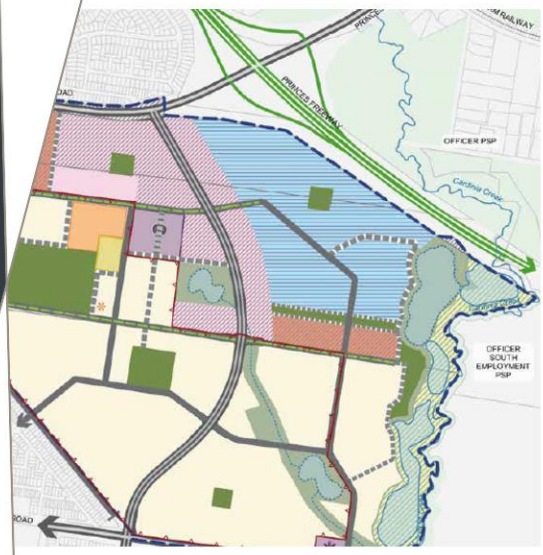
Expert Evidence Statement – Infrastructure Costings by Michael Francis Steer

Minta Farm Infrastructure Contributions Plan (ICP) –C269

V181544



Instructed by

Hall & Wilcox Lawyers on behalf of Victorian Planning Authority

03 June 2020

Cardno®

Contact Information

Cardno Victoria Pty Ltd
ABN 47 106 610 913

Level 4
501 Swanston Street
Melbourne 3000
Australia

www.cardno.com
Phone +61 3 8415 7777
Fax +61 3 8415 7788

Document Information

Prepared for	Hall & Wilcox Lawyers on behalf of Victorian Planning Authority
Project Name	Minta Farm Infrastructure Contributions Plan (ICP) – C269
File Reference	V181544 C269 Statement Costings.docx
Job Reference	V181544
Date	3 June 2020

Table of Contents

Appendices

1 Qualifications and Expertise

In accordance with the 'Guide to Expert Evidence' prepared by Planning Panels Victoria, my qualifications and expertise to undertake this work are summarised below:

Name:

Michael Francis Steer

Address:

Cardno

Level 4, 501 Swanston Street

Melbourne Vic 3000

Professional Qualifications:

- Associate Diploma of Civil Engineering Queensland Institute of Technology, 1984
- Degree of Bachelor of Civil Engineering Queensland University of Technology, 1998
- Master of Engineering Science (Infrastructure Management), 2002
- Registered Professional Engineer of Queensland (Member No. 6900)
- Chartered Professional Engineer, Engineers Australia (Member No. 831023), National Professional Engineers Register, 2019-2020
- Fellow, Engineers Australia.

Professional Experience:

- Cardno Victoria, Major Projects Design & Construction Manager, July 2018 – Present
- Ventia, Contracts Manager Victoria, 2017-2018
- Fluor, Principal Civil Engineer, 2012-2017
- Emerson Stewart, General Manager P+UD, 2010-2011
- Self Employed, 2009
- FMG Consulting, State Manager (Qld), 2007-2009
- DPM, State Manager (Qld), 2004-2007
- Gold Coast City Council, Supervisor Engineering Compliance, 2002-2004
- Brisbane City Council, Senior Asset Officer, 1998-2002
- Plus, various early career roles between 1980-1998 that included work as a cadet engineer and later engineer with Brisbane City Council, engineering design and construction supervision roles with engineering consultancies in Brisbane, project management of road construction works in England, maintenance and construction management for Pine Rivers Shire Council.
- With regards to transport and community infrastructure I have overseen projects from strategic planning through to functional and detailed design, construction and maintenance in both urban and rural environments including municipal, VicRoads and private roads, car parks, path networks, railway

systems, and all types of municipal community and recreation facilities. I also have extensive overseas and interstate experience on road networks through design and construction.

Areas of Expertise:

- Planning, development, design (including cost estimating), construction and maintenance of diverse infrastructure assets, including transport and community infrastructure;
- Whole of life asset management;
- Stakeholder and risk management;
- Financial analysis including life cycle cost;
- Business Planning and Reporting.

I am employed by Cardno in the capacity of Major Projects Design and Construction Manager, within the Urban Infrastructure Business Unit in the Melbourne office.

Expertise to Prepare this Report:

My training and experience including involvement with all forms of asset development and use over the past 40 years qualifies me to comment on the infrastructure costing aspects of the Minta Farm Infrastructure Contributions Plan (ICP).

In terms of questions falling outside the expert's expertise:

- I am not a Quantity Surveyor; however, it is a normal and widely accepted practice in the engineering and development industries to adopt 'Engineers Estimates' of costs, based on quantity take-offs by engineering staff and use of rates developed and updated by engineers, especially for road and drainage infrastructure.

Instructions which Defined the Scope of this Report:

I have been instructed by Hall & Wilcox Lawyers on behalf of the Victorian Planning Authority (VPA) to provide expert evidence at the Panel Hearing for C269.

Facts, Matters and Assumptions Relied Upon:

- The work done by Cardno on the broader Benchmark Project, which included development of a range of 'template' functional designs and associated costs, to be used to support the general development of ICP's for Precinct Structure Plans across all the growth areas – *Refer Appendix A*;
- The design guidelines and standards referenced in the various Cardno reports developed for the VPA in reference to benchmark costs and ICP's – *Refer Appendix A*;
- Cardno's specific reports to the VPA on the Minta Farm Infrastructure Contributions Plan (ICP);
- Submissions received on the exhibited documents;
- Outcomes from the functional layout design conclaves held for C269 dated 23 April 2020 (to consider a second option of IN-02 and IN-03).

Identity of Persons Undertaking the Work:

Michael Steer, assisted by Viraj Abeykoon (Civil Engineer) and Samuel Beckham (Graduate Civil Engineer) of Cardno Victoria.

Aspects of the broader (predecessor) work were also undertaken by former or other current Cardno employees.

'I have made all the inquiries that I believe are desirable and appropriate and no matters of significance which I regard as relevant have to my knowledge been withheld from the Panel.'

Michael Steer

Principal

for **Cardno**

2 Introduction

I have been instructed by Hall & Wilcox Lawyers on behalf of the VPA to provide my opinion on the proposed Minta Farm Infrastructure Contributions Plan (ICP) – C269. In this report I comment specifically (and only) on **Infrastructure Costing** matters.

The full scope of my engagement is as follows:

- Consider the submissions to the exhibited Amendment in relation to infrastructure costing matters and provide an expert opinion in relation to these submissions by 29 May 2020; and
- Present my expert opinion at an expert witness conclave and sign off on the conclave statement by 19 June 2020.
- Present evidence at the C269 panel hearing, scheduled for 2 September 2020 onwards.

3 Previous instructions

With regard specifically to C269, a summary of Cardno's instruction from the VPA for the Exhibited ICP is as follows:

- Determination of scope and components of infrastructure costs and designs that are outside of the benchmark standards and recommendation of which costs should be included in the ICP;
- Assessment of standard quantities and rates (through benchmark costs);
- Application of standard rates to quantities required through design;

The concept plans for the *Exhibited ICP* were based on Traffix Group FLP's for Minta Farm PSP, dated 31 August 2018, with minor changes being made by Cardno to facilitate a staged approach. An initial approach was formulated with respect to interim FLP's on the 11th of January 2019, where a new staged approach to the costing assessment was agreed to by the VPA and Cardno. The initial staged approach followed the following assumptions;

> Stage 1 (Early Delivery Works – EDW-01) where only intersections IN-01 and IN-05 would be constructed. The road sections between these intersections 'Road 01-04' were to be constructed as well during this stage inclusive of 2 single lane (each way) 'through lane' portions;

> Subsequent stages of intersection works were assumed to follow a progressive South to North construction sequence (Stage 2 – IN-04, stage 3 – IN-03, Stage 4 – IN-02). New additional southbound road sections connecting the new intersection to the previously constructed intersection were to be also constructed during each of these stages (RD-04, RD-02 and RD-01). This was to be implemented instead of an interim single lane approach in both directions due to crossover limitations. The two initial 2 – way lanes (Road 01-04) will then become northbound lanes only.

The staged approach can be seen in the image below.

Figure 3-1 Exhibited ICP Projects

Costings submitted by Cardno in its Minta Farm Costings Report dated 14 March 2019 reflected the above staged approach. Road section costings were calculated at a pro rata rate based on the 'Interim Primary Arterial Road" arrangement which is detailed in the Benchmark Infrastructure Costings project (version D5-01.03.2019). The geometry of the intersections detailed on the FLP were entirely bespoke, which necessitated quantities being measured for each individual intersection, as opposed to taking quantities from the Benchmark Infrastructure Costings project.

The majority of rates for items mainly consisted of those derived from the Benchmark Infrastructure Costings project (version D5-01.03.2019), with a few rates derived from Cardno's internal resources (internal resources include contractor's tender rates received as part of other comparable projects and Rawlinson's Construction Handbook). The findings from the Minta Farm Costings Report (version D5-14.03.19) were then used in the Exhibited ICP.

Following exhibition of the ICP, amendments were subsequently made to the concept plans by Cardno and were submitted to the Victorian Planning Authority (VPA) on 13 March 2020. From a high-level perspective, the result was a change in the approach of development of the north-south arterial and geometry of the north-south arterial and related intersections. As these March 2020 concept plans were changed significantly compared to the exhibited plans, the cost estimates needed to be updated as well. Further details of the

updated cost estimates following the issue of new March 2020 plans and the subsequent functional conclave are outlined in section 4 below.

4 Updated Cost Estimates

Following the circulation of the updated March 2020 concept plans, a functional conclave was held on 23 April 2020. The key outcomes of the above two events that impacted infrastructure costings are;

- Re-costing all intersection and road projects based on the latest concept plans;
- Assuming that O'Shea Road would have already been constructed at the time of construction of IN-01;
- Costing an extra option for intersection IN-02;
- Costing an extra option for intersection IN-03.

The costs developed for specific infrastructure items in C269 have been developed via an iterative process, which logically follows that of developing designs, extracting quantities from designs and applying relevant cost rates. The cost rates used to develop the cost estimates are largely based on the Benchmark rates which have been *indexed to March 2020*. If there are unique design elements specific to a given bespoke design (e.g. utility protection/relocation), these are researched at the time and costed from available information sources, as they are usually not found in the DCP-data from which the benchmark rates were derived.

Cost estimates for the following transport infrastructure items (based on the updated plans) have been provided within this evidence statement. Refer to Appendix C for the relevant concept plans of these transport items.

> Roads – Early Works
  - Primary Arterial road section between intersection IN-01 and IN-05

> Intersections - Interim layout
  - IN-01
  - IN-02
  - IN-03
  - IN-04
  - IN-05

> Additional intersection variations for cost comparison purposes (the two intersections below were costed as part of an agreement of the functional conclave, to compare the costs of template variations of the intersections)
  - IN-02 – Option 2
  - IN-03 – Option 2

Cost estimates for the following infrastructure items have not been provided within this statement. These estimates have been adopted by the VPA for this ICP.

- BR-01 – Scaled-down Benchmark Cost item 24
- CU-01 – Scaled up Benchmark Cost item 31
- PS-01 – Based on Mt Atkinson ICP

4.1 Comparisons with previous costings

A comparison of the revised cost estimates with the previous Exhibited ICP costings are as follows (note scope of works changed from time of previous costing):

Infrastructure Item	Exhibited ICP P50 Cost excl. GST ($)	**Revised P50 Cost excl. GST ($)**	Exhibited ICP P90 Cost excl. GST ($)	**Revised P90 Cost excl. GST ($)**
IN-01	6,016,000	**4,027,899**	6,799,000	**4,593,955**
IN-02	5,789,000	**7,084,270**	6,575,000	**8,040,547**
IN-02 (Option 2)	-	**6,168,480**	-	**7,021,111**
IN-03	4,562,000	**4,956,830**	5,170,000	**5,631,626**
IN-03 (Option 2)	-	**4,532,752**	-	**5,160,426**
IN-04	3,691,000	**4,408,796**	4,187,000	**5,012,670**
IN-05	6,019,000	**9,887,736**	6,789,000	**11,215,492**
Early Works RD-01	4,947,000	**7,003,939**	5,634,000	**7,974,651**
RD-01	819,174	**N/A**	916,986	**N/A**
RD-02	829,045	**N/A**	930,732	**N/A**
RD-04	1,330,770	**N/A**	1,493,800	**N/A**

Table 4-1 Differences in P50 and P90 costs across initial and revised costings for Minta Farm PSP

The itemised key differences between intersections as follows:

4.1.1 IN-01

- The revised cost estimate assumes that O'Shea Rd will be already constructed when IN-01 is constructed, resulting in a reduction in construction work required at this intersection. This was not the assumption for the Exhibited cost estimates.
- The intersection is larger in size along with associated works in the exhibited issue compared to the revised issue. This includes the exhibited intersection having two left turn lanes leading on to the north-south arterial, while the revised intersection has one;
- Limit of works is extended in the exhibited issue in all directions, notably the southern leg is 95 metres longer than the revised leg. This is due to a change in design speed of the north-south arterial;
- However, utility relocation/protection has been included in the revised costing along with the inclusion of kerb removal and sawcut works to the revised costing. An increase Traffic management allowance of 8% (compared to the exhibited ICP's 5% has also been applied due to the brownfield nature of the intersection);
- The net result is the estimate for IN-01 being lower in the revised estimate compared to the exhibited ICP estimate.

4.1.2 IN-02

- Compared to the exhibited ICP, the eastern leg of the intersection has an increased pavement depth in the revised costing as it needs to be considered an industrial connector leg. It was costed as a connector pavement in the Exhibited ICP;
- Geometry of the intersection has included a slip lane and traffic island in the revised FLP;

- Limit of works is extended from the exhibited issue in the northern direction, the northern leg is 185 metres shorter than the revised leg. This difference was accounted for previously in a separate infrastructure item, RD-01, which is now superseded by IN-02;
- Kerb removal quantities significantly increased as well an extra inclusion of sawcut works to the revised costing. An increased Traffic management allowance of 6.5% due to the presence of the North-South arterial at the time of construction of the intersection has also been applied (compared to the exhibited ICP's 5% Traffic Management allowance).
- The net result is the estimate for IN-02 being higher in the revised estimate compared to the Exhibited ICP estimate.

4.1.3 IN-03

- Limit of works is extended from the exhibited issue in the western direction, the western leg is 80 metres shorter in the exhibited plans. The northern and southern legs of the exhibited intersection are larger than the revised counterparts, by approximately 80m and 60m respectively.
- Kerb removal quantities significantly increased as well an extra inclusion of sawcut and concrete footpath removal works to the revised costing. An increased Traffic management allowance of 6.5% due to the presence of the North-South arterial at the time of construction of the intersection has also been applied (compared to the exhibited ICP's 5% Traffic Management allowance).

4.1.4 IN-04

- Limit of works is reduced from the exhibited issue in the southern direction, the southern leg is 70 metres shorter than the revised leg. This difference was accounted for previously in a separate infrastructure item, RD-04, which is now superseded by IN-04;
- Kerb removal quantities significantly increased as well an extra inclusion of sawcut works and concrete path removal to the revised costing. An increased Traffic management allowance of 6.5% due to the presence of the North-South arterial at the time of construction of the intersection has also been applied (compared to the exhibited ICP's 5% Traffic Management allowance).;
- The net result is the estimate for IN-04 being higher in the revised estimate compared to the Exhibited ICP estimate.

4.1.5 IN-05

- In general, this intersection was revised in perspective as mainly a brownfield intersection with elements of greenfield, which differed from the initial perspective of a greenfield intersection with elements of brownfield. This has had an impact on the costings by incorporating more brownfield line items and rates, but one that I affirm is more representative of the nature of works that must take place.
- The assumption of an increase in renewal works compared to the initial issue has had an effect on the quantities through the entire costing for IN-05.
- It was assumed in the exhibited issue that new pavement on Grices Rd would be to a connector pavement standard. It has been assumed to be a primary arterial pavement in the revised costing. Temporary pavement and removal were also introduced into the costings within this report as a staged approach. Pavement removal was introduced as a line item in the revised costing.
- Drainage requirements were assumed to have increased significantly to the staged approach;
- Kerb removal quantities significantly increased as well an extra inclusion of sawcut works and concrete path removal to the revised costing.
- Limit of works is extended in the revised issue in the western and southern directions, roughly 150 metres longer for each leg;
- Significant inclusion of utility relocation/protection in the revised costing as well as increased Traffic Management allowance of 8%;

- The net result is the estimate for IN-05 being higher in the revised estimate compared to the Exhibited ICP estimate.

4.1.6 RD-01

- Extent of RD-01 in the early works stage is 1353 metres within the revised costing, an increase from 1222m in the Exhibited ICP costings. This is due to the changes in early works intersection limit boundaries
- Landscaping was included for the entire section in the revised costing instead of the area between the carriageway and western boundary line. This is as a result of adopting Planning Panel recommendations for Donnybrook Woodstock ICP for Minta Farm ICP;

4.2 Specific details on intersections

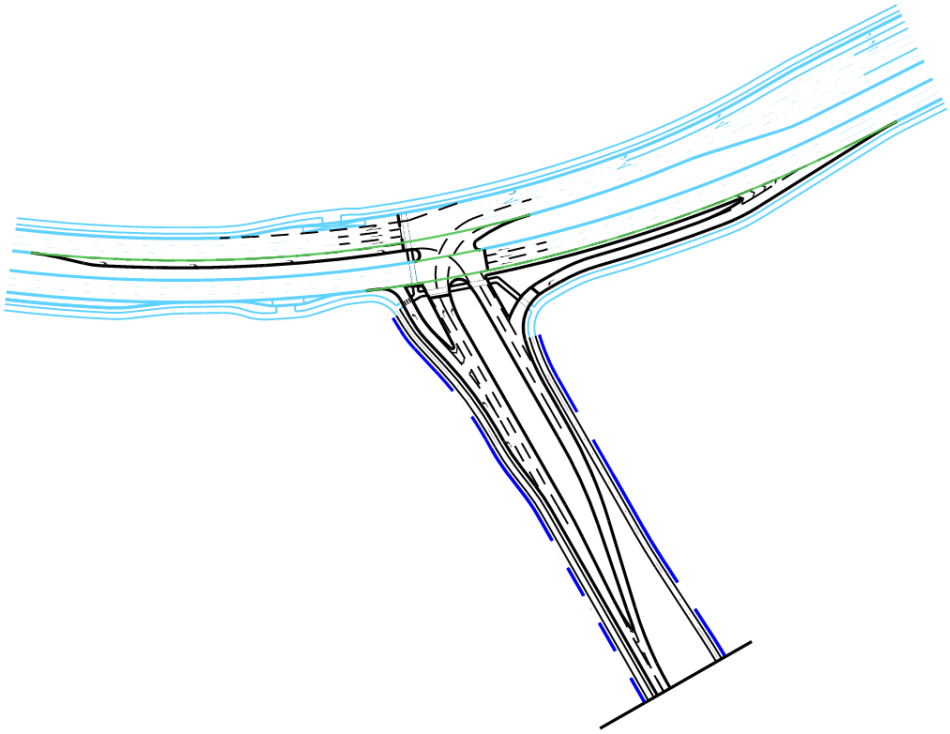
Specific details regarding the revised estimates conducted for several of the above intersections are outlined below.

1.1.1 O'Shea Road and North South Arterial T Intersection IN-01

IN-01 is a T intersection with the future O'Shea Road and the North South primary arterial. It has been assumed that O'Shea Road would have been constructed at the time of constructing IN-01 (as agreed during the functional conclave for Minta Farm ICP). Due to this, the majority of the East-West leg components of the intersection are not required to be included in the cost estimate of the intersection. The following costs have however been attributed to the final cost of IN-01;

- Costs for turn lane construction on O'Shea Road;
- Signal hardware installation on all legs;
- Construction of new traffic islands;
- Provision of additional pavements/ linemarking;
- Demolition of the central median on O'Shea Road and the construction of new pavement at this location.

Figure 4-1 IN-01 Intersection layout



In addition, the VPA noted that the Department of Transport (DOT) design levels for O'Shea Road were notably higher than the existing surface levels. This raised concerns whether when attempting to tie-into the DOT designs large batters will be required and whether these batters could be contained within the road reserve.

To gather additional information on the above, a 3D analysis was conducted at this intersection to identify batter extent requirements. This analysis was conducted based on LiDAR information provided by the VPA and the 3D design information for O'Shea Road provided by the DOT. The findings of this exercise can be found in Appendix E (these findings are subject to change at later design stages with the availability of more detailed information such feature surveys). The analysis showed that;

- The PAO for O'Shea Road is able to accommodate the batter extents on O'Shea Road and some of the batter on the North South Arterial;
- The remaining batter on the North South Arterial can be accommodated within the concept design boundaries;
- The PAO for the North South Arterial at the northern section isn't wide enough to accommodate the concept design boundaries.

1.1.2 Traffic Staging for IN -02/ IN-03 and IN-04

Intersections IN-02/ IN-03 and IN-04 are 4-leg intersections. It has been assumed that the north-south arterial is already constructed as part of the early works at the time of implementation of these three intersections. As part of the updated plans, there is no determined infrastructure item sequence after the implementation of the early works phase (as opposed to the North – South intersection development sequence adopted during the Exhibited ICP).

Since the implementation of the three intersections incorporate works along what is assumed to be an existing arterial, a staging plan to minimise traffic disruption would be a likely scenario for construction. An assumed staging plan simulates a realistic approach to construction which would affect the costing, but note that contractors will implement their own approach in practice. The staged approach for this item incorporates items such as pavement re-sheeting and concrete saw cutting works, items which are typically additional to a greenfield costing.

The staged approach assumed for the intersections is detailed in the table below:

Stage	Scope
Stage 1:	Construction of the eastern section of north-south primary arterial offline. Construction of two tapers connecting the newly constructed road to the existing western section.
Stage 2:	Diversion of north-south arterial traffic on to the newly constructed eastern section. Re-sheet pavement on western arterial section. Construct the East-West legs. Commence installation of intersection.
Stage 3:	Remove temporary works, and finalise installation of the intersection to specification.

Table 1-1 Staged construction approach for IN-02

1.1.3 North South Arterial and Grices Road IN – 05

IN-05 is a 4-leg intersection incorporating Grices Road, Soldiers Road and the north-south arterial. It has been assumed that the north-south arterial is already constructed at implementation of IN-05. The intersection also incorporates the separation and closing off of the northern section of Soldiers Road.

Since the implementation of IN-05 incorporates works along existing arterial roads on all legs, a staging plan to minimise traffic disruption would be a likely scenario for construction. An assumed staging plan simulates a realistic approach to construction which would affect the costing, but note that contractors will implement their own approach in practice. The staged approach for this item incorporates temporary pavement, drainage and concrete works, items which are typically additional to a greenfield costing.

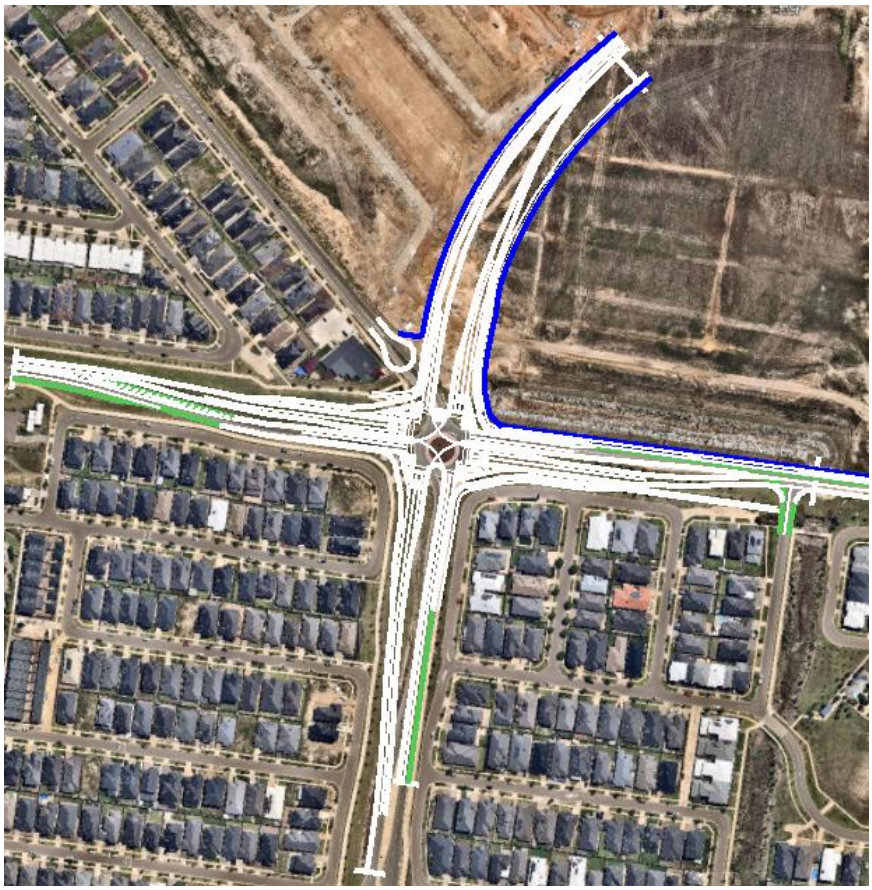
The staged approach assumed for IN-05 is detailed in the table below:

Stage	Scope
Stage 1:	Construction of temporary and permanent pavement around the existing infrastructure area. Traffic continues to utilise existing intersection. Connect new pavement to existing pavement for future use by traffic,
Stage 2:	In sections, block existing outbound lanes and divert outbound traffic to newly constructed pavement. Remove redundant works where possible, begin construction of outbound lanes, and begin works on intersection.
Stage 3:	Remove temporary works, and finalise installation of the intersection to specification.

Table 1-1 Staged construction approach for IN-05

Due to the brownfield nature of the intersection, several additional tasks have been conducted to more accurately estimate the cost. These are outlined below.

Figure 4-2 IN-05 Existing Roundabout Layout with Design Overlaid



Due to the brownfield nature of the intersection, several additional tasks have been conducted to more accurately estimate the cost. These are outlined below.

- Allowing for Temporary pavement provision – Temporary pavements have been costed at this intersection in order to allow for continuous traffic flow, as shown in figure 4-3. The pavements highlighted in pink in Figure 4-3 are the temporary pavements that will need to be constructed and later demolished. The pavements highlighted in blue in the same figure are the pavements that can be constructed 'offline' and are not temporary pavements. The construction of the temporary pavements initially will allow traffic flow to continue while the existing roundabout and existing pavements are demolished.

Figure 4-3 IN-05 Intermediate Interim Intersection showing pavement and temporary SUP

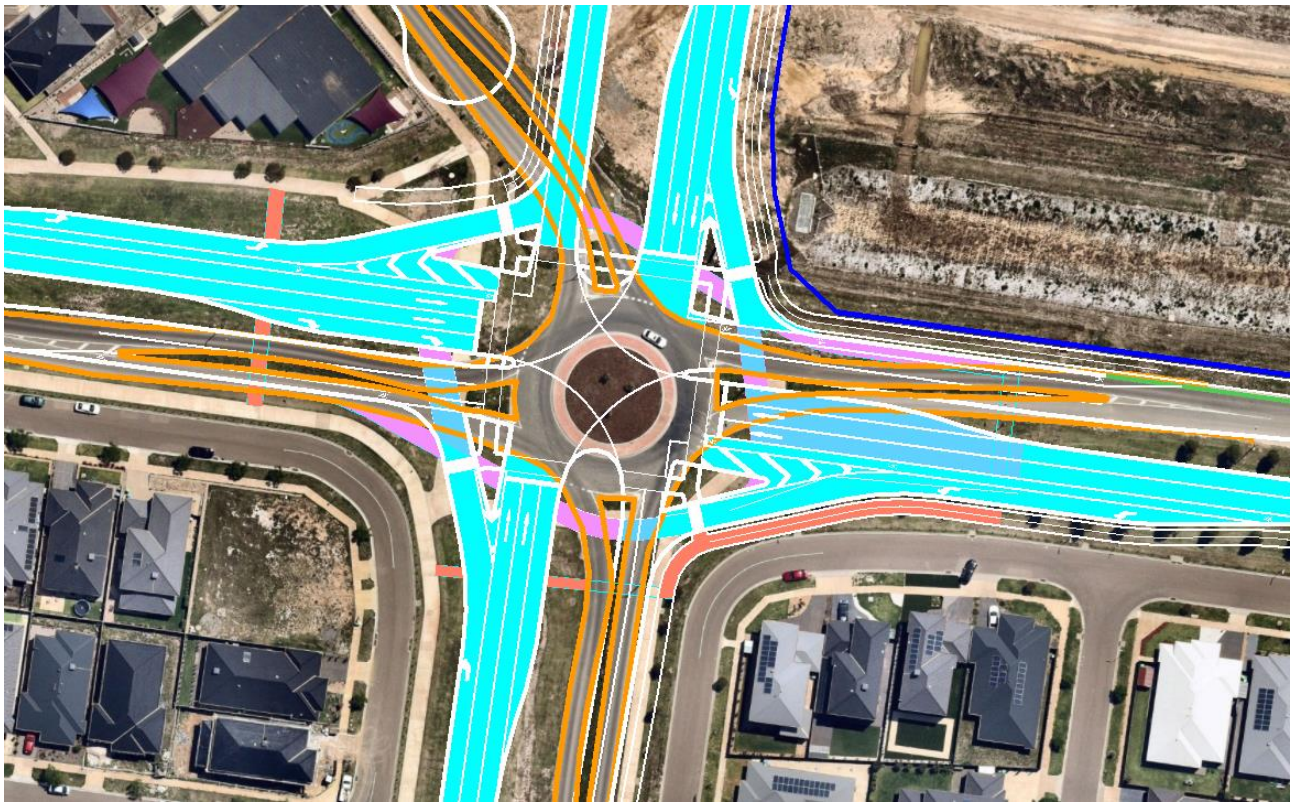
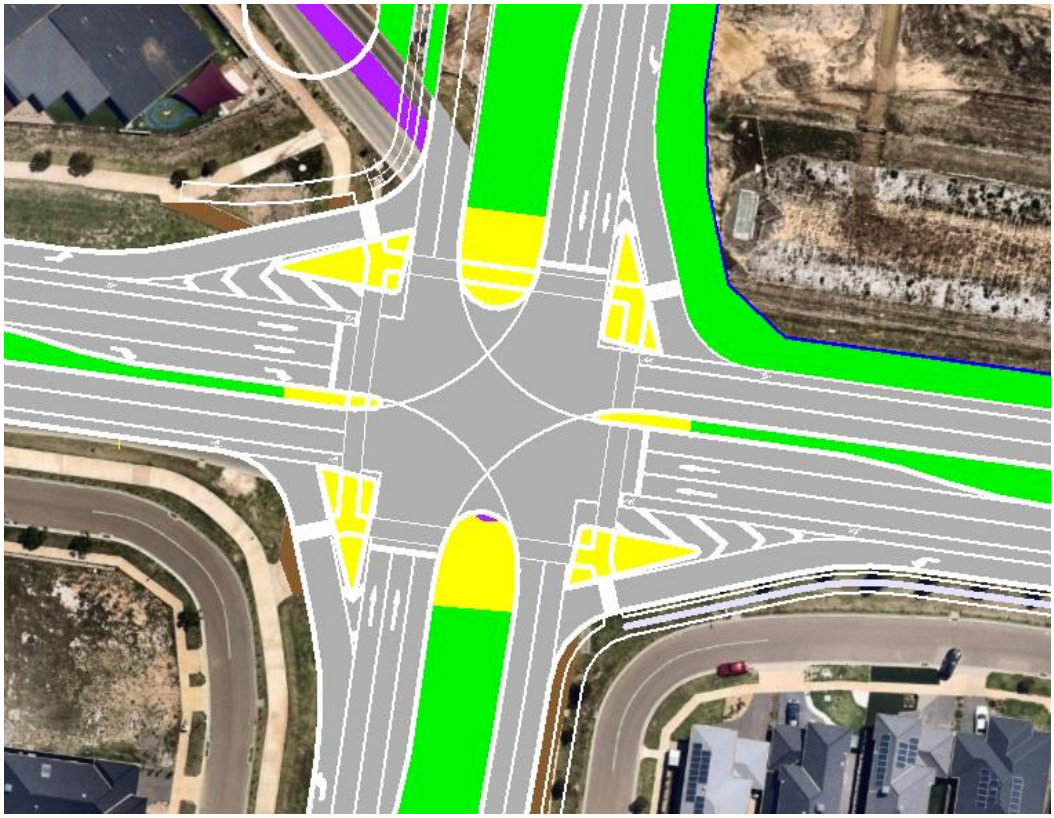


Figure 4-4 IN-05 Completed Interim Intersection showing primary pavement in grey



- Allowing for Pavement removal, kerb removal and shared path removal – A notable amount of development has occurred in the area over the recent years and along with the future growth in development it can be assumed that the traffic volumes on the intersection will increase. It is expected that the existing pavement will not have sufficient capacity to cater for this rise in traffic. Due to this, the existing pavement as outlined below has been assumed to be removed and replaced with new Primary arterial pavement. Shared paths that are no longer required have also been removed.

Figure 4-5 IN-05 Existing Pavement, Traffic Island and Concrete Removal

- Allowing for utility relocation and protection – A number of utilities were identified via a Dial Before You Dig (DBYD) search. Utilities that fall inside the proposed intersection's pavement areas have been assumed to require relocation or protection. Utilities that are expected to be under future shared path have not been included. Utilities that are expected to be deep (sewerage pipes) are also not included.

Figure 4-6 IN-05 Existing DYBD Utilities Overview

5 Review and response to submissions received

Submissions received in response to the exhibited documents, include:

- Stockland Minta Farm PSP Interim Proposal, received by Cardno by Stockland Group dated 12 February 2020
- Other submissions received which did not provide comments specific to Cardno's Exhibited ICP cost estimates.

The submission consisted of a revised functional layout plan (FLP) performed by Ratio Consultants dated 11 February 2020 and were accompanied by associated infrastructure costings performed by Charlton Degg dated 11 February 2020.

With regard to the Stockland submission:

- Stockland proposed an alternative to the interim functional layout plan submitted by Cardno in its Minta Farm Costings Report dated 14 March 2019. The key initiatives for this submission were to reduce the cost of the north-south arterial road and associated intersections.

Cardno's response to the received submission:

- The Stockland FLP proposal has been superseded by the revised Cardno FLPs. The changes to the Cardno FLPs were made after consultation with the VPA, Department of Transport (DoT) and Council. Key changes made to the existing FLP included a reduction in design speed for the north-south arterial, independent design of intersections IN-02, IN-03 and IN-04, an "outside-in" approach to design where possible, as well as various intersection amendments.
- The cost estimates submitted by Stocklands were lower than those in the Exhibited ICP due to a combination of cheaper rates used as well as differences in concept plans costed. The cheaper rates utilised in the Stockland submission is likely not reflective of the rates that will be incurred for the transport items. The Benchmark rates used as the basis in the cost estimates within this statement are the result of a detailed statistical analysis. The analysis may not reflect the cheapest contractor but rather reflects the

probably rates in a stronger market. The level of quality assurance systems required by contractors to meet the higher level of VicRoads prequalification required for these projects generally bring higher unit rates to cover the costs of these quality systems.

6 Conclusion

Accordingly, I am satisfied that the cost estimates outlined within this Expert Witness Statement will be sufficient to finalise cost estimate matters relating to the Minta Farm ICP. Note that from the cost estimates circulated on 22 March 2020, the following changes have been made within this report;

- IN-01: A correction has been made where connector pavements were costed in the 22 March 2020 estimates when they should not have been included for this intersection.
- IN-02 Option 2: Cost estimates have been updated due to a revision on the concept plan
- Delivery percentages for Traffic Management has been adjusted for several of the brownfield projects.
- All benchmark rates have been indexed from July 2018 to March 2020.

Appendix A – Explanation of Benchmark designs and costs in general

A significant proportion of the rates used in revised cost estimates of C269 are based on the rates recommended in the Benchmark Project (rates for sitework, new pavement and concrete works, drainage, lighting and landscaping). This section of the report provides a summary on how the Benchmark Project was developed and how the Benchmark Report provided input into the cost development for C269. For a full understanding of all the processes, assumptions and limitations of the Benchmark Project please refer to the latest version of the Benchmark Report.

Introduction to the benchmark Process

The Benchmark process was introduced to obtain three key outcomes. These were to;

- Streamline and shorten the overall delivery of Precinct Structure Plans (PSPs) and associated Infrastructure Contributions Plan (ICP) planning scheme amendments by providing a reference of benchmark infrastructure costs;
- Provide accurate and robust “benchmark” cost estimates for nominated ICP allowable items;
- Provide a high degree of confidence in likely costs.

In order to achieve the above, the Benchmark Project includes 43 nominated (by the VPA) sets of ‘standard’ infrastructure designs and their associated costings. The nominated infrastructure items include both transport projects and community and recreational projects. Under transport projects, road mid-blocks, intersections, bridges and culverts are covered. Within community and recreational projects various levels/ sizes of community facilities, sporting pavilions and sporting fields are covered. Further descriptions of the 43 infrastructure items are listed in the Benchmark Report.

The aforementioned nominated infrastructure items are expected to make up the bulk of the required ‘usual’ infrastructure for a particular PSP/ICP. Dependent on a variety of factors it is also however expected that certain PSPs/ ICPs may require bespoke infrastructure designs to be produced and costed (e.g. Growling Grass Frog Friendly culvert designs, Steel bridge structures for larger spans etc.). Based on the complexity of these projects benchmark rates may be applied to the bespoke designs to obtain project cost estimates. For highly complex bespoke designs it may also be more applicable to apply bespoke rates. Bespoke infrastructure items such as these are expected to be covered on a case by case basis and are not expected to be covered by the benchmark process. The benchmark process aims to cover typical infrastructure for a PSP/ ICP.

Development of benchmark designs

The Benchmark Project encompasses two main parts; producing benchmark designs and producing cost estimates for these designs. This section provides a brief summary on how the benchmark designs were produced.

The concept designs produced by Cardno for the Benchmark Project were created to comply with the VPA nominated infrastructure typologies (43 types) and a variety of design standards. The relevant standards in no hierarchy are;

> Victorian Planning Authority Standards

> Austroads Guide to Road Design – Full Set

> VicRoads supplement to Austroads Guide to Road Design – Full Set

> VicRoads Road Design Notes (RDNs)

> VicRoads Standard Drawings for Roadworks

> Austroads Guide to Traffic Management – Parts 1 to 13

> VicRoads supplement to Austroads Guide to Traffic Management – Parts 1 to 13

- Austroads Design Vehicles and Turning Path Templates

Drainage

- Victorian Planning Authority Standards
- Austroads guide to Road design – Part 5 and 5A
- VicRoads supplement to Austroads Guide to Road Design
- Australian Runoff Quality Guidelines

General

- VicRoads Traffic Engineering Manual Volume 1, Traffic Management
- VicRoads Traffic Engineering Manual Volume 2, Signs and Markings
- VicRoads Manual of Standard Drawings for Road Signs
- AS 1743 Road Signs Specifications

Note: no benchmark designs can be considered 'detailed' designs. As they are necessarily conceptual and preliminary in nature, they cannot and do not provide the level of detail that more advanced designs provide on a given site and are used to tender and construct works.

Development of benchmark Costings

The second major component of the Benchmark Project was to produce cost estimates for each of the 43 infrastructure items. Quantities were extracted from the benchmark designs previously produced and benchmark rates were applied against the extracted quantities to arrive at a final cost. Further details on the producing the benchmark rates are provided below.

The cost estimates and rates produced through the benchmark process were required to have a high degree of confidence within them. Therefore, a Monte Carlo analysis was utilised to produce the benchmark rates. Monte Carlo analyses is used as a tool in a wide range of industries such as supply chain, finance, engineering and cost estimates as well. A Monte Carlo analysis has the advantage of producing a variety of total project costs along with an expected probability of occurrence for each of the produced total project costs (i.e. the probability that the estimated cost covers the actual cost during construction). The ability of the Monte Carlo analysis to produce a probability of occurrence for each cost produced was identified as its key appropriateness in producing estimates with a high degree of confidence.

The Monte Carlo analysis requires a variety of inputs to function. For example, a range of inputs required will be 'several probable costs for a metre of kerb'. Similarly, it would require a probable range of costs for a square metre of pavement, a probable range of costs for a metre of drainage pipe etc. The probable inputs for each of these items (kerbs, pavements, drainage pipes etc.) in this case were obtained from 26 previously concluded DCPs (DCPs were applied to a variety of regions of Melbourne). Different previous DCPs would for example have a variety of rates for a metre of kerb, each acting as a probable kerb rate for use in the Monte Carlo analysis. One key reason for deeming previous DCP information as suitable to be used for this purpose was DCPs having been tested in panel in the past. A full list of DCPs used as input for the Monte Carlo analysis can be found in the Benchmark Report. The fact that the input DCPs were from a large variety of geographical regions of Melbourne and design consultants meant that it was appropriate for these to be used for a large geographic range of future ICPs as well.

Once the required information was collated from previous DCPs the Monte Carlo analysis was run and rates were obtained for a variety of probabilities. For the Benchmark Project's purposes two sets of key probabilities were selected. These were the 50% probability rates and the 90% probability rates. The 50% probability rates infer that 50% of the time, the estimated project cost sufficiently covers the actual construction cost. Similarly, the 90% probability rates infer that 90% of the time, the estimated project cost sufficiently covers the actual construction cost. These rates are referred to as the P50 rates and the P90 rates.

The increase in cost of the P90 rates compared to the P50 rates was in the range of 10% to 15% only. Therefore, it was deemed that P90 rates are not overly conservative and are in line with the basic and

essential nature of ICPs while also giving the high degree of confidence in the final produced cost (the high confidence being that 90% of the time the actual project cost can be covered). Due to this, P90 costs are used as the main benchmark rate.

Addressing gaps in costing

While a variety of useful information could be extracted for most infrastructure items from previous DCP cost estimates, one noteworthy exception for this is culvert projects. Analysis of previous DCP information showed that the culvert project estimates either did not match the nominated culvert sizes to be used in the Benchmark Project for culvert assets or did not have sufficient information to be used *reliably* (e.g. lump sums, small sample sizes). Due to this, for culvert projects only, a Monte Carlo analysis was not run. Instead, Cardno's internal rates (later also supplemented by stakeholder rates through the stakeholder engagement process) were used as P50 rates. Cardno's internal resources include contractor's tender rates received as part of other comparable projects and obtaining rates from Rawlinson's Construction Handbook. As noted previously a 10% to 15% difference was noted between P50 and P90 rates for infrastructure items that had Monte Carlo analyses run. Based on this, the P50 rates for culverts were increased by 15% to arrive at the P90 culvert rates.

Application of overheads and delivery percentages

Eight delivery percentages were applied to the cost estimates (under the delivery section of the cost sheets) to cover;

- Council fees
- Authority fees/ VicRoads fees
- Traffic management
- Environmental management
- Surveying and design
- Supervision and project management
- Site establishment
- Contingency

The delivery percentages were consistently applied in all of the Benchmark Project's specific item project cost estimates, as well as in specific ICP costing exercises carried out by Cardno for a particular group of infrastructure items (refer to example costing sheets in Appendix D of this document).

In the case of community and recreational infrastructure items, an additional delivery percentage – Environmentally Sustainable Design has been added (following the stakeholder engagement process). The percentages for the above delivery items were advised by the VPA and were deemed suitable to be used in this application. The contingency percentage however is capped at 20% for bridges and 15% for other infrastructure items by the ministerial direction on the Preparation and Content of Infrastructure Contributions plans.

Stakeholder Feedback Process

Once the benchmark plans and benchmark costs were developed, these were then presented to a variety of stakeholders for comment on 27 August 2018. As part of this process submissions were received from the following stakeholders over the period of mid-late October 2018.

- Cardinia Shire Council
- City of Casey
- Melton City Council
- City of Whittlesea
- UDIA (Urban Development Institute of Australia)

Through this process, City of Whittlesea together with Melton City Council provided feedback in the form of peer reviews by WTP for the transport infrastructure items. City of Whittlesea additionally provided a range of comments.

A summary of the changes made to the Benchmark Project as a result of the stakeholder feedback received is listed below (a detailed analysis of the feedback received can be found in the report - Stakeholder Comments review – Benchmark Infrastructure Costings project, 12 December 2018 (Document number V170524 Stakeholder Comment Review.docx);

- Allocate quantities and rates for several cost sheet line items (subgrade preparation, landscape maintenance, street lighting)
- Include a 2% ESD deliverable for Community and Recreation infrastructure projects
- Calibrate the estimates by adding in construction rates for allowable items from a variety of relevant infrastructure projects provided by the submitters into the input data of the Monte Carlo analysis
- Include base rates from quantity surveyors WTP and T&T in the Monte Carlo statistical analysis
- Make minor adjustments to concept drawings/ quantities/ cost sheets as per Councils comments
- Index historic data used in the analysis using ABS PPI data (as per the ministerial direction)
- Re-run the Monte-Carlo analysis following the completion of the above tasks and update the P50 and P90 rates

Summary of the Benchmark Reports uploaded in the VPA website

The following table summarises the 3 versions of the Benchmark Report that have been uploaded on the VPA website over the duration of its development.

Issue Date	Purpose	Document
23 July 2019	Release for stakeholder comment	Review of Benchmark Infrastructure Costings, 23 July 2018, document number V170524-RPT-0001.docx
14 March 2019	Release following addressing accepted stakeholder comments	Benchmark Infrastructure Report, 14 March 2019, document number V181544-RPT-0001.docx, version D6
11 April 2019	Release following minor update to intersection 15 (benchmark item 15) to include a dedicated right turn lane.	Benchmark Infrastructure Report, 11 April 2019, document number V181544-RPT-0001.docx, version D8

Appendix B – Revised Detailed Cost Sheets

Appendix B	
Description:	IN-01 - Primary - Primary Intersection
Civil Component Number:	IN-01

Group	Sub Item	Qty	Unit	Rate (P50)	Amount (P50)	Rate (P90)	Amount (P90)
Siteworks/ Earthworks	Site Preperation	14677	m2	3.82	56040.82	5.15	75533.28
	Earthworks	4501	m3	35.35	159111.12	42.04	189233.42
Road Pavement	Primary Arterial Pavement	5620	m2	175.99	989083.05	193.26	1086113.71
	Secondary Arterial Pavement	0	m2	131.78	0.00	138.81	0.00
	Collector Arterial Pavement	901	m2	109.10	98299.98	116.66	105115.08
	Subgrade Preparation	1305	m2	14.75	19254.38	16.77	21881.21
	Pavement Rehab	579	m2	53.52	30986.98	61.55	35636.83
	Pavement Other	0	m2	0.00	0.00	0.00	0.00
Concrete Works	Kerb and Channel	1615	m	56.87	91844.19	63.19	102049.11
	Kerb Removal	542	m	60.00	32520.00	69.00	37398.00
	Cycle Path	668	m2	79.47	53084.52	95.39	63723.61
	SUP/ Footpath	110	m2	65.90	7248.60	76.40	8403.63
	SUP/ Footpath Removal	0	m2	45.03	0.00	49.53	0.00
	Traffic Island	1418	m2	80.52	114171.40	87.23	123690.59
Drainage	Drainage Pipe 300mm CR Bfilled	0	m	186.61	0.00	205.40	0.00
	Drainage Pipe 375mm CR Bfilled	210	m	268.84	56455.48	293.59	61654.35
	Drainage Pipe 450mm CR Bfilled	164	m	310.68	50951.68	346.89	56890.35
	Drainage Pipe 525mm CR Bfilled	0	m	419.03	0.00	464.86	0.00
	Drainage - pits	10	No.	2661.78	26617.84	2911.54	29115.38
	Drainage – Sub-soil drainage	1615	m	35.15	56772.15	45.03	72724.65
	Drainage Culvert	0	No.	0.00	0.00	0.00	0.00
Traffic signals	Traffic Signals (all inclusive)	4	Item/ Per Leg	113853.36	455413.46	133625.45	534501.80
Landscape	Tree Planting	60	No.	314.74	18884.27	376.65	22599.00
	Landscaping	4756	m2	22.42	106638.98	26.11	124157.19
	Topsoil Seeding	4756	m2	7.48	35579.23	8.76	41648.91
Street Lighting	Street Lighting - Road	0	m	224.47	0.00	234.15	0.00
	Street Lighting - Intersections	4	Item/ Per Leg	50290.14	201160.55	57707.56	230830.24
Misc.	Regulatory Signage	10	Item	351.15	3511.46	394.68	3946.83
	Line marking	7493	m2 of Pavement	3.23	24178.84	4.24	31797.90
	Landscape maintenance (intersections)	1	Item	74025.42	74025.42	91442.94	91442.94
	Landscape maintenance (roads)	0	m2 of l'scape	3.01	0.00	3.07	0.00
	Tactile Pavers (Hazard only)	24	Item	303.42	7282.03	331.80	7963.10
	Telecom/power relocation allowance	0	m	1300.00	0.00	1495.00	0.00
	Water/gas relocation allowance	52	m	300.00	15600.00	345.00	17940.00
	Sawcut pavement tie ins, new kerb & channel, etc.	542	m	14.00	7588.00	16.10	8726.20
Delivery	Council Fees	1	%	3.25	90749.89	3.25	103503.31
	VicRoads Fees	1	%	1.00	27923.04	1.00	31847.17
	Traffic Management	1	%	8.00	223384.36	8.00	254777.38
	Environmental Management	1	%	0.50	13961.52	0.50	15923.59
	Surveying and Design	1	%	5.00	139615.22	5.00	159235.87
	Supervision and Project management	1	%	9.00	251307.40	9.00	286624.56
	Site Establishment	1	%	2.50	69807.61	2.50	79617.93
	Contingency	1	%	15.00	418845.67	15.00	477707.60
Total	Excluding Delivery				**2,792,304**		**3,184,717**
	Including Delivery				**4,027,899**		**4,593,955**

Appendix B	
Description:	IN-02 - Primary - Industrial Collector Intersection (Ind. Coll. Road & North-South Arterial Road)
Civil Component Number:	IN-02 - Option 1

Group	Sub Item	Qty	Unit	Rate (P50)	Amount (P50)	Rate (P90)	Amount (P90)
Siteworks/ Earthworks	Site Preperation	16332	m2	3.82	62360.07	5.15	84050.53
	Earthworks	9367	m3	35.35	331125.05	42.04	393812.36
Road Pavement	Primary Arterial Pavement	10782	m2	175.99	1897561.10	193.26	2083714.96
	Secondary Arterial Pavement	0	m2	131.78	0.00	138.81	0.00
	Collector Arterial Pavement	3097	m2	109.10	337885.74	116.66	361311.20
	Subgrade Preparation	2776	m2	14.75	40957.97	16.77	46545.77
	Pavement Resheet	3572	m2	53.52	191166.67	61.55	219841.67
	Pavement Removal	449	m2	140.00	62860.00	161.00	72289.00
Concrete Works	Kerb and Channel	3097	m	56.87	176124.75	63.19	195694.17
	Kerb Removal	719	m	60.00	43140.00	69.00	49611.00
	Cycle Path	1470	m2	79.47	116817.74	95.39	140230.09
	SUP/ Footpath	739	m2	65.90	48697.42	76.40	56457.11
	Concrete Removal	188	m2	45.03	8465.64	49.53	9311.64
	Traffic Island	600	m2	80.52	48309.48	87.23	52337.34
Drainage	Drainage Pipe 300mm CR Bfilled	0	m	186.61	0.00	205.40	0.00
	Drainage Pipe 375mm CR Bfilled	596	m	268.84	160226.02	293.59	174980.92
	Drainage Pipe 450mm CR Bfilled	292	m	310.68	90718.85	346.89	101292.57
	Drainage Pipe 525mm CR Bfilled	0	m	419.03	0.00	464.86	0.00
	Drainage - pits	24	No.	2661.78	63882.81	2911.54	69876.92
	Drainage – Sub-soil drainage	3097	m	35.15	108868.94	45.03	139460.21
	Drainage Culvert	0	No.	0.00	0.00	0.00	0.00
Traffic signals	Traffic Signals (all inclusive)	4	Item/ Per Leg	113853.36	455413.46	133625.45	534501.80
Landscape	Tree Planting	87	No.	314.74	27382.20	376.65	32768.55
	Landscaping	11504	m2	22.42	257942.57	26.11	300316.29
	Topsoil Seeding	11504	m2	7.48	86060.43	8.76	100742.03
Street Lighting	Street Lighting - Road	0	m	224.47	0.00	234.15	0.00
	Street Lighting - Intersections	4	Item/ Per Leg	50290.14	201160.55	57707.56	230830.24
Misc.	Regulatory Signage	6	Item	351.15	2106.88	394.68	2368.10
	Line marking	17379	m2 of Pavement	3.23	56079.55	4.24	73750.93
	Landscape maintenance (intersections)	1	Item	74025.42	74025.42	91442.94	91442.94
	Landscape maintenance (roads)	0	m2 of l'scape	3.01	0.00	3.07	0.00
	Tactile Pavers (Hazard only)	18	Item	303.42	5461.52	331.80	5972.32
	Sawcut pavement tie ins, new kerb & channel, etc.	565	m	14.00	7910.00	16.10	9096.50
Delivery	Council Fees	1	%	3.25	161288.10	3.25	183059.73
	VicRoads Fees	1	%	1.00	49627.11	1.00	56326.07
	Traffic Management	1	%	6.50	322576.20	6.50	366119.47
	Environmental Management	1	%	0.50	24813.55	0.50	28163.04
	Surveying and Design	1	%	5.00	248135.54	5.00	281630.36
	Supervision and Project management	1	%	9.00	446643.97	9.00	506934.64
	Site Establishment	1	%	2.50	124067.77	2.50	140815.18
	Contingency	1	%	15.00	744406.62	15.00	844891.07
Total	Excluding Delivery				**4,962,711**		**5,632,607**
	Including Delivery				**7,084,270**		**8,040,547**

Appendix B	
Description:	IN-02 - Primary - Industrial Collector Intersection (Ind. Coll. Road & North-South Arterial Road)
Civil Component Number:	IN-02 - Option 2

Group	Sub Item	Qty	Unit	Rate (P50)	Amount (P50)	Rate (P90)	Amount (P90)
Siteworks/ Earthworks	Site Preperation	14035	m2	3.82	53589.49	5.15	72229.31
	Earthworks	7097	m3	35.35	250880.16	42.04	298375.82
Road Pavement	Primary Arterial Pavement	7991	m2	175.99	1406363.45	193.26	1544330.01
	Secondary Arterial Pavement	0	m2	131.78	0.00	138.81	0.00
	Collector Arterial Pavement	2585	m2	109.10	282026.04	116.66	301578.77
	Subgrade Preparation	2116	m2	14.75	31220.13	16.77	35479.41
	Pavement Resheet	3572	m2	53.52	191166.67	61.55	219841.67
	Pavement Removal	449	m2	140.00	62860.00	161.00	72289.00
Concrete Works	Kerb and Channel	2861	m	56.87	162703.56	63.19	180781.73
	Kerb Removal	719	m	60.00	43140.00	69.00	49611.00
	Cycle Path	1222	m2	79.47	97109.71	95.39	116572.23
	SUP/ Footpath	749	m2	65.90	49356.38	76.40	57221.07
	Concrete Removal	188	m2	45.03	8465.64	49.53	9311.64
	Traffic Island	609	m2	80.52	49034.12	87.23	53122.40
Drainage	Drainage Pipe 300mm CR Bfilled	0	m	186.61	0.00	205.40	0.00
	Drainage Pipe 375mm CR Bfilled	562	m	268.84	151085.61	293.59	164998.78
	Drainage Pipe 450mm CR Bfilled	292	m	310.68	90718.85	346.89	101292.57
	Drainage Pipe 525mm CR Bfilled	0	m	419.03	0.00	464.86	0.00
	Drainage - pits	23	No.	2661.78	61221.03	2911.54	66965.38
	Drainage – Sub-soil drainage	2861	m	35.15	100572.82	45.03	128832.96
	Drainage Culvert	0	No.	0.00	0.00	0.00	0.00
Traffic signals	Traffic Signals (all inclusive)	4	Item/ Per Leg	113853.36	455413.46	133625.45	534501.80
Landscape	Tree Planting	84	No.	314.74	26437.98	376.65	31638.60
	Landscaping	13761	m2	22.42	308549.00	26.11	359236.13
	Topsoil Seeding	13761	m2	7.48	102944.85	8.76	120506.87
Street Lighting	Street Lighting - Road	0	m	224.47	0.00	234.15	0.00
	Street Lighting - Intersections	4	Item/ Per Leg	50290.14	201160.55	57707.56	230830.24
Misc.	Regulatory Signage	6	Item	351.15	2106.88	394.68	2368.10
	Line marking	14148	m2 of Pavement	3.23	45653.58	4.24	60039.59
	Landscape maintenance (intersections)	1	Item	74025.42	74025.42	91442.94	91442.94
	Landscape maintenance (roads)	0	m2 of l'scape	3.01	0.00	3.07	0.00
	Tactile Pavers (Hazard only)	18	Item	303.42	5461.52	331.80	5972.32
	Sawcut pavement tie ins, new kerb & channel, etc.	565	m	14.00	7910.00	16.10	9096.50
Delivery	Council Fees	1	%	3.25	140438.25	3.25	159850.17
	VicRoads Fees	1	%	1.00	43211.77	1.00	49184.67
	Traffic Management	1	%	6.50	280876.50	6.50	319700.35
	Environmental Management	1	%	0.50	21605.88	0.50	24592.33
	Surveying and Design	1	%	5.00	216058.85	5.00	245923.34
	Supervision and Project management	1	%	9.00	388905.92	9.00	442662.02
	Site Establishment	1	%	2.50	108029.42	2.50	122961.67
	Contingency	1	%	15.00	648176.54	15.00	737770.03
Total	Excluding Delivery				**4,321,177**		**4,918,467**
	Including Delivery				**6,168,480**		**7,021,111**

Appendix B	
Description:	IN-03 - Primary - Bvd Connector Intersection
Civil Component Number:	IN-03 - Option 1

Group	Sub Item	Qty	Unit	Rate (P50)	Amount (P50)	Rate (P90)	Amount (P90)
Siteworks/ Earthworks	Site Preperation	11316	m2	3.82	43207.60	5.15	58236.33
	Earthworks	5787	m3	35.35	204571.44	42.04	243300.11
Road Pavement	Primary Arterial Pavement	4534	m2	175.99	797954.19	193.26	876234.80
	Secondary Arterial Pavement	0	m2	131.78	0.00	138.81	0.00
	Collector Arterial Pavement	4757	m2	109.10	518993.37	116.66	554974.94
	Subgrade Preparation	1859	m2	14.75	27428.27	16.77	31170.24
	Pavement Rehab	2927	m2	53.52	156647.49	61.55	180153.73
	Pavement Other	0	m2	0.00	0.00	0.00	0.00
Concrete Works	Kerb and Channel	2580	m	56.87	146723.23	63.19	163025.82
	Cycle Path	982	m2	79.47	78037.43	95.39	93677.52
	SUP/ Footpath	1091	m2	65.90	71892.94	76.40	83348.72
	Kerb Removal	584	m	80.00	46720.00	88.00	51392.00
	SUP/ Footpath Removal	76	m2	45.03	3422.28	49.53	3764.28
	Traffic Island	403	m2	80.52	32447.87	87.23	35153.25
Drainage	Drainage Pipe 300mm CR Bfilled	0	m	186.61	0.00	205.40	0.00
	Drainage Pipe 375mm CR Bfilled	355	m	268.84	95436.64	293.59	104225.21
	Drainage Pipe 450mm CR Bfilled	263	m	310.68	81709.10	346.89	91232.69
	Drainage Pipe 525mm CR Bfilled	0	m	419.03	0.00	464.86	0.00
	Drainage - pits	25	No.	2661.78	66544.60	2911.54	72788.46
	Drainage – Sub-soil drainage	2580	m	35.15	90694.82	45.03	116179.32
	Drainage Culvert	0	No.	0.00	0.00	0.00	0.00
Traffic signals	Traffic Signals (all inclusive)	4	Item/ Per Leg	113853.36	455413.46	133625.45	534501.80
Landscape	Tree Planting	26	No.	314.74	8183.19	376.65	9792.90
	Landscaping	7314	m2	22.42	163994.43	26.11	190934.75
	Topsoil Seeding	7314	m2	7.48	54715.40	8.76	64049.65
Street Lighting	Street Lighting - Road	0	m	224.47	0.00	234.15	0.00
	Street Lighting - Intersections	4	Item/ Per Leg	50290.14	201160.55	57707.56	230830.24
Misc.	Regulatory Signage	20	Item	351.15	7022.93	394.68	7893.66
	Line marking	9291	m2 of Pavement	3.23	29980.73	4.24	39428.04
	Landscape maintenance (intersections)	1	Item	74025.42	74025.42	91442.94	91442.94
	Landscape maintenance (roads)	0	m2 of l'scape	3.01	0.00	3.07	0.00
	Tactile Pavers (Hazard only)	24	Item	303.42	7282.03	331.80	7963.10
Other	Sawcut pavement tie ins, new kerb & channel, etc.	584	m	14.00	8176.00	16.10	9402.40
Delivery	Council Fees	1	%	3.25	112852.53	3.25	128215.65
	VicRoads Fees	1	%	1.00	34723.85	1.00	39450.97
	Traffic Management	1	%	6.50	225705.05	6.50	256431.30
	Environmental Management	1	%	0.50	17361.93	0.50	19725.48
	Surveying and Design	1	%	5.00	173619.27	5.00	197254.84
	Supervision and Project management	1	%	9.00	312514.69	9.00	355058.72
	Site Establishment	1	%	2.50	86809.63	2.50	98627.42
	Contingency	1	%	15.00	520857.81	15.00	591764.53
Total	Excluding Delivery				**3,472,385**		**3,945,097**
	Including Delivery				**4,956,830**		**5,631,626**

Appendix B	
Description:	IN-03 - Primary - Bvd Connector Intersection
Civil Component Number:	IN-03 - Option 2

Group	Sub Item	Qty	Unit	Rate (P50)	Amount (P50)	Rate (P90)	Amount (P90)
Siteworks/ Earthworks	Site Preperation	8267	m2	3.82	31565.68	5.15	42545.05
	Earthworks	5006	m3	35.35	176962.95	42.04	210464.89
Road Pavement	Primary Arterial Pavement	4172	m2	175.99	734244.57	193.26	806275.16
	Secondary Arterial Pavement	0	m2	131.78	0.00	138.81	0.00
	Collector Arterial Pavement	3780	m2	109.10	412401.71	116.66	440993.33
	Subgrade Preparation	1591	m2	14.75	23474.11	16.77	26676.63
	Pavement Rehab	2918	m2	53.52	156165.83	61.55	179599.79
	Pavement Other	0	m2	0.00	0.00	0.00	0.00
Concrete Works	Kerb and Channel	2475	m	56.87	140751.94	63.19	156391.04
	Cycle Path	1120	m2	79.47	89003.99	95.39	106841.97
	SUP/ Footpath	764	m2	65.90	50344.83	76.40	58367.02
	Kerb Removal	523	m	80.00	41840.00	88.00	46024.00
	SUP/ Footpath Removal	278	m2	45.03	12518.34	49.53	13769.34
	Traffic Island	391	m2	80.52	31481.68	87.23	34106.50
Drainage	Drainage Pipe 300mm CR Bfilled	0	m	186.61	0.00	205.40	0.00
	Drainage Pipe 375mm CR Bfilled	353	m	268.84	94898.97	293.59	103638.03
	Drainage Pipe 450mm CR Bfilled	200	m	310.68	62136.20	346.89	69378.47
	Drainage Pipe 525mm CR Bfilled	0	m	419.03	0.00	464.86	0.00
	Drainage - pits	13	No.	2661.78	34603.19	2911.54	37850.00
	Drainage – Sub-soil drainage	2475	m	35.15	87003.75	45.03	111451.09
	Drainage Culvert	0	No.	0.00	0.00	0.00	0.00
Traffic signals	Traffic Signals (all inclusive)	4	Item/ Per Leg	113853.36	455413.46	133625.45	534501.80
Landscape	Tree Planting	26	No.	314.74	8183.19	376.65	9792.90
	Landscaping	6697	m2	22.42	150160.07	26.11	174827.73
	Topsoil Seeding	6697	m2	7.48	50099.68	8.76	58646.50
Street Lighting	Street Lighting - Road	0	m	224.47	0.00	234.15	0.00
	Street Lighting - Intersections	4	Item/ Per Leg	50290.14	201160.55	57707.56	230830.24
Misc.	Regulatory Signage	20	Item	351.15	7022.93	394.68	7893.66
	Line marking	10869	m2 of Pavement	3.23	35072.71	4.24	46124.56
	Landscape maintenance (intersections)	1	Item	74025.42	74025.42	91442.94	91442.94
	Landscape maintenance (roads)	0	m2 of l'scape	3.01	0.00	3.07	0.00
	Tactile Pavers (Hazard only)	24	Item	303.42	7282.03	331.80	7963.10
Other	Sawcut pavement tie ins, new kerb & channel, etc.	535	m	14.00	7490.00	16.10	8613.50
Delivery	Council Fees	1	%	3.25	103197.50	3.25	117487.80
	VicRoads Fees	1	%	1.00	31753.08	1.00	36150.09
	Traffic Management	1	%	6.50	206395.00	6.50	234975.60
	Environmental Management	1	%	0.50	15876.54	0.50	18075.05
	Surveying and Design	1	%	5.00	158765.39	5.00	180750.46
	Supervision and Project management	1	%	9.00	285777.70	9.00	325350.83
	Site Establishment	1	%	2.50	79382.69	2.50	90375.23
	Contingency	1	%	15.00	476296.16	15.00	542251.39
Total	Excluding Delivery				**3,175,308**		**3,615,009**
	Including Delivery				**4,532,752**		**5,160,426**

Appendix B	
Description:	IN-04 - Primary - Connector Street
Civil Component Number:	IN-04

Group	Sub Item	Qty	Unit	Rate (P50)	Amount (P50)	Rate (P90)	Amount (P90)
Siteworks/ Earthworks	Site Preperation	7676	m2	3.82	29309.08	5.15	39503.54
	Earthworks	4947	m3	35.35	174877.29	42.04	207984.38
Road Pavement	Primary Arterial Pavement	4152	m2	175.99	730724.70	193.26	802409.99
	Secondary Arterial Pavement	0	m2	131.78	0.00	138.81	0.00
	Collector Arterial Pavement	3697	m2	109.10	403346.33	116.66	431310.14
	Subgrade Preparation	1570	m2	14.75	23164.27	16.77	26324.52
	Pavement Rehab	3197	m2	53.52	171097.38	61.55	196771.94
	Pavement Other	0	m2	0.00	0.00	0.00	0.00
Concrete Works	Kerb and Channel	2300	m	56.87	130799.78	63.19	145333.09
	Cycle Path	780	m2	79.47	61984.92	95.39	74407.80
	SUP/ Footpath	910	m2	65.90	59965.70	76.40	69520.93
	Kerb Removal	508	m	80.00	40640.00	88.00	44704.00
	SUP/ Footpath Removal	58	m2	45.03	2611.74	49.53	2872.74
	Traffic Island	469	m2	80.52	37761.91	87.23	40910.36
Drainage	Drainage Pipe 300mm CR Bfilled	0	m	186.61	0.00	205.40	0.00
	Drainage Pipe 375mm CR Bfilled	331	m	268.84	88984.59	293.59	97179.00
	Drainage Pipe 450mm CR Bfilled	118	m	310.68	36660.36	346.89	40933.30
	Drainage Pipe 525mm CR Bfilled	0	m	419.03	0.00	464.86	0.00
	Drainage - pits	23	No.	2661.78	61221.03	2911.54	66965.38
	Drainage – Sub-soil drainage	2300	m	35.15	80851.97	45.03	103570.71
	Drainage Culvert	0	No.	0.00	0.00	0.00	0.00
Traffic signals	Traffic Signals (all inclusive)	4	Item/ Per Leg	113853.36	455413.46	133625.45	534501.80
Landscape	Tree Planting	18	No.	314.74	5665.28	376.65	6779.70
	Landscaping	5734	m2	22.42	128567.69	26.11	149688.25
	Topsoil Seeding	5734	m2	7.48	42895.56	8.76	50213.39
Street Lighting	Street Lighting - Road	0	m	224.47	0.00	234.15	0.00
	Street Lighting - Intersections	4	Item/ Per Leg	50290.14	201160.55	57707.56	230830.24
Misc.	Regulatory Signage	20	Item	351.15	7022.93	394.68	7893.66
	Line marking	7849	m2 of Pavement	3.23	25327.60	4.24	33308.65
	Landscape maintenance (intersections)	1	Item	74025.42	74025.42	91442.94	91442.94
	Landscape maintenance (roads)	0	m2 of l'scape	3.01	0.00	3.07	0.00
	Tactile Pavers (Hazard only)	24	Item	303.42	7282.03	331.80	7963.10
Other	Sawcut pavement tie ins, new kerb & channel, etc.	508	m	14.00	7112.00	16.10	8178.80
Delivery	Council Fees	1	%	3.25	100375.39	3.25	114123.83
	VicRoads Fees	1	%	1.00	30884.74	1.00	35115.02
	Traffic Management	1	%	6.50	200750.78	6.50	228247.65
	Environmental Management	1	%	0.50	15442.37	0.50	17557.51
	Surveying and Design	1	%	5.00	154423.68	5.00	175575.12
	Supervision and Project management	1	%	9.00	277962.62	9.00	316035.21
	Site Establishment	1	%	2.50	77211.84	2.50	87787.56
	Contingency	1	%	15.00	463271.03	15.00	526725.35
Total	Excluding Delivery				**3,088,474**		**3,511,502**
	Including Delivery				**4,408,796**		**5,012,670**

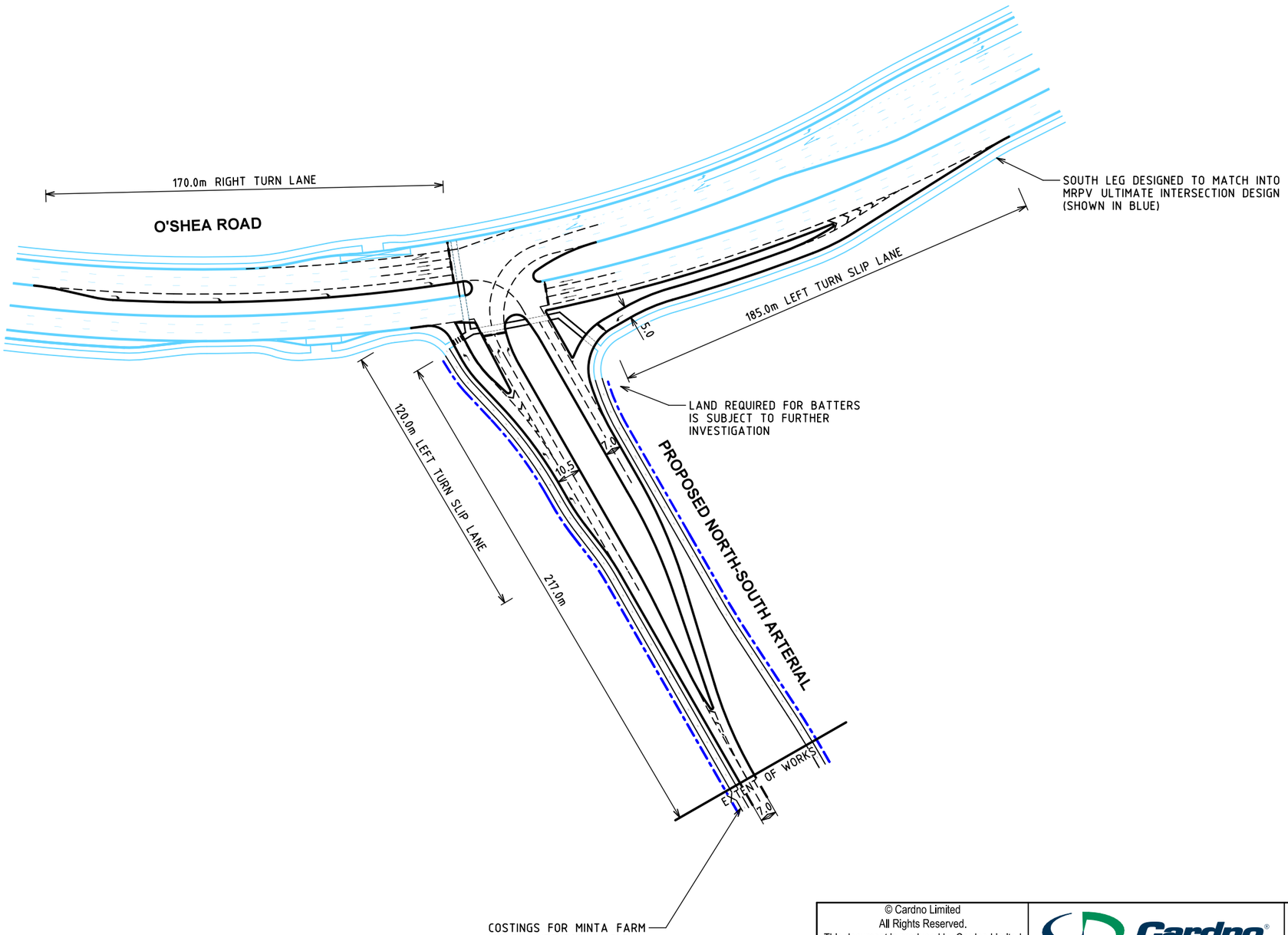
Appendix B	
Description:	IN-05 - Primary - Primary Intersection (Grices Road - North South Arterial)
Civil Component Number:	IN-05

Group	Sub Item	Qty	Unit	Rate (P50)	Amount (P50)	Rate (P90)	Amount (P90)
Siteworks/ Earthworks	Site Preperation	36672	m2	3.82	140023.78	5.15	188727.70
	Earthworks	11095	m3	35.35	392210.14	42.04	466461.85
Road Pavement	Primary Arterial Pavement	15517	m2	175.99	2730889.97	193.26	2998794.75
	Secondary Arterial Pavement	0	m2	131.78	0.00	138.81	0.00
	Collector Arterial Pavement	0	m2	109.10	0.00	116.66	0.00
	Subgrade Preparation	3104	m2	14.75	45797.39	16.77	52045.41
	Pavement Removal and Disposal	5048	m2	45.00	227160.00	49.50	249876.00
	Pavement Rehab	3234	m2	53.52	173077.55	61.55	199049.25
	Temporary Pavements (incl. removal)	999	m2	61.36	61298.64	67.50	67428.50
Concrete Works	Kerb and Channel	4646	m	56.87	264215.56	63.19	293572.84
	Cycle Path	0	m2	79.47	0.00	95.39	0.00
	SUP/ Footpath	1876	m2	65.90	123621.59	76.40	143320.07
	SUP/ Footpath Removal	635	m2	80.00	50800.00	88.00	55880.00
	Kerb Removal	1660	m	45.03	74749.80	49.53	82219.80
	Traffic Island	949	m2	80.52	76409.49274	87.23	82780.23266
Drainage	Drainage Pipe 300mm CR Bfilled	0	m	186.61	0.00	205.40	0.00
	Drainage Pipe 375mm CR Bfilled	830	m	268.84	223133.56	293.59	243681.48
	Drainage Pipe 450mm CR Bfilled	650	m	310.68	201942.65	346.89	225480.03
	Drainage Pipe 525mm CR Bfilled	149	m	419.03	62436.20	464.86	69264.83
	Drainage - pits	38	No.	2661.78	101147.79	2911.54	110638.46
	Drainage – Sub-soil drainage	4646	m	35.15	163320.98	45.03	209212.83
	Drainage Culvert	0	No.	0.00	0.00	0.00	0.00
Traffic signals	Traffic Signals (all inclusive)	4	Item/ Per Leg	113853.36	455413.46	133625.45	534501.80
Landscape	Tree Planting	16	No.	314.74	5035.81	376.65	6026.40
	Landscaping	14101	m2	22.42	316172.48	26.11	368111.96
	Topsoil Seeding	14101	m2	7.48	105488.36	8.76	123484.30
Street Lighting	Street Lighting - Road	0	m	224.47	0.00	234.15	0.00
	Street Lighting - Intersections	4	Item/ Per Leg	50290.14	201160.55	57707.56	230830.24
Misc.	Regulatory Signage	20	Item	351.15	7022.93	394.68	7893.66
	Line marking	18751	m2 of Pavement	3.23	60506.80	4.24	79573.26
	Landscape maintenance (intersections)	1	Item	74025.42	74025.42	91442.94	91442.94
	Landscape maintenance (roads)	0	m2 of l'scape	3.01	0.00	3.07	0.00
	Tactile Pavers (Hazard only)	24	Item	303.42	7282.03	331.80	7963.10
Other	Rock excavation	0	m3	100.00	0.00	115.00	0.00
	Telecom/power relocation allowance	292	m	1300.00	379600.00	1495.00	436540.00
	Water/gas relocation allowance	358	m	300.00	107400.00	345.00	123510.00
	Sawcut pavement tie ins, new kerb & channe	1660	m	14.00	23240.00	16.10	26726.00
Delivery	Council Fees	1	%	3.25	222773.95	3.25	252688.73
	VicRoads Fees	1	%	1.00	68545.83	1.00	77750.38
	Traffic Management	1	%	8.00	548366.63	8.00	622003.02
	Environmental Management	1	%	0.50	34272.91	0.50	38875.19
	Surveying and Design	1	%	5.00	342729.15	5.00	388751.89
	Supervision and Project management	1	%	9.00	616912.46	9.00	699753.39
	Site Establishment	1	%	2.50	171364.57	2.50	194375.94
	Contingency	1	%	15.00	1028187.44	15.00	1166255.66
Total	Excluding Delivery				**6,854,583**		**7,775,038**
	Including Delivery				**9,887,736**		**11,215,492**

Appendix B	
Description:	RD-01 - Primary Early Works Interim Arterial Road (North-South Arterial, 1353m)
Civil Component Number:	RD-01

Group	Sub Item	Qty	Unit	Rate (P50)	Amount (P50)	Rate (P90)	Amount (P90)
Siteworks/ Earthworks	Site Preperation	55473	m2	3.82	211811.17	5.15	285484.62
	Earthworks	6772	m3	35.35	239391.36	42.04	284712.00
Road Pavement	Primary Arterial Pavement	9471	m2	175.99	1666833.72	193.26	1830352.84
	Secondary Arterial Pavement	0	m2	131.78	0.00	138.81	0.00
	Collector Arterial Pavement	0	m2	109.10	0.00	116.66	0.00
	Subgrade Preparation	1895	m2	14.75	27959.42	16.77	31773.86
	Pavement Rehab	0	m2	53.52	0.00	61.55	0.00
	Pavement Other	0	m2	0.00	0.00	0.00	0.00
Concrete Works	Kerb and Channel	2706	m	56.87	153888.79	63.19	170987.54
	Cycle Path	4059	m2	79.47	322560.00	95.39	387206.76
	SUP/ Footpath	0	m2	65.90	0.00	76.40	0.00
	Traffic Island	0	m2	80.52	0.00	87.23	0.00
Drainage	Drainage Pipe 300mm CR Bfilled	0	m	186.61	0.00	205.40	0.00
	Drainage Pipe 375mm CR Bfilled	800	m	268.84	215068.49	293.59	234873.71
	Drainage Pipe 450mm CR Bfilled	553	m	310.68	171806.59	346.89	191831.47
	Drainage Pipe 525mm CR Bfilled	0	m	419.03	0.00	464.86	0.00
	Drainage - pits	27	No.	2661.78	71868.16	2911.54	78611.54
	Drainage – Sub-soil drainage	2706	m	35.15	95124.10	45.03	121853.19
	Drainage Culvert	0	No.	0.00	0.00	0.00	0.00
Traffic signals	Traffic Signals (all inclusive)	0	Item/ Per Leg	113853.36	0.00	133625.45	0.00
Landscape	Tree Planting	180	No.	314.74	56652.82	376.65	67797.00
	Landscaping	41943	m2	22.42	940445.52	26.11	1094937.95
	Topsoil Seeding	41943	m2	7.48	313771.97	8.76	367300.33
Street Lighting	Street Lighting - Road	1353	m	224.47	303706.44	234.15	316804.26
	Street Lighting - Intersections	0	Item/ Per Leg	50290.14	0.00	57707.56	0.00
Misc.	Regulatory Signage	31	Item	351.15	10885.54	394.68	12235.17
	Line marking	9471	m2 of Pavement	3.23	30561.57	4.24	40191.90
	Landscape maintenance (intersections)	0	Item	74025.42	0.00	91442.94	0.00
	Landscape maintenance (roads)	41943	m2 of l'scape	3.01	126205.09	3.07	128816.23
	Tactile Pavers (Hazard only)	0	Item	303.42	0.00	331.80	0.00
Other	Rock excavation	0	m3	100.00	0.00	115.00	0.00
Delivery	Council Fees	1	%	3.25	161152.57	3.25	183487.54
	VicRoads Fees	1	%	1.00	49585.41	1.00	56457.70
	Traffic Management	1	%	5.00	247927.04	5.00	282288.52
	Environmental Management	1	%	0.50	24792.70	0.50	28228.85
	Surveying and Design	1	%	5.00	247927.04	5.00	282288.52
	Supervision and Project management	1	%	9.00	446268.67	9.00	508119.33
	Site Establishment	1	%	2.50	123963.52	2.50	141144.26
	Contingency	1	%	15.00	743781.11	15.00	846865.56
Total	Excluding Delivery				**4,958,541**		**5,645,770**
	Including Delivery				**7,003,939**		**7,974,651**

Appendix C – Revised Supporting Drawings



N

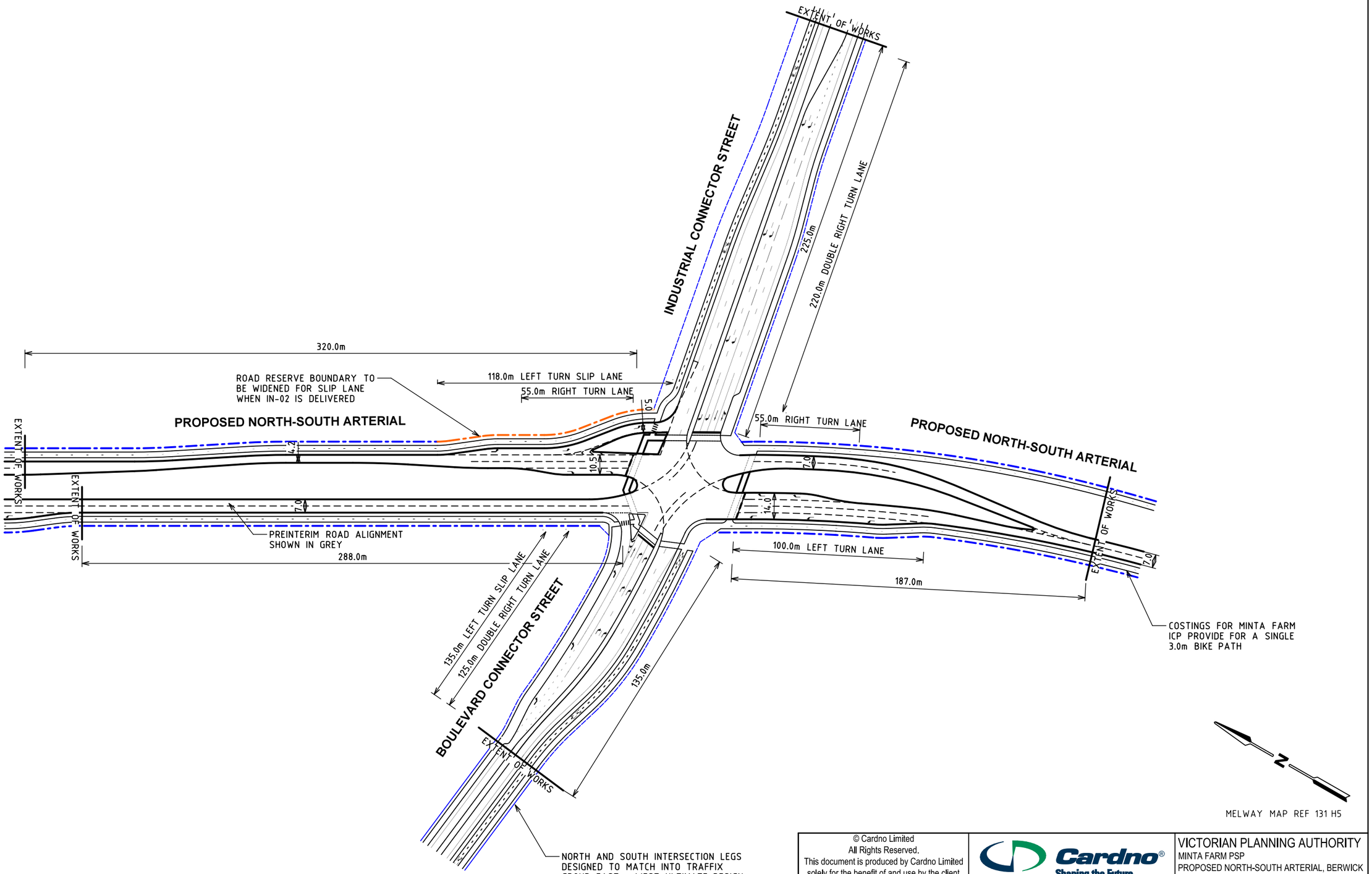
MELWAY MAP REF 131 H4

Cardno
Shaping the Future
ABN: 47 106 610 913
501 Swanston Street, Melbourne, VIC Australia 3000
Phone (+61 3) 8415 7777 Fax (+61 3) 8415 7788
Email: victoria@cardno.com.au Web: www.cardno.com.au/victoria

VICTORIAN PLANNING AUTHORITY
MINTA FARM PSP
O'SHEA ROAD, BERWICK
INTERIM INTERSECTION CONCEPT LAYOUT
IN-01

Drawn/Check	Date	Scale	Size
EC / CS	11.03.2020	1:2000	A3

Drawing Number	Revision
V181544-TR-DG-0301	3



MELWAY MAP REF 131 H5

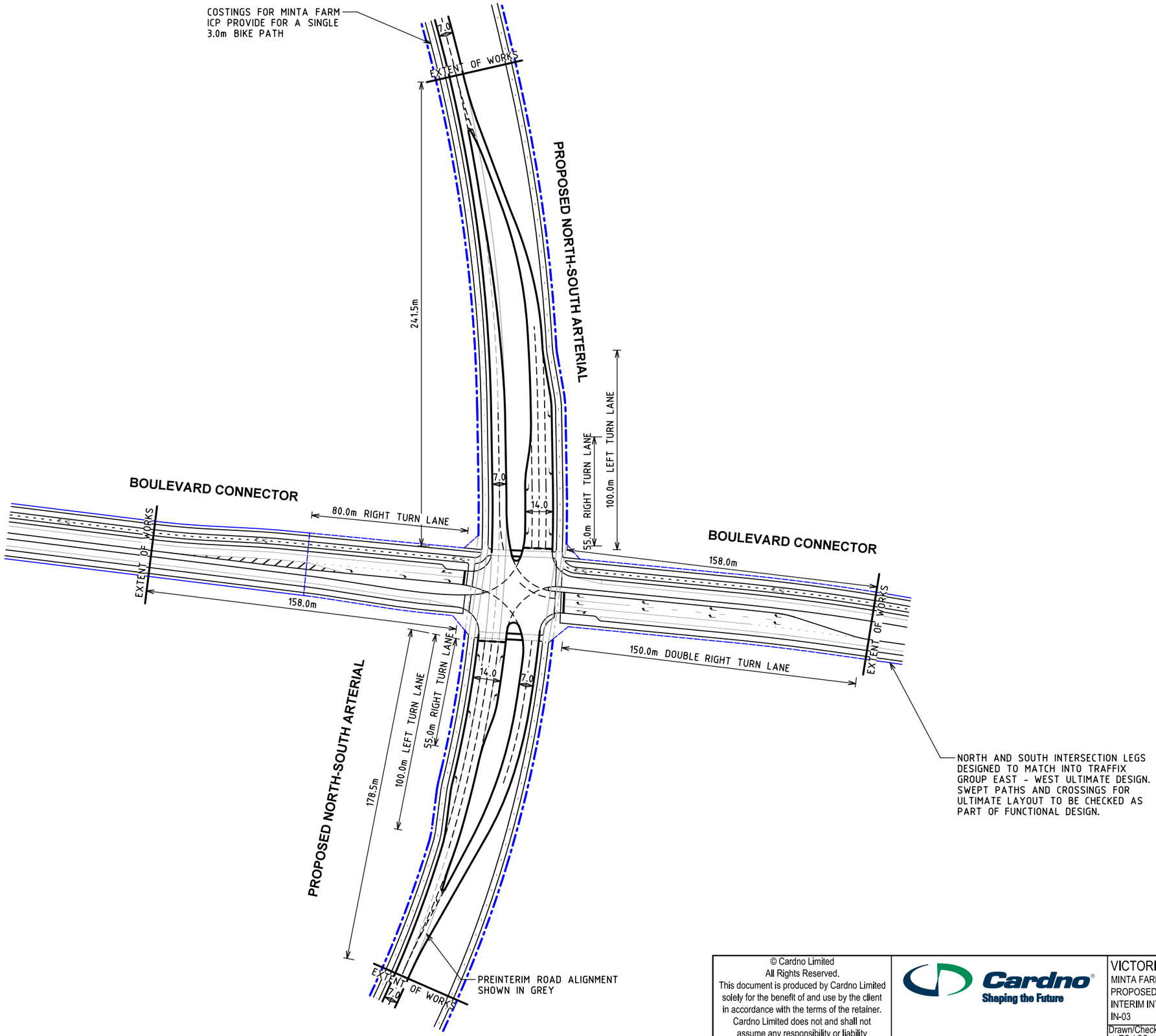
Cardno® Shaping the Future
ABN: 47 106 610 913
501 Swanston Street, Melbourne, VIC Australia 3000
Phone (+61 3) 8415 7777 Fax (+61 3) 8415 7788
Email: victoria@cardno.com.au Web: www.cardno.com.au/victoria

VICTORIAN PLANNING AUTHORITY
MINTA FARM PSP
PROPOSED NORTH-SOUTH ARTERIAL, BERWICK
INTERIM INTERSECTION CONCEPT LAYOUT
IN-02

Drawn/Check	Date	Scale	Size
EC / CS	11.03.2020	1:2000	A3

Drawing Number: V181544-TR-DG-0302
Revision: 3

DATE PLOTTED: 18/05/2020 5:17:55 PM BY: User:nitin.batra
CAD File: M:\2018\1501_2000\V181544_VPA_ICP_Program_Implementation\Traffic\Drafting\03 Sketches\01 CAD\V181544-TR-SK-0302.dgn



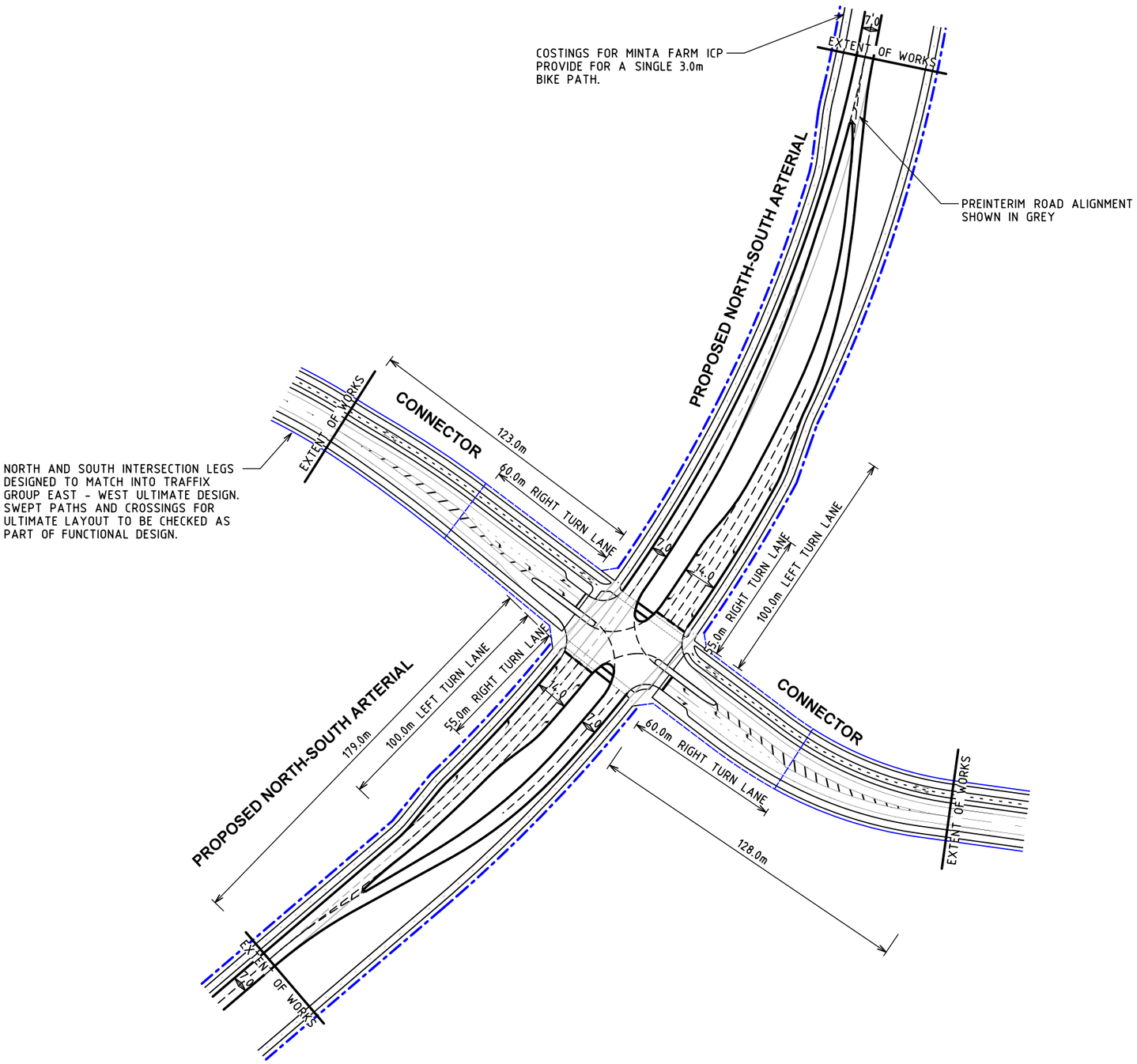
MELWAY MAP REF 131 H4

Cardno
Shaping the Future
ABN: 47 106 610 913
501 Swanston Street, Melbourne, VIC Australia 3000
Phone (+61 3) 8415 7777 Fax (+61 3) 8415 7788
Email: victoria@cardno.com.au Web: www.cardno.com.au/victoria

VICTORIAN PLANNING AUTHORITY
MINTA FARM PSP
PROPOSED NORTH-SOUTH ARTERIAL, BERWICK
INTERIM INTERSECTION CONCEPT LAYOUT
IN-03

Drawn/Check	Date	Scale	Size
EC / CS	11.03.2020	1:2000	A3

Drawing Number	Revision
V181544-TR-DG-0303	2



N

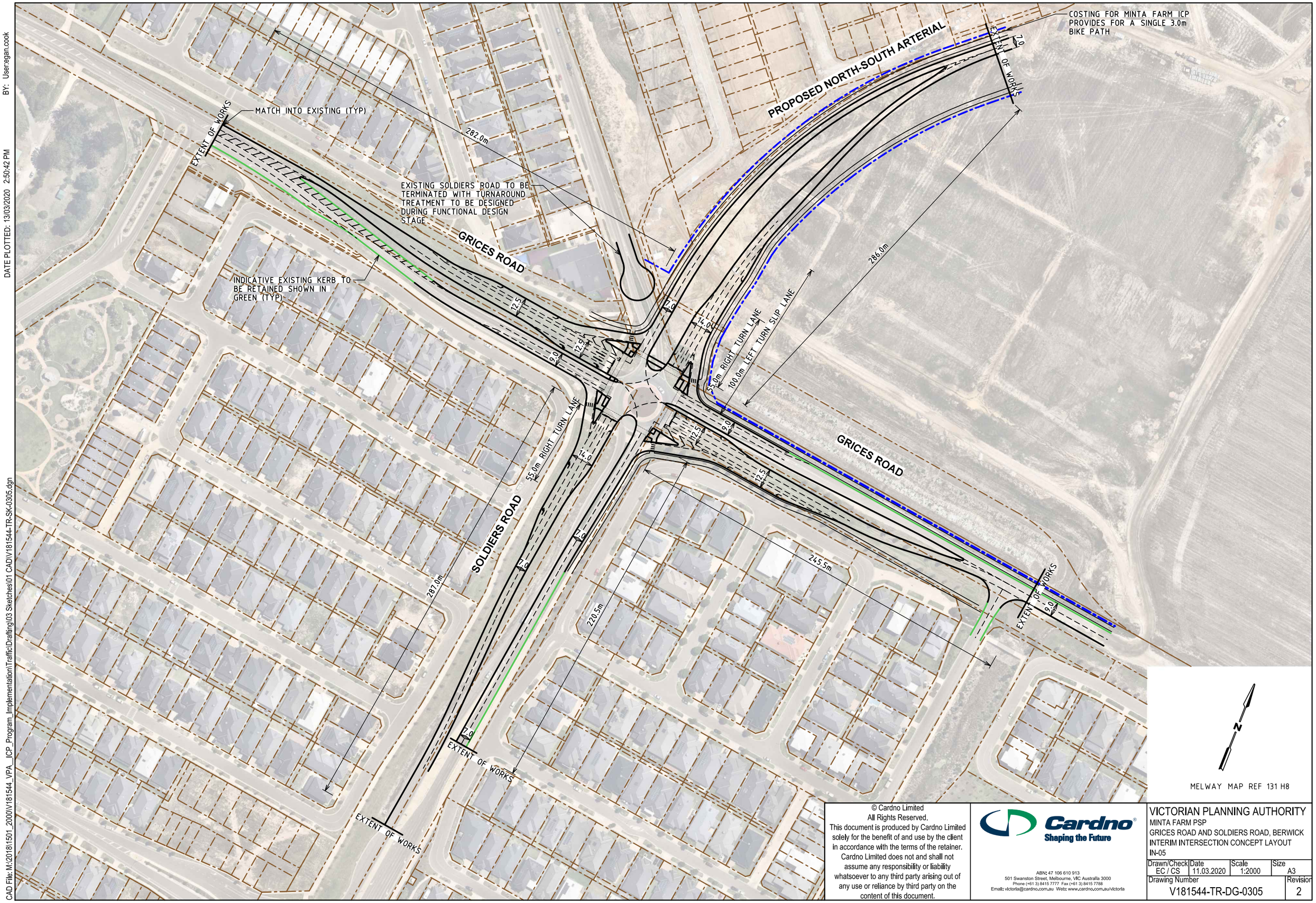
MELWAY MAP REF 131 H7

Cardno
Shaping the Future
ABN: 47 106 610 913
501 Swanston Street, Melbourne, VIC Australia 3000
Phone (+61 3) 8415 7777 Fax (+61 3) 8415 7788
Email: victoria@cardno.com.au Web: www.cardno.com.au/victoria

VICTORIAN PLANNING AUTHORITY
MINTA FARM PSP
PROPOSED NORTH-SOUTH ARTERIAL, BERWICK
INTERIM INTERSECTION CONCEPT LAYOUT
IN-04

Drawn/Check	Date	Scale	Size
EC / CS	11.03.2020	1:2000	A3

Drawing Number	Revision
V181544-TR-DG-0304	2



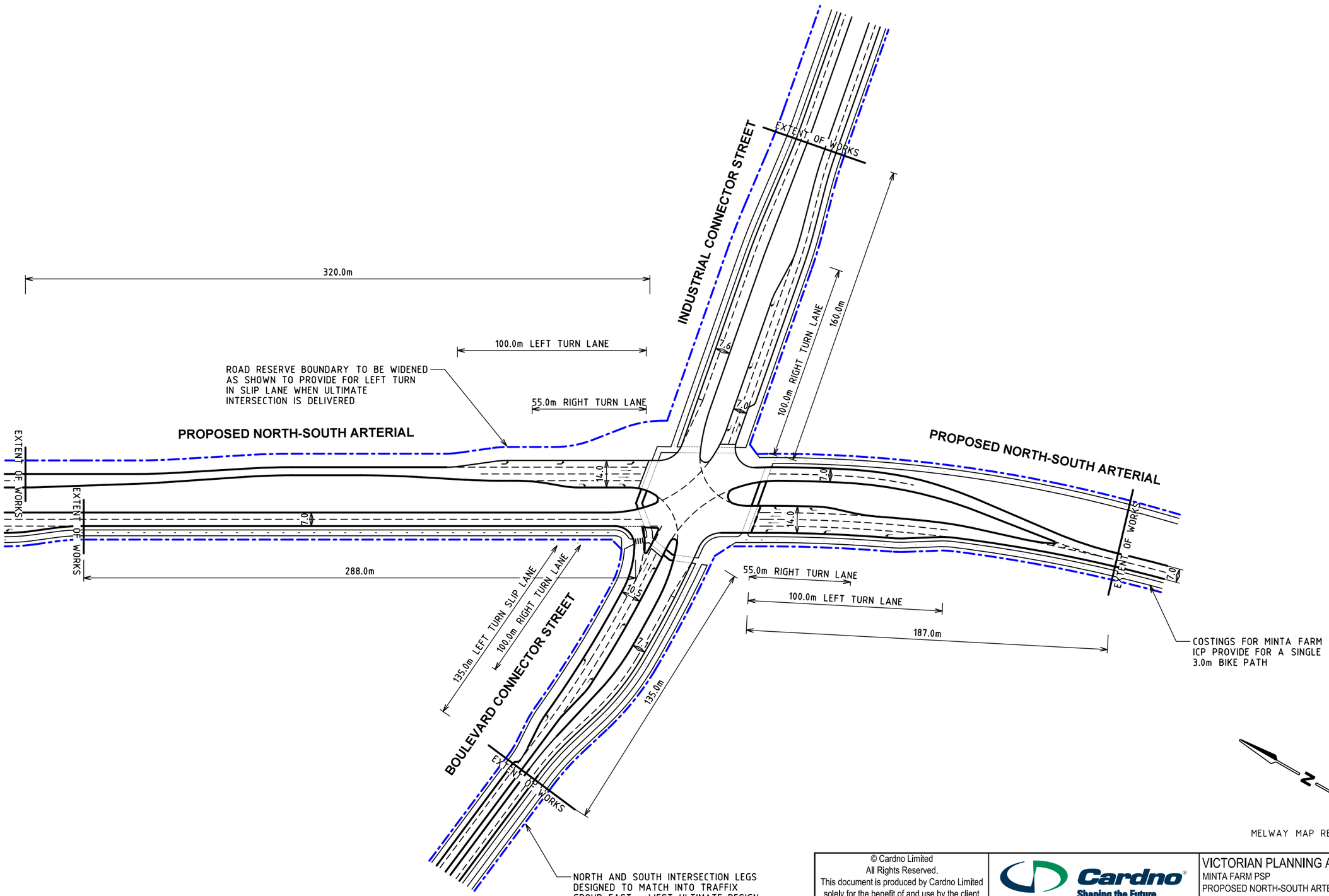
MELWAY MAP REF 131 H8

Cardno
Shaping the Future
ABN: 47 106 610 913
501 Swanston Street, Melbourne, VIC Australia 3000
Phone (+61 3) 8415 7777 Fax (+61 3) 8415 7788
Email: victoria@cardno.com.au Web: www.cardno.com.au/victoria

VICTORIAN PLANNING AUTHORITY
MINTA FARM PSP
GRICES ROAD AND SOLDIERS ROAD, BERWICK
INTERIM INTERSECTION CONCEPT LAYOUT
IN-05

Drawn/Check	Date	Scale	Size
EC / CS	11.03.2020	1:2000	A3

Drawing Number	Revision
V181544-TR-DG-0305	2



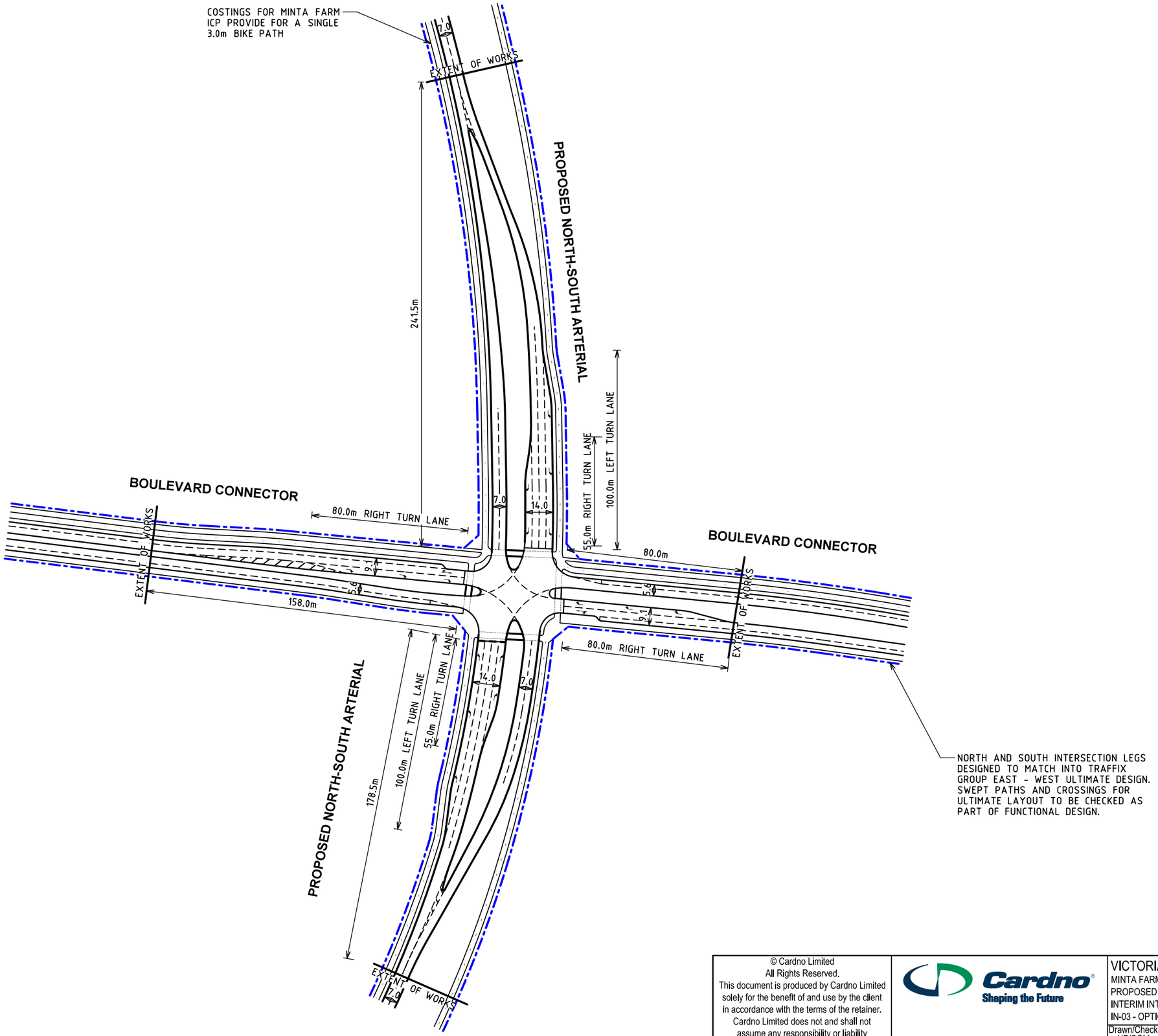
MELWAY MAP REF 131 H5

Cardno
Shaping the Future
ABN: 47 106 610 913
501 Swanston Street, Melbourne, VIC Australia 3000
Phone (+61 3) 8415 7777 Fax (+61 3) 8415 7788
Email: victoria@cardno.com.au Web: www.cardno.com.au/victoria

VICTORIAN PLANNING AUTHORITY
MINTA FARM PSP
PROPOSED NORTH-SOUTH ARTERIAL, BERWICK
INTERIM INTERSECTION CONCEPT LAYOUT
IN-02 - OPTION 2

Drawn/Check	Date	Scale	Size
NB/SGM	13.05.2020	1:2000	A3

Drawing Number	Revision
V181544-TR-DG-0312	2



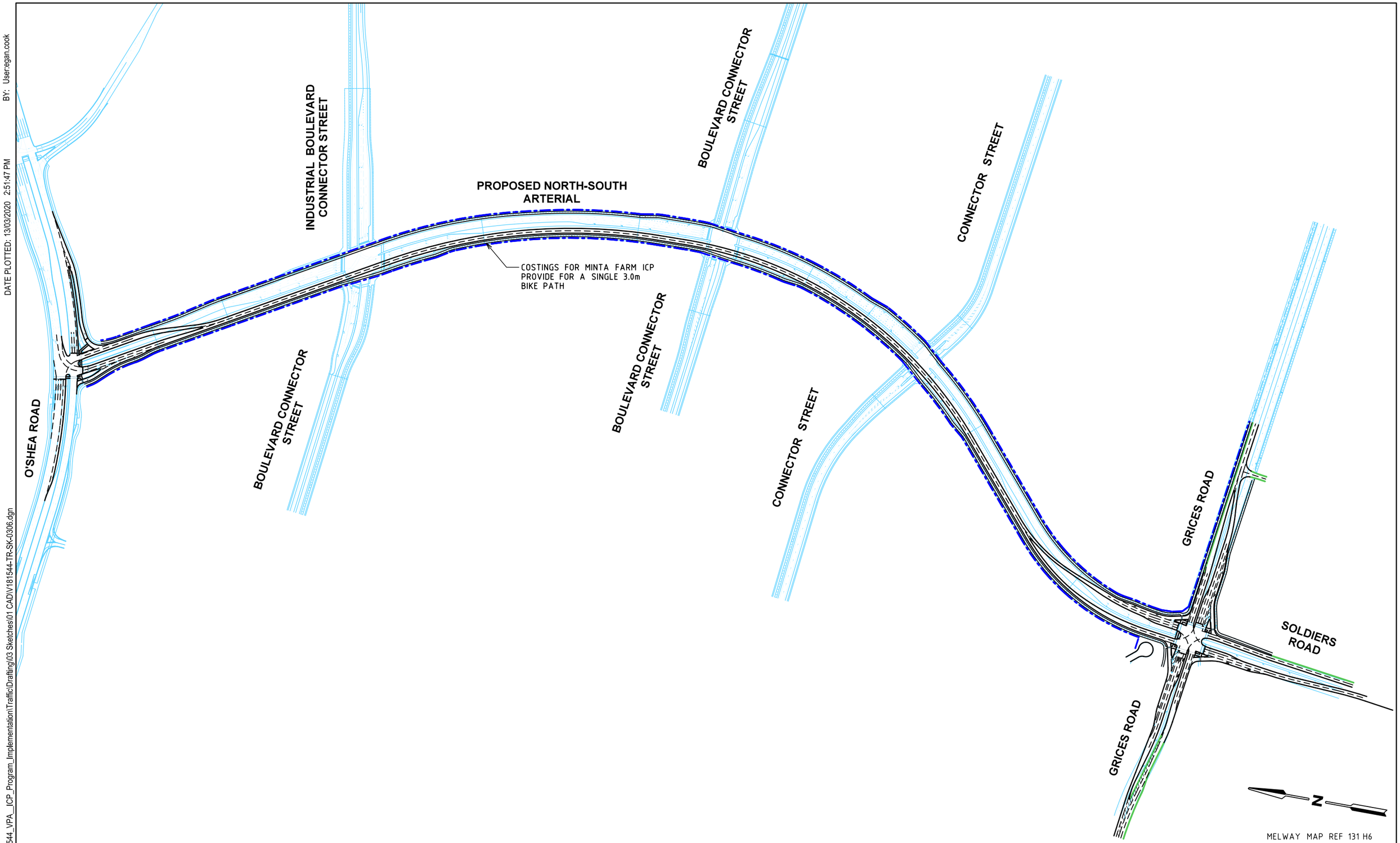
MELWAY MAP REF 131 H4

Cardno
Shaping the Future
ABN: 47 106 610 913
501 Swanston Street, Melbourne, VIC Australia 3000
Phone (+61 3) 8415 7777 Fax (+61 3) 8415 7788
Email: victoria@cardno.com.au Web: www.cardno.com.au/victoria

VICTORIAN PLANNING AUTHORITY
MINTA FARM PSP
PROPOSED NORTH-SOUTH ARTERIAL, BERWICK
INTERIM INTERSECTION CONCEPT LAYOUT
IN-03 - OPTION 2

Drawn/Check	Date	Scale	Size
NB/SGM	13.05.2020	1:2000	A3

Drawing Number	Revision
V181544-TR-DG-0313	2



MELWAY MAP REF 131 H6

Cardno
Shaping the Future
ABN: 47 106 610 913
501 Swanston Street, Melbourne, VIC Australia 3000
Phone (+61 3) 8415 7777 Fax (+61 3) 8415 7788
Email: victoria@cardno.com.au Web: www.cardno.com.au/victoria

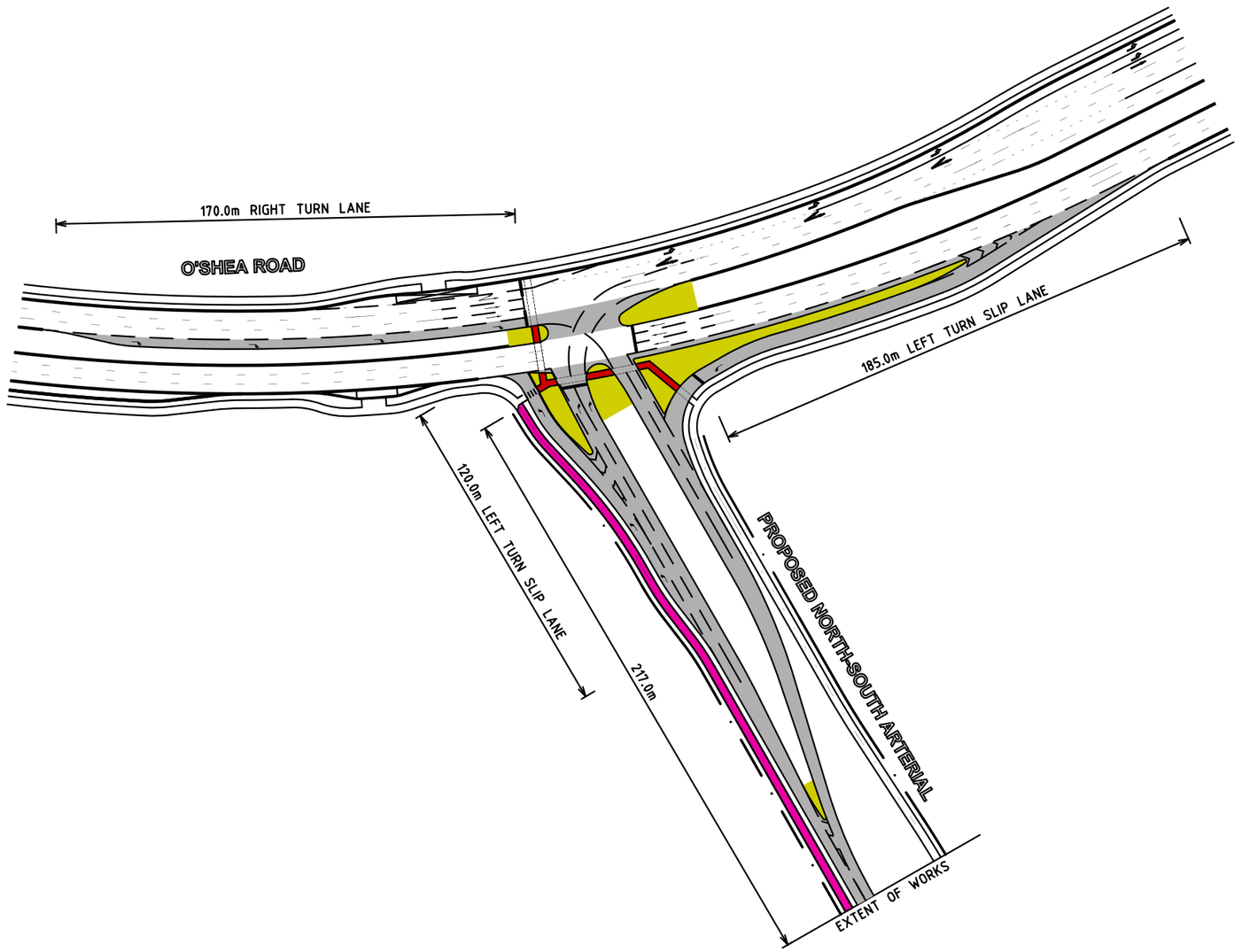
VICTORIAN PLANNING AUTHORITY
MINTA FARM PSP
PROPOSED NORTH-SOUTH ARTERIAL, BERWICK
INTERIM INTERSECTION CONCEPT LAYOUT
OVERVIEW - IN01 - IN05

Drawn/Check	Date	Scale	Size
EC / CS	11.03.2020	1:5000	A3

Drawing Number	Revision
V181544-TR-DG-0306	3

BY: User:regan.cook
DATE PLOTTED: 13/03/2020 2:51:47 PM
CAD File: M:\2018\1501_2000\V181544_VPA_ICP_Program_Implementation\Traffic\Drafting\03 Sketches\01 CAD\V181544-TR-SK-0306.dgn

Appendix D – Quantities Drawings



PRIMARY ARTERIAL PAVEMENT, 715mm DEPTH

CONCRETE, TRAFFIC ISLAND

CONCRETE, BICYCLE PATH

CONCRETE FOOTPATH/SUP

N

MELWAY MAP REF 131 H4

Cardno®
Shaping the Future
ABN: 47 106 610 913
501 Swanston Street, Melbourne, VIC Australia 3000
Phone (+61 3) 8415 7777 Fax (+61 3) 8415 7788
Email: victoria@cardno.com.au Web: www.cardno.com.au/victoria

VICTORIAN PLANNING AUTHORITY
MINTA FARM PSP
PROPOSED NORTH-SOUTH ARTERIAL, BERWICK
PAVEMENT DETAIL SKETCH, IN-01
SHEET 1 OF 5

Drawn/Check	Date	Scale	Size
SB / MS	15/05/2020	1:2000	A3

Drawing Number	Revision
V181544-CI-SK-0311	1

PRIMARY ARTERIAL PAVEMENT, 715mm DEPTH

PRIMARY ARTERIAL RESHEET, 200mm DEPTH

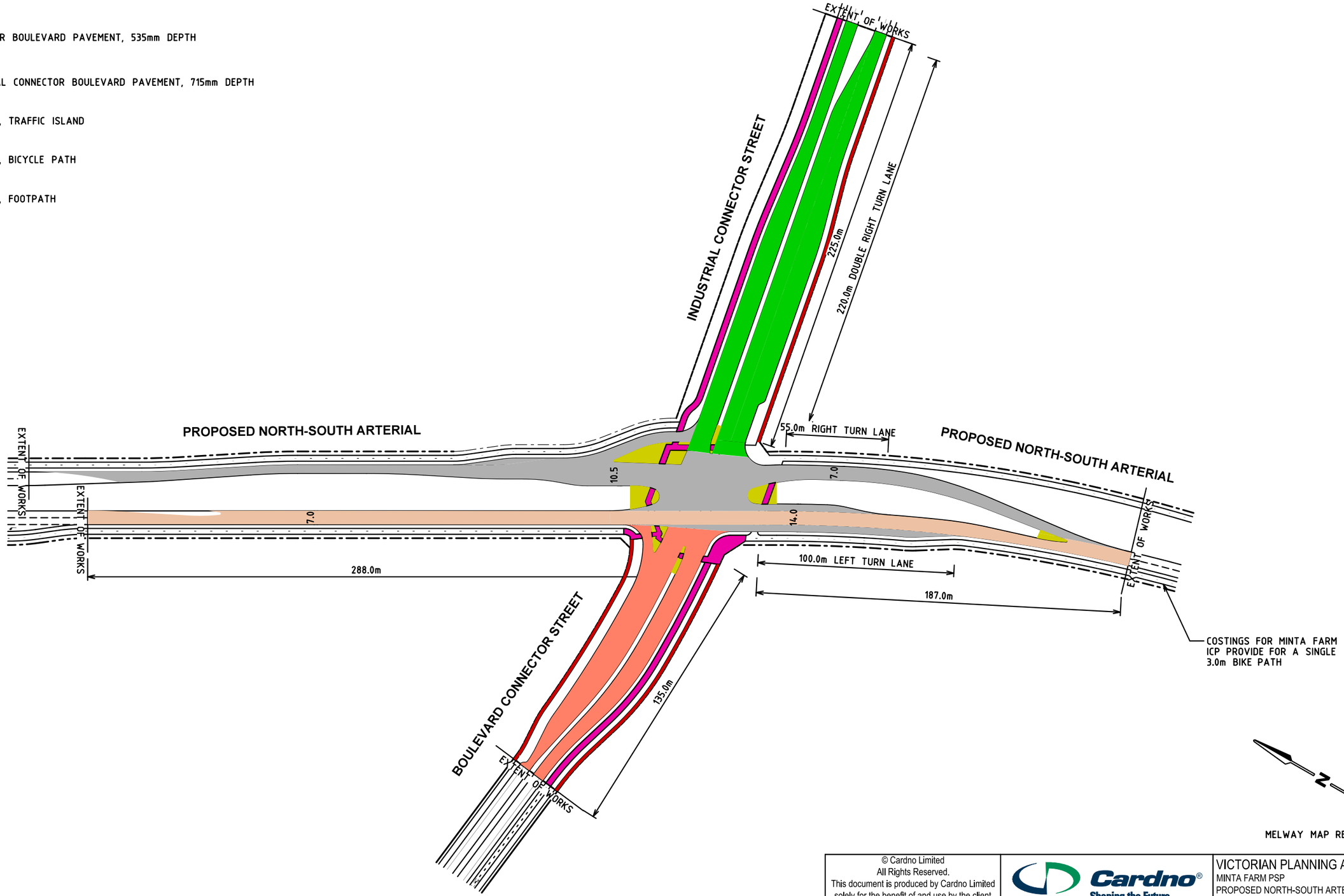
CONNECTOR BOULEVARD PAVEMENT, 535mm DEPTH

INDUSTRIAL CONNECTOR BOULEVARD PAVEMENT, 715mm DEPTH

CONCRETE, TRAFFIC ISLAND

CONCRETE, BICYCLE PATH

CONCRETE, FOOTPATH



MELWAY MAP REF 131 H5

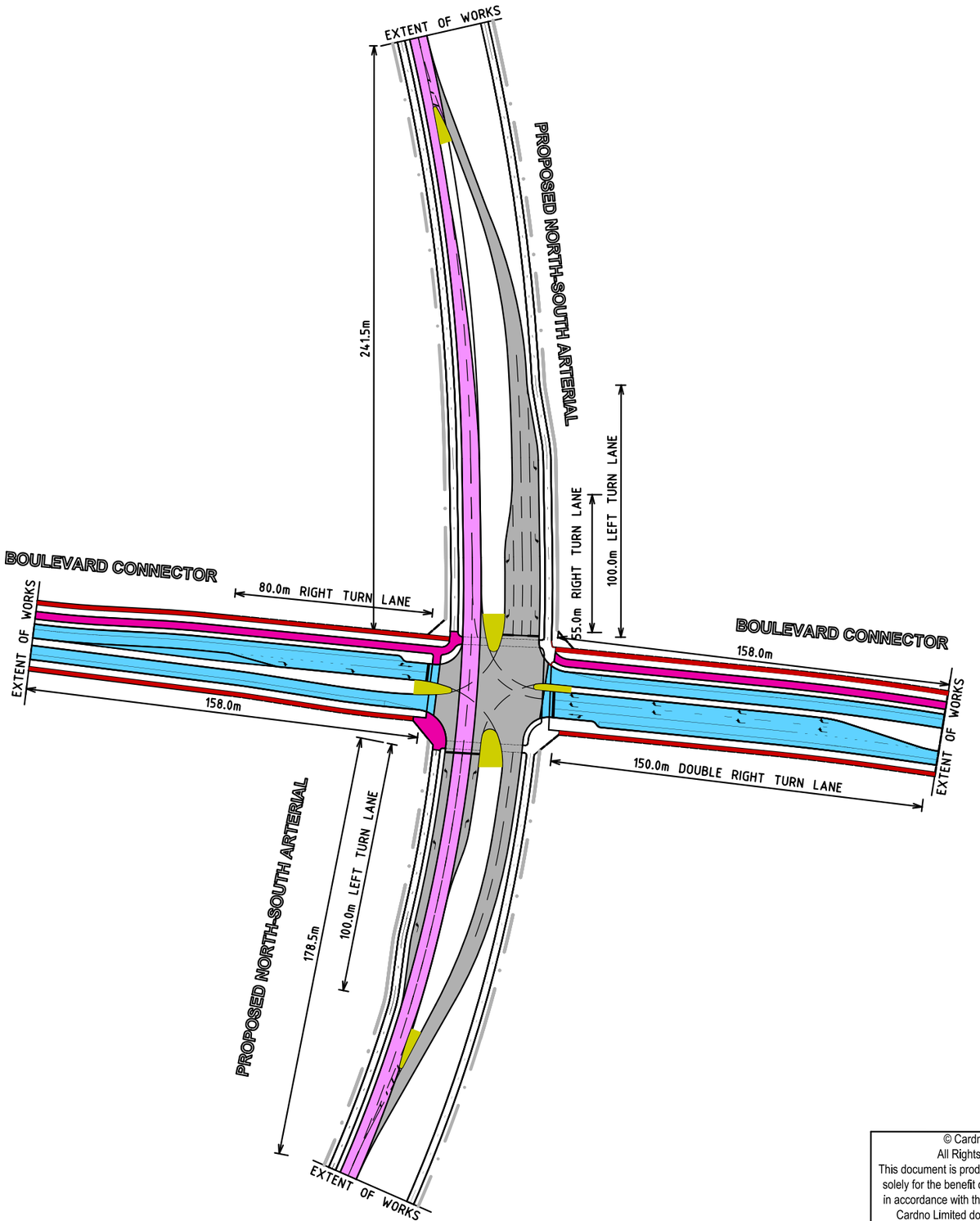
Cardno® Shaping the Future
ABN: 47 106 610 913
501 Swanston Street, Melbourne, VIC Australia 3000
Phone (+61 3) 8415 7777 Fax (+61 3) 8415 7788
Email: victoria@cardno.com.au Web: www.cardno.com.au/victoria

VICTORIAN PLANNING AUTHORITY
MINTA FARM PSP
PROPOSED NORTH-SOUTH ARTERIAL, BERWICK
INTERIM INTERSECTION CONCEPT LAYOUT
IN-02

Drawn/Check	Date	Scale	Size
VA/MS	18.05.2020	1:2000	A3

Drawing Number	Revision
V181544-CI-DG-0312	1

BY: $USER$
DATE PLOTTED: 19/05/2020 11:28:10 AM
CAD File: M:\2018\1501_2000\V181544_VPA__ICP_Program_Implementation\Civil\Reports\Minta Farm ICP\Final ICP\Drawings\V181544-TR-SK-0302.dgn



PRIMARY ARTERIAL PAVEMENT, 715mm DEPTH

PRIMARY ARTERIAL RESHEET

CONNECTOR BOULEVARD PAVEMENT, 535mm DEPTH

CONCRETE, TRAFFIC ISLAND

CONCRETE, BICYCLE PATH

CONCRETE, FOOTPATH

N

MELWAY MAP REF 131 H5

Cardno®
Shaping the Future

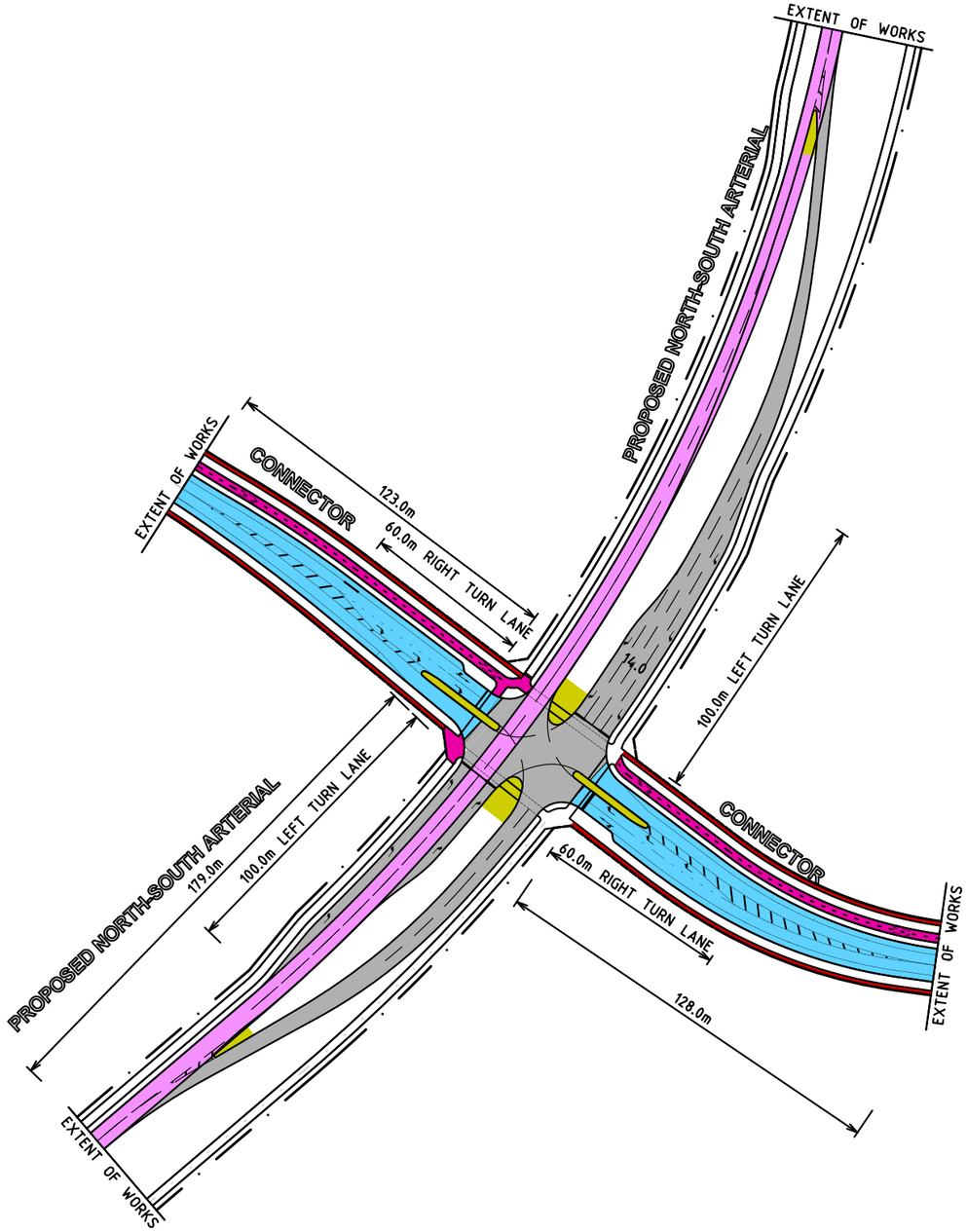
ABN: 47 106 610 913
501 Swanston Street, Melbourne, VIC Australia 3000
Phone (+61 3) 8415 7777 Fax (+61 3) 8415 7788
Email: victoria@cardno.com.au Web: www.cardno.com.au/victoria

VICTORIAN PLANNING AUTHORITY
MINTA FARM PSP
PROPOSED NORTH-SOUTH ARTERIAL, BERWICK
PAVEMENT DETAIL SKETCH, IN-03
SHEET 3 OF 5

Drawn/Check	Date	Scale	Size
SB / MS	15.05.2020	1:2000	A3

Drawing Number: V181544-CI-SK-0313
Revision: 1

CAD File: \\AUMELCFS03.cardno.corp\VicData\120181501_2000\V181544_VPA_ICP_Program_Implementation\Civil\Reports\Minta Farm ICP\Final ICP\Drawings\v181544-ci-dg-0313.dgn
DATE PLOTTED: 18/05/2020 12:52:57 PM
BY: $USER$



PRIMARY ARTERIAL PAVEMENT, 715mm DEPTH

PRIMARY ARTERIAL RESHEET

CONNECTOR BOULEVARD PAVEMENT, 535mm DEPTH

CONCRETE, TRAFFIC ISLAND

CONCRETE, BICYCLE PATH

CONCRETE, FOOTPATH

N

MELWAY MAP REF 131 H6

Cardno®
Shaping the Future

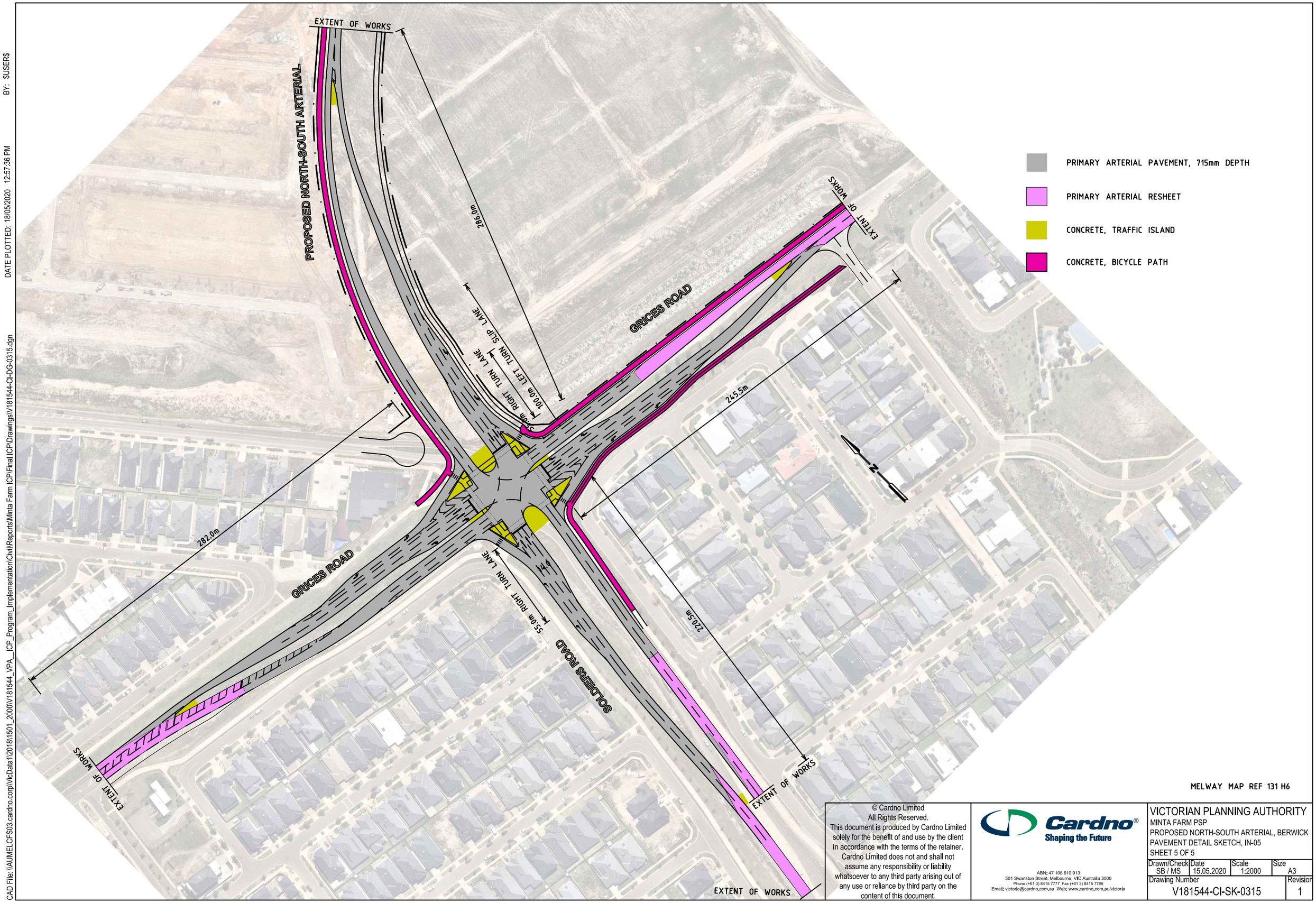
ABN: 47 106 610 913
501 Swanston Street, Melbourne, VIC Australia 3000
Phone (+61 3) 8415 7777 Fax (+61 3) 8415 7788
Email: victoria@cardno.com.au Web: www.cardno.com.au/victoria

VICTORIAN PLANNING AUTHORITY
MINTA FARM PSP
PROPOSED NORTH-SOUTH ARTERIAL, BERWICK
PAVEMENT DETAIL SKETCH, IN-04
SHEET 4 OF 5

Drawn/Check	Date	Scale	Size
SB / MS	15.05.2020	1:2000	A3

Drawing Number	Revision
V181544-CI-SK-0314	1

CAD File: \\AUMELCFS03.cardno.corp\VicData\120181501_2000\V181544_VPA_ICP_Program_Implementation\Civil\Reports\Minta Farm ICP\Final ICP\Drawings\v181544-ci-dg-0314.dgn
DATE PLOTTED: 18/05/2020 12:43:30 PM
BY: $USER$



MELWAY MAP REF 131 H6

Cardno®
Shaping the Future

ABN: 47 106 610 913
501 Swanston Street, Melbourne, VIC Australia 3000
Phone (+61 3) 8415 7777 Fax (+61 3) 8415 7788
Email: victoria@cardno.com.au Web: www.cardno.com.au/victoria

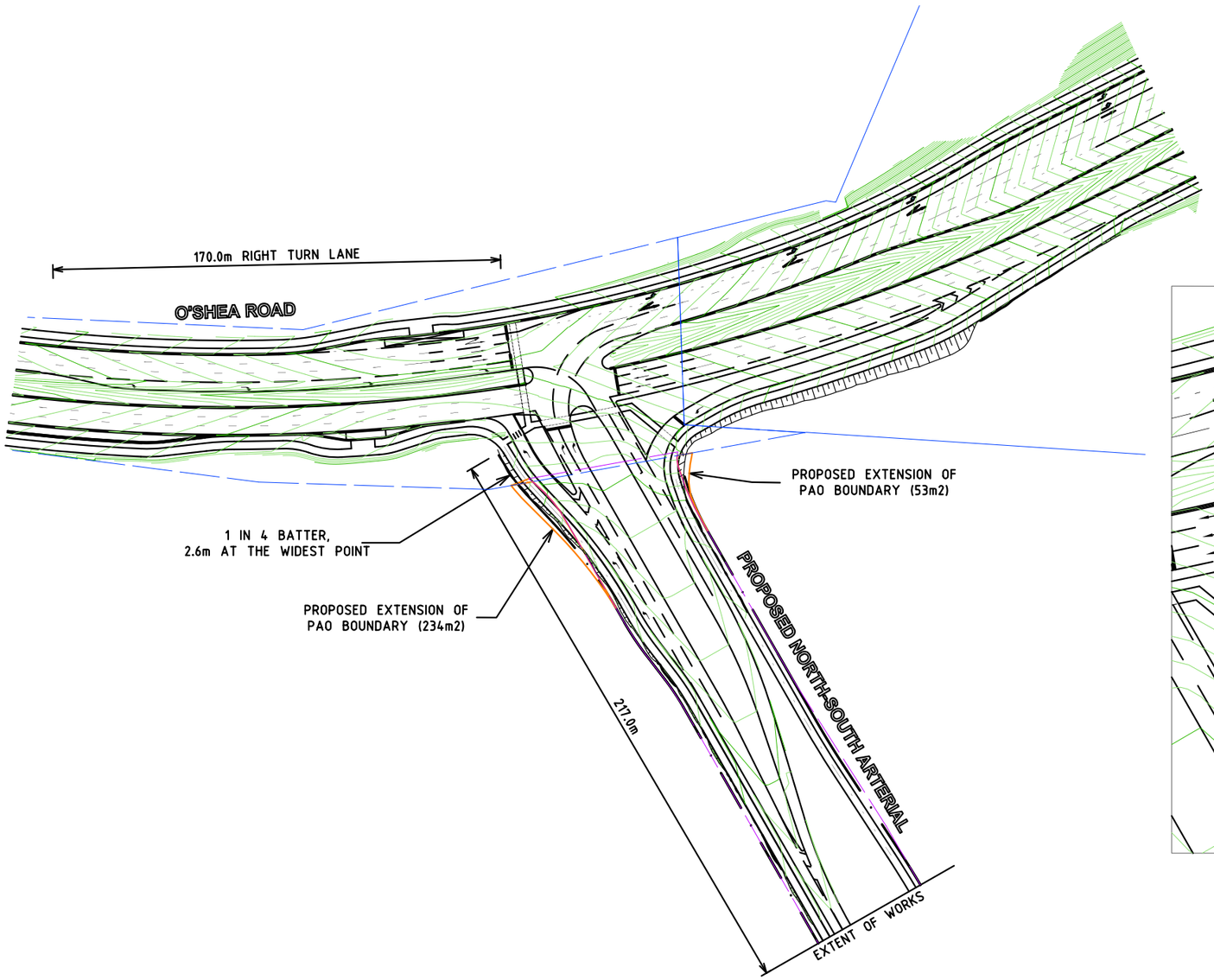
VICTORIAN PLANNING AUTHORITY
MINTA FARM PSP
PROPOSED NORTH-SOUTH ARTERIAL, BERWICK
PAVEMENT DETAIL SKETCH, IN-05
SHEET 5 OF 5

Drawn/Check	Date	Scale	Size
SB / MS	15.05.2020	1:2000	A3

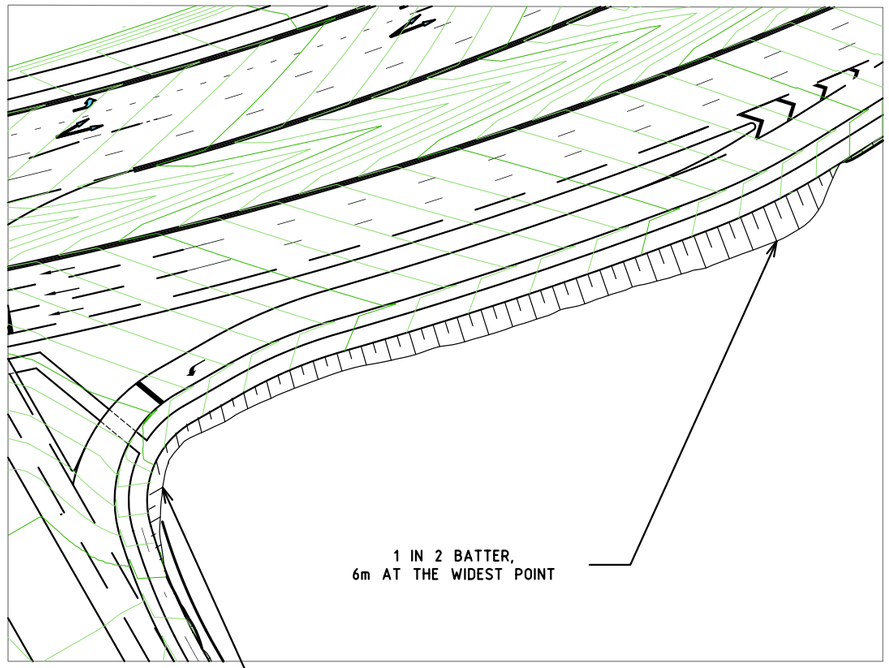
Drawing Number	Revision
V181544-CI-SK-0315	1

CAD File: \\AUMELCFS03.cardno.corp\VicData\12018\1501_2000\V181544_VPA_ICP_Program_Implementation\Civil\Reports\Minta Farm ICP\Final ICP\Drawings\V181544-CI-DG-0315.dgn
DATE PLOTTED: 18/05/2020 12:57:36 PM
BY: $USER$

Appendix E – 3D Analysis for IN - 01



INSET : NTS



MELWAY MAP REF 131 H4

NOTES
1) INFORMATION SHOWN IN PLAN BASED ON LIDAR DATA AND IS FROM A HIGH LEVEL CONCEPT DESIGN. DETAILED WORK WILL BE REUIRED FOR ACCURACY
2) 1 IN 2 BATTER SLOPE SUBJECT TO GEOTECHNICAL ENGINEER'S ASSESSMENT AT A LATER STAGE
3) PROPOSED PAO BOUNDARY TO SUMMATE TO AN ADDITIONAL 287m² FROM THE EXISTING NORTH-SOUTH ARTERIAL PAO BOUNDARY.

Cardno® Shaping the Future
ABN: 47 106 610 913
501 Swanston Street, Melbourne, VIC Australia 3000
Phone (+61 3) 8415 7777 Fax (+61 3) 8415 7788
Email: victoria@cardno.com.au Web: www.cardno.com.au/victoria

VICTORIAN PLANNING AUTHORITY
MINTA FARM PSP
PROPOSED NORTH-SOUTH ARTERIAL, BERWICK
BATTER DETAIL SKETCH, IN-01
SHEET 1 OF 1

Drawn/Check	Date	Scale	Size
VA / MS	27/05/2020	1:2000	A3

Drawing Number	Revision
V181544-CI-SK-0351	3

CAD File: M:\2018\1501_2000\V181544_VPA_ICP_Program_Implementation\Civil\Reports\Minta Farm ICP\Final ICP\Drawings\Batter Extent Plans\V181544-CI-DG-0351.dgn
DATE PLOTTED: 28/05/2020 11:56:19 AM BY: $USER$