to my knowledge been withheld from the Panel. I have r ead the Guide to Expert Evidence and agree to be bound by it.

Signed

3. Specific Responses

3.1 The GHD Report

The GHD report Sunbury South Lancefield Road ICP, Design and Costings, November 2019 provides the basis for the VPA Sunbury South and Lancefield Road Infrastructure Contributions Plan April 2020.

3.2 Engagement by VPA

GHD was 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).

GHD updated many of the conceptual plans and cost plans provided by the VPA with revised quantities based on updated design amendments and direction from the VPA,

Not all drawings and quantities calculations were updated, only those that have been changed as a result of the design amendments. Other consultants have prepared similar cost plans for the previous designs, however, in general, previous costings were considered superseded.

Many of the assumptions formulated throughout the development of the ICP by other consultants were reviewed by GHD and the VPA. Where considered appropriate, these assumptions were adopted and were expressed in the GHD report.

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 was built upon by GHD and they formed the basis of the GHD report.

3.3 Basis for the ICP

The Sunbury South and Lancefield Road Precinct Structure Plans (PSP 1074 and PSP 1075) are the Plans used as a basis for the generation of the ICP.

These were 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 will 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 Standards as a base.

The desired lane arrangements for each intersection were provided by the VPA. The road alignments used were drawn from those established by GTA, Aurecon, Hume City Council Standards 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 also provided a geotechnical report in 2016, which 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.

3.4 Are the Costings of Infrastructure in the ICP reasonable?

3.4.1 Background to the Development of Costing Rates

It is understood that WT Partnership were engaged by Hume Council to review costings. GHD worked with WT to confirm a number of items and engaged Slattery to undertake costing of bridges and roads. These costings were used to derive rates for the cost estimates.

3.4.2 Key Assumptions used in the Development of Costing Rates

The GHD Report lists a range of assumptions taken into consideration within each high-level cost estimate: The substantive assumptions include:

1. The cost estimates assume road works outside the alignments for each option are excluded
2. Cost template was supplied by the VPA
3. 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%
4. 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.
5. 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
6. 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
7. 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)
8. 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.
9. GHD has made no allowance for contaminated material

10. An allowance for traffic signals has been made based on type and size of intersection at locations
11. 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
12. 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.
13. All structural rates are high level allowances based on concept drawings. Adjustments to structural rates upon further structural design developments are anticipated.
14. No flood modelling have been incorporated into the costing allowance for culverts that appear in the cost sheets
15. 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
16. 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
17. Habitat compensation fees were provided by the VPA following receipt of advice from DELWP
18. 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.

3.4.3 Assessment of rates

Development costs have been estimated for the Intersections, Roads and Bridges shown in the Precinct Structure Plans.

The plans prepared for the Intersections, Roads and Bridges were used to take off quantities.

As noted above, the cost estimates were based on the rate information provided to GHD and knowledge of similar projects. The costs used for calculations were validated by Slattery cost consultants.

The rates used were also assessed against the benchmark VPA rates, and while geotechnical and terrain will create some differences, the rates are generally similar.

A selection of comparative rates is shown in the following table.

Table 1 Broad cost comparison

Item	GHD Rates	VPA Benchmark Rate	Difference
Roads and Intersections			
Earthworks (per m3)	$43.20	$34.07 - $50.07	3.0% of average
Pavement (per m2)	$156.60	$169.62	8.2%
Kerb and Channel (per m)	$48.60	$54.81	12.7%
Footpath (per m2)	$66.00	$63.51	3.8%

Item	GHD Rates	VPA Benchmark Rate	Difference
450mm dia Drain	$260.00	$299.43	15.1%
Bridge Works [1]			
Decking (per m2) for Concrete Super T	$2450.00	$4425.57	Not applicable
Delivery Costs			
Roads and Intersections (% of Cost of Works)	41.25	41.25	0 %
Bridges (% of Cost of Works)	46.00 - 49.00 [2]	46.25	.5 %- 5.9%

1. These costs are not comparable due to differing spans.
2. Varies based on complexity of the structure

It is considered given the preliminary nature of these rates that there is only marginal difference between the GHD and Benchmark rates excepting the bridge decking rates which are not directly comparable due to the addition of different items in both bridge deck rates.

3.4.4 Matters raised in submissions

13 submissions were provided and reviewed in relation to the costing of infrastructure. The submissions could generally be divided into 3 categories, namely:

a. The extent of the proposed infrastructure should be modified (eg inclusion of redevelopment of parts of Lancefield Road, which is not provided in the ICP)

b. The proportion of funding that should be provided in the ICP was questioned (particularly for bridges SS-BR-01 and LR-BR-01 which several submitters considered could be funded by GAIC).

c. The quantum of cost was too high and not supported by cost benefit reviews (particularly for bridges SS-BR-01 and LR-BR-01 which several submitters considered was not warranted for the forecast demand).

GHD was instructed by the VPA to include the steel girder solution within the ICP costings and in conjunction with Slattery concluded that the cost of the bridge was $103,867,741 which included Works and Delivery costs. This cost was included in the draft ICP made available for review.

Upon request from the VPA to provide a concrete super T costing for LR-BR-01 an adjustment has been made to the steel bridge costs following the more detailed assessment. The costs for the bridge columns has been amended. The initial columns had a larger volume of concrete than is shown in the proposed steel girder design and consequently the cost of the bridge should be reduced to $92,496,734.

Submission 11.10 noted that “the intersection project costs for signalized intersections LR-IN-02 and LR-IN-03 do not include an allowance for the relocation of overhead electrical poles and cables at each intersection, as well as protection of the Nextgen fibre optic cable that runs along Lancefield Road. These costs should be included.” These are direct costs to the proposed works and should be included in the ICP.

3.4.5 The design and costings prepared by GHD.

The VPA on 22nd June 2018 provided instructions to GHD to redesign the bridge LR-BR-01 to provide the following:

The design intent for the bridge is to be:

- *Lightweight in appearance*
- *Visually recessive relative to the landscape*
- *Incorporate at least one 'lingering space' along the bridge's length to allow pedestrians/cyclists to stop along the bridge and observe the surrounding landscape*
- *Indicate pedestrian/cyclist paths underneath the bridge (with the opportunity to enjoy views from underneath)*
- *Minimise the disruption of land underneath the bridge (at piers) and at the launch points on either end of the bridge – 60m between spans is preferred*

A design with fewer piers should be further progressed – maximum increased cost is 20%.

Upon review of the previous design work completed by Parsons Brinkerhoff for LR-BR-01 GHD reviewed the overall bridge gradients and noted some improvements could be made to reduce gradients from maximums to preferred, which would facilitate a better driver experience. GHD adopted road grading varied from 2% to 7% over 300 metres on the western side with a 2% grade on the bridge and a 7% grade on the eastern side of the bridge over approximately 205 metres up the escarpment with a maximum cutting through the escarpment of 13.99 metres, refer Appendix A for long sections.

This resulted in a bridge with 8no 50 metre spans and 2no 45 metre spans totalling 490 metres approximately 35.5 metres above Jackson Creek. Due to the length of the spans a steel box girder bridge was selected using 3 units per span with a depth of 3.0 metres. The bridge cross section is 13.5 metres between kerbs comprising two 3.5 metre traffic lanes and one 2 metre and one 3 metre shared pathway. These details are shown in the drawings in Appendix A.

The costings were developed by GHD in conjunction with Slattery and were based on relevant similar bridge costs.

The total bridge costs were assessed at $103,867,741 comprising $68,672,887 for works and $35,194,854 for delivery costs. The works included all construction works, including road and structural works. The delivery costs were based on percentages of the cost of the works and included all fees, design and investigation costs, supervision and a contingency sum. The delivery costs are comparable to the VPA benchmarking costs.

As noted previously, the initial columns had a larger volume of concrete than is shown in the proposed steel girder design and consequently the cost of the bridge should be reduced to $92,496,734.

3.5 Expert Witness reports

3.5.1 Report by Mr Henry Turnbull

Mr Turnbull identified an issue with the interim design at the intersection of Lancefield Road and Sunningdale Avenue referred to as LR-IN-01. The current design shows the southbound leg of Lancefield Road being duplicated and constructed in the ultimate road configuration.

Mr Turnbull has identified that the southbound leg of Lancefield Road should taper and connect to the existing roadway and not be constructed in the ultimate design, refer Figure 15 below from Mr Turnbull's report.

GHD has reviewed the design and agrees that Lancefield Road sits outside the ICP elements identified in the current design and costings, coupled with unknown staging of development in the precinct it should be assumed that that the intersection will connect to the existing Lancefield Road and not the ultimate design.

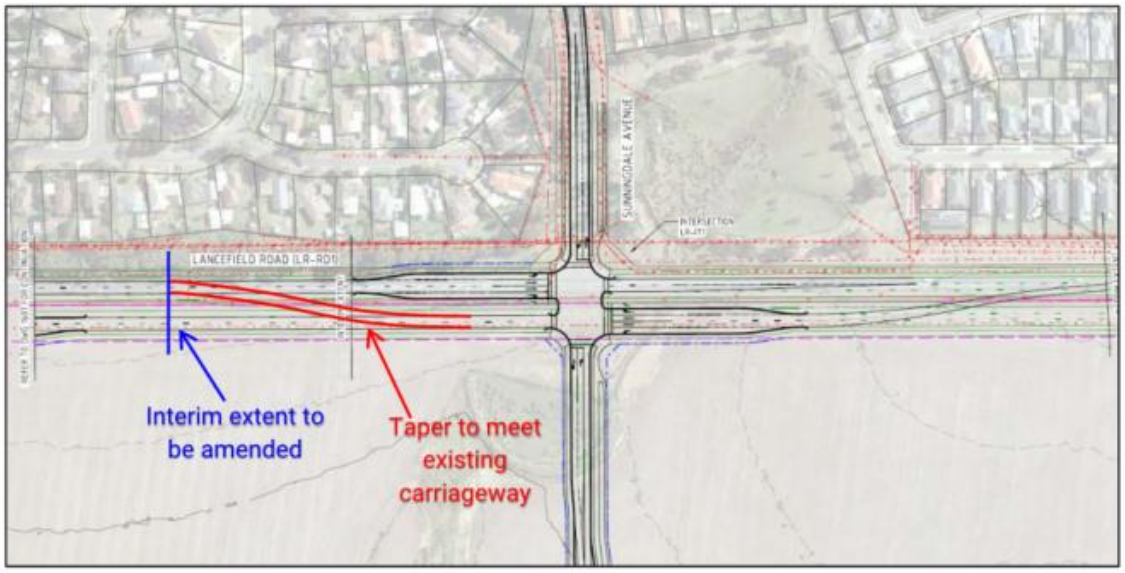


Figure 15: Lancefield Road/Sunningdale Avenue Interim Signalised Intersection Modified with Taper (LR-IN-01)

3.5.2 Report by Mr Mark Breuer

Mr Breuer had design options prepared using some of the AGRD and GHD parameters listed in his report.

Bridge LR-BR-01

Two Design Options, A and B were proposed for consideration to cross Jacksons Creek. As far as practicable, the alignment for both options was adopted to minimise any impact on the gazetted PSPs thus not impacting developments that have already commenced or for which planning approvals had been obtained.

Option A Description

Option A used the same horizontal alignment as the interim ICP and GHD report. A steeper vertical alignment on the east side of the creek was used to reduce the bridge structure length.

The vertical grade is set at the maximum allowable 9% over a distance of approximately 457 metres and continues further into the creek valley to reduce the bridge clearance above the creek from 35.5 metres shown in the GHD report to 13.2 metres. This option requires substantial earthworks through the eastern escarpment which Mr Breuer has estimated at 81,100m3 which is significantly greater than the 15,000m3 provided for in the GHD estimates.

This results in the bridge span reducing from 490 metres (ICP adopted) to 245 metres. Additional road and earthworks were included in the Opinion of Cost. The new vertical alignment presented in option A reduces the height of the piers. This reduction enabled a concrete super-T option, permitted a simpler pier shape and changed the bored piles to driven piles. The changes to the vertical alignment reduced the length of the structure by 50% but due to the use of super T's the cost reduction is greater than 50%.

Commentary

At the proposed bridge crossing, the Jacksons Creek waterway is constrained due to its narrowing. The flood plain width is in the order of 260 metres. The Option A proposal proposes a filled embankment on the west side prior to the bridge structure extending 60 metres into the flood plain resulting in a reduction in the flood plain width which has potential to cause an increase in the Creek's flood afflux. Commonly, Melbourne Water will require additional flood attenuation works to mitigate the increase in afflux. However there is no indication such works are proposed or costed. Without these attenuating works it is considered that the extension of the embankment will not be acceptable as it does not accord with generally accepted hydrologic principles.

Regarding the 9% grade on the east side of the creek, AustRoads Guide to Road Design Part 3: Geometric Design and referring to, Section 8.5.4 and Table 8.4 which provide details on desirable maximum lengths of grades. The desirable maximum length for a 9% grade is 300 metres. The Option A design runs between CH 760 and CH 1217.66 for a distance of 457.66 metres, which is greater than the desirable maximum length and may result in safety and capacity issues, particularly if there are heavy vehicles. It recommends that for sections of road with grades greater than those given in Table 8.4 shown below, a risk analysis to identify operational and safety effects be undertaken to determine the most appropriate treatment.

The relevant clause and table are shown below:

8.5.4 Length of Steep Grades

Maximum grade in itself is not a complete design control, as designers need to also consider what impact the length of the grade has on vehicle performance. Most standards do not explicitly limit the length of grades, but suggest that it is desirable to limit the length of sections with maximum grades. AASHTO (2011b) discusses the term 'critical length of grade' which is used to indicate the maximum length of a designated upgrade on which a loaded truck can operate without an unreasonable reduction in speed. AASHTO notes that to establish design values for critical lengths of grade for which gradeability of trucks is the determining factor, the following needs to be considered:

- Size and power of a representative truck or truck combination to be used as a design vehicle along with the gradeability data for that vehicle. AASHTO propose adoption of a weight/power ratio of about 120 kg/KW. This is roughly equivalent to a 19 m semi-trailer carrying an average load.
- Figure 3.11 provides truck performance curves for a 19 m semi-trailer. Designers should refer to Figure 9.9 to Figure 9.12 for the performance curves of alternative truck combinations.
- Speed of the truck at the entrance to the critical length of grade.
- Minimum speed on the grade below which the interference to following vehicles is unreasonable. AASHTO propose a maximum speed reduction of 15 km/h be adopted for the determination of critical lengths of grade as the likelihood of the truck being involved in a crash increases significantly beyond this speed.

However, it must be remembered that length of grade can affect both safety and capacity. Studies show that, regardless of the average speed on the highway, the more a vehicle deviates from the average speed, the greater are its chances of becoming involved in a crash. On both the upgrade and downgrade, the lower operating speed of trucks may cause inconvenience to cars. Long gradients, for example 5 km at 4%, could result in a high risk of serious accidents involving descending vehicles as a result of brake failure. Such gradients could also cause climbing vehicles to slow down to well below the 85th percentile speed. Current vehicle standards require multi-combination vehicles to be able to maintain a speed of 70 km/h on a 1% grade. The length of grade plays an important factor in the performance of those vehicles. For sections of road with grades greater than those given in Table 8.4, a risk analysis to identify operational and safety effects should be undertaken to determine the most appropriate treatment.

Where sprayed seal surfacing is proposed, there is evidence that long uphill grades on roads operating at 100 km/h should be limited to 4% maximum (absolute maximum of 5%) to reduce the risk of flushing (bitumen exposed due to loss of aggregate or other issues) caused by heavy vehicles tractioning up the grade. Pavement surfacing advice should be sought where long uphill grades with sprayed seal surfacing are proposed.

Table 8.4: Desirable maximum lengths of grades

Grade %	Length (m)
2–3	1800
3–4	900
4–5	600
5–6	450
> 6	300

In summary, the desirable maximum length of a 9% grade is 300 metres. Based on the advice provided by Austroads, by providing a 9% grade over 457.66 metres will likely result in:

- Speed differential between cars and trucks as trucks will find it find it more difficult and take longer to get up to the speed limit particularly on the uphill
- There may be some minor effects on achieving speed on the downhill which can result in greater demands and operational costs for the vehicle due to the increased breaking and gear changing
- Safety issues due to speed differential may result in increased overtaking requirements and additional queuing, which can be particularly problematic when there are higher traffic volumes
- Would need to provide a climbing lane or auxiliary lane to mitigate the safety issues resulting in a wider bridge
- Possible surface maintenance issues due to heavy vehicle tractioning up the grades

Effects on Costs

GHD's initial costing for the Steel girder bridge was $103,867,741; this was subsequently amended to $92,496,734 due to a revision in the bridge columns. Mr Breuer's estimate for a similarly aligned bridge using concrete super T's and reduced span is $47,914,254, over a 50 % reduction.

However, as noted above there are substantive questions regarding the criteria upon which this bridge has been designed.

Option B Description

Option B explores alternate horizontal alignments to find a more cost efficient solution, whilst still maintaining the same "connection points" to the PSP. This eliminates any need for amendment of the PSP or impact on approved developments.

Option B used an alignment sloping to the south, adding an additional 620 metres approximately of roadway. Again, a steeper vertical alignment on the east side of the creek was used to reduce the bridge structure length.

The additional disturbance to land by the additional length of road will be substantial, which will result in some increased environmental and other impacts. Environmental and archaeological considerations are outside the scope of this brief as are Habitat Compensation fees. Mr Breuer considers the quantum of fees will be minor in the context of the overall costs. This is a broad assumption which should be clarified.

The vertical grade is set at the maximum allowable 9% over a distance of approximately 400 metres and continues further into the creek valley to reduce the bridge clearance above the creek from 35.5 metres shown in the GHD report to 9.098 metres.

This results in a bridge span of 90 metres. Additional road and earthworks were included in the Opinion of Cost. The new vertical alignment presented in option B reduces the height of the piers. This reduction enabled a concrete super-T option, permitted a simpler pier shape and changed the bored piles to driven piles. The changes to the vertical alignment reduced the length of the structure by 50% but due to the use of super T's the cost reduction is greater than 50%.

Commentary

Similarly to Option A, the proposed bridge crossing, the Jacksons Creek waterway is constrained due to its narrowing. The Option B proposal proposes a filled embankment on the west side prior to the bridge structure extending 10 metres into the 1 in 100 year flood envelope resulting in a small reduction in the flood plain width which has potential to cause an increase in the Creek's flood afflux. Commonly, Melbourne Water will require additional flood attenuation works to mitigate the increase in afflux. However there is no indication such works are proposed or costed. Without these attenuating works it is considered that the extension of the embankment will not be acceptable as it does not accord with generally accepted hydrologic principles.

Melbourne Water requires a minimum 600mm clearance from a nominated 1 in 100yr flood level to the soffit of the bridge structure. The MWC nominated flood level at this location is 200.3 metres which when taking freeboard of 600mm and 1800mm deep concrete super T's will require a minimum road design level of 202.7 metres. From chainage 1189.97 to Ch 1222 the bridge design level is below this and will require adjustment to be compliant.

Regarding the 9% grade on the east side of the creek, the discussion above is again relevant. In summary, the desirable maximum length of a 9% grade is 300 metres. Based on the advice provided by Austroads, by providing a 9% grade over 457.66 metres will likely result in:

- Speed differential between cars and trucks as trucks will find it find it more difficult and take longer to get up to the speed limit particularly on the uphill
- There may be some minor effects on achieving speed on the downhill which can result in greater demands and operational costs for the vehicle due to the increased breaking and gear changing
- Safety issues due to speed differential may result in increased overtaking requirements and additional queuing, which can be particularly problematic when there are higher traffic volumes
- Would need to provide a climbing lane or auxiliary lane to mitigate the safety issues resulting in a wider bridge

- Possible surface maintenance issues due to heavy vehicle tractioning up the grades

Effects on Costs

As noted previously, GHD's initial costing for the Steel girder bridge was $103,867,741; this was subsequently amended to $92,496,734 due to a revision in the bridge columns. Mr Breuer's estimate for the alternative aligned bridge using concrete super T's and reduced span is $30,527,193. However, as noted above there are substantive questions regarding the criteria upon which this bridge has been designed and it is considered that in its current form it would not be an acceptable alternative.

SS-BR-01

Two Design Options, A and B were proposed for consideration to cross Jacksons Creek. As far as practicable, the alignment for both options was adopted to minimise any impact on the gazetted PSPs thus not impacting developments that have already commenced or for which planning approvals had been obtained.

Option A Description

Option A used the same horizontal alignment as the interim ICP and GHD report. A steeper vertical alignment on the east side of the creek was used to reduce the bridge span but created additional earthworks.

The vertical grade is set at the maximum allowable 9% and continues further into the creek valley to reduce the bridge clearance above the creek from 43.0 metres shown in the GHD report to 38.1 metres. This option requires substantial earthworks through the eastern escarpment which Mr Breuer has estimated at 20,100m3 which is significantly greater than the 10, 3m3 provided for in the GHD estimates.

This results in the bridge span reducing from 315Lm (ICP adopted) to 240 Lm. Additional road and earthworks were included in the Opinion of Cost. The new vertical alignment presented in option A marginally reduces the height of the piers. Steel Box girders were proposed, using 4 spans each spanning 60 metres.

Effects on Costs

GHD's initial costing for the super T's bridge was $41,735,843. Mr Breuer's estimate for a similarly aligned bridge using Steel girders and reduced span is $43,553,373, a slight increase due to the use of steel girders.

In comparing the costs, Mr Breuer noted the structural solution differed from the solution adopted in GHD report which was a steel box girder and added that the use of super T's were considered a more cost effective and constructible solution and is consistent with other bridge types adopted in the interim ICP. This statement is not correct as the option shown in the GHD report (Dwg 2113308A-STR-0103) shows super T's.

His report also states that the design is not constructible due to the need to lift super T beams by craneage some 85 metres which it is agreed is not possible. However, the valley slopes are very steep, approximately 30%-50% in some parts which will prohibit the use of cranes.

It is proposed to use a gantry solution progressively constructed from one or both sides, span by span, meeting in the middle regardless of whether the beams are steel or concrete super T's. While there are additional costs for the gantry, these would be offset by constructing platforms on the steep slopes to enable very large cranes to lift the beams from the ground. This construction methodology was effectively used on the Caulfield to Dandenong railway grade separation project, and it is understood previously for the Charles Grime Bridge in Docklands.

Option B Description

Mr Breuer states that option B is considered a refinement of the horizontal alignment adopted in the GHD report and is a minor departure of the horizontal alignment to locate a more optimal solution reducing the bridge size and bulk earthworks.

Option B reduces the span of the bridge from 315 metres to 240 metres. Additional road and earthworks have been accounted for in the OPC.

This option has a 31 metre height to the Creek. However, with option B the valley reduces in depth away from the central span. A 60 metre steel launched span has been proposed for the central span with 2 spans of super T's on the west side and 4 sets on the east side.

The change from 1.8 metre super T's to a 3.0 metre Steel girder will produce a noticeable difference in the visual profile of the bridge which would need to be considered by urban designers when considering its suitability.

Effects on Costs

GHD's initial costing for the concrete super T's was $41,735,843. Mr Breuer's estimate for a moderately realigned bridge using a central steel girder, super T spans on either side and reduced span is $36,391,021, a saving due to the reduced span of the bridge.

This option has additional earthworks (35,600m3 cf 20,100m3 in option 1) associated with it. The differences are due to the shorter span with the costs of bridge spans and associated barriers and screens providing the cost difference**.**

Opinion of Probable Costs – Excavation

In section 7 of Mr Breuer's report he notes that he considers the excavation rate to be too high, based on works done in the area. He has adopted a rate of $43.20/m3 for all excavation.

The rates cited in the GHD report use a rate of $43.20/m3 for all general excavation plus and extra over rate of $96.80/m3 for rock anticipated to be encountered in the area.

While this appears substantially different, adopting the average for both excavation rates yields a rate of $61.00/m3.

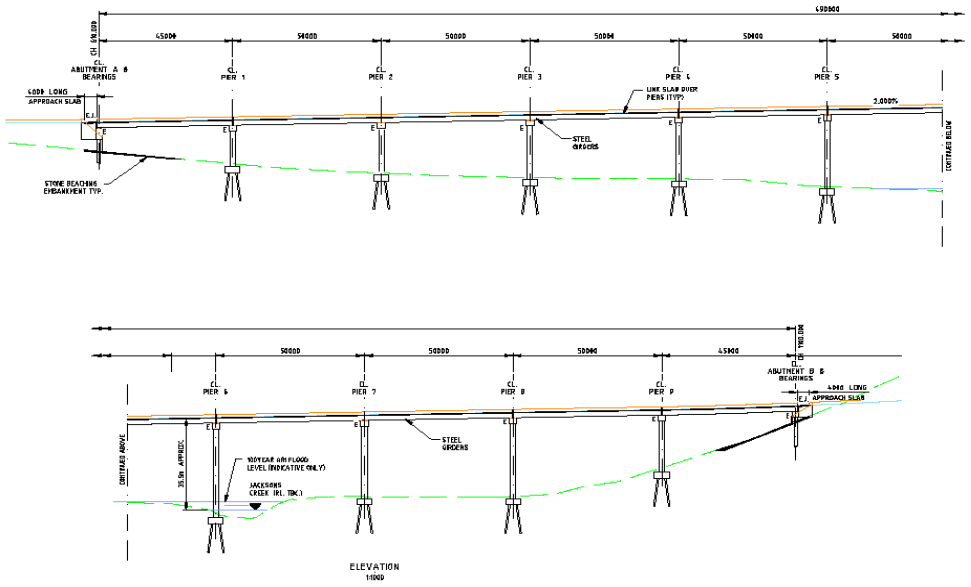
Cost consultants Slattery's have quoted an excavation rate of $50/m3 for the bridge with an extra over provision of $80.00/m3 in their cost review dated 5th March 2019. (Ref: Slattery, GHD Sunbury South & Lancefield Rd PSP Cost Review (5 May 2019))

Mr Watters in his expert witness statement has cited excavation rates of $55.00/m3 and $60.00/m3 and notes he has undertaken development works in the region since 2016. (Ref: ICP Transport Projects Cost Estimate Review EXPERT WITNESS REPORT Sunbury South and Lancefield Road ICP, 14 October 2020).

In considering the above and given the varying ways to estimate earthworks, for example can dozers rip the rock in place or are excavators required, the rates for excavation can vary substantially and an average excavation rate in the order of $60/m3 is considered suitable.

Appendices

Appendix A



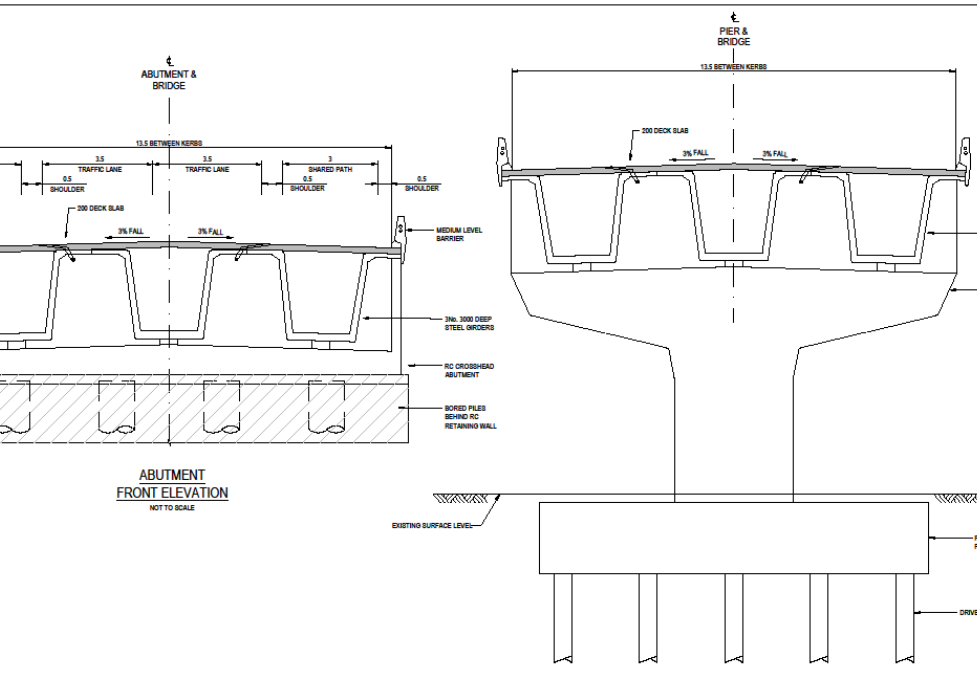
C	UPDATED ARRANGEMENT LENGTH	TC	LM	MW	15.08.19
B	PRELIMINARY ISSUE - GHD	DAC	LM*	MW*	22.08.19
A	ISSUED FOR INFORMATION - PB	JD	--	--	22.03.17

DO NOT SCALE

PRELIMINARY GHD Drawing No. 31-36206-STR-0402

SUNBURY STH AND LANCEFIELD RD PSP
JACKSON CREEK BRIDGE (LR-BR-01)
ALTERNATIVE LONG OPTION 3
GENERAL ARRANGEMENT SHEET 2

A3 Drawing No: 2113308A-STR-0402 Rev: C



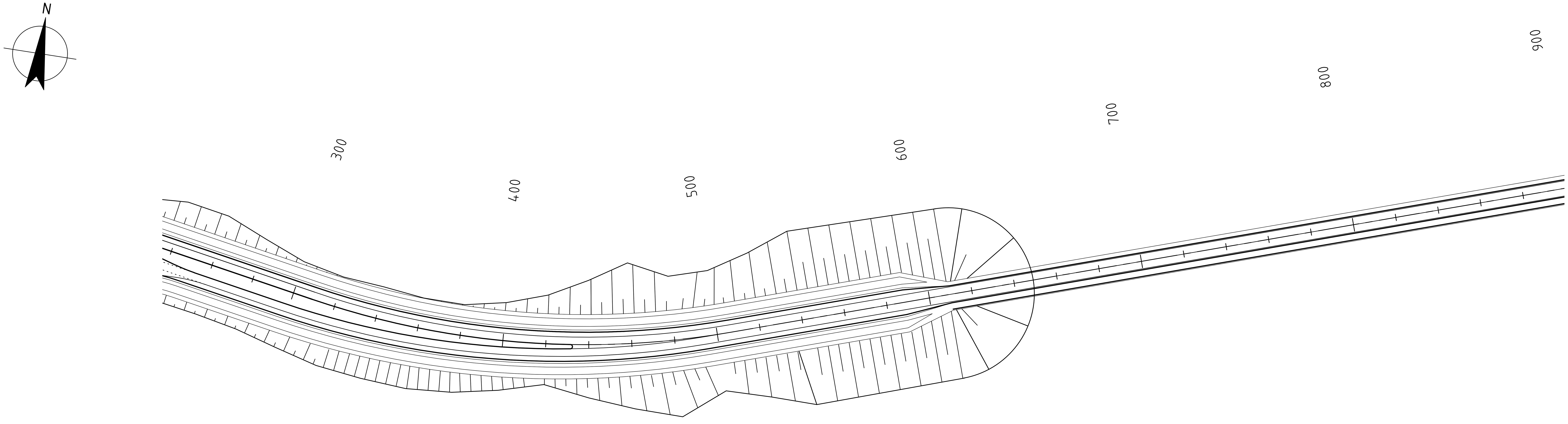
C	ISSUED FOR INFORMATION	SL	LM*	MW	12.08.19
B	AMENDED TO VPA COMMENTS - GHD	DH	LM*	MW*	27.05.19
A	ISSUED FOR INFORMATION	DAC	GK		29.05.19

DO NOT SCALE

PRELIMINARY GHD Drawing No. 31-36206-CIV-0403

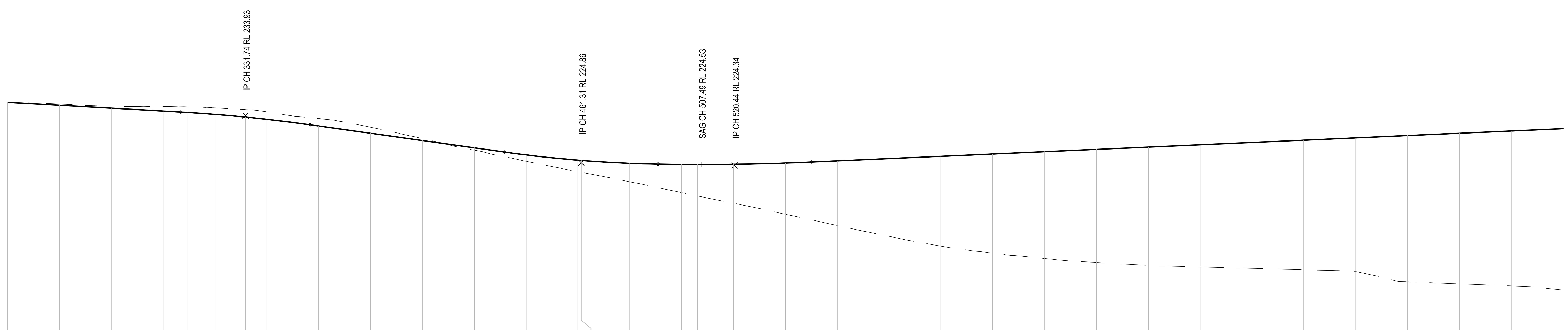
SUNBURY STH AND LANCEFIELD RD PSP
JACKSON CREEK BRIDGE (LR-BR-01)
ALTERNATIVE LONG OPTION 3
GENERAL ARRANGEMENT SHEET 3

A3 Drawing No: 2113308A-STR-0403 Rev: C



PLAN

SCALE 1:1000



DATUM RL. 192.00

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HORIZONTAL ALIGNMENT	L=309.24m				L=196.84m R=-394.00m										
LEVEL DIFFERENCE CUT - / FILL +	0.05	-0.23	-0.37	-0.89	-1.07	-1.25	-1.45	-1.46	-1.44	-1.17	-0.37	0.46	1.23	2.21	2.28
DESIGN SURFACE LEVEL	236.514	235.950	235.386	234.822	234.558	234.184	233.665	233.231	231.948	230.548	229.148	227.748	226.384	225.362	225.310
EXISTING SURFACE LEVEL	236.46	236.18	235.76	235.71	235.62	235.44	235.11	234.69	233.39	231.71	229.52	227.29	225.15	223.15	223.03
CHAINAGE	240.00	260.00	280.00	300.00	309.24	320.00	331.74	340.00	360.00	380.00	400.00	420.00	440.00	460.00	461.31

VERTICAL ALIGNMENT						L=550m G=2.22%													
HORIZONTAL ALIGNMENT				L=960.30m															
LEVEL DIFFERENCE CUT - / FILL +	3.56	5.42	6.05	7.48	9.87	12.43	14.97	17.30	19.15	20.58	21.79	22.79	23.54	24.26	24.97	25.76	28.18	29.03	29.86	31.09
DESIGN SURFACE LEVEL	224.756	224.542	224.528	224.569	224.804	225.222	225.667	226.111	226.555	227.000	227.444	227.888	228.333	228.777	229.221	229.666	230.110	230.555	230.999	231.443
EXISTING SURFACE LEVEL	221.19	219.12	218.48	217.09	214.94	212.79	210.70	208.81	207.41	206.41	205.65	205.09	204.79	204.51	204.25	203.91	201.93	201.53	201.14	200.35
CHAINAGE	480.00	500.00	506.09	520.00	540.00	560.00	580.00	600.00	620.00	640.00	660.00	680.00	700.00	720.00	740.00	760.00	780.00	800.00	820.00	840.00

LONGITUDINAL SECTION - LR RD02

HORZ 1:1000 VERT 1:500

0 10 20 30 40 50m
SCALE 1:1000 AT ORIGINAL SIZE

PRELIMINARY

A	PRELIMINARY ISSUE	JT	LM	MW	21.10.20
No	Revision Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director	Date

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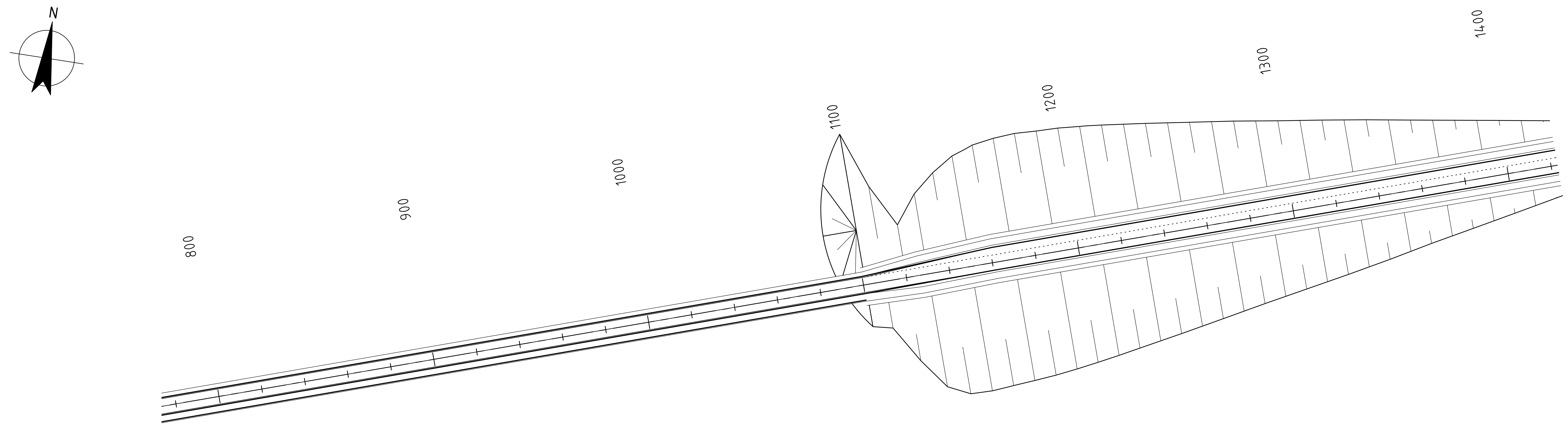
Drawn	Designer
Drafting Check	Design Check
Approved (Project Director)	
Date	
Scale AS SHOWN	This Drawing must not be used for Construction unless signed as Approved

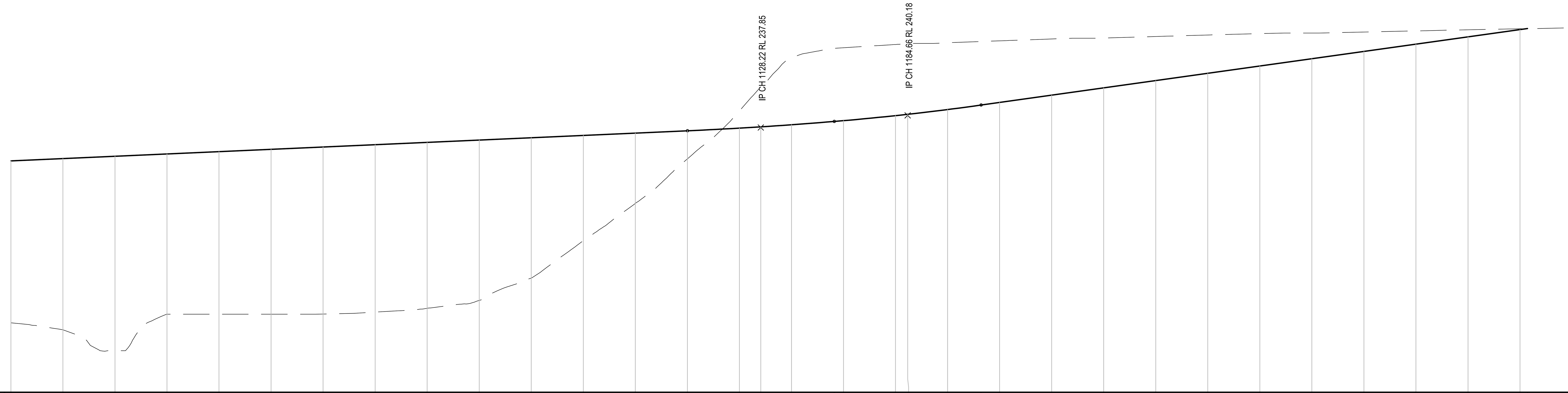
Client **VPA**
Project **SUNBURY STH AND LANCEFIELD RD PSP**
Title **JACKSON CREEK - LR-BR-01**
PLAN AND LONGITUDINAL SECTION - SHEET 1 OF 2
Original Size **A1** **Drawing No: 31-36206-CIV-SKT0003** **Rev: A**

Plot Date: 21 October 2020 - 11:15 AM Plotted by: James Thai Cad File No: C:\Users\jthai\Desktop\Sunbury\LSEC ROAD01-1.dwg



PLAN

SCALE 1:1000



DATUM RL. 187.00

VERTICAL ALIGNMENT: L=550m, G=2.22% | K=29.41, L=56.44m | G=4.14% | K=19.74, L=56.44m | L=210m, G=7%

HORIZONTAL ALIGNMENT: L=960.30m

CHAINAGE	840.00	860.00	880.00	900.00	920.00	940.00	960.00	980.00	1000.00	1020.00	1040.00
LEVEL DIFFERENCE CUT - / FILL +	31.09	32.88	37.33	30.78	31.22	31.67	32.08	32.15	31.87	30.79	26.95
DESIGN SURFACE LEVEL	231.443	231.888	232.332	232.776	233.221	233.665	234.109	234.554	234.998	235.443	235.887
EXISTING SURFACE LEVEL	200.35	199.01	195.00	202.00	202.00	202.00	202.03	202.40	203.13	204.65	208.94

CHAINAGE	1060.00	1080.00	1100.00	1120.00	1128.22	1140.00	1160.00	1180.00	1184.66	1200.00	1220.00
LEVEL DIFFERENCE CUT - / FILL +	20.22	13.49	5.40	-3.29	-7.60	-12.89	-13.99	-13.66	-13.56	-12.83	-11.84
DESIGN SURFACE LEVEL	236.331	236.776	237.220	237.732	237.982	238.381	239.166	240.132	240.386	241.300	242.658
EXISTING SURFACE LEVEL	216.11	223.29	231.82	241.02	245.58	251.27	253.16	253.80	253.95	254.13	254.50

CHAINAGE	1240.00	1260.00	1280.00	1300.00	1320.00	1340.00	1360.00	1380.00	1400.00	1420.00	1440.00
LEVEL DIFFERENCE CUT - / FILL +	-10.80	-9.58	-8.47	-7.36	-6.22	-4.94	-3.73	-2.55	-1.36	-0.15	
DESIGN SURFACE LEVEL	244.058	245.458	246.858	248.258	249.658	251.058	252.458	253.858	255.258	256.658	
EXISTING SURFACE LEVEL	254.86	255.04	255.33	255.62	255.88	256.00	256.19	256.41	256.62	256.81	256.99

LONGITUDINAL SECTION - LR RD02

HORZ 1:1000 VERT 1:500

0 10 20 30 40 50m

SCALE 1:1000 AT ORIGINAL SIZE

PRELIMINARY

No	Revision	Drawn	Job Manager	Project Director	Date
A	PRELIMINARY ISSUE	JT	LM	MW	21.10.20

Note: * indicates signatures on original issue of drawing or last revision of drawing

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Drawn | Designer
Drafting Check | Design Check
Approved (Project Director)
Date
Scale AS SHOWN

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Client **VPA**
Project **SUNBURY STH AND LANCEFIELD RD PSP**
Title **JACKSON CREEK - LR-BR-01**
PLAN AND LONGITUDINAL SECTION - SHEET 2 OF 2

Original Size A1 Drawing No: **31-36206-CIV-SKT0004** Rev: **A**

Plot Date: 21 October 2020 - 11:16 AM Plotted by: James Thai Cad File No: C:\Users\jthai\Desktop\Sunbury\LSEC ROAD01-1.dwg

Appendix B – Curriculum Vitae

Mark Whalen

Senior Project Director

Qualified. Master Preliminary (urban planning), 1981; Bachelor of Engineering (Civil), 1972
Connected. Institution of Engineers (Fellow); Association of Land Development Engineers (ex-President); recipient of the Bill Foley award for services to the industry

Relevance. Mark's ability to operate effectively in demanding environments, and his technical capability and comprehensive understanding of the infrastructure and land development industries offers clients the high level strategic, commercial and technical advice that is required for complex, multi-disciplinary projects.

Mark provides services to both the public and private sector and has successfully delivered projects for over 45 years at local, state and federal levels. Projects have encompassed a wide range of residential & industrial developments and major civil infrastructure projects.

He appreciates the challenges that are encountered when dealing with government procedures and readily works with all parties in an highly collaborative manner

Relevant experience

Director Utilities

Utilities Group | LXRA, Victoria

Mark was seconded into the Level Crossing Removal Authority to establish a utilities group to manage and direct dealings with all relevant infrastructure agencies and was responsible for identifying particular agencies and addressing their issues. He worked closely with project partnering teams while continuing to deal with the agencies at both commercial and technical levels on a program wide basis.

He was also responsible for establishing contract terms of engagement for the Authority which have been used in negotiations with agencies and is providing on-going advice and assistance to the Authority.

Project Director

Servicing Assessments | Victorian Planning Authority | ongoing

Mark has prepared reports assessing the capacity and capability of infrastructure for various Precinct Structure Plans in greenfield and brownfield areas.

These assessments have enabled integrated solutions that recognise the relationship between existing and augmented servicing strategies and sustainable urban development.

Project Director

Secondary Commercial Activity Opportunities | Melbourne Water

Mark managed this innovative project to analyse Melbourne Water's Land Portfolio using spatially enabled multi-criteria analysis, the objective of which was to get more out of existing assets.

Challenges relating to differing views of various Melbourne Water departments involved saw Mark employing a systematic process so that the benefits of what could realistically be achieved were well understood across the organisation.

Mark coordinated with a multi-disciplinary team to facilitate the evaluation of development and other options for some 4700 properties.

Senior Technical Director

Victorian Office Contract Reviews

Due to his substantial background in dealings of both a commercial and legal nature, Mark regularly assists the in-house legal team in reviewing commercial contracts with existing and potential clients.

Expert Witness Roles

Mark has undertaken various key assignments acting as an expert witness for authorities in land compensation cases developing and costing before and after scenarios and has also engaged with developers at VCAT regarding planning and engineering matters.

Senior Technical Director

Melbourne Water Retailer Developer Agreements

In his various roles with the Association of Land Development Engineers (ALDE) Mark negotiated directly with the MWR agencies during the preparation of their development agreements.

Senior Technical Director and Publisher Engineering Design and Construction Manual | Metropolitan Planning Authority, Victoria

Mark's comprehensive urban development experience and previous work for the federal and state governments in drafting development codes led to the Victorian Planning Authority's invitation to prepare the Engineering Design & Construction Manual. This manual is now used by the metropolitan growth area municipalities for all new developments.

Mark liaised with several high profile stakeholders with strong opinions on the matter. However, a pragmatic approach and inherent diplomacy enabled him to deliver this project to the satisfaction of all involved parties. He provided a perspective and technical leadership that added value, thereby aligning multiple stakeholders to the end result.

Project Director

Edgewater Estate | Lend Lease

Mark managed the design and delivery of this award winning development which was one of Australia's largest urban renewal projects, ultimately housing a population or approximately 3000 new residents

Despite initial opposition, Mark championed an original approach involving onsite treatment of the Coode Island Silt present beneath the site. Implementing this approach enabled substantial saving in development costs.

Mark also addressed on-site flooding issues with the design of a substantial lake system to provide protection from floods. He was also responsible for the design and construction of a 200,000 m^3 engineered facility to accommodate waste from the remediation works undertaken on the site.

Project Director

Flemington Racecourse Flood Protection Strategy | Victoria Racing Club

This project presented a major challenge around hostile community opposition and concerns that the flood protection works at the racecourse would adversely impact surrounding properties.

Mark's approach included providing the community with clear and factual engineering information to them to alleviate their concerns. Following lengthy and, at times, highly emotional community consultation the project proceeded.

Mark's tasks involved investigating the effects of major flooding on the Flemington Racecourse then developing and implementing the flood protection strategy while mitigating adverse impacts for other stakeholders along the Maribyrnong River.

Project Director

Kensington Banks | Major Projects Victoria & Urban Pacific

A major challenge and risk associated with this project was the presence of Coode Island Silt across the redevelopment site.

At the beginning of this project, little redevelopment had occurred in areas of Melbourne that contained this soil type therefore remediation methodologies were not well understood. Mark developed pre-loading and remediation techniques as well as EMPs and OH&S documentation to allow construction to proceed.

Mark responded to high levels of complexity such as mitigating existing flooding issues by advising on geotechnical treatments.

To allow development of the site, Mark was responsible for a hydraulic solution to install box culverts in the Maribyrnong River to increase conveyance and effectively lower the flood levels thereby removing the flood plain designation from the site.

This award winning residential development was one of Australia's largest inner urban developments.

Project Director

Dandenong Logis | Places Victoria / Melbourne Water (MWC)

Mark was involved with the initial stages of this high quality industrial project that has become an extremely successful development for Places Victoria and MWC.

As this was a joint venture between two organisations, the expectations of each party varied on occasion. Mark effectively navigated differing client expectations by providing considered advice, maintaining an open dialogue with both organisations and maintaining a neutral position.

Project Manager

Defence Site Maribyrnong | Places Victoria

Mark provided development feasibility advice and costings for the valuation of Defence Site Maribyrnong, including participating in the initial master planning of the site.

Design Director

Melbourne City Link | TOJV | Victoria

Mark was responsible for a substantial design team and managed design services in a strong collaborative environment for the Southern Link section of the Melbourne City Link project, involving the design of the Monash Freeway widening, the Domain Tunnel under the Yarra River, Exhibition Street extension and the Southbank Interchange, founded in highly compressible Coode Island Silts.

Project Director

Integrated Water Management Systems East Werribee Employment Precinct | Metropolitan Planning Authority | Victoria

Mark led the assessment and preliminary design of an integrated water management systems for the East Werribee Employment Precinct, which has incorporated a major lake system, providing substantial environmental and amenity benefits.

Project Director and Lead Design

Nowingi Long Term Containment Facility | Major Projects Victoria | Melbourne, Victoria

Mark undertook the functional design for the proposed Long Term Containment Facility at Nowingi, which included assessing alternative sites and developing a design solution that was required to last for over 1000 years due to the highly sensitive environment. A containment facility with a design life of this amount was potentially unique in the world.

He was also required to appear at the Panel hearings as an expert witness to support the development.

Key areas of interest

- Urban infrastructure and development systems
- Master planning
- Commercial evaluation of proposed professional services to clients
- Financial assessments and studies for land development
- Development of regulatory codes and specifications

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Document Status

Revision	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
1	M Whalen	L Morrison	* L Morrison	M Whalen		21/10/2020

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