TASMAN HIGHWAY (A0113)

HOBART AIRPORT INTERCHANGE

-

CONTRACT NO. 2960

DESIGN

VOLUME 2 OF 2

SETOUT REVIEW NAME - SIGNED ... DATE -	DESIGNED NAME - SIGNED ... DATE -	THESE DRAWINGS HAVE BEEN CHECKED, TAKEN TO SITE AND VERIFIED THAT THEY ARE APPROPRIATE FOR SITE CONDITIONS AND CONSTRAINTS. THE DRAWINGS ARE RECOMMENDED FOR ACCEPTANCE. DESIGN MANAGER - (DESIGN ORGANISATION) SIGNED ... DATE -	I CERTIFY THESE DRAWINGS HAVE BEEN PREPARED IN ACCORDANCE WITH THE BRIEF AND AS DETAILED IN THE FINAL DESIGN REPORT. PRINCIPAL R.CASIMATY (DESIGN ORGANISATION) SIGNED ... DATE -	Department of State Growth THESE DRAWINGS HAVE BEEN PREPARED IN ACCORDANCE WITH THE DESIGN BRIEF AND PROJECT SCOPE. THE DRAWINGS ARE RECOMMENDED FOR ACCEPTANCE. PROJECT MANAGER - SIGNED ... DATE -	ACCEPTED MANAGER - SIGNED ... DATE -	CONTRACT No. 2960 DRAWING HB17138-C2000 PRINTED DATE 20-Feb-18, 4:14 PM REGISTRATION NUMBER A0113.023 ROAD LINK No. START: LINK 07 / 11.4 FINISH: LINK 11 / 1.08	No. of SHEETS - SHEET No. 2000 REVISION A
STRUCTURAL REVIEW NAME - SIGNED ... DATE -	DESIGN REVIEW NAME - SIGNED ... DATE -						

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2000	A	COVER SHEET
2005	A	TABLE OF CONTENT
2101	A	LONGITUDINAL SECTION (MC30) - DRG 1 OF 3
2102	A	LONGITUDINAL SECTION (MC30) - DRG 2 OF 3
2103	A	LONGITUDINAL SECTION (MC30) - DRG 3 OF 3
2106	A	LONGITUDINAL SECTION (MC20)
2108	A	LONGITUDINAL SECTION (MC70)
2110	A	LONGITUDINAL SECTION (MC80) - DRG 1 OF 3
2111	A	LONGITUDINAL SECTION (MC80) - DRG 2 OF 3
2112	A	LONGITUDINAL SECTION (MC80) - DRG 3 OF 3
2114	A	LONGITUDINAL SECTION (MC10)

No.	Amendment Description	Initials	Date
A	PRELIMINARY DESIGN	D.C	12/07/2018

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SCALES
(A3)

Co-ordinate System: MGA ZONE 55 | Height Datum: A.H.D.

pitt&sherry | Tasmanian Government

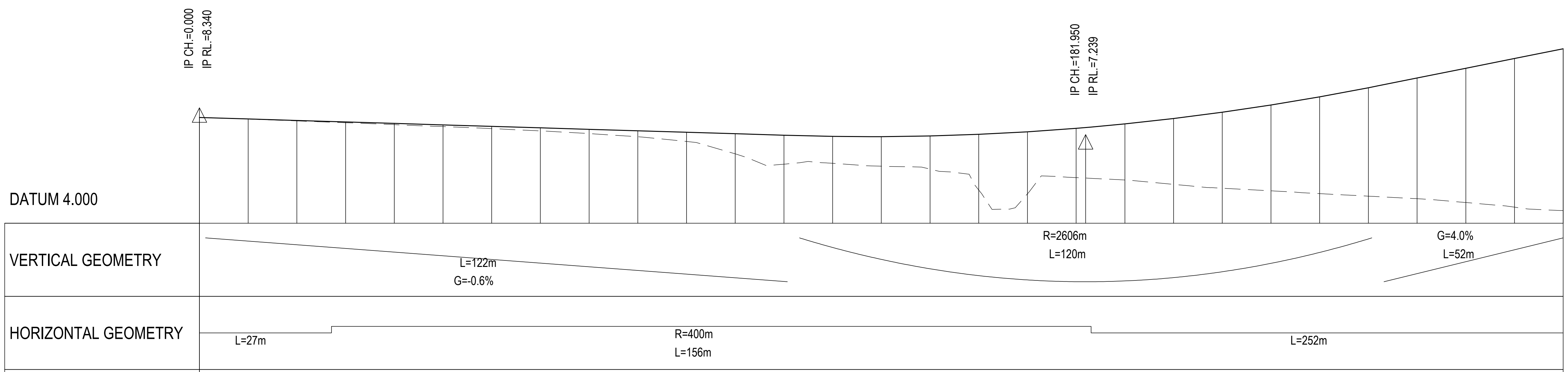
DESIGNED F.SHADWICK
REVIEWED D.CONLEY

Department of State Growth
TASMAN HIGHWAY (A0113)
HOBART AIRPORT INTERCHANGE
-
TABLE OF CONTENT

CONTRACT No.	DRAWING	PRINTED DATE	SHEET No.
2960	HB17138-C2005	20-Feb-18, 4:14 PM	2005

REGISTRATION NUMBER
A0113.023

REVISION A



LEVEL DIFFERENCE DESIGN TO EXISTING	-0.001	0.003	0.017	0.032	0.051	0.071	0.091	0.125	0.174	0.245
INTERPOLATED GROUND LEVELS	8.341	8.276	8.201	8.126	8.047	7.966	7.885	7.792	7.682	7.550
DESIGN LEVELS	8.340	8.279	8.219	8.158	8.098	8.037	7.977	7.916	7.856	7.795
CHAINAGE	0	10	20	30	40	50	60	70	80	90

LEVEL DIFFERENCE DESIGN TO EXISTING	0.378	0.824	1.189	1.106	1.213	1.361	2.283	2.546	2.023	2.304
INTERPOLATED GROUND LEVELS	7.357	6.850	6.424	6.459	6.342	6.222	5.367	5.208	5.875	5.775
DESIGN LEVELS	7.735	7.674	7.614	7.566	7.555	7.583	7.650	7.754	7.897	8.079
CHAINAGE	100	110	120	130	140	150	160	170	180	190

LEVEL DIFFERENCE DESIGN TO EXISTING	2.702	3.119	3.522	3.972	4.449	4.952	5.509	6.101	6.641
INTERPOLATED GROUND LEVELS	5.597	5.438	5.331	5.217	5.112	5.008	4.851	4.660	4.520
DESIGN LEVELS	8.299	8.557	8.853	9.188	9.562	9.961	10.361	10.761	11.161
CHAINAGE	200	210	220	230	240	250	260	270	280

GEOMETRY DATA
IS ROUNDED

HORIZONTAL SCALE: 1:1000

10 0 10 20 30 40
SCALE IN METRES - 1:1000

VERTICAL SCALE: 1:200

2 0 2 4 6 8
SCALE IN METRES - 1:200

No.	Amendment Description	Initials	Date
A	PRELIMINARY DESIGN	D.C	12/07/2018

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SCALES
AS SHOWN (A3)

Co-ordinate System: MGA ZONE 55 | Height Datum: A.H.D.

DESIGNED F.SHADWICK
REVIEWED D.CONLEY

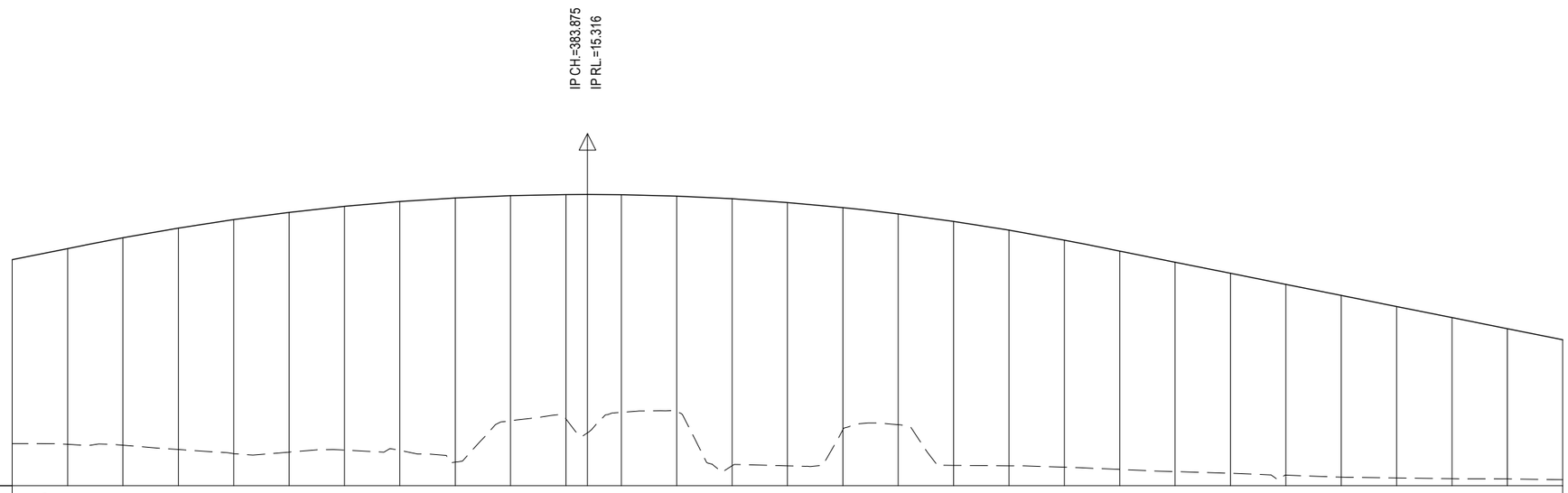
Department of State Growth

TASMAN HIGHWAY (A0113)
HOBART AIRPORT INTERCHANGE
-
LONGITUDINAL SECTION (MC30) - DRG 1 OF 3

CONTRACT No.	DRAWING	PRINTED DATE	SHEET No.
2960	HB17138-C2101	20-Feb-18, 4:14 PM	2101

REGISTRATION NUMBER
A0113.023

REVISION A



DATUM 3.000

VERTICAL GEOMETRY	G L										L=180m R=-2250m																	L=146m G=-4.0%		
HORIZONTAL GEOMETRY	L=252m																											R=-200m L=205m		
LEVEL DIFFERENCE DESIGN TO EXISTING	6.641	7.066	7.492	7.996	8.454	8.658	8.803	8.982	9.540	8.128	8.103	7.858	7.782	9.645	9.508	8.023	7.611	8.811	8.511	8.200	7.885	7.560	7.223	6.889	6.562	6.193	5.817	5.426	5.055
INTERPOLATED GROUND LEVELS	4.520	4.494	4.460	4.307	4.156	4.213	4.285	4.279	3.850	5.346	5.409	5.649	5.677	3.719	3.717	5.021	5.204	3.734	3.718	3.668	3.587	3.510	3.449	3.381	3.309	3.279	3.253	3.245	3.216
DESIGN LEVELS	11.161	11.561	11.953	12.303	12.609	12.871	13.088	13.261	13.389	13.473	13.513	13.508	13.458	13.364	13.226	13.043	12.816	12.544	12.228	11.868	11.471	11.071	10.671	10.271	9.871	9.471	9.071	8.671	8.271
CHAINAGE	280	290	300	310	320	330	340	350	360	370	380	390	400	410	420	430	440	450	460	470	480	490	500	510	520	530	540	550	560

GEOMETRY DATA
IS ROUNDED

HORIZONTAL SCALE: 1:1000

10 0 10 20 30 40
SCALE IN METRES - 1:1000

VERTICAL SCALE: 1:200

2 0 2 4 6 8
SCALE IN METRES - 1:200

No.	Amendment Description	Initials	Date
A	PRELIMINARY DESIGN	D.C	12/07/2018

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SCALES
AS SHOWN (A3)

Co-ordinate System: MGA ZONE 55 **Height Datum:** A.H.D.

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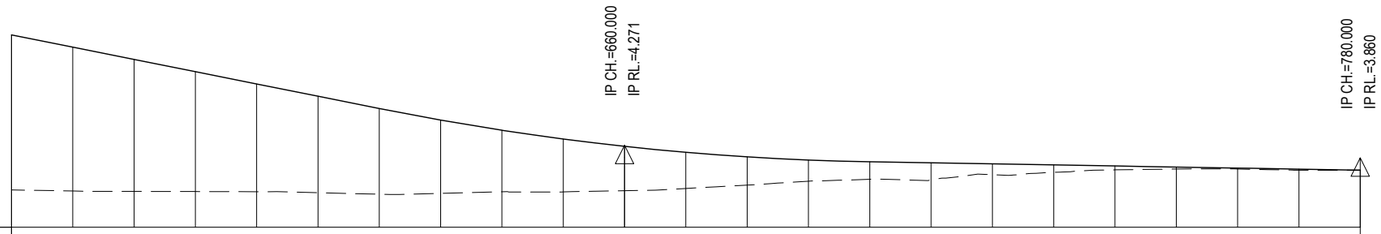
DESIGNED F.SHADWICK
REVIEWED D.CONLEY

Department of State Growth
TASMAN HIGHWAY (A0113)
HOBART AIRPORT INTERCHANGE
-
LONGITUDINAL SECTION (MC30) - DRG 2 OF 3

CONTRACT No.	DRAWING	PRINTED DATE	SHEET No.
2960	HB17138-C2102	20-Feb-18, 4:14 PM	2102

REGISTRATION NUMBER
A0113.023

REVISION A



LEVEL DIFFERENCE DESIGN TO EXISTING	5.055	4.689	4.303	3.907	3.513	3.145	2.795	2.390	2.007	1.725	1.446	1.179	0.921	0.690	0.572	0.560	0.353	0.242	0.127	0.064	0.030	0.035	-0.002
INTERPOLATED GROUND LEVELS	3.216	3.182	3.168	3.163	3.158	3.125	3.076	3.104	3.156	3.151	3.191	3.263	3.372	3.501	3.562	3.539	3.712	3.790	3.870	3.898	3.898	3.860	3.863
DESIGN LEVELS	8.271	7.871	7.471	7.071	6.671	6.271	5.871	5.494	5.162	4.877	4.637	4.442	4.294	4.191	4.134	4.100	4.065	4.031	3.997	3.963	3.928	3.894	3.860
CHAINAGE	560	570	580	590	600	610	620	630	640	650	660	670	680	690	700	710	720	730	740	750	760	770	780

GEOMETRY DATA
IS ROUNDED

HORIZONTAL SCALE: 1:1000

10 0 10 20 30 40
SCALE IN METRES - 1:1000

VERTICAL SCALE: 1:200

2 0 2 4 6 8
SCALE IN METRES - 1:200

No.	Amendment Description	Initials	Date
A	PRELIMINARY DESIGN	D.C	12/07/2018

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SCALES
AS SHOWN (A3)

Co-ordinate System: MGA ZONE 55 | Height Datum: A.H.D.

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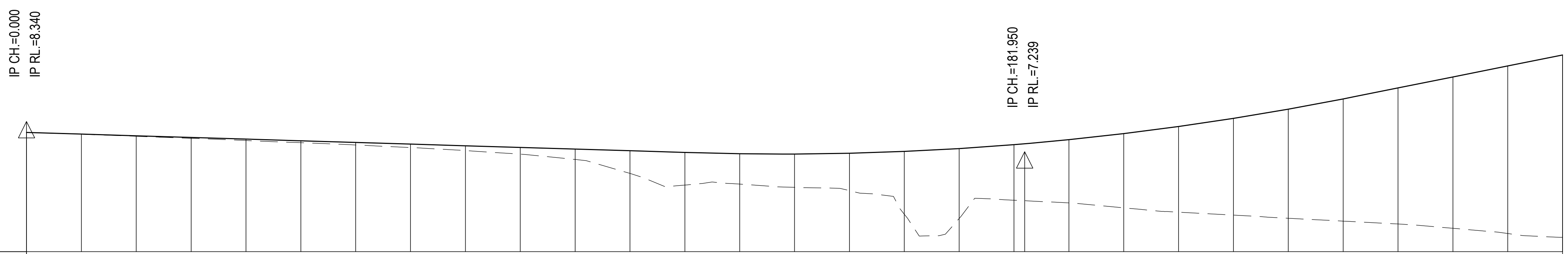
DESIGNED F.SHADWICK
REVIEWED D.CONLEY

Department of State Growth
TASMAN HIGHWAY (A0113)
HOBART AIRPORT INTERCHANGE
-
LONGITUDINAL SECTION (MC30) - DRG 3 OF 3

CONTRACT No.	DRAWING	PRINTED DATE	SHEET No.
2960	HB17138-C2103	20-Feb-18, 4:14 PM	2103

REGISTRATION NUMBER
A0113.023

REVISION A



VERTICAL GEOMETRY: L=122m G=-0.6% | R=2606m L=120m | G=4.0% L=52m

HORIZONTAL GEOMETRY: L=27m | R=400m L=156m | L=252m

CHAINAGE	0	10	20	30	40	50	60	70	80	90
LEVEL DIFFERENCE DESIGN TO EXISTING	-0.001	0.003	0.017	0.032	0.051	0.071	0.091	0.125	0.174	0.245
INTERPOLATED GROUND LEVELS	8.341	8.276	8.201	8.126	8.047	7.966	7.885	7.792	7.682	7.550
DESIGN LEVELS	8.340	8.279	8.219	8.158	8.098	8.037	7.977	7.916	7.856	7.795

CHAINAGE	100	110	120	130	140	150	160	170	180	190
LEVEL DIFFERENCE DESIGN TO EXISTING	0.378	0.824	1.189	1.106	1.213	1.361	2.283	2.546	2.023	2.304
INTERPOLATED GROUND LEVELS	7.357	6.850	6.424	6.459	6.342	6.222	5.367	5.208	5.875	5.775
DESIGN LEVELS	7.735	7.674	7.614	7.566	7.555	7.583	7.650	7.754	7.897	8.079

CHAINAGE	200	210	220	230	240	250	260	270	280
LEVEL DIFFERENCE DESIGN TO EXISTING	2.702	3.119	3.522	3.972	4.449	4.952	5.509	6.101	6.641
INTERPOLATED GROUND LEVELS	5.597	5.438	5.331	5.217	5.112	5.008	4.851	4.660	4.520
DESIGN LEVELS	8.299	8.557	8.853	9.188	9.562	9.961	10.361	10.761	11.161

GEOMETRY DATA
IS ROUNDED

HORIZONTAL SCALE: 1:1000

SCALE IN METRES - 1:1000

VERTICAL SCALE: 1:200

SCALE IN METRES - 1:200

No.	Amendment Description	Initials	Date
A	PRELIMINARY DESIGN	D.C	12/07/2018

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SCALES
AS SHOWN (A3)

Co-ordinate System: MGA ZONE 55 | Height Datum: A.H.D.

DESIGNED F.SHADWICK
REVIEWED D.CONLEY

Department of State Growth

TASMAN HIGHWAY (A0113)
HOBART AIRPORT INTERCHANGE
-

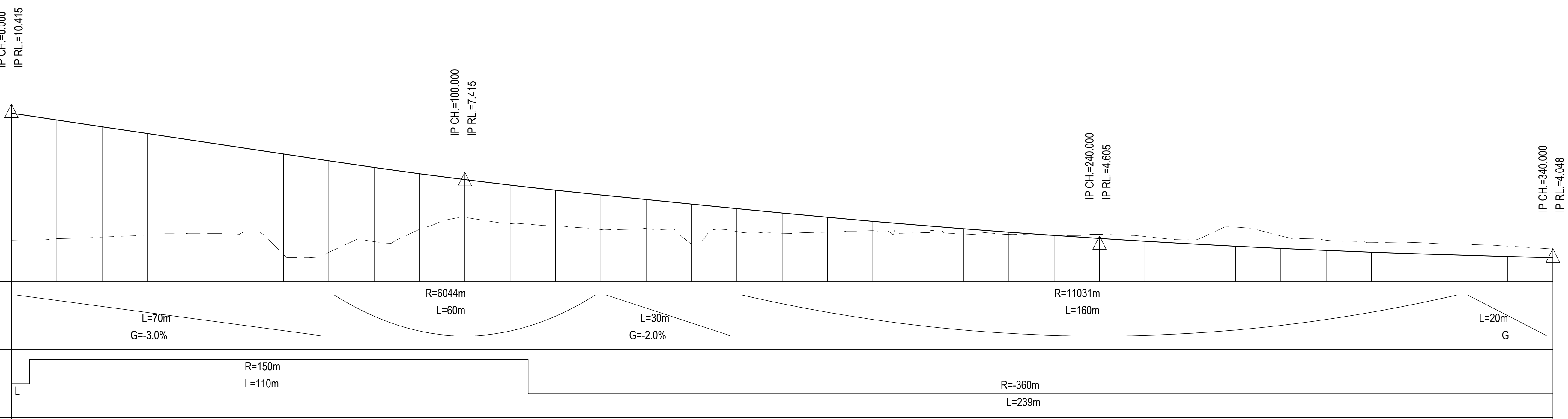
LONGITUDINAL SECTION (MC20)

CONTRACT No.	DRAWING	PRINTED DATE	SHEET No.
2960	HB17138-C2106	20-Feb-18, 4:14 PM	2106

REGISTRATION NUMBER
A0113.023

REVISION A

DATUM 3.000



CHAINAGE	DESIGN LEVELS	INTERPOLATED GROUND LEVELS	LEVEL DIFFERENCE DESIGN TO EXISTING
0	10.415	4.816	5.600
10	10.115	4.885	5.230
20	9.815	4.953	4.862
30	9.515	5.041	4.473
40	9.215	5.122	4.092
50	8.915	5.064	3.851
60	8.615	4.183	4.432
70	8.315	4.284	4.030
80	8.023	4.755	3.268
90	7.748	5.295	2.453
100	7.489	5.827	1.663
110	7.247	5.547	1.700
120	7.022	5.445	1.577
130	6.813	5.289	1.524
140	6.612	5.329	1.284
150	6.411	4.674	1.738
160	6.211	5.200	1.010
170	6.014	5.124	0.890
180	5.827	5.168	0.660
190	5.649	5.235	0.414
200	5.480	5.144	0.336
210	5.320	5.094	0.227
220	5.169	5.075	0.094
230	5.028	5.031	-0.004
240	4.895	5.072	-0.177
250	4.771	4.981	-0.210
260	4.657	4.836	-0.180
270	4.551	5.395	-0.843
280	4.455	5.003	-0.548
290	4.367	4.813	-0.445
300	4.289	4.708	-0.419
310	4.220	4.713	-0.494
320	4.159	4.644	-0.484
330	4.104	4.556	-0.453
340	4.048	4.429	-0.381

GEOMETRY DATA
IS ROUNDED

HORIZONTAL SCALE: 1:1000

10 0 10 20 30 40
SCALE IN METRES - 1:1000

VERTICAL SCALE: 1:200

2 0 2 4 6 8
SCALE IN METRES - 1:200

No.	Amendment Description	Initials	Date
A	PRELIMINARY DESIGN	D.C	12/07/2018

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SCALES
AS SHOWN (A3)

Co-ordinate System: MGA ZONE 55 | Height Datum: A.H.D.

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DESIGNED F.SHADWICK
REVIEWED D.CONLEY

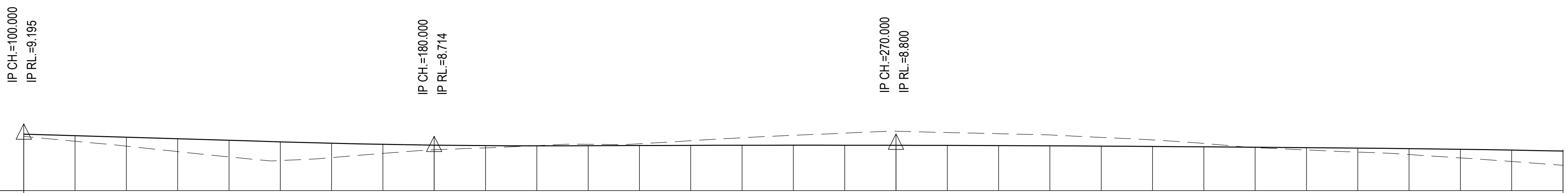
Department of State Growth

TASMAN HIGHWAY (A0113)
HOBART AIRPORT INTERCHANGE
-
LONGITUDINAL SECTION (MC70)

CONTRACT No.	DRAWING	PRINTED DATE	SHEET No.
2960	HB17138-C2108	20-Feb-18, 4:14 PM	2108

REGISTRATION NUMBER
A0113.023

REVISION A



DATUM 7.000

VERTICAL GEOMETRY
L=50m G=-0.6% | R=8611m L=60m | L=120m R=-45763m | L=30m G=-0.2% | L=180m R=-17053m

HORIZONTAL GEOMETRY
L | R=-2230m L=450m

LEVEL DIFFERENCE DESIGN TO EXISTING	0.093	0.217	0.347	0.500	0.646	0.727	0.558	0.351	0.181	0.087	-0.009	-0.057	-0.070	-0.180	-0.293	-0.387
INTERPOLATED GROUND LEVELS	9.102	8.917	8.728	8.515	8.308	8.168	8.283	8.447	8.586	8.660	8.748	8.800	8.822	8.938	9.054	9.150
DESIGN LEVELS	9.195	9.135	9.075	9.015	8.954	8.894	8.840	8.797	8.766	8.747	8.739	8.743	8.751	8.757	8.761	8.763
CHAINAGE	100	110	120	130	140	150	160	170	180	190	200	210	220	230	240	250

LEVEL DIFFERENCE DESIGN TO EXISTING	-0.469	-0.545	-0.500	-0.462	-0.422	-0.339	-0.254	-0.131	0.015	0.087	0.154	0.229	0.335	0.443	0.554
INTERPOLATED GROUND LEVELS	9.233	9.306	9.256	9.211	9.162	9.068	8.969	8.832	8.668	8.580	8.495	8.401	8.270	8.131	7.982
DESIGN LEVELS	8.763	8.761	8.756	8.749	8.740	8.729	8.716	8.700	8.683	8.667	8.650	8.630	8.605	8.574	8.536
CHAINAGE	260	270	280	290	300	310	320	330	340	350	360	370	380	390	400

GEOMETRY DATA
IS ROUNDED

HORIZONTAL SCALE: 1:1000

10 0 10 20 30 40
SCALE IN METRES - 1:1000

VERTICAL SCALE: 1:200

2 0 2 4 6 8
SCALE IN METRES - 1:200

No.	Amendment Description	Initials	Date
A	PRELIMINARY DESIGN	D.C	12/07/2018

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SCALES
AS SHOWN (A3)

Co-ordinate System: MGA ZONE 55 | Height Datum: A.H.D.

DESIGNED F.SHADWICK
REVIEWED D.CONLEY

Department of State Growth

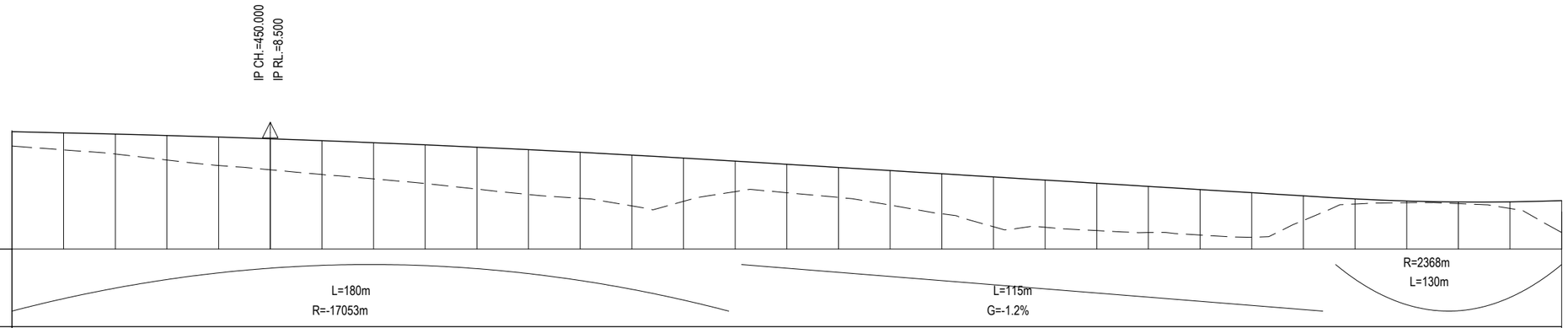
TASMAN HIGHWAY (A0113)
HOBART AIRPORT INTERCHANGE
-

LONGITUDINAL SECTION (MC80) - DRG 1 OF 3

CONTRACT No.	DRAWING	PRINTED DATE	SHEET No.
2960	HB17138-C2110	20-Feb-18, 4:15 PM	2110

REGISTRATION NUMBER
A0113.023

REVISION A



LEVEL DIFFERENCE DESIGN TO EXISTING	0.554	0.659	0.770	0.947	1.101	1.198	1.310	1.398	1.496	1.620	1.732	1.779	1.964	1.676	1.181	1.101	1.158	1.334	1.548	1.926	1.824	1.831	1.786	1.758	1.726	0.950	0.199	0.067	0.064	0.256	1.234
INTERPOLATED GROUND LEVELS	7.982	7.835	7.675	7.442	7.228	7.064	6.881	6.714	6.532	6.317	6.109	5.961	5.668	5.844	6.220	6.177	5.997	5.699	5.363	4.863	4.842	4.713	4.637	4.542	4.452	5.105	5.739	5.791	5.757	5.569	4.637
DESIGN LEVELS	8.536	8.493	8.444	8.390	8.329	8.262	8.190	8.112	8.028	7.938	7.842	7.740	7.633	7.519	7.400	7.278	7.156	7.033	6.911	6.789	6.667	6.544	6.422	6.300	6.178	6.056	5.939	5.859	5.821	5.825	5.872
CHAINAGE	400	410	420	430	440	450	460	470	480	490	500	510	520	530	540	550	560	570	580	590	600	610	620	630	640	650	660	670	680	690	700

GEOMETRY DATA
IS ROUNDED

HORIZONTAL SCALE: 1:1000

10 0 10 20 30 40
SCALE IN METRES - 1:1000

VERTICAL SCALE: 1:200

2 0 2 4 6 8
SCALE IN METRES - 1:200

No.	Amendment Description	Initials	Date
A	PRELIMINARY DESIGN	D.C	12/07/2018
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SCALES
AS SHOWN (A3)

Co-ordinate System: MGA ZONE 55 Height Datum: A.H.D.

pitt&sherry

Tasmanian Government

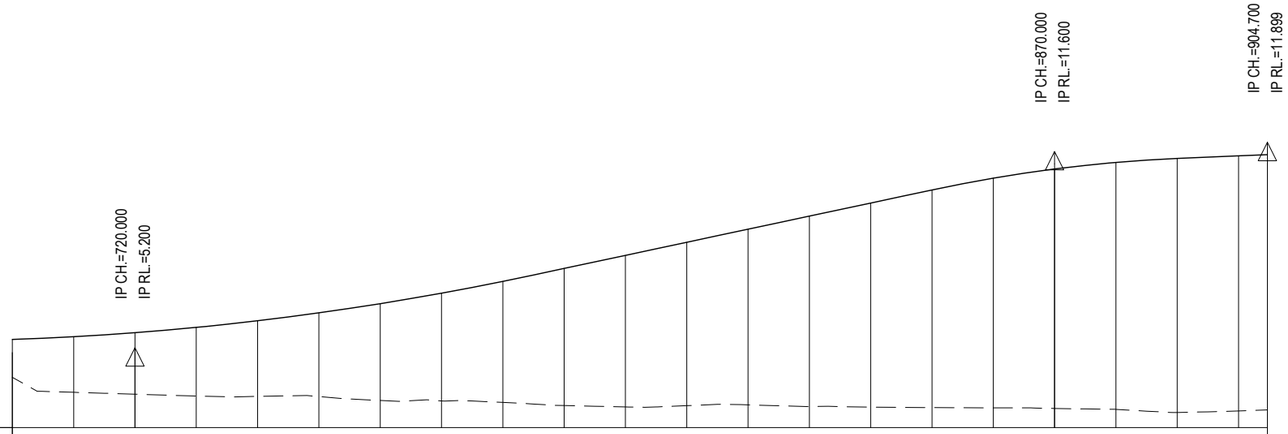
DESIGNED F.SHADWICK
REVIEWED D.CONLEY

Department of State Growth
TASMAN HIGHWAY (A0113)
HOBART AIRPORT INTERCHANGE
-
LONGITUDINAL SECTION (MC80) - DRG 2 OF 3

CONTRACT No.	DRAWING	PRINTED DATE	SHEET No.
2960	HB17138-C2111	20-Feb-18, 4:15 PM	2111

REGISTRATION NUMBER
A0113.023

REVISION A



LEVEL DIFFERENCE DESIGN TO EXISTING	1.234	1.813	2.004	2.238	2.464	2.730	3.157	3.513	3.947	4.469	4.943	5.328	5.727	6.209	6.653	7.097	7.488	7.807	8.051	8.282	8.319				
INTERPOLATED GROUND LEVELS	4.637	4.148	4.088	4.027	4.016	4.009	3.882	3.867	3.819	3.717	3.671	3.712	3.740	3.684	3.666	3.650	3.643	3.622	3.593	3.491	3.540	3.576			
DESIGN LEVELS	5.872	5.961	6.092	6.265	6.481	6.739	7.039	7.381	7.765	8.187	8.613	9.040	9.467	9.893	10.320	10.747	11.131	11.430	11.644	11.772	11.859	11.899			
CHAINAGE	700	710	720	730	740	750	760	770	780	790	800	810	820	830	840	850	860	870	880	890	900	905			

GEOMETRY DATA
IS ROUNDED

HORIZONTAL SCALE: 1:1000

10 0 10 20 30 40
SCALE IN METRES - 1:1000

VERTICAL SCALE: 1:200

2 0 2 4 6 8
SCALE IN METRES - 1:200

No.	Amendment Description	Initials	Date
A	PRELIMINARY DESIGN	D.C	12/07/2018

A3 original | This sheet may be prepared using colour and may be incomplete if copied | **Co-ordinate System:** MGA ZONE 55 | **Height Datum:** A.H.D.

SCALES
AS SHOWN (A3)

pitt&sherry | Tasmanian Government

DESIGNED F.SHADWICK
REVIEWED D.CONLEY

Department of State Growth

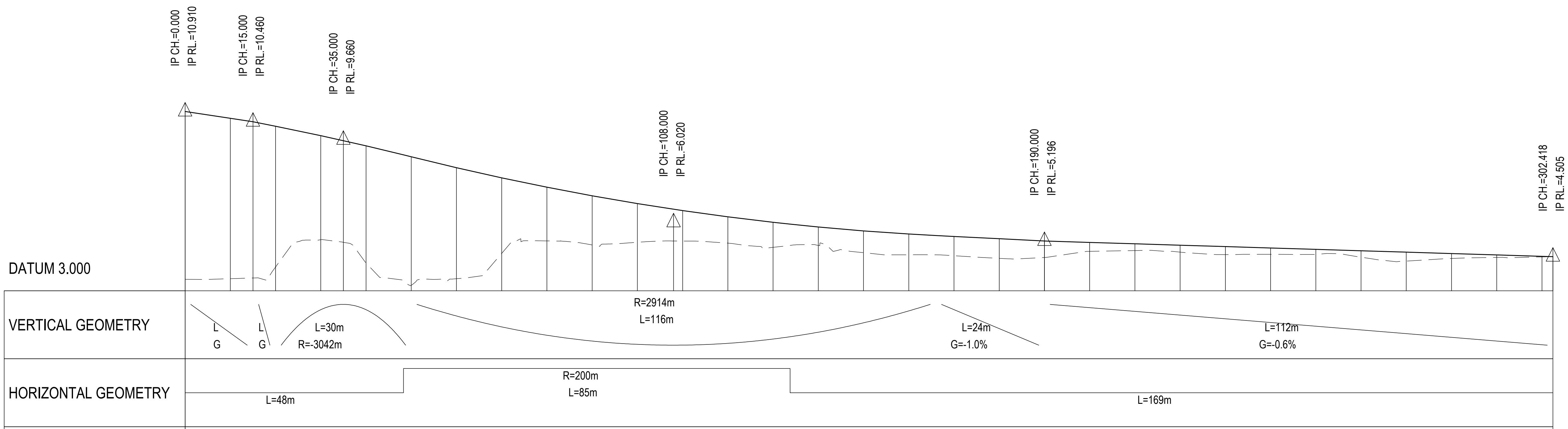
TASMAN HIGHWAY (A0113)
HOBART AIRPORT INTERCHANGE
-

LONGITUDINAL SECTION (MC80) - DRG 3 OF 3

CONTRACT No.	DRAWING	PRINTED DATE	SHEET No.
2960	HB17138-C2112	20-Feb-18, 4:15 PM	2112

REGISTRATION NUMBER
A0113.023

REVISION A



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60	4.898	3.533	8.431
70	3.335	4.649	7.983
80	2.369	5.201	7.571
90	2.169	5.023	7.192
100	1.707	5.141	6.848
110	1.345	5.194	6.538
120	1.160	5.103	6.263
130	1.106	4.915	6.021
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150	0.960	4.681	5.642
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170	0.849	4.548	5.397
180	0.866	4.430	5.296
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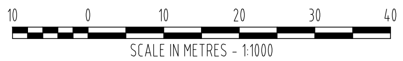

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A	PRELIMINARY DESIGN	D.C	12/07/2018

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SCALES
AS SHOWN (A3)

Co-ordinate System: MGA ZONE 55 | Height Datum: A.H.D.

DESIGNED F.SHADWICK
REVIEWED D.CONLEY

Department of State Growth

TASMAN HIGHWAY (A0113)
HOBART AIRPORT INTERCHANGE
-
LONGITUDINAL SECTION (MC10)

CONTRACT No.	DRAWING	PRINTED DATE	SHEET No.
2960	HB17138-C2114	20-Feb-18, 4:15 PM	2114

REGISTRATION NUMBER
A0113.023

REVISION A

Appendix B

Hydraulic analysis

Memo

To: **David Conley**

From: **Hamish Peacock**

Date: **7 February 2016**

RE: **HB16477 –– Holyman Avenue – Stormwater Drainage**

1. Brief

An assessment of drainage through the concept Holyman Avenue Intersection site was required for the latest proposed design option. A capacity check of the existing design and the implications of a new road design on the stormwater flows is to be investigated.

It is expected that Clarence City Council will require no increase in peak runoff rates in the post development scenario. The concept sizing has been undertaken on this basis.

2. Result and Analysis

2.1 Hydrologic and Hydraulic Analysis

The stormwater flow determination was assessed using AR&R 2016 procedures for rainfall runoff and the computer hydraulic modelling software, Drains. The extended rational hydrologic model was used for initial assessment and then ILSAX storage routing method calibrated against the extended rational method peak discharge. Multiple storm durations from 5min up to 3h were assessed for 1:100Y ARI & 1:20Y ARI events.

The following significant assumptions were made in the modelling:

- No blockage in the primary drainage system including the open drains and culverts.
- Culverts were assessed with detention capacity where applicable.
- Invert levels for drains and pipes were estimated from lidar data and old drawings.

2.2 Catchment analysis and description

The catchment delineation was based on Lidar information available for the area around Hobart airport. Time of concentration for each catchment was estimated based on a combination of Friend's equation for sheet flow and combination of stream velocity method and simplified Izzard's equation for concentrated channel flows where appropriate.

The catchment gradient is relatively flat for the non-paved areas. The paved areas are the road surface and industrial buildings. Most of the flow follows open drains along the road side and are of very low gradient typically 0.2-0.5%.

Catchment sizes for the larger areas are a rough approximation due to insufficient data further from the site such as industrial runoff stormwater networks. The catchments were sized from the proposed road design surface and existing lidar data. Survey data was not used at this stage.

Values used for depression storages were 1mm for paved areas and 5mm for grassed areas. Manning's roughness (0.025 grass swale, 0.013 concrete pipes), Horton's coefficients (0.015 paved, unpaved 0.045), and the antecedent moisture content was assumed to be 3 (12.5-25mm rainfall in previous 5 days).

2.3 Results

With the proposed road design, several additional culverts will be required.

It is possible to detain the additional flow created by the extra road surface in major storm events. This can be achieved by using the basins created by the banks of the overpass. The proposed sizes are detailed in the drawing file.

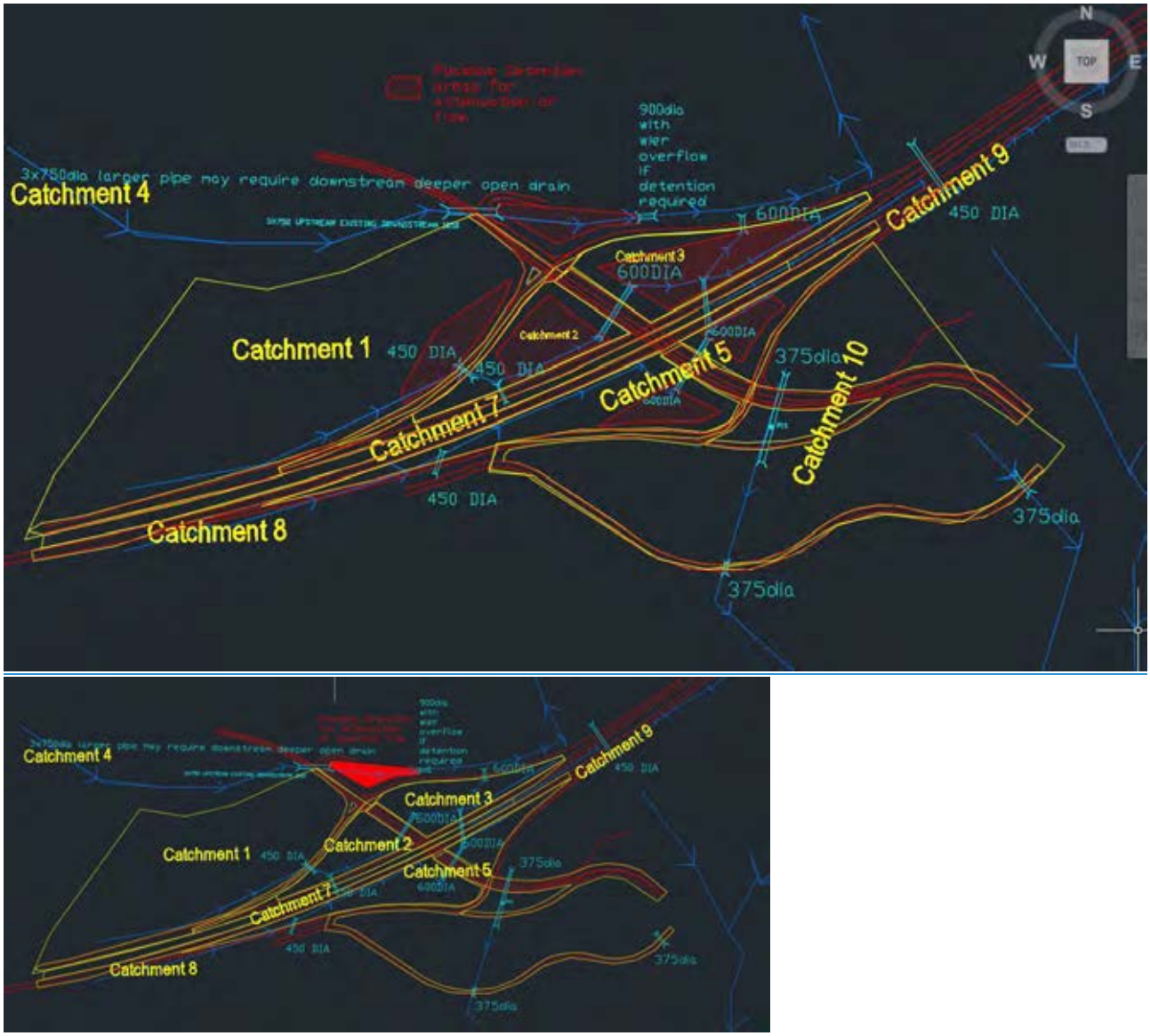


Figure 1 – Concept Drainage Design

Catchment 10 flowing to the south of the overpass will flow first under the re-aligned Cranston Parade which will require only 375 dia pipes. The flow then moves to the Llanherne Golf course and eventually under the

airport runway. This additional flow added to the catchment area is insignificant as the catchment is approximately 1000 hectares, has a large storage capacity and already has roughly 50ha of paved areas.

The majority of the road catchment area will flow through the sections enclosed by the ramps and highway and exit via a 600dia pipe into the large open drain north of catchment 3. Suggested sizes are shown in the figure 1.

The flow that comes from the industrial area on the northern side of the highway (catchment 4) could be directed through 3x750dia (existing pipes on a small access very close to the proposed pipe location are this size) pipes under the ramp where Kennedy Drive meets the new overpass. Past this point it would flow into an open drain which would meet the existing open drain on the north of the Kennedy drive/Tasman Highway Intersection. Modelling the existing system against the concept drainage creates a scenario where the flow in the major storm event may be higher than the existing flow due to the possible removal of natural detention behind the existing 1050dia pipe. Some allowance should therefore be made to detain this flow in either the main detention basin or a secondary basin on the north of the site. It should be noted that the model was based off lidar data and old drawings and as such results may alter with detailed survey data. Detailed survey may reveal the basin has little effect on the flow into the 1050dia pipe if the invert level is significantly lower than the assumed invert. And as such detaining this flow would be unnecessary.

If necessary, detention of this flow coming from the industrial area is possible between the proposed two northern most ramps and the new access off Kennedy drive. From hydraulic Modelling with significant assumptions made a culvert located appropriately along the open drain with a weir overflow back into the open drain downstream or other detention configuration could attenuate the flow to match existing peak flow conditions. Detailed survey with existing large table drain dimensions, inverts etc would be necessary to accurately size.

Additional pipes from the median strip may also be required depending on detailed road design levels and median drains.

3. Conclusion

The result of the drainage assessment is summarised below:

- As the terrain and drainage system is very flat the drainage model is quite sensitive to small changes in relative levels. Detailed design may reveal larger pipes are required or redesign of proposed detention areas.
- The increased flow to the north of the Tasman Highway created by the additional road surface area can be mitigated by appropriate sizing and location of pipes to allow some detention behind the banks where the Tasman Highway and the new overpass on/off ramps meet.
- The sizes suggested are indicative only and include some major assumptions owing to the lack of detailed survey information including table drain invert levels and pipe invert levels.
- The increase in flow on the southern side is insignificant at the location of the airport runway as the catchment is already large with significant paved areas and the additional flow from the increased road area is very small <0.2% (rough estimate of 1% increase in paved area) If necessary the newly aligned Cranston parade would have the ability to detain some of this flow if required.
- Detention of the industrial area flow is possible with an appropriately located detention basin.
- Suggested culvert sizes and approximate locations are referenced in the dwg file below.

4. Design File and Reference

Reference/Design File	Link

Catchment Delineation	Drainage Catchments Updated.dwg
Hydraulic Models (Drains)	holyman ave intersection updated concept detention of idustrial area inside bank ilsax.drn holyman ave intersection updated concept ilsax.drn
Calculation Spreadsheet	Catchment Areas.xlsx
Suggested culvert sizing and locations.	Drainage Catchments Updated.dwg

Appendix C

Flora and Fauna Assessment

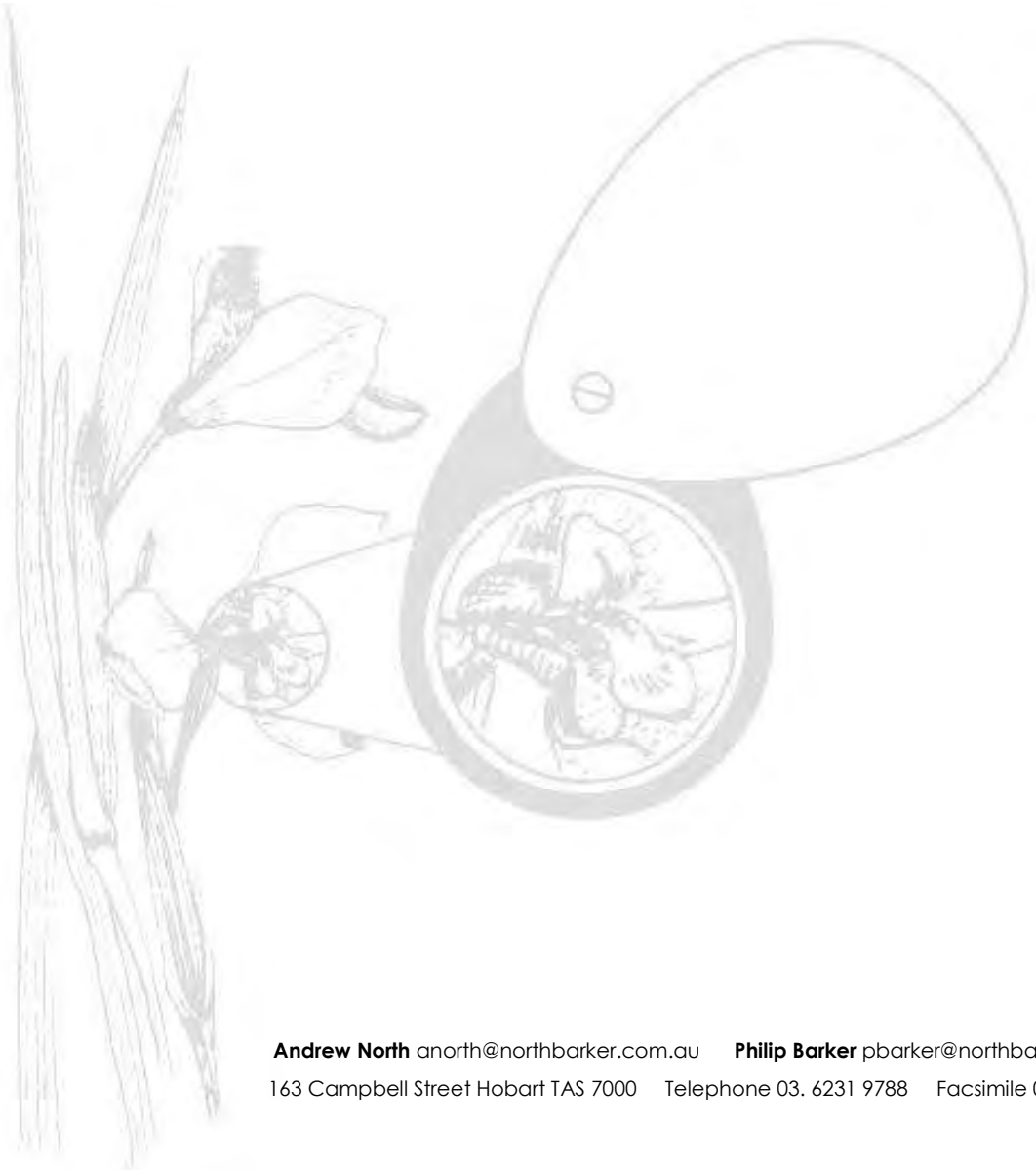
northbarker
ECOSYSTEM SERVICES

Holyman Avenue

Natural Values Assessment

For Department of State Growth

16th June 2017
DSG004



Andrew North anorth@northbarker.com.au **Philip Barker** pbarker@northbarker.com.au
163 Campbell Street Hobart TAS 7000 Telephone 03. 6231 9788 Facsimile 03. 6231 9877

Summary

The Department of State Growth (State Growth) is in the planning and development phase for road upgrades around the intersection of Holyman Avenue and the Tasman Highway. To assist with planning and determine potential impacts to natural values, North Barker Ecosystem Services (NBES) have been engaged to undertake the current flora and fauna assessment.

Vegetation

The following native vegetation types are found within the survey area:

- Saline sedgeland/rushland (ARS) – 0.25 ha
- *Eucalyptus viminalis – E. globulus* coastal forest and woodland (DVC) – 1.64 ha
- Lowland grassland complex (GCL) – 1.19 ha
- Lowland *Poa labillardierei* grassland (GPL) – 13.62 ha
- *Bursaria – Acacia* woodland and scrub (NBA) – 8.42 ha

The *Eucalyptus viminalis – E. globulus* coastal forest and woodland is a threatened community under the Tasmanian *Nature Conservation Act 2002* (NCA).

The ARS on site corresponds to the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBCA) vulnerable 'subtropical and temperate coastal saltmarsh' ecological community.

Around 13.5 ha of the GPL and GCL qualifies as the EPBCA critically endangered 'lowland grasslands of Tasmania'.

Direct impacts on these communities of native vegetation are relatively minor, with the most important loss being 0.91 ha of the lowland grasslands of Tasmania. This is the smallest possible direct impact to this community, as a result of redesign to reduce impacts. To compensate for this unavoidable loss and to avoid significant impacts upon the grassland system as a whole, we have recommended that the proponent place a remaining patch of c. 3.7 ha of this community on their land into a formal management agreement for perpetuity, with a focus on maintaining threatened flora, controlling weeds and suppressing woody plant invasion.

Threatened Flora

Seven species listed as rare under the Tasmanian *Threatened Species Protection Act 1995* (TSPA) have been recorded from the site.

Any impact on threatened plant species listed under the TSPA will require a 'permit to take' from the Policy and Conservation Assessments Branch at the Department of Primary Industries, Parks, Wildlife and the Environment. Thus, with the current design, the proposal will require a permit to take:

- *Austrostipa scabra*
- *Calocephalus citreus*
- *Haloragis heterophylla*
- *Juncus amabilis*
- *Ranunculus pumilio* var. *pumilio*
- *Senecio squarrosus*

Large numbers of TSPA rare flora will be impacted by the proposal, but in the context of species ecology and statewide populations, the impacts to *Calocephalus citreus* are considered to be the greatest and will be offset by an appropriate mechanism as specified by DPIPWE within a permit condition.

Threatened Fauna

No threatened fauna have been recorded from the impact area, despite a targeted survey for the TSPA vulnerable tussock skink (*Pseudemoia pagenstecheri*). The site is not considered to contain any critical habitat elements that are likely to impact the persistence of threatened fauna species within the local area. Species such as the eastern barred bandicoot (*Perameles gunnii*) and Latham's snipe (*Gallinago hardwickii*) may utilise the site, but the potential for their presence is unlikely to be significantly impacted by the proposal nor to trigger any legislation. Nonetheless, some mitigation is recommended for the potential loss of bandicoot shelter sites, in the form of creating piles of native plant debris within the remaining vegetation following clearance elsewhere.

Weeds

Ten declared weeds have been observed within the survey area. Nine of the declared weeds are classed as Zone B species in the Clarence Council, with the other treated as a Zone A.

In addition, adjacent properties are known to support the declared species crow garlic *Allium vineale,* which is a Zone A weed for Clarence Council and a category 2 eradication species under the Department of State Growth *State Roadside Weed Management Strategy*.

Implications and Requirements

With the proposed mitigation, the current proposal can avoid a significant impact under the EPBCA in relation to the reduction in extent of lowland grasslands of Tasmania and the potential effects of fragmentation. The proponent however intends to self-refer to the Australian Government Department of the Environment for a decision on whether the proposal will require assessment under the Act as a controlled action.

Acknowledgements

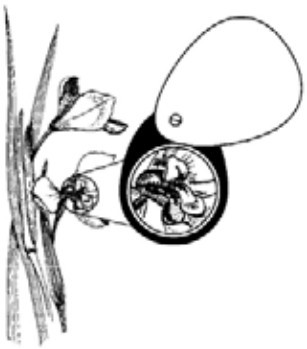
Fieldwork and photographs: Grant Daniels (gdaniels@northbarker.com.au) and Andrew North (anorth@northbarker.com.au)

Report: Grant Daniels and Andrew North

Mapping: Grant Daniels and Sue Jungalwalla

Project Management: Andrew North and Grant Daniels

Client liaison: Tori Harvey, Department of State Growth



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List of Abbreviations and Acronyms

ARS – saline sedgeland/ rushland (TASVEG unit)

DPIPWE – Department of Primary Industries, Parks, Water and the Environment, Tasmania

DVC – *Eucalyptus viminalis – E. globulus* coastal forest and woodland (TASVEG unit)

EPBCA – *Environment Protection and Biodiversity Conservation Act 1999*

GCL – Lowland grassland complex (TASVEG unit)

GPL – Lowland *Poa labillardierei* grassland (TASVEG unit)

GPS – Global positioning system

LUPAA – Tasmanian *Land Use and Planning Approvals Act 1993*

NBA – *Bursaria – Acacia* woodland and scrub (TASVEG unit)

NCA – Tasmanian *Nature Conservation Act 2002*

NBES – North Barker Ecosystem Services

NVA – Natural Values Atlas database (DPIPWE, Tasmania)

PCAB – Policy, Conservation and Assessments Branch, DPIPWE

SRWMS – State Roadside Weed Management Strategy

TSPA – Tasmanian *Threatened Species Protection Act 1995*

TSSC – Threatened Species Scientific Committee (national)

VCA – Vegetation condition assessment (TASVEG)

WMA – Tasmanian *Weed Management Act 1999*

1. Introduction and Methods

1.1 Background

The Department of State Growth (State Growth) is in the planning and development phase for road upgrades around the intersection of Holyman Avenue and the Tasman Highway. To assist with planning and determine potential impacts to natural values, North Barker Ecosystem Services (NBES) have been engaged to undertake a flora and fauna assessment.

1.2 Survey Area

The survey area (also referred to as the site) included a buffer around the confluence of four roads at the Holyman Avenue and Tasman Highway roundabout (Figure 1). It is located in the Tasmanian South East bioregion[1] and within the jurisdiction of the Clarence City Council.

In addition to the buffer around the existing roads, the survey area extended into adjacent parcels owned by State Growth and the Commonwealth to allow for design considerations and provide some context on the populations and extent of threatened values within the footprint. The total survey area was 45.25 ha (Figure 2).

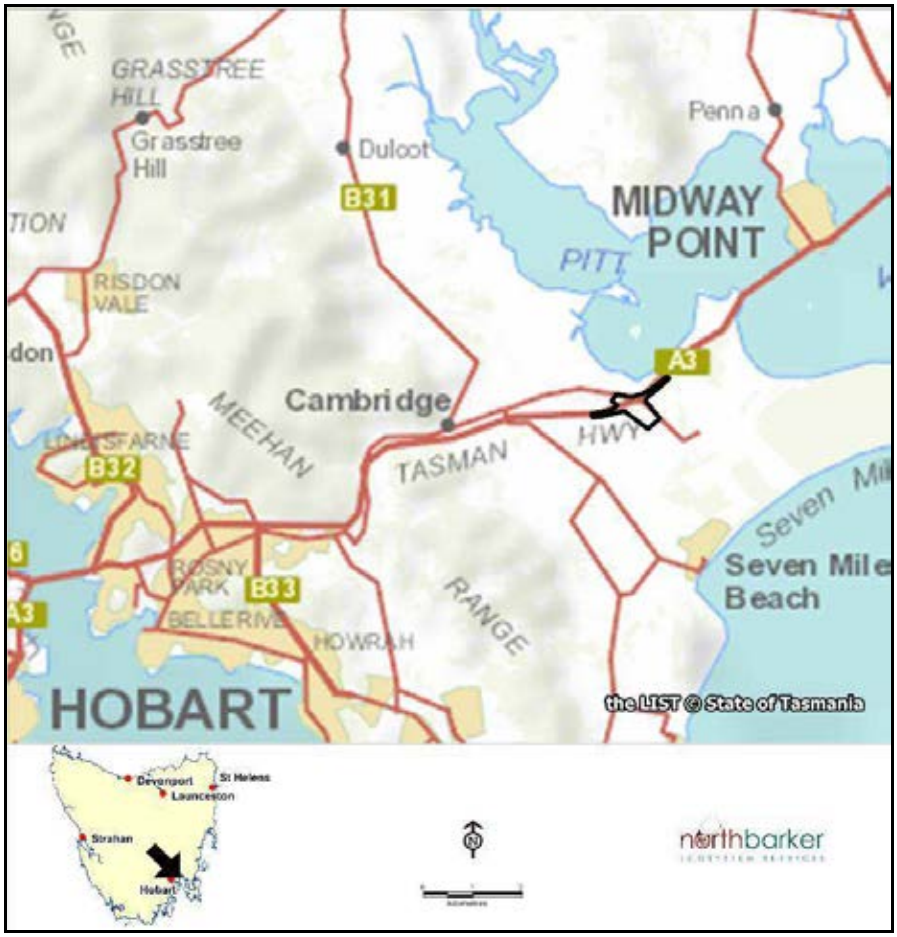

Figure 1 – Location of the survey area (black line)

[1] IBRA7 - Commonwealth of Australia 2012

Figure 2 – Design for Tasman Highway/ Holyman Avenue intersection upgrade – red line denotes survey area (45.25 ha); blue lines are development footprint (5.79 ha clearance footprint – native vegetation only)

1.3 Site Characteristics

Soil within the survey area is comprised primarily of black, alkaline, cracking clay known as black vertosol. Although similar to soils derived from basalt, black vertosols are Quaternary depositions of Jurassic dolerite colluvium. Black vertosols develop in depressions and lower landscape positions. The site also includes other soils of Quaternary origin, such as wind deposited sediments. These distinct soil types support distinct vegetation and habitat characteristics. In the case of the study area, the vertosols support the grassland communities.

The site is essentially flat and occurs almost entirely below 5 m asl, with a small area in the northwest exceeding 10 m asl (Figure 2). Average annual rainfall is around 500 mm per year[2].

The land uses of the broader area include protected native vegetation, drainage easements, motorcycle tracks, fill storage and unformed tracks.

1.4 Vegetation Field Survey

Flora surveys for the present assessment were undertaken on various dates between November and December 2016. NBES have also monitored and/or assessed parts of the site and nearby areas on several previous occasions over the course of 26 years.

Native vegetation types were mapped across the site in accordance with units defined in TASVEG 3.0[3]. Non-native types were treated collectively as modified land as defined under the TASVEG system. Vascular plant species lists were compiled within each vegetation type using the current census of Tasmanian plants[4] for nomenclature; minimum survey effort was determined by a meandering area search technique[5], with additional effort applied within potential threatened species[6] habitats and within threatened native vegetation types[7].

Some of the TASVEG units found on site were noted as potential equivalents to ecological communities listed under the EPBCA. In the case of the EPBCA listed 'lowland native grasslands of Tasmania', patches that meet the key defining traits must also meet each of the following criteria to qualify as threatened[8]:

- Extent:
    - Patch size must be ≥ 1 ha
- Perennial Native Tussock Cover:
    - ≥ 50 % of the cover of perennial tussocks must be represented by the grass genera *Poa* and/or *Themeda*; OR
    - Where the perennial tussock cover represented by these two genera is < 50 %, then the ground cover of native herbs (excluding grasses, other than from the genera *Poa* or *Themeda*) needs to be ≥ 50 % of total ground cover.

[2] Station details: Hobart Airport, Lower Derwent, Tasmania, 42.8339°S, 147.5033°E, 4m asl, commenced 1958

[3] DPIPWE 2013, Harris & Kitchener 2005

[4] de Salas and Baker 2016

[5] Goff *et al.* 1982

[6] Tasmanian *Threatened Species Protection Act 1995* (TSPA) and/or the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBCA)

[7] Tasmanian *Nature Conservation Act 2002* (NCA) or the EPBCA

[8] TSSC 2008

- Species Richness:
    - When *P. labillardierei* is the dominant native perennial tussock species the grassland has ≥ 5 native wildflower species per 0.5 ha during September to March; OR
    - When *T. triandra* or *P. rodwayi* is the dominant native perennial tussock species the grassland has ≥ 10 native wildflower species per 0.25 ha during September to March;

- Tree and Shrub Cover:
    - ≤ 5 mature (> 5 m tall) *Eucalyptus* trees per hectare; AND
    - ≤ 30 % solid crown cover of other native trees and tall shrubs greater than 2 m (e.g. *Bursaria*, *Acacia* and/or *Allocasuarina* species); AND
    - ≤ 10 % solid crown cover of regenerating *Eucalyptus* trees or other woody native species.

    Note: The ecological community may also contain tree stumps or dead trees. Where present, these do not contribute to the calculation of solid crown cover

- Weeds:
    - Perennial non-native plant species account for < 20 % of total ground cover at any time of the year.

To test where the lowland native grassland patch met the definition of the listed ecological community, the criteria were measured within twenty-two 25 m x 25 m quadrats with minimum centroid spacing of 50 m. The quadrats were located with a bias along a patch boundary that had been identified during the general flora survey as the most likely area to fail, based on the prevalence of perennial weeds and only sparse tussocks. Whether the quadrats passed or failed the condition criteria was then used as a guide to map the edge of the qualifying patch using a handheld GPS unit. A TASVEG Vegetation Condition Assessment (VCA)[9] was then undertaken within the qualifying patch to quantify the level of condition for any offset requirements.

Declared weeds[10] were mapped throughout the entire survey area, but woody environmental weeds were only mapped where they occurred in native vegetation.

1.5 Fauna Habitat Assessment and Survey

Observations of habitat suitability for fauna were made concurrently with the flora surveys. Due to the presence of suitable habitat within the known range of the tussock skink *Pseudemoia pagenstecheri*, a targeted skink survey was undertaken according to the following methods.

1.5.1 Tussock skink, Pseudemoia pagenstecheri

In late October 2016, a grid of clay-based roof tiles were placed within suitable habitat in a rectangular configuration of 12 x 4 tiles at 10 m spacing. The tiles were the surveyed for skinks after being in place for one month and then re-checked at intervals between 2-5 weeks for a total of 6 surveys over three months (*i.e.* until late February 2017). The tile survey involved two people, with one person lifting one tile at a time and the second person spotting and catching skinks that were sheltered under

[9] Michaels 2006

[10] Tasmanian *Weed Management Act 1999*

the tiles. Skinks were identified while in hand and released unharmed at the point of capture with less than 2 minutes handling time.

1.6 Limitations

Data points were recorded on a handheld GPS with an average accuracy of < 10 m.

Due to seasonal variations in detectability and identification, there may be some species that have been overlooked or were seasonally absent during our surveys. To compensate for these limitations to some degree, data from our field surveys are supplemented with data from the:

- TASVEG version 3.0 digital layer[11];
- Tasmanian Natural Values Atlas (NVA)[12];
- EPBCA Significant Matters database[13];
- RIMS database (State Growth); and
- Previous natural values assessments in the local area by NBES.

Buffers of 500 m and 5 km were used for identifying previous observations of natural values stored in these sources.

Population estimates for highly abundant species are limited to estimates within small areas extrapolated to broader areas with apparently uniform distributions, and thus have large potential error estimates but are nonetheless indicative.

1.7 Impact Calculations

To allow for edge effects, a 6 m buffer of the footprint was used for calculating impacts to natural values. To allow for impacts associated with concentrated construction activities, we also included with the footprint all internal areas within the central road diamond of the proposal (see Figure 3 or 4). Much of the proposed road works and new alignment will occur within areas already covered by roads or highly modified road edges. Impact assessment for the present proposal thus focusses on proposed clearance of native vegetation or habitat elements that may support native species.

2. Biological Values

2.1 Vegetation

Our survey verified the TASVEG 3.0 database in terms of the presence of vegetation types, but our assessments resulted in minor boundary corrections. The following native TASVEG types are found within the survey area (Figure 3):

- Saline sedgeland/rushland (ARS) – 0.25 ha
- *Eucalyptus viminalis – E. globulus* coastal forest and woodland (DVC) – 1.64 ha
- Lowland grassland complex (GCL) – 1.19 ha
- Lowland *Poa labillardierei* grassland (GPL) – 13.62 ha
- *Bursaria – Acacia* woodland and scrub (NBA) – 8.42 ha

DVC corresponds to a listed threatened community under the NCA. ARS is not listed on the NCA but corresponds to the EPBCA vulnerable ecological community 'subtropical and temperate coastal saltmarsh'. Similarly, whilst no grasslands are listed

[11] nvr_4_15-Dec-2016

[12] nvr_4_15-Dec-2016

[13] EPBC Act Protected Matters report (PMST_41AWP3, 8th December 2016 (Commonwealth of Australia, 2016)

on the NCA, GPL corresponds to the EPBCA critically endangered 'lowland grasslands of Tasmania' where it meets the condition criteria. GCL and NBA may also form part of the same community if they meet the description and key diagnostic traits as well as the condition criteria. Based on our assessment, 13.48 ha of the GPL and GCL qualify as lowland native grasslands of Tasmania under the EPBCA.

Vegetation types across the survey area are summarised in text below, including in relation to diagnostic criteria for EPBCA listings. Distribution of TASVEG native vegetation communities are presented in Figure 3, with patch floristics in Appendix A and the distribution of EPBCA qualifying vegetation in Figure 4.

2.1.1 SALINE SEDGELAND/RUSHLAND (ARS)

The survey area includes only 0.25 ha of this community (Figure 3), with this being the edge of a larger patch (> 14 ha) forming the relatively well drained landward edge of the Barilla Bay saltmarshes. The patch occurs in a saline area subject to tidal influence. It is dominated by graminoids between 30 cm and 1 m high, predominantly *Austrostipa stipoides*, with patches of *Juncus kraussii* ssp. *australiensis* and occasional *Gahnia filum* (Plate 1). Gaps between tussocks include small succulent or semi-succulent herbs such as *Lobelia anceps*, *Samolus repens*, *Sarcocornia quinqueflora* and *Sebaea* spp. Larger tussock free spaces occur in depressions dominated by *Wilsonia backhousei* and *W. rotundifolia*.

The ARS qualifies entirely for EPBCA listing under the subtropical and temperate coastal saltmarsh community as it meets the diagnostics and condition thresholds[14].

Plate 1 – Edge of ARS within the survey area

[14] TSSC 2013

2.1.2 *EUCALYPTUS VIMINALIS – E. GLOBULUS* COASTAL FOREST (DVC)

The survey area includes 1.64 ha of this community (Figure 3), with the main patch being a 1.47 ha remnant between the ARS and the Tasman Highway (Plate 2). Remnants of this community also occur on the other side of the highway (covering an extent of > 6 ha beyond the survey area), but the nominated survey area only captures minor edges of these patches, with some clearance being evident for maintenance of a powerline easement in this area (Plate 3).

The examples of this community in the survey area are dominated exclusively by trees of *Eucalyptus viminalis* up to 25 m tall. The understorey is mostly in good condition, with high cover of sagg *Lomandra longifolia* and an open tall shrub layer with *Dodonaea viscosa*, various *Acacia* spp. and *Allocasuarina littoralis*. Occasional thickets of woody weeds are present, including *Lycium ferocissimum* (African boxthorn), *Rubus fruticosus* (blackberry) and *Rosa rubiginosa* (sweet briar).

Eucalyptus viminalis – E. globulus coastal forest and woodland is listed as threatened under the Tasmanian NCA.

Plate 2 – Typical understorey in the DVC remnant on the north-west of the Tasman Highway

Plate 3 – A permanent powerline easement on the edge of DVC remnants (on the right)

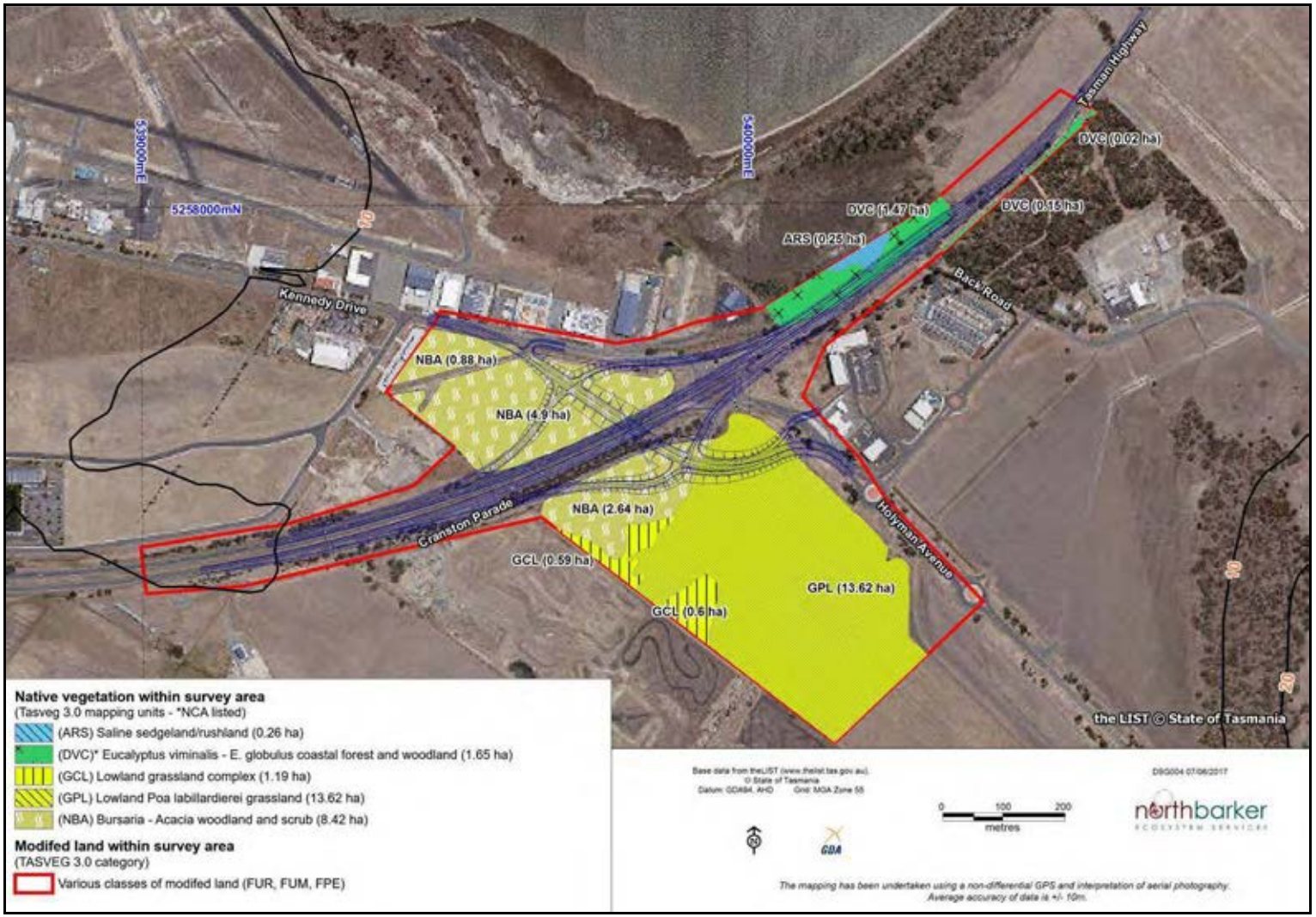

Figure 3 – Distribution of TASVEG units within survey area – red lines denote survey area; blue lines are development footprint

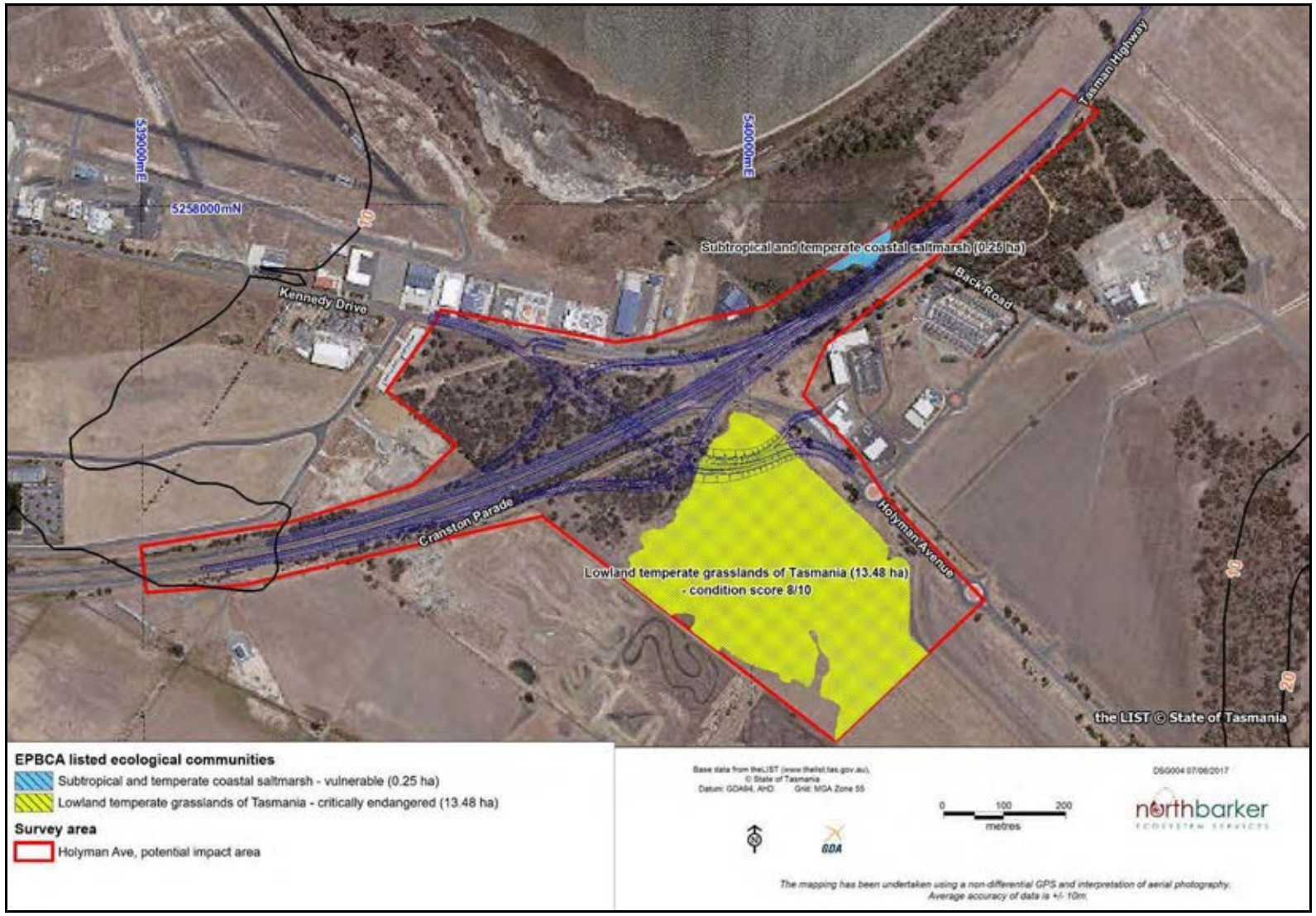

Figure 4 – Distribution of EPBCA listed communities within survey area – red lines denote survey area; blue lines are development footprint

2.1.3 LOWLAND GRASSLAND COMPLEX (GCL)

The survey area includes 1.19 ha of this community (Figure 3), located within two patches that merge into each other beyond the survey area and intergrade with the adjacent NBA and GPL on site. The GCL is differentiated from the NBA primarily by the absence of trees of *Acacia mearnsii*, and differentiated from the GPL by the lower amounts of cover of *Poa labillardierei*. Dominant grass tussocks in the GCL are from the genera *Austrodanthonia* and *Austrostipa*, although in patches *Poa labillardierei* is co-dominant. Native herb cover is very high (> 50 %), particularly in localised areas that have been burned in recent years and in which tussock grass cover is recovering (Plate 4). It is possible that as these areas regrow following disturbance, the cover of *Poa* may become greater than *Austrodanthonia* and *Austrostipa*, thus warranting a change in classification. Dominant herbs at the time of survey were *Senecio* species, with four taxa present. Other frequent natives included *Ranunculus pumilio* var. *pumilio*, *Linum marginale*, *Coronidium gunnianum*, *Epilobium billardierianum* ssp. *intermedium*, *Eryngium vesiculosum* and *Acaena* spp.

GCL is not listed as threatened under the NCA, but parts of the patches with co-dominant *Poa labillardierei* and high native herb cover (> 50 %) meet the criteria for EPBCA listing as lowland grasslands of Tasmania (Figure 4, Plate 4).

Plate 4 – A herb rich area of GCL with re-growing grass tussocks (including *Poa labillardierei*) and which qualifies as EPBCA lowland grasslands of Tasmania

2.1.4 *BURSARIA – ACACIA* WOODLAND AND SCRUB (NBA)

The survey area includes 8.42 ha of this community, located on each side of the highway to the west of the roundabout (Figure 3). The NBA is dominated by a woodland of 10-15 m tall trees of *Acacia mearnsii*. The dense grass layer is dominated by tussocks from the genera *Austrostipa* and *Austrodanthonia* (Plate 5). Tall shrubs are sparse but include *Dodonaea viscosa, Allocasuarina* spp. and some thickets of *Acacia mearnsii* in disturbed areas. Ground shrubs are locally dense, with patches of *Astroloma humifusum* and

occasional *Hibbertia hirsuta*. Native herbs are less dense than in the grass communities, but include most of the same species.

NBA is not listed as threatened under the NCA and no parts of the community on site meet the definition of EPBCA listed lowland grasslands of Tasmania, due to the high cover of woody plants and the lack of *Poa* and *Themeda* tussocks.

Plate 5 – NBA woodland within the survey area

2.1.5 LOWLAND *POA LABILLARDIEREI* GRASSLAND (GPL)

The survey area includes 13.62 ha of this community (Figure 3), located in a single patch adjacent to Holyman Avenue. The structurally simple community is dominated by a dense cover (up to 100 %) of robust tussocks of *Poa labillardierei* (Plate 6). Native herbs are diverse within the spaces between tussocks, with the most frequent including *Senecio* spp., *Ranunculus pumilio* var. *pumilio*, *Linum marginale*, *Calocephalus citreus*, *Coronidium gunnianum*, *Epilobium billardierianum* ssp. *intermedium*, *Eryngium vesiculosum* and *Acaena* spp. Small graminoids are also frequent, with *Juncus amabilis* and *J. holoschoenus* being the most abundant.

GPL is not listed as threatened under the NCA, but the majority of the patch was found to meet the criteria for EPBCA listing as lowland grasslands of Tasmania (Figure 4). Small parts of the patch suffered from edge effects, which resulted in high levels (25-60 %) of perennial weed cover (mostly *Lolium perenne*, but also *Phalaris aquatica* and *Dactylus glomerata*) at the expense of *Poa* tussocks (Plate 7); thus, percentage cover of perennial weeds was the determining factor in the extent of EPBCA qualifying grassland within the GPL patch. Within the qualifying patch, the VCA assessment quantified the condition of the grassland at 83/100 (Table 1).

2.1.6 POTENTIAL FOR OTHER EPBCA LISTED COMMUNITIES

The site has nil likelihood of supporting or impacting potential habitat for giant kelp marine forests of south east Australia, which are predicted as possibly occurring nearby by the EPBCA protected matters database, but are not known within 5 km.

Plate 6 – A high quality area of GPL (dominated by *Poa labillardierei*) that qualifies as EPBCA lowland grasslands of Tasmania

Plate 7 – Edge effects within an area of GPL that does not qualify as EPBCA lowland grasslands of Tasmania – weedy perennial grasses have invaded this area at the expense of *Poa*

Table 1 – TASVEG VCA score for GPL qualifying as EPBCA listed lowland grassland of Tasmania

	'Site condition score'							***'Landscape context score'***			
	Dominant life form	Understorey summary	Lack of weeds	Persistence potential	Organic litter	**Sub-total (/70)**	**Multiplied sub-total (by 1.07)**	Patch size	Neighbourhood	Distance to core area	***Total VCA score***
GPL Holyman Avenue	15	25	7	10	5	62	66	8	5	4	**83**
Maximum possible score	**15**	**25**	**15**	**10**	**5**	**70**	**75**	**10**	**10**	**5**	**100**

2.2 Flora of Conservation Significance

2.2.1 Threatened flora recorded by NBES

A total of 285 vascular plant taxa were recorded during our field surveys for the present assessment (Appendix B). This included seven species listed as rare under the TSPA, most of which were concentrated within the area of lowland grasslands of Tasmania (Figures 5 and 6):

- *Austrostipa scabra* (rare) – 115 plants at one location (Plate 8)
- *Calocephalus citreus* (rare) – > 15,000 ± 3,500 plants, concentrated within grasslands (Plate 9)
- *Haloragis heterophylla* (rare) – 144 m^2 of occupation (< 1 % cover) at 3 locations (Plate 10)
- *Juncus amabilis* (rare) – around 950 plants within various poorly drained areas (Plate 11)
- *Ranunculus pumilio* var. *pumilio* (rare) – 2,500 ± 250 plants within GPL (Plate 12)
- *Senecio squarrosus* – (rare) around 5000 +/- 1000 plants concentrated within grasslands (Plate 13)
- *Wilsonia rotundifolia* (rare) – around 300 m square within the ARS community (Plate 14)

No EPBCA listed flora species have been recorded within the survey area.

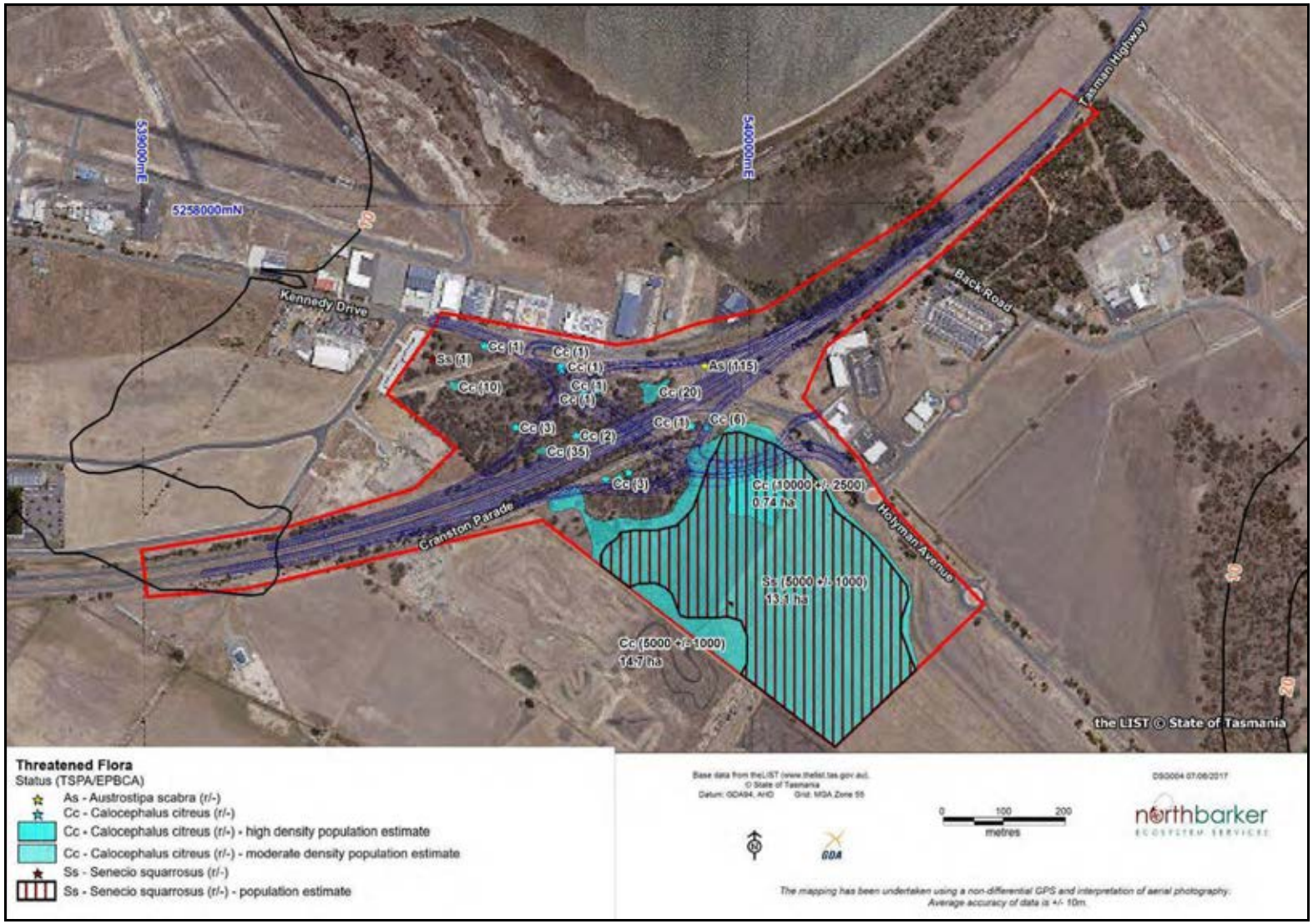

Figure 5 – Distribution of threatened flora within survey area – red lines denote survey area; blue lines are development footprint

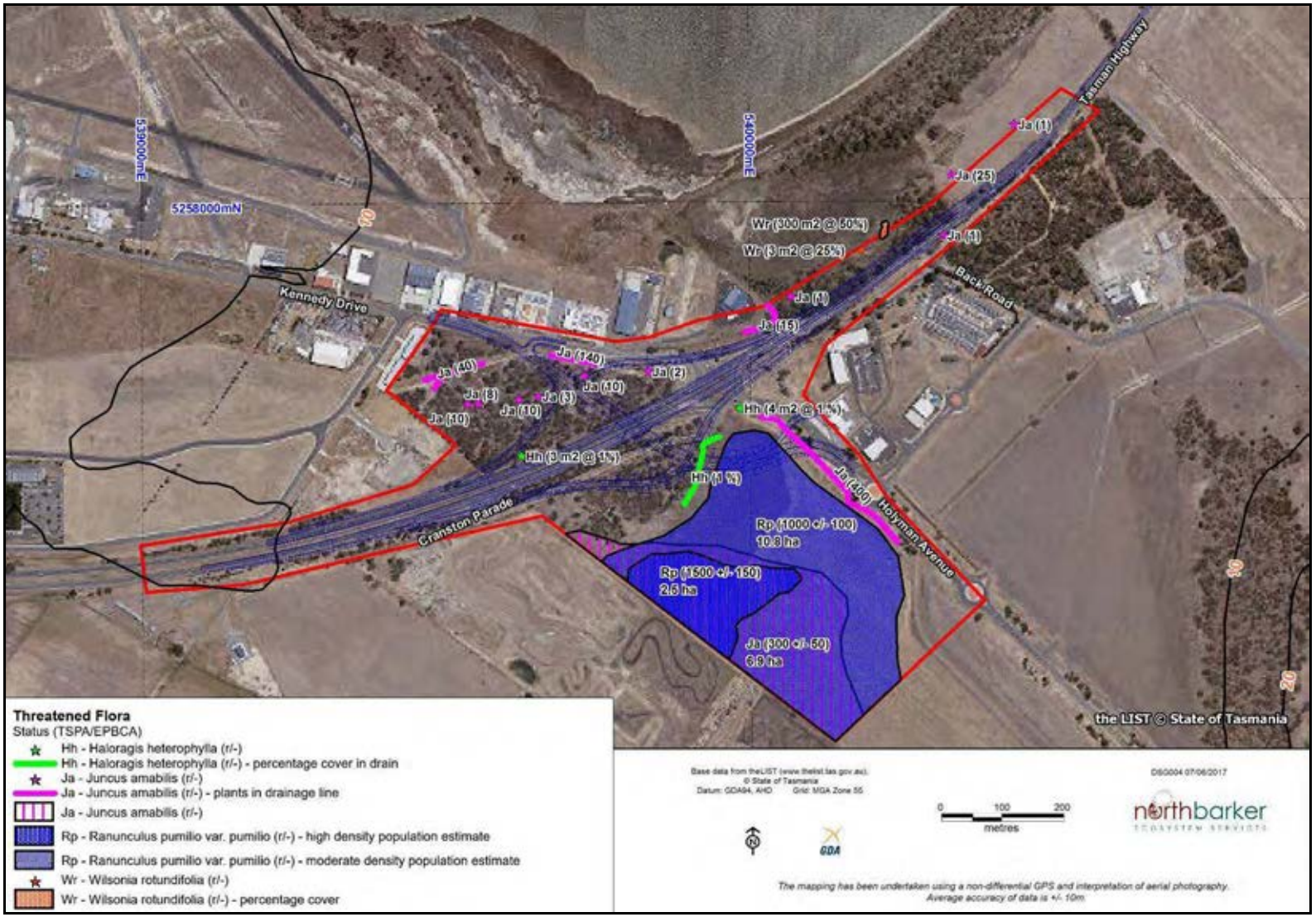

Figure 6 – Distribution of threatened flora within survey area – red lines denote survey area; blue lines are development footprint

Plate 8 – Rough spear grass *Austrostipa scabra* was recorded in modified land on the edge of the highway roundabout

Plate 9 – Lemon beautyheads *Calocephalus citreus* was very abundant within the grassy communities

Plate 10 – Small areas of variable raspwort *Haloragis heterophylla* were observed in some poorly drained depressions

Plate 11 – Gentle rush *Juncus amabilis* was locally very abundant in poorly drained areas

Plate 12 – Ferny buttercup *Ranunculus pumilio* was very abundant throughout the GPL

Plate 13 – Leafy fireweed *Senecio squarrosus* was frequent in grassy habitats

Plate 14 – Roundeaf wilsonia, *Wilsonia rotundifola* was restricted to tussock-free depressions within the ASF community

2.2.2 Previous monitoring and population assessment by NBES

Previous monitoring at the site has focussed on the core population of *C. citreus* of around 0.75 ha. This site has been monitored periodically since 1991 and numbers have been found to vary significantly depending on recent management. After a burn or soil disturbance the abundance of plants is high. Populations then reduce in numbers but increase in cover as some plants fail to establish and others grow. Estimates of this population over the 25-year period of monitoring vary between 10,000 and 60,000, with significant error margins in estimates due to counting difficulties. When plants are small they are easily overlooked, and seedlings present at one point in the season may perish within a few months, or conversely may have not been present at all a few months earlier – with the season shifting in relation to environmental conditions. When larger, individuals coalesce into a tangle of stems, making it difficult to be certain of precise individual numbers. A population peak was recorded in 2001, four years after a burn when there were many small plants present. These have since formed large clumps and although observed numbers have reduced, area of cover has increased. A similar pattern has been casually observed for *Senecio squarrosus,* but this species has not been the subject of monitoring. The annual *Ranunculus pumilio* var. *pumilio* is considered to have been absent from the site for at least 20 of the years since monitoring began, with the few years of records documenting populations of dozens to hundreds of individuals, but never as many as recorded during the present observations. What is considered to be consistent for these species are the extents of occurrence within suitable habitat and the relative densities between patches (Figures 5 and 6). Area is thus the variable that we consider to be the most appropriate measure of impact given the highly variable population numbers.

2.2.3 THREATENED FLORA KNOWN FROM OTHER SURVEYS NEARBY

Other surveys have previously identified several other species of threatened flora within 500 m and 5 km of the site (Tables 2 and 3)[15]. The likelihood of these species having been overlooked on site is discussed in detail in Appendix C and summarised below.

All of the species known within 500 m have suitable habitat within the survey area. However, all of the species are also quite distinctive and are unlikely to have been overlooked given the repeated visits to the site during this assessment and previous surveys by NBES.

Some of the threatened species known from within 5 km include EPBCA and TSPA listed orchid species from the genera *Prasophyllum* and *Caladenia*, which can be sporadic in their annual occurrence and/or flowering. However, it is considered very unlikely that these species might occur within the survey area as it has only marginally suitable habitat and observed orchid diversity is quite low, with no species from either of those genera present. Furthermore, the habitat most suitable to the *Caladenia* spp., the DVC community, has only a small extent in the survey area (Figure 3) and only 0.8 ha within the proposed footprint.

2.2.4 THREATENED FLORA PREDICTED BY HABITAT MAPPING

Several other EPBCA listed flora are predicted as possibly occurring within 5 km of the site based purely on habitat mapping within the EPBCA protected matters database (Table 4)[16]. Other than those orchid species already known to occur within 5 km, these species either have no suitable habitat within the survey area or are very unlikely to have been overlooked (Appendix C).

Table 2 – Threatened flora observations (from the Tasmanian NVA) attributed to within 500 m of the site (SS = TSPA; NS = EPBCA)

Species	Common Name	SS	NS	Bio	Observation Count	Last Recorded
Aphelia gracilis	slender fanwort	r		n	1	01-Jan-1993
Calocephalus citreus	lemon beautyheads	r		n	86	09-Apr-2015
Haloragis heterophylla	variable raspwort	r		n	13	09-Apr-2015
Juncus amabilis	gentle rush	r		n	37	31-Mar-2015
Juncus vaginatus	clustered rush	r		n	2	01-Jan-2008
Lachnagrostis punicea subsp. punicea	bristle blowngrass	r		n	1	01-Feb-2007
Lachnagrostis robusta	tall blowngrass	r		n	2	20-Aug-2007
Limonium australe var. australe	yellow sea-lavender	r		n	4	20-Aug-2007
Lobelia pratioides	poison lobelia	v		n	8	18-May-2015
Myriophyllum integrifolium	tiny watermilfoil	v		n	2	05-Dec-1986
Prasophyllum milfordense	milford leek-orchid	e	CR	e	1	30-Nov-1995
Ranunculus pumilio var. pumilio	ferny buttercup	r		n	2	16-Dec-2013
Rytidosperma indutum	tall wallabygrass	r		n	2	14-Apr-2005
Senecio squarrosus	leafy fireweed	r		n	48	25-Feb-2015
Stylidium despectum	small triggerplant	r		n	1	05-Dec-1986
Vittadinia gracilis	woolly new-holland-daisy	r		n	7	20-Oct-2014
Vittadinia muelleri	narrowleaf new-holland-daisy	r		n	15	06-Jan-2011
Vittadinia muelleri (broad sense)	narrow leaf new holland daisy	p		n	7	16-Jun-2005
Wilsonia rotundifolia	roundleaf wilsonia	r		n	6	20-Aug-2007
Xerochrysum palustre	swamp everlasting	v	VU	n	9	08-Jan-2014

[15] nvr_4_15-Dec-2016 - DPIPWE 2016

[16] EPBCA Protected Matters search report (PMST 41AWP3) – 8th December 2016

Table 3 – Threatened flora observations (from the Tasmanian NVA) attributed to within 5 km of the site (SS = TSPA; NS = EPBCA)

Species	Common Name	SS	NS	Bio	Observation Count	Last Recorded
Aphelia gracilis	slender fanwort	r		n	1	01-Jan-1993
Austrostipa scabra	rough speargrass	r		n	17	14-Oct-2011
Bolboschoenus caldwellii	sea clubsedge	r		n	12	09-Oct-2012
Caladenia caudata	tailed spider-orchid	v	VU	e	14	11-Oct-2013
Caladenia saggicola	sagg spider-orchid	e	CR	e	34	10-Oct-2013
Calocephalus citreus	lemon beautyheads	r		n	109	02-Dec-2015
Cotula vulgaris var. australasica	slender buttons	r		n	3	21-Apr-2004
Eryngium ovinum	blue devil	v		n	2	22-Dec-2010
Eucalyptus risdonii	risdon peppermint	r		e	18	04-Oct-2006
Eutaxia microphylla	spiny bushpea	r		n	2	23-Sep-1984
Haloragis heterophylla	variable raspwort	r		n	16	09-Apr-2015
Juncus amabilis	gentle rush	r		n	100	15-Apr-2016
Juncus vaginatus	clustered rush	r		n	2	01-Jan-2008
Lachnagrostis punicea subsp. punicea	bristle blowngrass	r		n	1	01-Feb-2007
Lachnagrostis robusta	tall blowngrass	r		n	3	20-Aug-2007
Limonium australe var. australe	yellow sea-lavender	r		n	9	20-Aug-2007
Lobelia pratioides	poison lobelia	v		n	20	28-Oct-2015
Myriophyllum integrifolium	tiny watermilfoil	v		n	2	05-Dec-1986
Prasophyllum milfordense	milford leek-orchid	e	CR	e	11	16-Dec-2013
Pterostylis wapstrarum	fleshy greenhood	e	CR	e	1	05-Oct-1890
Ranunculus pumilio var. pumilio	ferny buttercup	r		n	2	16-Dec-2013
Rytidosperma indutum	tall wallabygrass	r		n	10	22-Dec-2010
Scleranthus diander	tufted knawel	v		n	1	01-Jan-1995
Scleranthus fasciculatus	spreading knawel	v		n	13	17-Jun-2010
Senecio squarrosus	leafy fireweed	r		n	51	25-Feb-2015
Stuckenia pectinata	fennel pondweed	r		n	1	06-Apr-1970
Stylidium despectum	small triggerplant	r		n	1	05-Dec-1986
Triglochin minutissima	tiny arrowgrass	r		n	4	06-Nov-2010
Velleia paradoxa	spur velleia	v		n	1	01-Nov-1938
Vittadinia cuneata var. cuneata	fuzzy new-holland-daisy	r		n	1	01-Nov-1984
Vittadinia gracilis	woolly new-holland-daisy	r		n	9	20-Oct-2014
Vittadinia muelleri	narrowleaf new-holland-daisy	r		n	58	23-Jan-2015
Vittadinia muelleri (broad sense)	narrow leaf new holland daisy	p		n	17	09-Dec-2007
Wilsonia humilis	silky wilsonia	r		n	4	18-Oct-2011
Wilsonia rotundifolia	roundleaf wilsonia	r		n	35	14-Oct-2015
Xerochrysum bicolor	eastcoast everlasting	r		n	1	01-Feb-1929
Xerochrysum palustre	swamp everlasting	v	VU	n	10	08-Jan-2014

Table 4 – EPBCA listed flora predicted as potentially occurring within 5 km of the site

Plants		
Caladenia caudata Tailed Spider-orchid [17067]	Vulnerable	Species or species habitat known to occur within area
Caladenia saggicola Sagg Spider-orchid [64859]	Critically Endangered	Species or species habitat known to occur within area
Dianella amoena Matted Flax-lily [64886]	Endangered	Species or species habitat likely to occur within area
Diuris lanceolata Snake Orchid [10231]	Endangered	Species or species habitat likely to occur within area
Glycine latrobeana Clover Glycine, Purple Clover [13910]	Vulnerable	Species or species habitat likely to occur within area
Lepidium hyssopifolium Basalt Pepper-cress, Peppercress, Rubble Pepper-cress, Pepperweed [16542]	Endangered	Species or species habitat likely to occur within area
Leucochrysum albicans var. tricolor Hoary Sunray, Grassland Paper-daisy [56204]	Endangered	Species or species habitat may occur within area
Prasophyllum apoxychilum Tapered Leek-orchid [64947]	Endangered	Species or species habitat may occur within area
Prasophyllum milfordense Milford Leek-orchid [64950]	Critically Endangered	Species or species habitat known to occur within area
Pterostylis ziegeleri Grassland Greenhood, Cape Portland Greenhood [64971]	Vulnerable	Species or species habitat may occur within area

2.3 Weeds

Our surveys recorded 120 introduced plant species within the survey area, including 10 declared weeds and several environmental weeds, most of which were concentrated within (but not restricted to) modified land (Table 5, Figures 7 and 8, Plate 15).

In addition, adjacent properties are known to support the declared species crow garlic *Allium vineale,* which is a Zone A weed for Clarence Council and a category 2 eradication species under the *State Roadside Weed Management Strategy*[17].

[17] NBES 2017

Table 5 – Declared weeds within survey area

Species	Comment	Zone within Clarence Council[18]	Category under SRWMS[19]
Carduus pycnocephalus slender thistle	Occasional clusters in modified land and DVC	Zone B containment	Category 4 containment
Chrysanthemoides monilifera ssp. *monilifera* boneseed	Occasional sub-adults within modified land around highway	Zone B containment	Category 3 containment
Cytisus scoparius English broom	Occasional sub-adults within modified land around highway	Zone B containment	Category 3 containment
Erica lusitanica Spanish heath	Localised patches in DVC	Zone B containment	Category 3 containment
Foeniculum vulgare fennel	Occasional occurrences in modified land	Zone B containment	Category 3 containment
Genista monspessulana canary broom	Occasional occurrences in modified land	Zone B containment	Category 3 containment
Lepidium draba hoary cress/white weed	Restricted to one patch within modified land near the roundabout	Zone A eradication	Category 4 containment
Lycium ferocissimum African boxthorn	Occasional thickets within modified land and DVC	Zone B containment	Category 3 containment
Marrubium vulgare horehound	Occasional occurrences in modified land	Zone B containment	Category 4 containment
Rubus fruticosus blackberry	Frequent throughout the road reserve	Zone B containment	Category 3 containment

Plate 15 – Declared weeds were most prevalent in an area of modified land adjacent to the highway roundabout

[18] Tasmanian *Weed Management Act 1999*

[19] State Roadside Weed Management Strategy

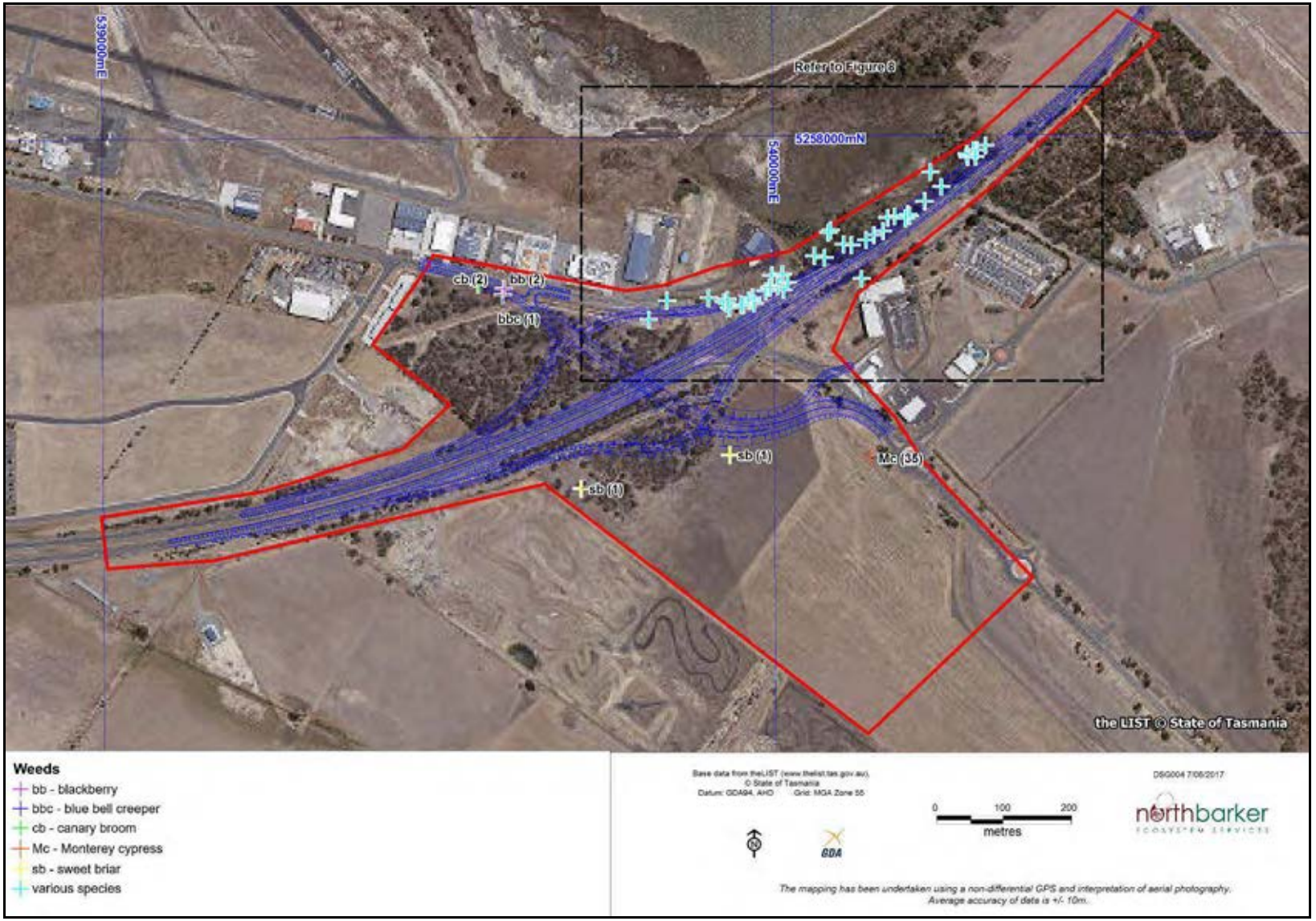

Figure 7 - Observations of declared weeds throughout survey area and environmental weeds within native vegetation

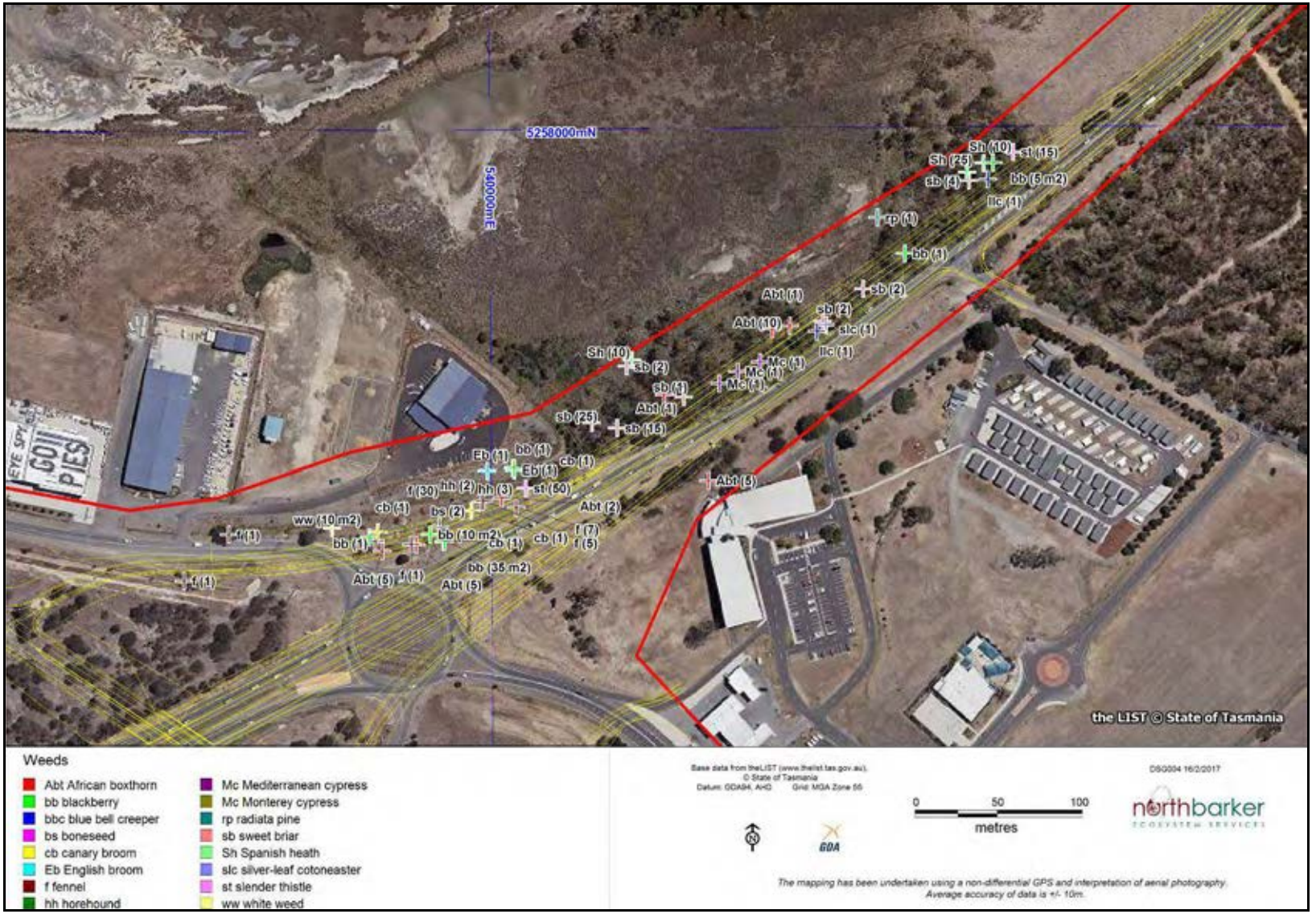

Figure 8 - Observations of declared weeds in the most infested area

2.4 Fauna of Conservation Significance

The existing road reserve supports only a small amount of native woodland and remnant plants, which constitute relatively poor habitat for threatened native fauna and do not include any critical habitat elements that are likely to impact the persistence of species within the local area. The areas of NBA and grasslands beyond the road reserve are higher quality habitat, but meet the habitat preferences of a limited number of species, and are limited in habitat value due to the lack of connectivity to extensive woodland, as well as the history of human modification in the area.

The threatened fauna species most likely to use the site for both breeding and foraging is the eastern barred bandicoot (*Perameles gunnii*). This species is listed under the EPBCA but not listed as threatened in Tasmania due to a stable and widespread population. It is resilient to various types of human disturbance and can reach higher than natural densities in periurban environments. A development of this scale and nature thus has nil likelihood of resulting in significant impacts upon the eastern barred bandicoot. Only 5.79 ha of potential habitat for this species will be modified by the proposal. Other than the footprint of the road itself, the modifications are unlikely to deter the species from utilising the site, as it is commonly found in non-native vegetation.

The site constitutes only potential foraging habitat for other threatened fauna, with the widespread migrant Latham's snipe being the most likely to occur. The lowland grassland habitat is highly suitable for the tussock skink (*Pseudemoia pagenstecheri*), but no individuals were recorded during our targeted survey.

Table 6 discusses all threatened fauna known from within 5 km of the site (or predicted to occur based on habitat mapping) and provides an assessment of the likelihood of their occurrence on site[20]. The site does not contain any habitat for marine species or coastal shorebirds – no habitat for these species will be indirectly impacted by the proposal – these species are nonetheless addressed in Appendix D.

Table 6: Threatened fauna species previously recorded[21], or which may potentially occur[22], within 5 km of the site

Species	Status TSPA/EPBCA	Potential to occur	Comments, habitat niche[23], previous records, *etc*.
Known within 500 m			
Calidris ferruginea curlew sandpiper	-/ CRITICALLY ENDANGERED	Nil	No suitable habitat for these shorebirds. No potential impacts associated with the proposal.
Numenius madagascariensis eastern curlew	Endangered/ CRITICALLY ENDANGERED		

[20] Obligate marine species such as cetaceans, fish, seals, seabirds, seastars and shells have been excluded from this analysis and will not conceivably be impacted by the proposal due to lack of suitable habitat and nil likelihood of indirect or facilitated impacts – for the same reasons, shorebirds have been excluded from the section pertaining to predictions from habitat mapping only

[21] nvr_4_15-Dec-2016 - DPIPWE 2016

[22] nvr_4_15-Dec-2016 - DPIPWE 2016; EPBCA Protected Matters search report (PMST 41AWP3) – 8th December 2016

[23] Bryant & Jackson 1999

Species	Status TSPA/EPBCA	Potential to occur	Comments, habitat niche[23], previous records, *etc*.
Gallinago hardwickii Latham's snipe	-/ Migratory	Moderate	A non-breeding migrant to Tasmania that uses wetlands, farm dams and inundated pasture. Habitat within the area of lowland grasslands of Tasmania is suitable for this species and is likely to be used for occasional foraging during wet periods.
Perameles gunnii eastern barred bandicoot	-/ VULNERABLE	**High**	Native vegetation within the potential impact area is suitable for this species to breed and forage and previous records are known from within the survey area. However, the species is highly unlikely to go locally extinct due to a proposal of this scale and nature, and is capable of persisting in modified periurban environments with high rates of mortality.
Pseudemoia pagenstecheri tussock skink	Vulnerable/ -	Low – moderate	Tussock grassland habitat is suitable for this species, but no individuals were recorded during our targeted survey.
Sarcophilus harrisii Tasmanian devil	Endangered/ ENDANGERED	Foraging: low Denning: none	No suitable denning habitat occurs within the study area and the only record known within 500 m is from roadkill, which was probably a dispersing individual. Very unlikely for individuals to be reliant on the habitat on site as a permanent part of a territory.
Tyto novaehollandiae masked owl	Endangered/ VULNERABLE	Nesting: nil Foraging: moderate	Requires a mosaic of forest and open areas for foraging, and large old-growth hollow-bearing trees for nesting. No viable nesting hollows observed on site and the survey area is likely to represent part of a foraging range only.
Known within 5 km			
Accipiter novaehollandiae grey goshawk	Endangered/ -	Nil	Inhabits large tracts of wet forest and requires specific forest structure for nesting and hunting. Only one observation known within 5 km and no suitable nest habitat on the land. No potential impacts associated with the proposal.
Aquila audax subsp. *fleayi* wedge-tailed eagle	Endangered/ ENDANGERED	Nesting: nil Foraging: very low	Requires large sheltered trees for nesting and is highly sensitive to disturbance during the breeding season. No suitable nest habitat present on the land nor within 500 m or 1 km line of sight. Nearest known eagle nests are around 4 km away at Mt Rumney. No potential impacts associated with the proposal.
Calidris tenuirostris great knot	-/ CRITICALLY ENDANGERED	Nil	No suitable habitat for shorebirds on site. No potential impacts associated with the proposal.
Dasybela achroa saltmarsh looper moth	Vulnerable/ -	Very low	Insufficient extent of saltmarsh species to support meaningful numbers of this species. ARS habitat may be used as the margin of more suitable habitat. No potential impacts associated with the proposal.

Species	Status TSPA/EPBCA	Potential to occur	Comments, habitat niche[23], previous records, *etc*.
Dasyurus viverrinus eastern quoll	-/ ENDANGERED	Low	Only one known observation within 5 km and the species is not typically present within fragmented habitats. No potential impacts associated with the proposal.
Haliaeetus leucogaster white-bellied sea-eagle	Vulnerable/ -	Very low	Occurs in coastal habitats and large inland waterways. Species may occasionally forage in the area but no breeding habitat is present. Nearest known eagle nests possibly used by this species are around 4 km away. No potential impacts associated with the proposal.
Lathamus discolor swift parrot	Endangered/ ENDANGERED	Very low	Requires tree hollows for nesting and feeds on nectar of blue gum (*E. globulus*) and black gum (*E. ovata*) flowers. There are numerous records of swift parrots within 5 km of the site but there is no suitable foraging or breeding habitat present within the survey area. No potential impacts associated with the proposal.
Litoria raniformis green and gold frog	Vulnerable/ VULNERABLE	Nil	Permanent breeding habitat consists of large ponds and slow rivers with dense aquatic vegetation. The only record from within 5 km is from 1910 and the species has since had a large decline in frequency in the south and has contracted in range towards the north. No suitable habitat present on site. No potential impacts associated with the proposal.
Sterna nereis ssp. *nereis* fairy tern	Vulnerable/ VULNERABLE	Nil	No suitable habitat for shorebirds on site. No potential impacts associated with the proposal.
Theclinesthes serpentata chequered blue	Rare/ -	Very low	Insufficient extent of saltmarsh species to support meaningful numbers of this species. ARS habitat may be used as the margin of more suitable habitat. No potential impacts associated with the proposal.
Thinornis rubricollis hooded plover	-/ VULNERABLE	Nil	No suitable habitat for shorebirds on site. No potential impacts associated with the proposal.
Potential to occur based on habitat mapping only [24]			
BIRDS			
Apus pacificus fork-tailed swift	-/ Migratory	Nil	An aerial insectivore occasionally recorded in northern Tasmania. No potential impacts associated with the proposal.

[24] nvr_4_15-Dec-2016 - DPIPWE 2016; EPBCA Protected Matters search report (PMST 41AWP3) – 8th December 2016

Species	Status TSPA/EPBCA	Potential to occur	Comments, habitat niche[23], previous records, *etc*.
Ardea alba great egret	-/ Migratory	Nil	A non-breeding wetland species with no habitat on site. No potential impacts associated with the proposal.
Ardea ibis cattle egret	-/ Migratory	Low	A cosmopolitan species that self-colonised Tasmania in the 1960's and migrates annually for the non-breeding season. Often recorded foraging in pasture but mostly in the north. No potential impacts associated with the proposal.
Botaurus poiciloptilus Australasian bittern	-/ ENDANGERED	Nil	Typically inhabits shallow, well-vegetated, permanent wetlands. Suitable habitat not present on site. No potential impacts associated with the proposal.
Ceyx azureus diemenensis azure kingfisher	Endangered/ ENDANGERED	Nil	A species of riparian habitats along major rivers, mostly in north-western Tasmania. No suitable habitat present on site. No potential impacts associated with the proposal.
Hirundapus caudacutus white-throated needletail	-/ Migratory	Very low	Uncommonly recorded in Tasmania. An aerial species most likely unaffected by terrestrial habitat alteration outside of its Northern Hemisphere breeding range. No potential impacts associated with the proposal.
Myiagra cyanoleuca satin flycatcher	-/ Migratory	Nil	An interstate migrant of which some of the population spends the summer breeding months in Tasmania. Widely distributed across forested environments but is sensitive to fragmentation and canopy thinning. No suitable habitat present. No potential impacts associated with the proposal.
Pardalotus quadragintus forty-spotted pardalote	Endangered/ ENDANGERED	Very low	Restricted to forest and woodland along the east coast containing mature white gum (*E. viminalis*). Suitable habitat occurs within the DVC community but the species is not known within 5 km. In addition, the site is dominated by large, aggressive edge species such as the noisy miner (*Manorina melanocephala*), which are highly incompatible with small woodland birds such as the forty-spotted pardalote. No potential impacts associated with the proposal.
MAMMALS			
Dasyurus maculatus subsp. *maculatus* spotted-tailed quoll	Rare/ VULNERABLE	Nil	This naturally rare forest-dweller inhabits wet forest and forages and hunts on farmland and pasture. It shelters in burrows, logs, rocks or thick vegetation. No suitable habitat within the survey area or surrounds. No potential impacts associated with the proposal.
FISH			

Species	Status TSPA/EPBCA	Potential to occur	Comments, habitat niche[23], previous records, *etc*.
Prototroctes maraena Australian grayling	Vulnerable/ VULNERABLE	None	Occurs in freshwater, particularly in low and mid catchment watercourse with no barriers to the sea, where it spends part of its lifecycle. No suitable habitat present in the survey area. No potential impacts associated with the proposal.
INVERTEBRATES			
Amelora acontistica chevron looper moth	Vulnerable/ -	Nil	No records within 5 km despite extensive suitable saltmarsh habitat in local estuaries. No potential impacts associated with the proposal.
Antipodia chaostola chaostola skipper	Endangered/ ENDANGERED	Nil	Occurs in dry sclerophyll forest at low altitudes in eastern Tasmania. Among other species, larvae are known to live and feed in looped leaves of the sedge *Gahnia radula*. No suitable habitat within the survey area. No potential impacts associated with the proposal.
Chrysolarentia decisaria Tunbridge looper moth	Endangered/ -	Nil	No records within 5 km despite extensive suitable saltmarsh habitat in local estuaries. No potential impacts associated with the proposal.
Discocharopa vigens ammonite snail	Endangered/ CRITICALLY ENDANGERED	Nil	The ammonite snail is endemic to Tasmania and occurs only in the Hobart area. The species occurs in a variety of forest habitats, but has only been found under dolerite rocks. No suitable habitat is found on site. No potential impacts associated with the proposal.

3. Potential Impacts of Project

Potential impacts to threatened natural values are summarised in Table 7.

- 5.79 ha of native vegetation will be directly impacted by the road footprint (including the 6 m buffer and internal sections of the road diamond).
- The greatest single impact from the proposal will be the direct loss of 0.91 ha of the EPBCA listed lowland grasslands of Tasmania. An additional 0.36 ha of this community may be impacted indirectly by new edge effects and reduced patch size (Figure 9). Mitigation measures are proposed to prevent these impacts resulting in a significant impact under the EPCBA.
- In terms of other threatened communities, the proposal will result in the loss of 0.03 ha of EPBCA subtropical and temperate coastal saltmarsh (ARS) and 0.80 ha of the NCA listed *Eucalyptus viminalis – E. globulus* coastal forest and woodland (DVC).
- Habitat for hundreds of individuals of various species of TSPA rare flora will be impacted; in the context of species ecology and overall populations, the impact to 1.1 ha of *Calocephalus citreus* habitat is the greatest.
- The loss of native vegetation will result in the loss of some potential threatened fauna habitat. Impacts to threatened fauna are however expected to be negligible, as the potential species that may use the site are widespread and resilient to disturbance. No significant impacts are likely to EPBCA listed fauna.

Table 7 – Summary of potential impacts to natural values from proposed road upgrade

Natural value	Potential impacts	Context and comments on mitigation[25]
Extent of EPBCA ecological communities (ha)		
Lowland grasslands of Tasmania (critically endangered)[26]	0.91 ha out of 13.48 ha in the survey area will be lost to direct impacts. A further 0.36 ha is at risk of indirect impacts resulting from fragmentation from the main patch and the impacts of small patch size, including increased edge effects (Figure 9).	Total extent in Tasmanian reserve estate: < 4,100 Total extent in Tasmania: < 21,000 Total extent in reserves in Clarence Council: 0 Total extent in Clarence Council: < 110 The patch within the survey area is part of a broader system of *Poa* dominated grasslands that cover at least an additional 75 ha within 2.5 km of the footprint (Figure 10). Beyond the current survey area, an additional 16.5 ha of this grassland system located on Hobart Airport was found to qualify for EPBCA listing when last assessed (Figure 11), with further areas currently under assessment and considered likely to qualify based on preliminary data. All of the EPBCA qualifying grassland in this system is under informal management plans operated by the Hobart Airport or the Department of State Growth. The adjoining private property immediately to the west of Hobart Airport and 500 m south of the study area supports an additional 20 ha of *Poa* grassland that has only recently been documented and has not yet been incorporated into TASVEG mapping. An assessment of that site undertaken in 2017 confirmed 15 ha to qualify as EPBCA lowland grassland. The direct loss of 0.91 ha of EPBCA lowland grassland is thus relatively small at a local and State level. Nonetheless, based on the EPBCA guidelines for significant impacts to critically endangered communities, the proposal is at risk of a significant impact in relation to criteria covering the overall reduction in extent of the patch and the potential

[25] Includes statements from DPIPWE Threatened Species Link summaries and note sheets

[26] Total extent estimates are maximums due to the requirement of condition thresholds for qualification

Natural value	Potential impacts	Context and comments on mitigation[25]
		effects of fragmentation. Options are available to mitigate impacts to a degree that residual impacts do not constitute significant impacts under the EPBCA. To mitigate and compensate for the impacts of fragmentation and increased edge effects, we recommend that the isolated patch of 0.36 ha is managed to maintain condition at the current level or better. This will primarily involve the control of weed invasion and prevention of the loss of herb diversity. In parallel, the remaining 3.7 ha of EPBCA grassland within land owned by State Growth (Figure 12) should be placed under a formal management agreement. Management priorities within this area will need to concentrate on the control of weeds and the invasion of woody shrubs and trees from the adjacent woodland. Management should include regular ecological monitoring and reporting to ensure the management is effective. The formal management agreement should be guaranteed for perpetuity under the appropriate mechanism. With this in place, the residual impacts from the direct loss of 0.91 ha are not likely to constitute a significant impact to the grassland system as a whole. It should also be noted that the current design from the proponent has been modified following advice from NBES that an earlier design would have had a larger detrimental impact upon the lowland grassland community, particularly in the form of fragmentation, and was likely to result in a significant impact under the EPBCA (Figure 13).
Subtropical and temperate coastal saltmarsh (vulnerable)	0.03 out of 2.5 ha will be lost in the survey area. The total patch size beyond the survey area is > 14 ha.	Total extent in Australia: 81,000 – 162,000[27] Total extent in Tasmanian reserve estate: 4,950 Total extent in Tasmania: 8,050

[27] Estimated in TSSC 2013

Natural value	Potential impacts	Context and comments on mitigation[25]
		Total extent in reserves in Clarence Council: 110 Total extent in Clarence Council: 505 The total patch size beyond the survey area is > 14 ha (Figure 10). This is a negligible loss of this community at all levels. Communities listed as vulnerable do not get assessed against the EPBCA criteria for significant impacts to Matters of National Environmental Significance.
TSPA listed flora		
Austrostipa scabra rough speargrass TSPA rare	115 plants will be lost – 100 % of those recorded in the survey area.	There are over 1000 observation records of this species on the NVA, with the total statewide population likely to be in the tens to hundreds of thousands. It is a highly frequent component of highway verges throughout the Midlands and Derwent Valley and seemingly benefits from the disturbance and style of management in this niche. Species may be delisted from the TSPA following the clarification of taxonomic difficulties at the sub-specific level. Based on these factors, potential impacts from the present proposal are considered to be negligible and to not require mitigation.
Calocephalus citreus lemon beautyheads TSPA rare	70 scattered plants will be lost, in addition to 0.2 ha of the high-density population polygon (27 % of the total area) and 0.9 ha of the moderate-density population polygon (6 % of the total area). Given that the high-density population polygon has been found to fluctuate between 10,000 and 60,000 plants, the loss of 27 % of this area may represent a loss of between 2,700 and 16,200 plants, with a middle value of 9,450. The moderate-density population polygon loss of 6 % is considered to constitute an equivalent loss of 300 plants. Thus, using the middle value for the loss of plants	This species is found in relatively few locations in the southeast, with records concentrated around four main areas. The population within the survey area, along with plants at the Hobart Airport, is considered to be important for the conservation of the species and may be the largest population in the State, with tens of thousands of plants in any given year over several hectares. Based on the total number of plants and the area of habitat being lost, impacts to this species from the present proposal may be required to be offset for approval. Discussions have been undertaken with DPIPWE and a likely offset will involve the direct planting of replacement *C. citreus*.

Natural value	Potential impacts	Context and comments on mitigation[25]
	within the high-density population polygon, the estimated total impacts to *C. citreus* are 9,820 plants within approximately 1.1 ha of habitat.	
Haloragis heterophylla variable raspwort TSPA rare	Around 135 of the 144 m^2 occupied (with stems covering less than 1 % of the ground in these areas) by this stoloniferous species will be impacted.	This species was assessed for possible delisting in 2014, though the available abundance data was considered inadequate to determine if the species no longer qualifies for the rare category. It is widespread and the known number of records has increased significantly in recent years, but individual occurrences tend to be very localised. The present proposal will impact most of the area occupied by this species. It is capable of persisting through some disturbance and expected to survive in the remaining locations (and even some of the impacted areas) and to not require mitigation.
Juncus amabilis gentle rush TSPA rare	Around 170 of the c. 950 plants will be lost due to the proposal.	Observations and the known distribution of this species have increased in recent years, with increasing knowledge of its tolerance of human modified habitats. Several large populations are known in the southeast, with the total statewide population likely to be in the tens of thousands. Dozens more plants were observed in the immediate areas beyond the survey area. Based on these factors, potential impacts from the present proposal are considered to be negligible and to not require mitigation.
Ranunculus pumilio var. *pumilio* ferny buttercup TSPA rare	Around 0.65 ha of the moderate-density population polygon will be lost to the proposal, which represents 6 % of that polygon and 5 % of the extent of occurrence within the study area. This loss of area is considered to represent around 60 of the estimated 2,500 plants observed during the present assessment, but it is acknowledged that in most years this species is actually absent from the area.	This species is found in relatively few locations, mostly throughout the Midlands. There are no available population estimates, but based on our survey, the survey area is likely to represent an important site for the species. Because it is an annual species, it has large fluctuations in populations and thus loss of habitat may be a more useful measure of impact than loss of annual plants. It is not known if the species extends into suitable habitat beyond the survey area, but given the extent of lowland grasslands nearby it is considered to be highly likely (Figure 10). Thus, the loss of 0.65 ha may represent a loss of potential habitat as small as 1.1 %. The small proposed loss of potential habitat within the occasionally occupied moderate-density area is not considered likely to impact the persistence of the species in the broader area. The proposal will not

Natural value	Potential impacts	Context and comments on mitigation[25]
		impact habitat viability in any way, including hydrology. Thus, the impacts to this species are not considered to warrant mitigation through offsetting, and this would most likely be infeasible anyway because of its annual life strategy and only occasional appearance on site.
Senecio squarrosus leafy fireweed TSPA rare	Around 6 % (0.8 ha) of the area of the 13.1 ha population will be lost due to the proposal. Based on this seasons population estimate, this amounts to an equivalent of 300 plants.	Records for this species are concentrated around Hobart and Launceston, but it is likely to be under-reported elsewhere. It is a disturbance colonising species generally associated with forest fires. The survey area is considered to be part of an important population for this species, extending into adjacent grassy habitats covering over an additional 57 ha. Based on species ecology and the abundance of plants present, the proposal will not result in the local extinction of the species and is not considered to warrant mitigation.
Wilsonia rotundifolia round leaf wilsonia TSPA rare	No impacts proposed.	N/A
Extent of TASVEG units (ha) – asterisk denotes communities listed as threatened under Tasmanian *Nature Conservation Act 2002*		
(ARS) Saline sedgeland/rushland	0.03 out of 2.5 ha will be lost.	Total extent in Tasmanian reserve estate: 1,100 Total extent in Tasmania: 2,500 Total extent in reserves in Clarence Council: 0 Total extent in Clarence Council: 20
(DVC) *Eucalyptus viminalis – E. globulus* coastal forest*	0.80 out of 1.6 ha will be lost.	Total extent in Tasmanian reserve estate: 1,700 Total extent in Tasmania: 3,400 Total extent in reserves in Clarence Council: 40 Total extent in Clarence Council: 200
(GCL) Lowland grassland complex	No impacts proposed.	Total extent in Tasmanian reserve estate: 3,100

Natural value	Potential impacts	Context and comments on mitigation[25]
		Total extent in Tasmania: 70,000 Total extent in reserves in Clarence Council: 70 Total extent in Clarence Council: 1700
(GPL) Lowland *Poa labillardierei* grassland	0.91 ha out of 13.62 ha will be lost in the survey area. Community occurs more extensively (an additional 57 ha within 2.5 km) in adjacent land parcels, as discussed for lowland grassland of Tasmania and shown in Figure 10.	Total extent in Tasmanian reserve estate: 1,900 Total extent in Tasmania: 13,500 Total extent in reserves in Clarence Council: 0 Total extent in Clarence Council: 60
(NBA) *Bursaria – Acacia* woodland and scrub	4.03 out of 8.42 ha will be lost.	Total extent in Tasmanian reserve estate: 2,400 Total extent in Tasmania: 19,100 Total extent in reserves in Clarence Council: 30 Total extent in Clarence Council: 300
Total area of potential impact	5.79 ha out of the 25.12 ha of native vegetation will be lost due to the proposal.	Independent of those units that make up EPBCA listed communities, losses of TASVEG units are considered to be negligible on a local, regional and statewide level and do not warrant specific mitigation beyond standard works practices. Nonetheless, it is proposed to include the remaining extent of NBA woodland (c. 4 ha) on both sides of the highway into formal management zones with the adjacent grassland. This will facilitate the maintenance of habitat for threatened flora species and contribute to the integrity of the grassy ecosystem as a whole.
Threatened fauna habitat (ha)		
eastern barred bandicoot *Perameles gunnii* EPBCA vulnerable	5.79 ha out of the 25.12 ha of native vegetation potential habitat within the survey area will be lost.	Negligible impacts anticipated. Should any of these species be present on site, it is considered highly unlikely that the proposal would result in their local extinction and/or

Natural value	Potential impacts	Context and comments on mitigation[25]
Latham's snipe *Gallinago hardwickii* EPBCA marine/ migrant	0.91 ha out of 13.62 ha of potential habitat within the survey area will be lost.	significant impacts. Each of the species is widespread in Tasmania and the eastern barred bandicoot and Latham's snipe in particular are resilient to disturbance. No critical habitat elements will be lost in the area due to the proposal and suitable habitat extends beyond the study area in the broader area of lowland grasslands of Tasmania (Figure 10) and in the case of the bandicoot all surrounding areas are potential habitat, including several low-density residential areas within the region. Nonetheless, to compensate for the minor loss of potential bandicoot habitat, some recommended mitigation is outlined in section 5. Direct impacts to individual fauna are considered to be very unlikely with this proposal due to the nature of the species and the fact that the site will be busy with foot and small-vehicle traffic during work preparation and this is likely to scare animals away prior to the use of large machinery.
tussock skink *Pseudemoia pagenstecheri* TSPA vulnerable	0.91 ha out of 13.62 ha of potential habitat within the survey area will be lost.	
Adjacent Ramsar wetland		
Pitt water-Orielton lagoon	No possible impacts and no overlap with extent of Ramsar site.	No possible impacts will occur to this site directly, nor will the site or the processes that maintain it be impacted indirectly.

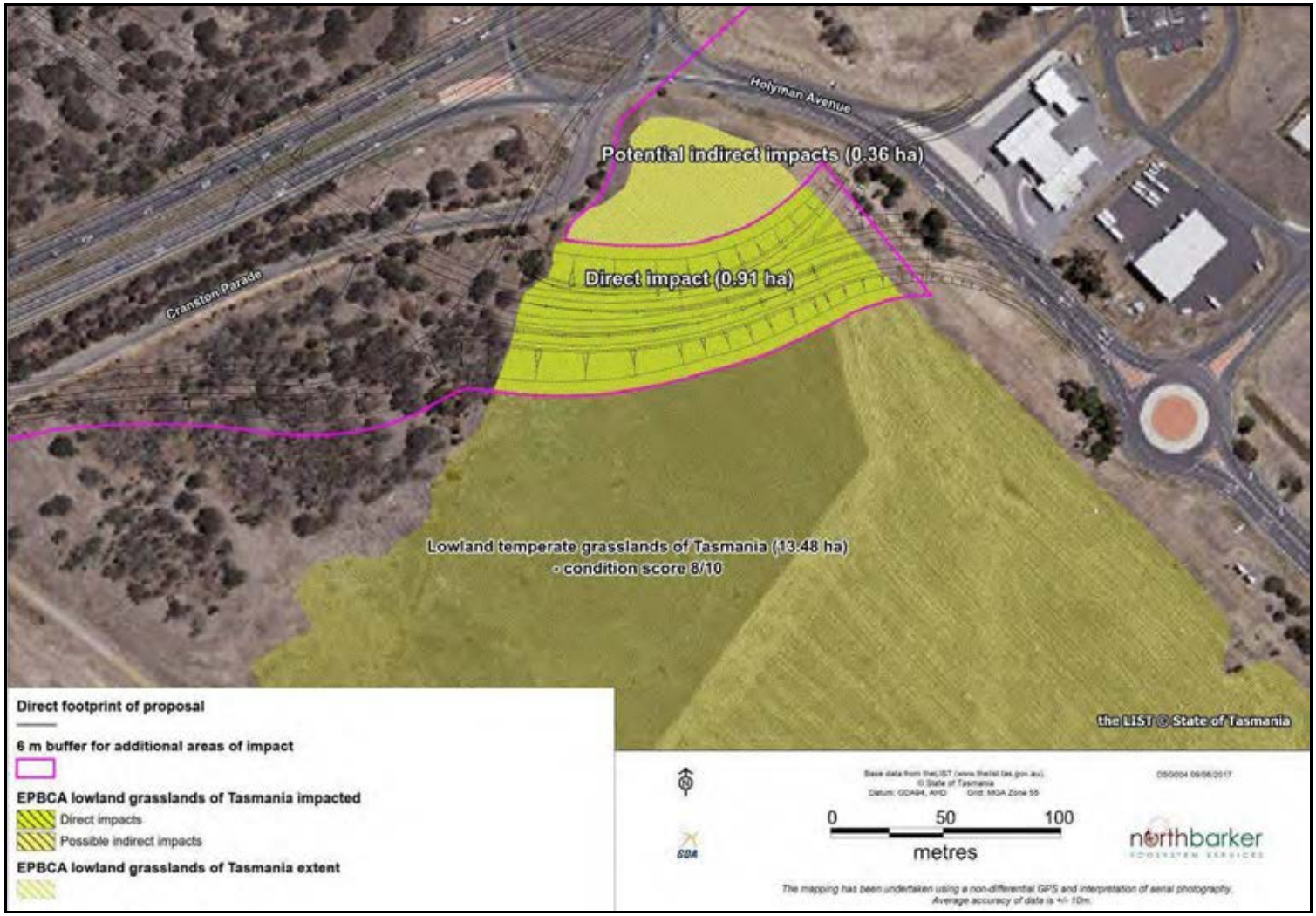

Figure 9- Expected impacts to EPBCA lowland grasslands of Tasmania

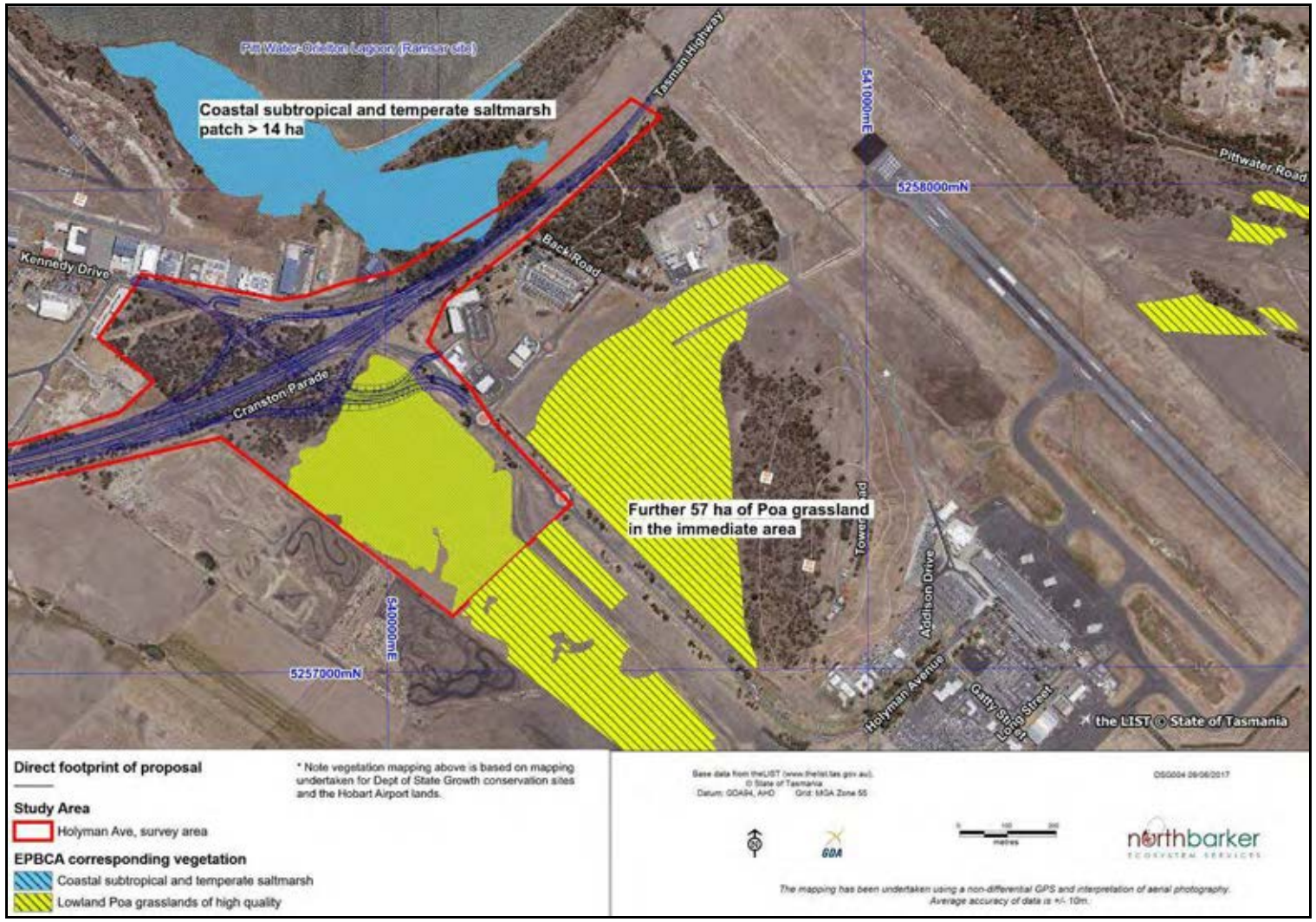

Figure 10- *Poa* dominated grasslands and coastal subtropical and temperate saltmarsh within the vicinity of the survey area

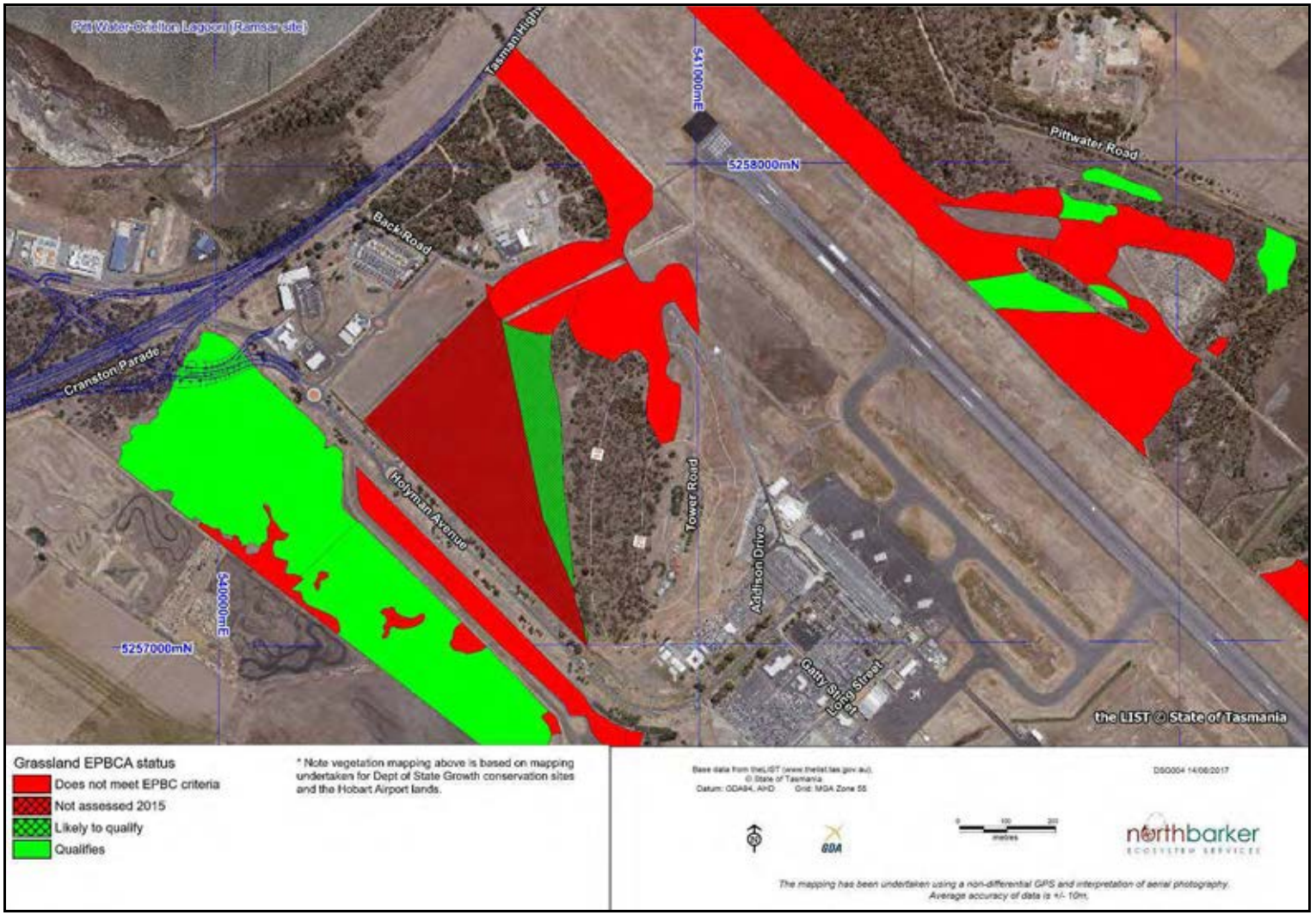

Figure 11- *Poa* dominated grasslands that have been found to meet the EPBCA condition criteria within the vicinity of the survey area

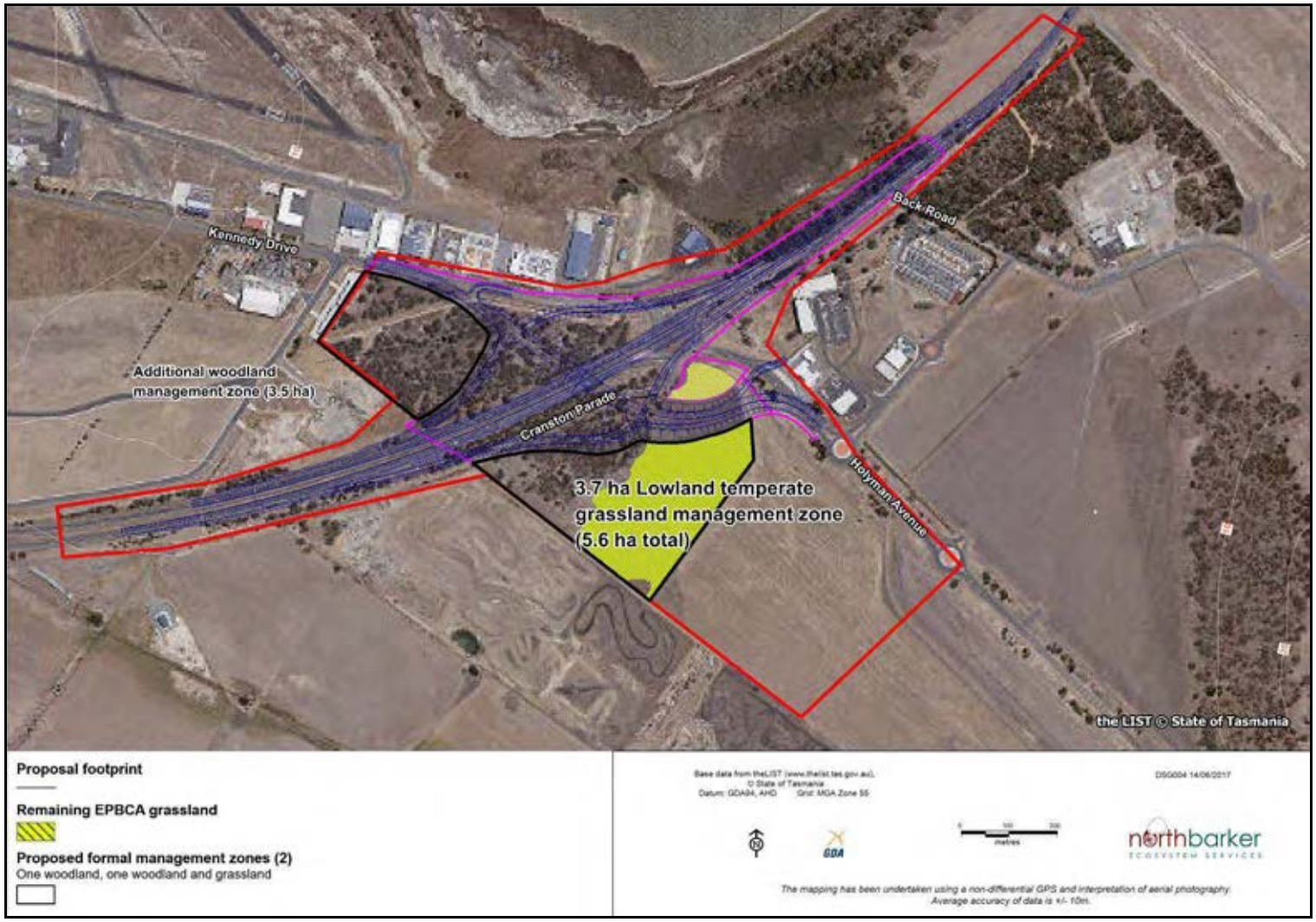

Figure 12 - Proposed management zones to compensate for direct loss of EPBCA grassland

Figure 13 – Earlier design proposal (pale yellow lines) from proponent, which would have resulted in greater fragmentation of the EPBCA grasslands and is likely to have constituted a significant impact under the EPBCA

4. Legislative Implications

4.1 Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*

The EPBCA is structured for self-assessment. There are guidelines and criteria available[28] to assist any person to determine if the action they propose is likely to have a significant impact on any species or community listed under the Act. If a significant impact is likely, then the Action should be referred to the Australian Government Department of the Environment for a decision by the Minister (the minister) on whether assessment and approval is required under the Act.

Minimal impacts are proposed to the 'subtropical and temperate coastal saltmarshes' community. In addition, communities listed in the vulnerable category under the EPBC Act are not treated as matters of national environmental significance for the purposes of environmental approvals. The impacts are nonetheless not considered to be equivalent to significant impacts under criteria for any listing category.

Potential impacts to any EPBCA fauna that may utilise the site are not likely to trigger the significant impact criteria but some basic mitigation measures are recommended below to minimise potential for any impacts whatsoever.

No EPBCA listed flora species are known from the site and none are likely to have been overlooked.

The proposal will have an unavoidable direct impact on the critically endangered community 'lowland grasslands of Tasmania', with an expected loss of 0.91 ha and potential indirect impacts within an additional 0. 36 ha. An action is likely to have a significant impact on a critically endangered community if there is a real chance or possibility that it will:

- reduce the extent of an ecological community
- fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines
- adversely affect habitat critical to the survival of an ecological community
- modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns
- cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example through regular burning or flora or fauna harvesting
- cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to:
    - -- assisting invasive species, that are harmful to the listed ecological community, to become established, or
    - -- causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community, or

[28] Commonwealth of Australia 2013

• interfere with the recovery of an ecological community.

It is our understanding that the proponent will implement the recommended mitigation measures (formal management agreement for the remaining main patch of lowland grasslands of Tasmania) on their land as a means of compensating for the loss of 0.91 ha and avoiding a significant impact to the grassland system overall. Nonetheless, the proponent intend to voluntarily refer the proposal to the Commonwealth for their decision as to whether the proposal warrants assessment as a controlled action under the EPBCA.

4.2 Tasmanian *Threatened Species Protection Act 1995*

Any impact on threatened plant species listed under the TSPA will require a 'permit to take' from the Policy and Conservation Assessments Branch (PCAB) at the Department of Primary Industries, Parks, Wildlife and the Environment (DPIPWE). Thus, with the current design, the proposal will require a permit to take:

- *Austrostipa scabra*
- *Calocephalus citreus*
- *Haloragis heterophylla*
- *Juncus amabilis*
- *Ranunculus pumilio* var. *pumilio*
- *Senecio squarrosus*

It is understood that permit conditions relating to impacts to *C. citreus* are likely to require some form of offset, likely direct replacement of individual plants.

4.3 Tasmanian *Weed Management Act 1999*

Nine of the declared weeds found in the survey area are classed as Zone B species in the Clarence Council. According to the provisions of the *Weed Management Act 1999* (WMA), Zone B municipalities are those that host infestations of the 'declared weed' that are not deemed eradicable because the feasibility of effective management is low at this time. Therefore, the objective is containment of infestations. The objective includes preventing spread of the 'declared weed' from the municipality and preventing spread to properties currently free of them. There is a requirement to prevent spread of the 'declared weeds' to properties containing sites for significant flora, fauna and vegetation communities.

One of the declared weeds (and one other known nearby) is treated as a Zone A species in Clarence. Zone A municipalities are those which are either free of the weed or host small isolated infestations which are able to be eradicated. The principle management objective should be their eradication.

4.4 Tasmanian *Land Use and Planning Approvals Act 1993*

LUPAA states that 'in determining an application for a permit, a planning authority must (amongst other things) seek out the objectives set out in Schedule 1'. Schedule 1 includes the 'objectives of the *Resource Management and Planning System of Tasmania*', which includes (amongst other things):

> 'to promote sustainable development of natural and physical resources and the maintenance of ecological processes and genetic diversity'.

Sustainable development includes 'avoiding, remedying or mitigating any adverse effects of activities on the environment'.

By conforming to the required Acts above and following the recommendations below, the proponent will satisfy the requirements of LUPAA.

5. Recommendations and Additional Considerations

In addition to meeting the requirements of the EPBCA, TSPA and WMA, the following recommendations will aid the proponent in ensuring any development of the site is sustainable in regards to maintaining the threatened ecological values of the site. Most importantly, the proposed management arrangement is intended to compensate for the reduction of extent of EPBCA grassland without breaching the significant impact guidelines in relation to overall impacts.

Threatened vegetation and flora management

1. The remaining main patch (3.7 ha) of lowland grasslands of Tasmania and *Bursaria-Acacia* woodland (as specified in Figure 12) should be entered into perpetual formal management agreements under the most appropriate mechanism. The management agreements should detail measures and frequencies of weed control, threatened flora species management, and woody shrub and tree control as appropriate. Existing informal management plans devised by NBES for the broader area should be used a guideline for the new formal plans.
2. The area of indirectly impacted 0.36 ha of lowland grasslands of Tasmania should be managed as specified in Table 7, but it is not practical for such a small area in this location to be protected under a formal agreement.

Threatened fauna mitigation – eastern barred bandicoot

1. It is possible that some sheltering sites for this species may be lost within the footprint. To compensate for this, new shelter sites should be made with piles of cleared native woody plants (mostly black wattle *Acacia mearnsii* from within the NBA community) placed within the areas of the new management agreements. One new shelter site will be made for every hectare of native habitat lost – totalling 6 new shelters. The constructed shelter sites will be located within or on the edges of the remaining NBA vegetation and will be a minimum of 2 cubic metres in size at the time of construction (they are likely to compact later).

In the works contract

1. Prepare a *Vegetation Management Plan* for the contract area to ensure retained values are protected and appropriately managed during the period of the contract. Specifically:
    a. identify in the contract specifications the locations of threatened values that are not permitted to be impacted and are required to be marked as exclusion zones, and
    b. delineate areas for the storing and movement of materials and machinery that will not further impact threatened values.
2. Prepare a *Weed Management Plan* to control 'declared' weeds throughout the works area and environmental weeds within patches of native vegetation. Specifically:
    a. plan for targeted pre-works control to reduce propagule pressure during works;
    b. ensure excavated soil from weed affected areas is not spread to weed free areas and preferably is buried beneath 500 mm of fill;
    c. include prescriptions for hygiene measures during work; and
    d. allow for targeted weed treatment on completion of works and during follow-up. This should include annual weed control on the site for up to five years following completion, to specifically target weeds that have exploited the disturbances associated with earthworks.

Regulatory commitment by State Growth

1. Undertake any auditing and reporting in accordance with relevant permit conditions. Ideally involvement of the chosen environmental auditor is made from the beginning of the project rather than after completion.

Additional considerations

1. If the contractor identifies additional areas for disturbance during works, these must be assessed appropriately and permits amended if necessary. Such alterations may include, but may not be limited to, sites for dumping surplus fill, sources of additional fill (quarries), site offices, temporary storage, parking areas and site access roads.
2. No suspected threatened fauna dens will be impacted by the proposal and the site is considered to be unsuitable for denning due to regular inundation. Nonetheless, if potential dens for species such as the Tasmanian devil, the eastern quoll and/or the spotted-tailed quoll are identified within 50 m of the impact area during works, appropriate advice will be sought on a course of action from DPIPWE and/or consultant ecologists. In this scenario, an appropriate course of action is likely to involve an activity assessment of the potential den, camera monitoring, and potentially decommissioning if the den was confirmed to be vacant. No active dens of any of these species will be at any risk of being impacted.

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Appendix A – Vascular Plant Species by Community

Modified land

Grid Reference:	539984E, 5257763N
Accuracy:	within 500 metres
Recorder:	Grant Daniels
Date of Survey:	11 Nov 2016
Tall Shrubs:	*Acacia mearnsii, Acacia retinodes, Allocasuarina littoralis, Allocasuarina verticillata, Dodonaea viscosa subsp. spatulata*
Shrubs:	*Acacia genistifolia, Daviesia ulicifolia subsp. ulicifolia, Dillwynia cinerascens, Melaleuca pallida, Solanum laciniatum*
Low Shrubs:	*Astroloma humifusum, Hibbertia procumbens, Pimelea humilis, Pultenaea pedunculata*
Herbs:	*Acaena novae-zelandiae, Carpobrotus rossii, Convolvulus angustissimus subsp. angustissimus, Cotula australis, Crassula decumbens var. decumbens, Crassula sieberiana, Daucus glochidiatus, Dianella brevicaulis, Dianella revoluta, Dichondra repens, Einadia nutans subsp. nutans, Epilobium billardierianum subsp. cinereum, Lobelia pedunculata, Lythrum hyssopifolia, Pseudognaphalium luteoalbum, Senecio minimus, Senecio quadridentatus, Senecio sp., Senecio squarrosus, Solenogyne dominii, Sonchus hydrophilus, Tetragonia implexicoma, Thelymitra sp., Veronica gracilis, Wahlenbergia sp.*
Graminoids:	*Carex inversa, Carex tasmanica, Carex tereticaulis, Eleocharis acuta, Ficinia nodosa, Isolepis marginata, Juncus amabilis, Juncus bufonius, Juncus holoschoenus, Juncus pallidus, Juncus procerus, Lepidosperma inops, Lomandra longifolia, Luzula sp., Schoenus apogon, Schoenus lepidosperma subsp. lepidosperma, Schoenus nitens, Typha sp.*
Grasses:	*Anthosachne scabra, Austrostipa scabra, Austrostipa sp., Distichlis distichophylla, Lachnagrostis filiformis, Rytidosperma caespitosum*
Ferns:	*Azolla filiculoides, Pteridium esculentum subsp. esculentum*
Weeds:	*Acacia baileyana, Acacia howittii, Acacia iteaphylla, Acacia pycnantha, Acetosella vulgaris, Achillea millefolium, Agrostis stolonifera, Aira caryophyllea, Arctotheca calendula, Avena barbata, Bellis perennis, Briza maxima, Briza minor, Bromus catharticus, Bromus diandrus, Bromus hordeaceus, Capsella bursa-pastoris, Carduus pycnocephalus, Carpobrotus edulis, Catapodium rigidum, Centaurium erythraea, Chamaecytisus palmensis, Chenopodium glaucum, Chrysanthemoides monilifera* ssp. *monilifera*, *Cirsium vulgare, Convolvulus arvensis, Conyza bonariensis, Cynodon dactylon var. dactylon, Cyperus eragrostis, Cytisus scoparius, Dactylis glomerata, Digitalis purpurea, Dimorphotheca fruticosa, Echium candicans, Ehrharta erecta, Ehrharta longiflora, Erodium cicutarium, Euphorbia peplus, Festuca arundinacea, Foeniculum vulgare, Fumaria muralis subsp. muralis, Fumaria sp., Gazania linearis, Genista monspessulana, Geranium dissectum, Helminthotheca echioides, Holcus lanatus, Hordeum sp., Hypochaeris radicata, Juncus articulatus, Lagurus ovatus, Lavandula stoechas var. stoechas, Leontodon saxatilis, Lepidium draba, Lolium perenne, Lysimachia arvensis, Malus pumila, Malva sylvestris, Marrubium vulgare, Matricaria chamomilla, Matricaria discoidea, Medicago lupulina, Medicago polymorpha, Medicago sativa, Melilotus indicus, Paraserianthes lophantha subsp. lophantha, Paspalum dilatatum, Pelargonium sp., Phalaris aquatica, Phalaris minor, Piptatherum miliaceum, Plantago coronopus, Plantago lanceolata, Poa annua, Poa bulbosa, Poa pratensis, Polycarpon tetraphyllum, Polygonum arenastrum, Polygonum aviculare, Prunus cerasifera, Prunus sp., Psoralea pinnata, Reseda luteola, Rosa rubiginosa, Rumex conglomeratus, Sanguisorba minor, Senna multiglandulosa, Silene gallica var. gallica, Silene gallica var. quinquevulnera, Sinapis arvensis, Sisymbrium irio, Sisyrinchium iridifolium, Sonchus asper subsp. asper, Spartium junceum, Spergularia marina, Stellaria media, Tragopogon porrifolius subsp. porrifolius, Trifolium campestre, Trifolium dubium, Trifolium repens, Trifolium subterraneum, Vellereophyton dealbatum, Verbascum thapsus, Vicia hirsuta, Vicia sativa subsp. sativa, Vulpia bromoides, Vulpia myuros forma megalura*

DVC south of road, including powerline easement

Grid Reference:	540319E, 5257934N
Accuracy:	within 100 metres
Recorder:	Grant Daniels
Date of Survey:	14 Nov 2016
Trees:	*Bursaria spinosa subsp. spinosa, Eucalyptus amygdalina, Eucalyptus viminalis subsp. viminalis*
Tall Shrubs:	*Acacia dealbata subsp. dealbata, Acacia mearnsii, Allocasuarina littoralis, Dodonaea viscosa subsp. spatulata, Exocarpos cupressiformis*
Shrubs:	*Acacia genistifolia, Bossiaea cinerea, Daviesia ulicifolia subsp. ulicifolia, Dillwynia glaberrima, Rhagodia candolleana subsp. candolleana*
Low Shrubs:	*Astroloma humifusum, Indigofera australis subsp. australis, Pimelea humilis*
Herbs:	*Carpobrotus rossii, Crassula sieberiana, Cynoglossum australe, Dianella revoluta, Dichondra repens, Kennedia prostrata, Opercularia varia, Poranthera microphylla, Senecio glomeratus, Thelymitra sp., Wahlenbergia sp.*
Graminoids:	*Isolepis marginata, Juncus pallidus, Lepidosperma concavum, Lomandra longifolia*
Grasses:	*Anthosachne scabra, Poa labillardierei, Rytidosperma sp.*
Ferns:	*Pteridium esculentum subsp. esculentum*
Weeds:	*Aira caryophyllea, Anthoxanthum odoratum, Arctotheca calendula, Avena barbata, Briza maxima, Dactylis glomerata, Ehrharta erecta, Ehrharta longiflora, Hypochaeris radicata, Lagurus ovatus, Lolium perenne, Lysimachia arvensis, Piptatherum miliaceum, Plantago coronopus, Poa bulbosa, Romulea rosea var. australis, Sonchus oleraceus, Vulpia bromoides*

DVC north of road

Grid Reference:	540320E, 5257973N
Accuracy:	within 100 metres
Recorder:	Grant Daniels
Date of Survey:	14 Nov 2016
Trees:	*Acacia melanoxylon, Bursaria spinosa subsp. spinosa, Eucalyptus viminalis subsp. viminalis*
Tall Shrubs:	*Acacia mearnsii, Allocasuarina littoralis, Allocasuarina monilifera, Allocasuarina verticillata, Exocarpos cupressiformis*
Shrubs:	*Acacia genistifolia, Acacia longifolia subsp. sophorae, Cassinia aculeata subsp. aculeata, Daviesia ulicifolia subsp. ulicifolia, Dillwynia glaberrima*
Low Shrubs:	*Astroloma humifusum, Lissanthe strigosa subsp. subulata, Pimelea humilis, Tetratheca pilosa*
Herbs:	*Acaena novae-zelandiae, Carpobrotus rossii, Crassula decumbens var. decumbens, Dianella brevicaulis, Dianella revoluta, Einadia nutans subsp. nutans,Goodenia lanata, Hydrocotyle hirta, Hypericum japonicum, Lagenophora stipitata, Lobelia anceps, Oxalis sp., Poranthera microphylla, Senecio glomeratus, Senecio sp., Tetragonia implexicoma, Veronica gracilis, Wahlenbergia sp.*
Graminoids:	*Apodasmia brownii, Ficinia nodosa, Isolepis hookeriana, Juncus kraussii subsp. australiensis, Juncus pallidus, Lepidosperma concavum, Lomandra longifolia, Luzula sp., Schoenus apogon, Schoenus lepidosperma subsp. lepidosperma*
Grasses:	*Distichlis distichophylla, Ehrharta stipoides, Poa labillardierei, Poa poiformis var. poiformis, Rytidosperma sp.*
Ferns:	*Hypolepis rugosula, Pteridium esculentum subsp. esculentum*
Weeds:	*Acetosella vulgaris, Arctotheca calendula, Briza maxima, Briza minor, Cerastium sp., Cirsium vulgare, Cotoneaster glaucophyllus var. serotinus, Cotoneaster pannosus, Ehrharta erecta, Ehrharta longiflora, Erica lusitanica, Helminthotheca echioides, Hypochaeris glabra, Lycium ferocissimum, Paspalum dilatatum, Rosa rubiginosa, Rubus fruticosus, Sanguisorba minor, Stellaria media, Vicia sativa*

ARS - also subtropical and temperate coastal saltmarsh

Grid Reference:	540210E, 5257917N
Accuracy:	within 100 metres
Recorder:	Grant Daniels
Date of Survey:	12 Dec 2016
Trees:	*Eucalyptus viminalis subsp. viminalis*
Tall Shrubs:	*Acacia mearnsii, Ozothamnus ferrugineus*
Shrubs:	*Acacia genistifolia, Sarcocornia quinqueflora, Wilsonia backhousei, Wilsonia rotundifolia*
Low Shrubs:	*Sarcocornia quinqueflora*
Herbs:	*Angianthus preissianus, Carpobrotus rossii, Dianella revoluta, Lobelia anceps, Lythrum hyssopifolia, Samolus repens var. repens, Sebaea albidiflora, Sebaea ovata, Selliera radicans, Senecio glomeratus, Sonchus hydrophilus, Wahlenbergia sp.*
Graminoids:	*Apodasmia brownii, Carex tereticaulis, Ficinia nodosa, Gahnia filum, Hypolaena fastigiata, Juncus kraussii subsp. australiensis, Juncus pallidus, Juncus sarophorus, Lepidosperma concavum, Lomandra longifolia, Schoenus nitens*
Grasses:	*Anthosachne scabra, Austrostipa stipoides, Distichlis distichophylla, Lachnagrostis filiformis, Poa poiformis var. poiformis, Rytidosperma caespitosum, Rytidosperma sp.*
Weeds:	*Briza minor, Centaurium erythraea, Cotula coronopifolia, Erica lusitanica, Holcus lanatus, Hypochaeris radicata, Lysimachia arvensis, Pinus radiata, Plantago coronopus, Polypogon monspeliensis, Rosa rubiginosa, Sonchus asper subsp. asper, Stenotaphrum secundatum*

NBA north side of highway (APT02)

Grid Reference:	539619E, 5257667N
Accuracy:	within 100 metres
Recorder:	Grant Daniels
Date of Survey:	12 Dec 2016
Trees:	*Acacia melanoxylon, Eucalyptus ovata var. ovata*
Tall Shrubs:	*Acacia mearnsii, Allocasuarina verticillata, Dodonaea viscosa subsp. spatulata, Exocarpos cupressiformis, Melaleuca ericifolia*
Shrubs:	*Acacia genistifolia, Bossiaea prostrata, Cassinia aculeata subsp. aculeata, Daviesia latifolia, Daviesia ulicifolia subsp. ulicifolia, Dillwynia sericea, Olearia*
Low Shrubs:	*Astroloma humifusum, Hibbertia hirsuta, Pimelea humilis, Pultenaea pedunculata*
Herbs:	*Acaena echinata, Acaena ovina, Brachyscome graminea, Calocephalus citreus, Carpobrotus rossii, Centrolepis strigosa subsp. strigosa, Convolvulus angustissimus subsp. angustissimus, Coronidium gunnianum, Crassula sieberiana, Dianella brevicaulis, Dianella revoluta, Dichondra repens, Drosera peltata subsp. peltata, Einadia nutans subsp. nutans, Epilobium billardierianum subsp. intermedium, Eryngium vesiculosum, Gnaphalium indutum, Gonocarpus tetragynus, Goodenia lanata, Haloragis heterophylla, Hypericum gramineum, Kennedia prostrata, Leptorhynchos squamatus subsp. squamatus, Limosella australis, Linum marginale, Lythrum hyssopifolia, Microtis unifolia, Senecio glomeratus, Senecio quadridentatus, Senecio squarrosus, Solenogyne dominii, Thelymitra sp., Veronica gracilis, Wahlenbergia sp.*
Graminoids:	*Carex breviculmis, Carex inversa, Carex tasmanica, Carex tereticaulis, Isolepis marginata, Juncus amabilis, Juncus australis, Juncus bufonius, Juncus pallidus, Juncus sarophorus, Lepidosperma inops, Lomandra longifolia, Luzula sp., Schoenus apogon*
Grasses:	*Anthosachne scabra, Austrostipa mollis, Austrostipa sp., Ehrharta stipoides, Lachnagrostis filiformis, Poa labillardierei, Rytidosperma caespitosum, Rytidosperma setaceum, Rytidosperma sp., Themeda triandra*
Weeds:	*Acetosella vulgaris, Agrostis stolonifera, Aira caryophyllea, Arctotheca calendula, Briza maxima, Briza minor, Centaurium erythraea, Cirsium vulgare, Cyperus eragrostis, Dactylis glomerata, Festuca arundinacea, Helminthotheca echioides, Hirschfeldia incana, Hypochaeris radicata, Juncus capitatus, Leontodon saxatilis, Lysimachia arvensis, Paspalum dilatatum, Phalaris aquatica, Plantago lanceolata, Rumex conglomeratus, Sanguisorba minor, Sonchus asper, S. oleraceus, Trifolium campestre, Trifolium glomeratum, Typha latifolia, Vellereophyton dealbatum*

GPL (APT01)

Grid Reference:	539989E, 5257577N
Accuracy:	within 100 metres
Recorder:	Grant Daniels
Date of Survey:	5 Dec 2016
Trees:	*Bursaria spinosa subsp. spinosa*
Tall Shrubs:	*Acacia mearnsii*
Shrubs:	*Olearia ramulosa*
Low Shrubs:	*Astroloma humifusum*
Herbs:	*Acaena echinata, Acaena ovina, Asperula conferta, Brachyscome graminea, Calocephalus citreus, Centella cordifolia, Coronidium gunnianum, Dichondra repens, Epilobium billardierianum subsp. intermedium, Eryngium vesiculosum, Euchiton japonicus, Geranium retrorsum, Haloragis heterophylla, Hypoxis glabella var. glabella, Leptorhynchos squamatus subsp. squamatus, Lythrum hyssopifolia, Microseris lanceolata, Microtis unifolia, Ranunculus pumilio var. pumilio, Senecio glomeratus, Senecio quadridentatus, Senecio sp., Senecio squarrosus, Thelymitra sp.*
Graminoids:	*Carex breviculmis, Isolepis hookeriana, Isolepis marginata, Juncus amabilis, Juncus australis, Juncus bufonius, Juncus holoschoenus*
Grasses:	*Anthosachne scabra, Austrostipa mollis, Austrostipa sp., Ehrharta stipoides, Poa labillardierei, Rytidosperma caespitosum, Rytidosperma dimidiatum, Rytidosperma setaceum*
Weeds:	*Agrostis stolonifera, Aira caryophyllea, Anthoxanthum odoratum, Avena fatua, Briza minor, Centaurium erythraea, Cirsium vulgare, Dactylis glomerata, Geranium dissectum, Hypochaeris radicata, Leontodon saxatilis, Lolium perenne, Lysimachia arvensis, Phalaris aquatica, Plantago coronopus, Plantago lanceolata, Rosa rubiginosa, Sanguisorba minor, Sonchus asper subsp. asper, Tragopogon porrifolius subsp. porrifolius, Trifolium campestre*

GCL (APT01)

Grid Reference:	539752E, 5257423N
Accuracy:	within 50 metres
Recorder:	Grant Daniels
Date of Survey:	5 Dec 2016
Trees:	*Bursaria spinosa subsp. spinosa*
Tall Shrubs:	*Acacia mearnsii*
Low Shrubs:	*Astroloma humifusum*
Herbs:	*Acaena echinata, Acaena ovina, Asperula conferta, Calocephalus citreus, Coronidium gunnianum, Dianella brevicaulis, Dichondra repens, Epilobium billardierianum subsp. intermedium, Eryngium vesiculosum, Linum marginale, Lythrum hyssopifolia, Microseris lanceolata, Microtis unifolia, Montia australasica, Ranunculus pumilio var. pumilio, Senecio glomeratus, Senecio quadridentatus, Senecio sp., Senecio squarrosus*
Graminoids:	*Eleocharis acuta, Isolepis hookeriana, Isolepis marginata, Juncus amabilis, Juncus australis, Juncus holoschoenus, Schoenus apogon*
Grasses:	*Anthosachne scabra, Ehrharta stipoides, Lachnagrostis filiformis, Poa labillardierei, Rytidosperma caespitosum, Rytidosperma sp.*
Weeds:	*Briza minor, Bromus hordeaceus, Centaurium erythraea, Cirsium vulgare, Dactylis glomerata, Helminthotheca echioides, Holcus lanatus, Hypochaeris radicata, Leontodon saxatilis, Lolium perenne, Lysimachia arvensis, Phalaris aquatica, Pinus radiata, Plantago coronopus, Plantago lanceolata, Rosa rubiginosa, Rumex conglomeratus, Sonchus asper subsp. asper, Tragopogon porrifolius subsp. porrifolius, Trifolium campestre, Vulpia myuros forma megalura*

NBA (APT01) south of highway

Grid Reference:	539811E, 5257534N
Accuracy:	within 100 metres
Recorder:	Grant Daniels
Date of Survey:	5 Dec 2016
Trees:	*Acacia melanoxylon*
Tall Shrubs:	*Acacia mearnsii, Allocasuarina verticillata, Dodonaea viscosa subsp. spatulata, Exocarpos cupressiformis*
Shrubs:	*Acacia stricta, Bossiaea prostrata, Cassinia aculeata subsp. aculeata, Dillwynia cinerascens, Solanum laciniatum*
Low Shrubs:	*Astroloma humifusum, Hibbertia hirsuta*
Herbs:	*Acaena echinata, Brachyscome graminea, Calocephalus citreus, Carpobrotus rossii, Centrolepis strigosa subsp. strigosa, Dianella brevicaulis, Einadia nutans subsp. nutans, Eryngium vesiculosum, Euchiton japonicus, Goodenia elongata, Goodenia lanata, Hypericum gramineum, Isolepis sp., Leptorhynchos squamatus, Linum marginale, Lythrum hyssopifolia, Oxalis sp., Senecio glomeratus, Senecio quadridentatus, Solenogyne dominii, Thelymitra sp.*
Graminoids:	*Carex breviculmis, Juncus amabilis, Juncus australis, Lepidosperma inops, Lomandra longifolia, Luzula sp., Schoenus apogon*
Grasses:	*Anthosachne scabra, Austrostipa mollis, Austrostipa rudis subsp. australis, Austrostipa sp., Ehrharta stipoides, Lachnagrostis filiformis, Pentapogon quadrifidus, Rytidosperma caespitosum, Themeda triandra*
Weeds:	*Agrostis capillaris, Aira caryophyllea, Arctotheca calendula, Centaurium erythraea, Dactylis glomerata, Holcus lanatus, Hypochaeris radicata, Juncus capitatus, Lactuca serriola f. serriola, Leontodon saxatilis, Lolium perenne, Lysimachia arvensis, Phalaris aquatica, Plantago coronopus, Plantago lanceolata, Rosa rubiginosa, Sonchus asper subsp. asper, Sonchus oleraceus, Trifolium campestre, Trifolium dubium*

Appendix B – Vascular Plant Species List

Status codes:

ORIGIN	NATIONAL SCHEDULE	STATE SCHEDULE
i - introduced	EPBC Act 1999	TSP Act 1995
d - declared weed WM Act	CR - critically endangered	e - endangered
en - endemic to Tasmania	EN - endangered	v - vulnerable
t - within Australia, occurs only in Tas.	VU - vulnerable	r - rare

Sites:

1	Modified land north of the highway - E539984, N5257763	11-11-2016	Grant Daniels
2	DVC south of road, easement - E540319, N5257934	14-11-2016	Grant Daniels
3	DVC north of road - E540320, N5257973	14-11-2016	Grant Daniels
4	ARS - also temperate coastal saltmarsh - E540210, N5257917	12-12-2016	Grant Daniels
5	NBA north side of highway (APT02) - E539619, N5257667	12-12-2016	Grant Daniels
6	GPL (APT01) - E539989, N5257577	5-12-2016	Grant Daniels
7	GCL (APT01) - E539752, N5257423	5-12-2016	Grant Daniels
8	NBA (APT01) south of highway - E539811, N5257534	5-12-2016	Grant Daniels

Site	Name	Common name	Status
	DICOTYLEDONAE		
	AIZOACEAE		
1	*Carpobrotus edulis*	yellow pigface	i
1 2 3 4 5 8	*Carpobrotus rossii*	native pigface	
3	*Tetragonia implexicoma*	bower spinach	
	APIACEAE		
6	*Centella cordifolia*	swampwort	
1	*Daucus glochidiatus*	australian carrot	
5 6 7 8	*Eryngium vesiculosum*	prickfoot	
3	*Hydrocotyle hirta*	hairy pennywort	
	ASTERACEAE		
1	*Achillea millefolium*	yarrow	i
4	*Angianthus preissianus*	salt cupflower	
1 2 3 5 8	*Arctotheca calendula*	capeweed	i
1	*Bellis perennis*	english daisy	i
5 6 8	*Brachyscome graminea*	grass daisy	
5 6 7 8	*Calocephalus citreus*	lemon beautyheads	r
1	*Carduus pycnocephalus*	slender thistle	d
3 5 8	*Cassinia aculeata subsp. aculeata*	dollybush	
1	*Chrysanthemoides monilifera* ssp. *monilifera*	boneseed	d
1 3 5 6 7	*Cirsium vulgare*	spear thistle	i
1	*Conyza bonariensis*	flaxleaf fleabane	i
5 6 7	*Coronidium gunnianum*	swamp everlasting	
1	*Cotula australis*	southern buttons	
4	*Cotula coronopifolia*	water buttons	i
1	*Dimorphotheca fruticosa*	trailing daisy	i
6 8	*Euchiton japonicus*	common cottonleaf	
1	*Foeniculum vulgare*	fennel	d
1	*Gazania linearis*	tufted gazania	i
5	*Gnaphalium indutum*	tiny cottonleaf	
1 3 5 7	*Helminthotheca echioides*	bristly oxtongue	i

3	*Hypochaeris glabra*	smooth catsear	i
1 2 4 5 6 7 8	*Hypochaeris radicata*	rough catsear	i
8	*Lactuca serriola f. serriola*	prickly lettuce	i
3	*Lagenophora stipitata*	blue bottledaisy	
1 5 6 7 8	*Leontodon saxatilis*	hairy hawkbit	i
5 6 8	*Leptorhynchos squamatus subsp. squamatus*	scaly buttons	
1	*Matricaria discoidea*	rayless mayweed	i
6 7	*Microseris lanceolata*	yam daisy	
5 6	*Olearia ramulosa*	twiggy daisybush	
4	*Ozothamnus ferrugineus*	tree everlastingbush	
1	*Pseudognaphalium luteoalbum*	jersey cudweed	
2 3 4 5 6 7 8	*Senecio glomeratus*	shortfruit purple fireweed	
1	*Senecio minimus*	shrubby fireweed	
1 5 6 7 8	*Senecio quadridentatus*	cotton fireweed	
3 6 7	*Senecio sp.*	groundsel	
5 6 7	*Senecio squarrosus*	leafy fireweed	r
5 8	*Solenogyne dominii*	smooth flat-herb	
1 4 5 6 7 8	*Sonchus asper subsp. asper*	green prickly sowthistle	i
4	*Sonchus hydrophilus*	native sowthistle	
2 5 8	*Sonchus oleraceus*	common sowthistle	i
1 6 7	*Tragopogon porrifolius subsp. porrifolius*	salsify	i
1 5	*Vellereophyton dealbatum*	white cudweed	i
	BORAGINACEAE		
2	*Cynoglossum australe*	coast houndstongue	
1	*Echium candicans*	pride of madeira	i
	BRASSICACEAE		
1	*Capsella bursa-pastoris*	shepherds purse	i
5	*Hirschfeldia incana*	hoary mustard	i
1	*Lepidium draba*	hoary cress	d
1	*Sinapis arvensis*	charlock	i
1	*Sisymbrium irio*	london rocket	i
	CAMPANULACEAE		
3 4	*Lobelia anceps*	angled lobelia	
1	*Lobelia pedunculata*	matted lobelia	
2 3 4 5	*Wahlenbergia sp.*	bluebell	
	CARYOPHYLLACEAE		
3	*Cerastium sp.*	mouse-ear chickweed	i
1	*Polycarpon tetraphyllum*	fourleaf allseed	i
1	*Silene gallica var. gallica*	french catchfly	i
1	*Silene gallica var. quinquevulnera*	french catchfly	i
1	*Spergularia marina*	lesser seaspurrey	i
1 3	*Stellaria media*	garden chickweed	i
	CASUARINACEAE		
1 2 3	*Allocasuarina littoralis*	black sheoak	
3	*Allocasuarina monilifera*	necklace sheoak	en
1 3 5 8	*Allocasuarina verticillata*	drooping sheoak	

	CHENOPODIACEAE		
1	*Chenopodium glaucum*	pale goosefoot	i
1 3 5 8	*Einadia nutans subsp. nutans*	climbing saltbush	
2	*Rhagodia candolleana subsp. candolleana*	coastal saltbush	
4	*Sarcocornia quinqueflora*	beaded glasswort	
	CLUSIACEAE		
5 8	*Hypericum gramineum*	small st johns-wort	
3	*Hypericum japonicum*	matted st johns-wort	
	CONVOLVULACEAE		
1 5	*Convolvulus angustissimus subsp. angustissimus*	blushing bindweed	
1	*Convolvulus arvensis*	field bindweed	i
1 2 5 6 7	*Dichondra repens*	kidneyweed	
4	*Wilsonia backhousei*	narrowleaf wilsonia	
4	*Wilsonia rotundifolia*	roundleaf wilsonia	r
	CRASSULACEAE		
1 3	*Crassula decumbens var. decumbens*	spreading stonecrop	
1 2 5	*Crassula sieberiana*	stone-crop	
	DILLENIACEAE		
5 8	*Hibbertia hirsuta*	hairy guineaflower	en
1	*Hibbertia procumbens*	spreading guineaflower	
	DROSERACEAE		
5	*Drosera peltata subsp. peltata*	pale sundew	
	EPACRIDACEAE		
1 2 3 5 6 7 8	*Astroloma humifusum*	native cranberry	
3	*Lissanthe strigosa subsp. subulata*	peachberry heath	
	ERICACEAE		
3 4	*Erica lusitanica*	spanish heath	d
	EUPHORBIACEAE		
1	*Euphorbia peplus*	petty spurge	i
2 3	*Poranthera microphylla*	small poranthera	
	FABACEAE		
2	*Bossiaea cinerea*	showy bossiaea	
5 8	*Bossiaea prostrata*	creeping bossiaea	
1	*Chamaecytisus palmensis*	tree lucerne	i
1	*Cytisus scoparius*	english broom	d
5	*Daviesia latifolia*	hop bitterpea	
1 2 3 5	*Daviesia ulicifolia subsp. ulicifolia*	yellow spiky bitterpea	
1 8	*Dillwynia cinerascens*	grey parrotpea	
2 3	*Dillwynia glaberrima*	smooth parrotpea	
5	*Dillwynia sericea*	showy parrotpea	
1	*Genista monspessulana*	canary broom	d
2	*Indigofera australis subsp. australis*	native indigo	
2 5	*Kennedia prostrata*	running postman	
1	*Medicago lupulina*	black medick	i
1	*Medicago polymorpha*	burr medick	i
1	*Medicago sativa*	lucerne	i
1	*Melilotus indicus*	sweet melilot	i
1	*Paraserianthes lophantha subsp.*	cape wattle	i

1	*Psoralea pinnata*	blue butterflybush	i
1 5	*Pultenaea pedunculata*	matted bushpea	
1	*Senna multiglandulosa*	glandular senna	i
1	*Spartium junceum*	spanish broom	i
1 5 6 7 8	*Trifolium campestre*	hop clover	i
1 8	*Trifolium dubium*	suckling clover	i
5	*Trifolium glomeratum*	cluster clover	i
1	*Trifolium repens*	white clover	i
1	*Trifolium subterraneum*	subterranean clover	i
1	*Vicia hirsuta*	hairy vetch	i
1 3	*Vicia sativa subsp. sativa*	common vetch	i
	FUMARIACEAE		
1	*Fumaria muralis subsp. muralis*	wall fumitory	i
1	*Fumaria sp.*	fumitory	i
	GENTIANACEAE		
1 4 5 6 7 8	*Centaurium erythraea*	common centaury	i
4	*Sebaea albidiflora*	white sebaea	
4	*Sebaea ovata*	yellow sebaea	
	GERANIACEAE		
1	*Erodium cicutarium*	common heronsbill	i
1 6	*Geranium dissectum*	cutleaf cranesbill	i
6	*Geranium retrorsum*	grassland cranesbill	
1	*Pelargonium sp.*	stork's-bill	
	GOODENIACEAE		
8	*Goodenia elongata*	lanky native-primrose	
3 5 8	*Goodenia lanata*	trailing native-primrose	
4	*Selliera radicans*	shiny swampmat	
	HALORAGACEAE		
5	*Gonocarpus tetragynus*	common raspwort	
5 6	*Haloragis heterophylla*	variable raspwort	r
	LAMIACEAE		
1	*Lavandula stoechas var. stoechas*	spanish lavender	i
1	*Marrubium vulgare*	white horehound	d
	LINACEAE		
5 7 8	*Linum marginale*	native flax	
	LYTHRACEAE		
1 4 5 6 7 8	*Lythrum hyssopifolia*	small loosestrife	
	MALVACEAE		
1	*Malva sylvestris*	tall mallow	i
	MIMOSACEAE		
1	*Acacia baileyana*	cootamundra wattle	i
2	*Acacia dealbata subsp. dealbata*	silver wattle	
1 2 3 4 5	*Acacia genistifolia*	spreading wattle	
1	*Acacia howittii*	howitt's wattle	i
1	*Acacia iteaphylla*	Flinder's Range wattle	i
3	*Acacia longifolia subsp. sophorae*	coast wattle	
1 2 3 4 5	*Acacia mearnsii*	black wattle	

6 7 8			
3 5 8	*Acacia melanoxylon*	blackwood	
1	*Acacia pycnantha*	golden wattle	i
1	*Acacia retinodes*	wirilda	i
8	*Acacia stricta*	hop wattle	
	MYRTACEAE		
2	*Eucalyptus amygdalina*	black peppermint	en
5	*Eucalyptus ovata var. ovata*	black gum	
2 3 4	*Eucalyptus viminalis subsp. viminalis*	white gum	
5	*Melaleuca ericifolia*	coast paperbark	
1	*Melaleuca pallida*	yellow bottlebrush	
	ONAGRACEAE		
1	*Epilobium billardierianum subsp. cinereum*	grey willowherb	
5 6 7	*Epilobium billardierianum subsp. intermedium*	marsh willowherb	
	OXALIDACEAE		
3 8	*Oxalis sp.*	woodsorrel	
	PITTOSPORACEAE		
2 3 6 7	*Bursaria spinosa subsp. spinosa*	prickly box	
	PLANTAGINACEAE		
1 2 4 6 7 8	*Plantago coronopus*	buckshorn plantain	i
1 5 6 7 8	*Plantago lanceolata*	ribwort plantain	i
	POLYGONACEAE		
1 3 5	*Acetosella vulgaris*	sheep sorrel	i
1	*Polygonum arenastrum*	small wireweed	i
1	*Polygonum aviculare*	creeping wireweed	i
1 5 7	*Rumex conglomeratus*	clustered dock	i
	PORTULACACEAE		
7	*Montia australasica*	white purslane	
	PRIMULACEAE		
1 2 4 5 6 7 8	*Lysimachia arvensis*	scarlet pimpernel	i
4	*Samolus repens var. repens*	creeping brookweed	
	RANUNCULACEAE		
6 7	*Ranunculus pumilio var. pumilio*	ferny buttercup	r
	RESEDACEAE		
1	*Reseda luteola*	weld	i
	ROSACEAE		
5 6 7 8	*Acaena echinata*	spiny sheeps burr	
1 3	*Acaena novae-zelandiae*	common buzzy	
5 6 7	*Acaena ovina*	hairy sheepsburr	
3	*Cotoneaster glaucophyllus var. serotinus*	largeleaf cotoneaster	i
3	*Cotoneaster pannosus*	velvet cotoneaster	i
1	*Malus pumila*	apple	i
1	*Prunus cerasifera*	myrobalan plum	i
1	*Prunus sp.*		i
1 3 4 6 7 8	*Rosa rubiginosa*	sweet briar	i

3	*Rubus fruticosus*	blackberry	d
1 3 5 6	*Sanguisorba minor*	salad burnet	i
	RUBIACEAE		
6 7	*Asperula conferta*	common woodruff	
2	*Opercularia varia*	variable stinkweed	
	SANTALACEAE		
2 3 5 8	*Exocarpos cupressiformis*	common native-cherry	
	SAPINDACEAE		
1 2 5 8	*Dodonaea viscosa subsp. spatulata*	broadleaf hopbush	
	SCROPHULARIACEAE		
1	*Digitalis purpurea*	foxglove	i
5	*Limosella australis*	southern mudwort	
1	*Verbascum thapsus*	great mullein	i
1 3 5	*Veronica gracilis*	slender speedwell	
	SOLANACEAE		
3	*Lycium ferocissimum*	african boxthorn	d
1 8	*Solanum laciniatum*	kangaroo apple	
	THYMELAEACEAE		
1 2 3 5	*Pimelea humilis*	dwarf riceflower	
	TREMANDRACEAE		
3	*Tetratheca pilosa*	hairy pinkbells	
	GYMNOSPERMAE		
	PINACEAE		
4 7	*Pinus radiata*	radiata pine	i
	MONOCOTYLEDONAE		
	CENTROLEPIDACEAE		
5 8	*Centrolepis strigosa subsp. strigosa*	hairy bristlewort	
	CYPERACEAE		
5 6 8	*Carex breviculmis*	shortstem sedge	
1 5	*Carex inversa*	knob sedge	
1 5	*Carex tasmanica*	curly sedge	
1 4 5	*Carex tereticaulis*	hollow sedge	
1 5	*Cyperus eragrostis*	drain flatsedge	i
1 7	*Eleocharis acuta*	common spikesedge	
1 3 4	*Ficinia nodosa*	knobby clubsedge	
4	*Gahnia filum*	chaffy sawsedge	
3 6 7	*Isolepis hookeriana*	grassy clubsedge	
1 2 5 6 7	*Isolepis marginata*	little clubsedge	
8	*Isolepis sp.*	club rush	
2 3 4	*Lepidosperma concavum*	sand swordsedge	
1 5 8	*Lepidosperma inops*	fan sedge	en
3 5 7 8	*Schoenus apogon*	common bogsedge	
3	*Schoenus lepidosperma subsp. lepidosperma*	slender bogsedge	
4	*Schoenus nitens*	shiny bogsedge	
	IRIDACEAE		
2	*Romulea rosea var. australis*	lilac oniongrass	i
1	*Sisyrinchium iridifolium*	blue pigroot	i
	JUNCACEAE		

1 5 6 7 8	*Juncus amabilis*	gentle rush	r
1	*Juncus articulatus*	jointed rush	i
5 6 7 8	*Juncus australis*	southern rush	
1 5 6	*Juncus bufonius*	toad rush	
5 8	*Juncus capitatus*	capitate rush	i
1 6 7	*Juncus holoschoenus*	jointleaf rush	
3 4	*Juncus kraussii subsp. australiensis*	sea rush	
1 2 3 4 5	*Juncus pallidus*	pale rush	
1	*Juncus procerus*	tall rush	
4 5	*Juncus sarophorus*	broom rush	
3 5 8	*Luzula sp.*	luzula	
	LILIACEAE		
1 3 5 7 8	*Dianella brevicaulis*	shortstem flaxlily	
1 2 3 4 5	*Dianella revoluta*	spreading flaxlily	
6	*Hypoxis glabella var. glabella*	tiny yellowstar	
	ORCHIDACEAE		
5 6 7	*Microtis unifolia*	common onion-orchid	
2 5 6 8	*Thelymitra sp.*	sun-orchid	
	POACEAE		
8	*Agrostis capillaris*	brown top bent grass	i
1 5 6	*Agrostis stolonifera*	creeping bent	i
1 2 5 6 8	*Aira caryophyllea*	silvery hairgrass	i
1 2 4 5 6 7 8	*Anthosachne scabra*	rough wheatgrass	
2 6	*Anthoxanthum odoratum*	sweet vernalgrass	i
5 6 8	*Austrostipa mollis*	soft speargrass	
8	*Austrostipa rudis subsp. australis*	southern speargrass	
1	*Austrostipa scabra*	rough spear grass	r
1 5 6 8	*Austrostipa sp.*	speargrass	
4	*Austrostipa stipoides*	coast speargrass	
1 2	*Avena barbata*	bearded oat	i
6	*Avena fatua*	wild oat	i
1 2 3 5	*Briza maxima*	greater quaking-grass	i
1 3 4 5 6 7	*Briza minor*	lesser quaking-grass	i
1	*Bromus catharticus*	prairie grass	i
1	*Bromus diandrus*	great brome	i
1 7	*Bromus hordeaceus*	soft brome	i
1	*Catapodium rigidum*	ferngrass	i
1	*Cynodon dactylon var. dactylon*	couchgrass	i
1 2 5 6 7 8	*Dactylis glomerata*	cocksfoot	i
1 3 4	*Distichlis distichophylla*	australian saltgrass	
1 2 3	*Ehrharta erecta*	panic veldtgrass	i
1 2 3	*Ehrharta longiflora*	annual veldtgrass	i
3 5 6 7 8	*Ehrharta stipoides*	weeping grass	
1 5	*Festuca arundinacea*	tall fescue	i
1 4 7 8	*Holcus lanatus*	yorkshire fog	i
1	*Hordeum sp.*	barley, barley grass	i
1 4 5 7 8	*Lachnagrostis filiformis*	common blowngrass	
1 2	*Lagurus ovatus*	harestail grass	i

1 2 6 7 8	*Lolium perenne*	perennial ryegrass	i
1 3 5	*Paspalum dilatatum*	paspalum	i
8	*Pentapogon quadrifidus*	five-awned spear-grass	
1 5 6 7 8	*Phalaris aquatica*	toowoomba canarygrass	i
1	*Phalaris minor*	lesser canarygrass	i
1 2	*Piptatherum miliaceum*	rice millet	i
1	*Poa annua*	winter grass	i
1 2	*Poa bulbosa*	bulbous meadowgrass	i
2 3 5 6 7	*Poa labillardierei*	silver tussockgrass	
3 4	*Poa poiformis var. poiformis*	coastal tussockgrass	
1	*Poa pratensis*	kentucky bluegrass	i
4	*Polypogon monspeliensis*	annual beardgrass	i
1 4 5 6 7 8	*Rytidosperma caespitosum*	common wallabygrass	
6	*Rytidosperma dimidiatum*	variable wallabygrass	
5 6	*Rytidosperma setaceum*	bristly wallabygrass	
2 3 4 5 7	*Rytidosperma sp.*	wallabygrass	
4	*Stenotaphrum secundatum*	buffalo grass	i
5 8	*Themeda triandra*	kangaroo grass	
1 2	*Vulpia bromoides*	squirreltail fescue	i
1 7	*Vulpia myuros forma megalura*	foxtail fescue	i
	RESTIONACEAE		
3 4	*Apodasmia brownii*	coarse twinerush	
4	*Hypolaena fastigiata*	tassel roperush	
	TYPHACEAE		
5	*Typha latifolia*	great reedmace	i
1	*Typha sp.*		
	XANTHORRHOEACEAE		
1 2 3 4 5 8	*Lomandra longifolia*	sagg	

PTERIDOPHYTA

	AZOLLACEAE		
1	*Azolla filiculoides*	pacific azolla	
	DENNSTAEDTIACEAE		
3	*Hypolepis rugosula*	ruddy groundfern	
1 2 3	*Pteridium esculentum subsp. esculentum*	bracken	

Appendix C – Conservation Significant Flora Within 5 km

Appendix C: Flora species of conservation significance known or predicted as having suitable habitat within a 5 km radius of the study area

Species	Status TSPA / EPBCA	Potential to occur if not observed	Observations and preferred habitat[29]
KNOWN FROM STUDY AREA			
Austrostipa scabra rough speargrass	Rare/ -	**PRESENT**	See results section 2.2 and impacts in section 3.
Calocephalus citreus lemon beautyheads	Rare/ -	**PRESENT**	See results section 2.2 and impacts in section 3.
Haloragis heterophylla variable raspwort	Rare/ -	**PRESENT**	See results section 2.2 and impacts in section 3.
Juncus amabilis gentle rush	Rare/ -	**PRESENT**	See results section 2.2 and impacts in section 3.
Ranunculus pumilio var. *pumilio* ferny buttercup	Rare/ -	**PRESENT**	See results section 2.2 and impacts in section 3.
Senecio squarrosus leafy fireweed	Rare/ -	**PRESENT**	See results section 2.2 and impacts in section 3.
Wilsonia rotundifolia roundleaf wilsonia	Rare/ -	**PRESENT**	See results section 2.2 and impacts in section 3.
REPORTED FROM WITHIN 500 m[30]			
Aphelia gracilis slender fanwort	Rare/ -	Very low	In Tasmania, *Aphelia gracilis* inhabits damp, sandy ground and wet places in the Midlands and north of the State. Records from pre-1950 suggest it used to be more widespread but it's range has contracted away from the south. The single known record attributed to within 500 m is from a nearby remnant

[29] Includes comments from DPIPWE threatened species note sheets and www.threatenedspecieslink.tas.gov.au

[30] Natural Values Report: nvr_4_15-Dec-2016

Species	Status TSPA / EPBCA	Potential to occur if not observed	Observations and preferred habitat[29]
			forest with habitat not found within the study area. Despite moderately suitable habitat niches within the project area, the species is unlikely to have been overlooked over the several years of previous work in the area.
Juncus vaginatus clustered rush	Rare/ -	Nil	This rush species tends to be locally abundant near the margins of streams or in permanently wet soaks near marshes. It is a large, perennial, highly distinctive species that is unlikely to have been overlooked in our surveys.
Lachnagrostis punicea ssp. *punicea* bristle blowngrass	Rare/ -	Very low	This species, although uncommon in Tasmania, with few records, evidently has a wide range and a broad ecological niche, with reports from dry woodland and forest, grazed pasture and wet areas. The apparent rarity may be a result of failure to identify plants to the subspecific level, with several similar looking congenerics occurring in the same habitats and areas. The only *Lachnagrostis* species observed within the study was determined to be *L. filiformis*. It is considered very unlikely that other species from this genus have been overlooked.
Lachnagrostis robusta tall blowngrass	Rare/ -	Very low	This species is widespread around the Tasmanian coastline, occurring in saline and sub-saline environments. Reporting rates around Hobart have declined, suggesting a contraction in range of the species. The only *Lachnagrostis* species observed within the study was determined to be *L. filiformis*. It is considered very unlikely that other species from this genus have been overlooked. There is no highly suitable habitat for this species within the proposed footprint.
Limonium australe var. *australe* yellow sea lavender	Rare/ -	Nil	A distinctive perennial species of salt marsh fringes. Unlikely to have been overlooked.
Lobelia pratioides poison lobelia	Vulnerable/ -	Low	The species grows in seasonally inundated to waterlogged soils at the margins of swamps, wetlands and drainage lines, as well as damp depressions within grassland and

Species	Status TSPA / EPBCA	Potential to occur if not observed	Observations and preferred habitat[29]
			grassy woodland. The species is a very small herb and populations are often limited to tiny drains and water edges. The grassy habitats within the study area contain suitable habitat niches for this species and it has been recorded on site in the past but not for several years. Given there is no expected change to the sites hydrology, there is no expected impact to habitat suitability and the likelihood of the species re-occurring on site in the future when conditions are suitable. It's possible it will colonise any new roadside drains established as part of the proposal.
Myriophyllum integrifolium tiny watermilfoil	Vulnerable/ -	Very low	The species grows in seasonally inundated to waterlogged soils at the margins of swamps, wetlands and drainage lines, as well as damp depressions within grassland and grassy woodland. The species is a very small herb and populations are often limited to tiny habitat patches. The grassy habitats within the study area contain suitable habitat niches for this species but it has been recorded and is not likely to have been overlooked. Given there is no expected change to the sites hydrology, there is no expected impact to habitat suitability and the likelihood of the species occurring on site. It's possible the proposal will create new habitat for the species in areas such as roadside drains.
Prasophyllum milfordense Milford leek-orchid	Endangered/ CRITICALLY ENDANGERED	Very low	*Prasophyllum milfordense* is a terrestrial orchid endemic to southern Tasmania. It is known from one site near Cambridge. This is on the property of Milford, with the species occurring within DVC habitat similar to that within the study area, but with a more suitable history of management and disturbance. Only 0.8 ha of the DVC within the study area is within the proposed footprint and this area was found to support very few orchids of any kind and is not considered likely to contain threatened species.
Rytidosperma indutum tall wallabygrass	Rare/ -	Very low	The species occurs on mudstone and dolerite in open, dry sclerophyll woodlands. No suitable habitat within the study area and unlikely to have been overlooked.

Species	Status TSPA / EPBCA	Potential to occur if not observed	Observations and preferred habitat[29]
Stylidium despectum small triggerplant	Rare/ -	Very low	The species grows in seasonally inundated to waterlogged soils at the margins of swamps, wetlands and drainage lines, as well as damp depressions within grassland and grassy woodland. The species is a very small herb and populations are often limited to tiny habitat patches. The grassy habitats within the study area contain suitable habitat niches for this species but it has been recorded and is not likely to have been overlooked. Given there is no expected change to the sites hydrology, there is no expected impact to habitat suitability and the likelihood of the species occurring on site. It's possible the proposal will create new habitat for the species in areas such as roadside drains.
Vittadinia species *cuneata* var. *cuneata*, *gracilis* and *muelleri* (*sensu lato*)	Rare/ -	Very low	These highly conspicuous species are unlikely to have been overlooked within the study area. Within their range they are frequent colonisers of dry grassy roadsides, thus the proposal can be expected to increase site suitability.
Xerochyrsum palustre swamp everlasting	Vulnerable/ VULNERABLE	Very low	A highly conspicuous species unlikely to have been overlooked but with suitable habitat within the study area and a known population on an immediately adjacent property. The species spreads largely from rhizomes, but seedlings could one day colonise the site in optimal conditions.
REPORTED FROM WITHIN 5 km[31]			
Bolboschoenus caldwellii sea clubsedge	Rare/ -	Very low	In Tasmania, *Bolboschoenus caldwellii* is widespread in shallow, standing, sometimes brackish water, rooted in heavy black mud. Site conditions are not suitable for this species due to the lack of standing water. Although it can go dormant for years in drought conditions, it's highly unlikely to be over-looked following periods of inundation, such have occurred during surveys on site.

[31] Natural Values Report: nvr_4_15-Dec-2016

Species	Status TSPA / EPBCA	Potential to occur if not observed	Observations and preferred habitat[29]
Caladenia caudata tailed spider-orchid	Vulnerable/ VULNERABLE	Very low	The species occurs in heathy and open eucalypt forest and woodland, often with sheoaks, and in heathland on sandy and loamy soils. It is most often found on sunny north-facing sites in lowland areas of northern, eastern and southeastern Tasmania. The species is also cryptic, avoiding detection as it tends to flower and be identifiable infrequently, often only flowering in response to disturbance such as fire. The nearest known location for this species is on the property of Milford, within DVC habitat similar to that within the study area, but with a more suitable history of management and disturbance. Only 0.8 ha of the DVC within the study area is within the proposed footprint and this area was found to support very few orchids of any kind and is not considered likely to contain threatened species.
Caladenia saggicola Sagg spider-orchid	Endangered/ CRITICALLY ENDANGERED	Very low	*Caladenia saggicola* is a terrestrial orchid endemic to southern Tasmania. It is known from two subpopulations, one near Cambridge (with up to 450 plants) and the other at Dodges Ferry (3 plants). At the Cambridge site, which is nearest to the study area, the species grows in DVC woodland on deep sands, with a ground layer dominated by the graminoid *Lomandra longifolia* (sagg). This is on the property of Milford, with DVC habitat similar to that within the study area, but with a more suitable history of management and disturbance. Only 0.8 ha of the DVC within the study area is within the proposed footprint and this area was found to support very few orchids of any kind and is not considered likely to contain threatened species.
Cotula vulgaris var. *australasica* slender buttons	Rare/ -	Very low	This small annual herb occurs in halophyte-dominated saltmarshes and rock outcrops within the salt-spray zone. It requires bare ground and little above-ground competition for germination and survival. In relation to the area of saltmarsh in the study area, the species would not be able to occur within the tussocks of sedges and rushes. The only potential area of habitat is within the patches dominated by *Wilsonia* sp., which are

Species	Status TSPA / EPBCA	Potential to occur if not observed	Observations and preferred habitat[29]
			not included within the footprint.
Eryngium ovinum blue devil	Vulnerable/ -	Very low	*Eryngium ovinum* (blue devil) is a perennial herb in the Apiaceae (carrot) family with distinctive spiny foliage and metallic-blue flower-heads. It is known in Tasmania from about 24 sites in the State's southeast and east, usually growing in fertile heavy soils in grasslands and grassy woodlands below about 350 m elevation. In these grassy environments it typically occurs in association with *Themeda triandra*, rather than *Poa* species such as those that dominate the study area. Wet *Poa* grasslands, salty areas and swampy habitats are occupied by a congeneric species *E. vesiculosum*, and thus the study area is not suitable habitat for *E. ovinum*.
Eucalyptus risdonii Risdon peppermint	Rare/ -	Nil	A highly distinctive small tree of northwest facing slopes on mudstone. No suitable habitat within study area.
Eutaxia microphylla spiny bushpea	Rare/ -	Nil	In Tasmania, *Eutaxia microphylla* occurs mostly in low, open coastal shrubbery and on cliff sides on a range of substrates. As well as the habitat being atypical, the species is most obvious during the spring flowering period and thus is unlikely to have been overlooked by surveys on site.
Pterostylis wapstrarum fleshy greenhood	Endangered/ CRITICALLY ENDANGERED	Very low	*Pterostylis wapstrarum* (fleshy greenhood) is a terrestrial orchid endemic to Tasmania. It is known from the southern Midlands, growing in native grasslands and grassy eucalypt woodlands on basalt. The substrate on site is not suitable for this species.
Scleranthus diander tufted knawel	Vulnerable/ -	Nil	In Tasmania, this species is found from the Central Midlands area to Hobart with most of the records from the Ross and Tunbridge areas. It inhabits grassy woodland and is associated with dolerite and basalt substrates. Habitat is marginally suitable in parts of the study area but the species is unlikely to have been overlooked.

Species	Status TSPA / EPBCA	Potential to occur if not observed	Observations and preferred habitat[29]
Scleranthus fasciculatus spreading knawel	Vulnerable/ -	Nil	In Tasmania, *Scleranthus fasciculatus* is only recorded from a few locations in the Midlands and south-east. The vegetation at most of the sites is silver tussock grassland/grassy woodland, however the tussock grasslands are generally drier facies than those found within the study area. Habitat is marginally suitable in parts of the study area but the species is unlikely to have been overlooked.
Stuckenia pectinata fennel pondweed	Rare/ -	Nil	A fully aquatic species with no suitable habitat on site.
Triglochin minutissima tiny arrowgrass	Rare/ -	Very low	This small annual herb occurs in halophyte-dominated saltmarshes and rock outcrops within the salt-spray zone. It requires bare ground and little above-ground competition for germination and survival. In relation to the area of saltmarsh in the study area, the species would not be able to occur within the tussocks of sedges and rushes. The only potential area of habitat is within the patches dominated by Wilsonia sp., which are not included within the footprint.
Velleia paradoxa spur velleia	Vulnerable/ -	Nil	*Velleia paradoxa* (spur velleia) is a short-lived perennial herb, known in Tasmania from the Midlands and Derwent Valley, where it grows in grassy woodlands and grasslands. Habitat on site is suitable within the NBA woodland in particular, but the species is highly unlikely to have been overlooked.
Wilsonia humilis silky wilsonia	Rare/ -	Nil	A species of halophytic herblands, with slightly more saline requirements than the *Wilsonia* species present within the study area. Very unlikely to have been overlooked due to the bright silver foliage.
Xerochyrsum bicolor eastcoast everlasting	Rare/ -	Nil	A highly conspicuous species unlikely to have been overlooked and with no suitable habitat within the study area.
PREDICTED BY HABITAT MAPPING ONLY[32]			

[32] Protected Matters Search Tool report PMST_41AWP3

Species	Status TSPA / EPBCA	Potential to occur if not observed	Observations and preferred habitat[29]
Dianella amoena matted flax-lily	Rare/ ENDANGERED	Nil	A species of fertile grassy habitats. Nil likelihood of being overlooked on site and habitat is suboptimal due to high moisture levels within grassland.
Diuris lanceolata snake orchid	Endangered/ ENDANGERED	Nil	Endemic to the north-west coast of Tasmania with no likelihood of being present on site.
Glycine latrobeana clover glycine	Vulnerable/ VULNERABLE	Nil	A species of fertile grassy habitats. Nil likelihood of being overlooked on site and habitat is suboptimal due to high moisture levels within grassland.
Lepidium hyssopifolium basalt peppercress	Endangered/ ENDANGERED	Very low	A species of the growth suppression zone of native and exotic trees (particularly conifers) with grassy environments. Very low likelihood of being overlooked. Many populations are found on roadsides, so habitat suitability is unlikely to be detrimentally impacted by the proposal.
Leucochrysum albicans var. *tricolor* grassland paper daisy	Endangered/ ENDANGERED	Nil	A species of fertile grassy habitats on basalt. Nil likelihood of being overlooked on site and habitat is suboptimal due to substrate and high moisture levels within grassland.
Prasophyllum apoxychilum tapered leek-orchid	Vulnerable/ ENDANGERED	Very low	An endemic Tasmanian orchid found mainly in near-coastal heathland and heathy woodland. Habitat on site is atypical in comparison with known populations.
Pterostylis ziegeleri Cape Portland greenhood	Vulnerable/ VULNERABLE	Very low	*Pterostylis ziegeleri* is endemic to Tasmania. It is known from widely separated localities ranging from lowland coastal regions in the northwest, north and east, and in the Midlands to 300 m altitude. In coastal areas it is found on the slopes of low stabilised sand dunes and in grassy dune swales, while in the Midlands it grows in native grassland or grassy woodland on well-drained clay loams derived from basalt. The habitat on site is moderately suitable for this species in places, but it is unlikely to have been overlooked and unlikely to have habitat viability impacted significantly.

Appendix D – Conservation Significant Flora Within 5 km

Appendix D: Marine and near coastal species with potential habitat within 5 km of the site[33]

Species	Status EPBCA	Potential to occur	Comments, habitat niche, previous records, *etc*.
BIRDS			
Albatross species: *Diomedea antipodensis** *D. epomophora (sensu stricto)** *D. exulans (sensu lato)** *D. gibsoni** *D. sanfordi*** *Thalassarche bulleri** *T. bulleri platei** *T. cauta** *T. chrysostoma*** *T. impavida** *T. melanophrys** *T. salvini** *T.* sp. nov.* *T. steadi**	* VULNERABLE ** ENDANGERED	Nil	Pelagic species with offshore habitat use. No marine habitat will be impacted by the proposal.
Other pelagic birds: *Fregetta grallaria grallaria** *Halobaena caerulea** *Macronectes giganteus*** *M. halli** *Pachyptila turtur subantarctica* *Pterodroma leucoptera leucoptera*	* VULNERABLE ** ENDANGERED (no asterisks denote marine/migratory species only)	Nil	Pelagic species with offshore habitat use. No marine habitat will be impacted by the proposal.

[33] Protected Matters Search Tool report PMST_41AWP3

Species	Status EPBCA	Potential to occur	Comments, habitat niche, previous records, *etc*.
Puffinus carneipes			
Waders/ shorebirds: *Actitis hypoleucos* *Arenaria interpres* *Calidris acuminata* *C. alba* *C. canutus*** *C. melanotos* *C. ruficollis* *C. tenuirostris**** *Charadrius bicinctus* *C. mongolus*** *C. veredus* *Heteroscelus brevipes* *Limosa lapponica baueri* and menzbieri**** *Limosa limosa* *Numenius phaeopus* *Philomachus pugnax* *Pluvialus fulva* *P. squatarola* *Tringa nebularia* *Xenus cinereus*	* VULNERABLE ** ENDANGERED *** CRITICALLY ENDANGERED (no asterisks denote marine/migratory species only)	Nil	Shorebird species with no suitable habitat within the study area and no potential for impacts to nearby habitat.
FISH			
Brachionichthys hirsutus spotted handfish	CRITICALLY ENDANGERED	Nil	A fully aquatic species of particular estuarine and off-shore habitats. No potential impacts to potential habitat nearby.

Species	Status EPBCA	Potential to occur	Comments, habitat niche, previous records, *etc*.
Carcharodon carcharias great white shark	VULNERABLE	Nil	An oceanic species with offshore habitat use. No marine habitat will be impacted by the proposal.
Hippocampus addominalis potbelly seahorse	Marine	Nil	A fully aquatic species of particular estuarine and off-shore habitats. No potential impacts to potential habitat nearby.
Hippocampus breviceps short-head seahorse	Marine	Nil	A fully aquatic species of particular estuarine and off-shore habitats. No potential impacts to potential habitat nearby.
Histiogamphelus briggsii crested pipefish	Marine	Nil	A fully aquatic species of particular estuarine and off-shore habitats. No potential impacts to potential habitat nearby.
Lamna nasus porbeagle	Migratory	Nil	An oceanic species with offshore habitat use. No marine habitat will be impacted by the proposal.
Maroubra perserrata sawtooth pipefish	Marine	Nil	A fully aquatic species of particular estuarine and off-shore habitats. No potential impacts to potential habitat nearby.
Pipefish species: *Mitotichthys mollisoni, M. semistriatus, M. tuckeri*	Marine	Nil	A fully aquatic species of particular estuarine and off-shore habitats. No potential impacts to potential habitat nearby.
Phyllopteryx taeniolatus common seadragon	Marine	Nil	A fully aquatic species of particular estuarine and off-shore habitats. No potential impacts to potential habitat nearby.
Solegnathus spinosissimus spiny pipehorse	Marine	Nil	A fully aquatic species of particular estuarine and off-shore habitats. No potential impacts to potential habitat nearby.
Pipefish species *Stigmatopora argus* *S. nigra, S. olivacea*	Marine	Nil	A fully aquatic species of particular estuarine and off-shore habitats. No potential impacts to potential habitat nearby.

Species	Status EPBCA	Potential to occur	Comments, habitat niche, previous records, *etc*.
Thymichthys politus red handfish	CRITICALLY ENDANGERED	Nil	A fully aquatic species of particular estuarine and off-shore habitats. No potential impacts to potential habitat nearby.
Urocampus carinirostris hairy pipefish	Marine	Nil	A fully aquatic species of particular estuarine and off-shore habitats. No potential impacts to potential habitat nearby.
Vanacampus phillipi Port Phillip pipefish	Marine	Nil	A fully aquatic species of particular estuarine and off-shore habitats. No potential impacts to potential habitat nearby.
INVERTEBRATES			
Parvulastra vivipara Tasmanian live-bearing seastar	VULNERABLE	Nil	A fully aquatic species of particular estuarine and off-shore habitats. No potential impacts to potential habitat nearby.
MAMMALS			
Arctocephalus forsteri New Zealand fur-seal	Marine	Nil	No resting areas found within 5 km and no potential impacts to marine foraging habitat.
Arctocephalus pusillus Australian fur-seal	Marine	Nil	No resting areas found within 5 km and no potential impacts to marine foraging habitat.
Delphinus delphis common dolphin	Marine	Nil	An oceanic species with offshore habitat use. No marine habitat will be impacted by the proposal.
Grampus griseus Risso's dolphin	Marine	Nil	An oceanic species with offshore habitat use. No marine habitat will be impacted by the proposal.
Lagenorhynchus obscurus dusky dolphin	Migratory	Nil	An oceanic species with offshore habitat use. No marine habitat will be impacted by the proposal.
Tursiops truncatus sensu stricto bottlenose dolphin	Marine	Nil	An oceanic species with offshore habitat use. No marine habitat will be impacted by the proposal.
Whales: *Balaenoptera*	* VULNERABLE ** ENDANGERED	Nil	Oceanic species with offshore habitat use. No marine habitat will be impacted by the

Species	Status EPBCA	Potential to occur	Comments, habitat niche, previous records, *etc*.
acutorostrata (minke) *B. musculus* (blue)** *Caperea marginata* (pygmy right whale) *Eubalaena australis* (southern right)** *Megaptera novaeangliae* (humpback)* *Orcinus orca* (killer)	(no asterisks denote marine/migratory species only)		proposal.

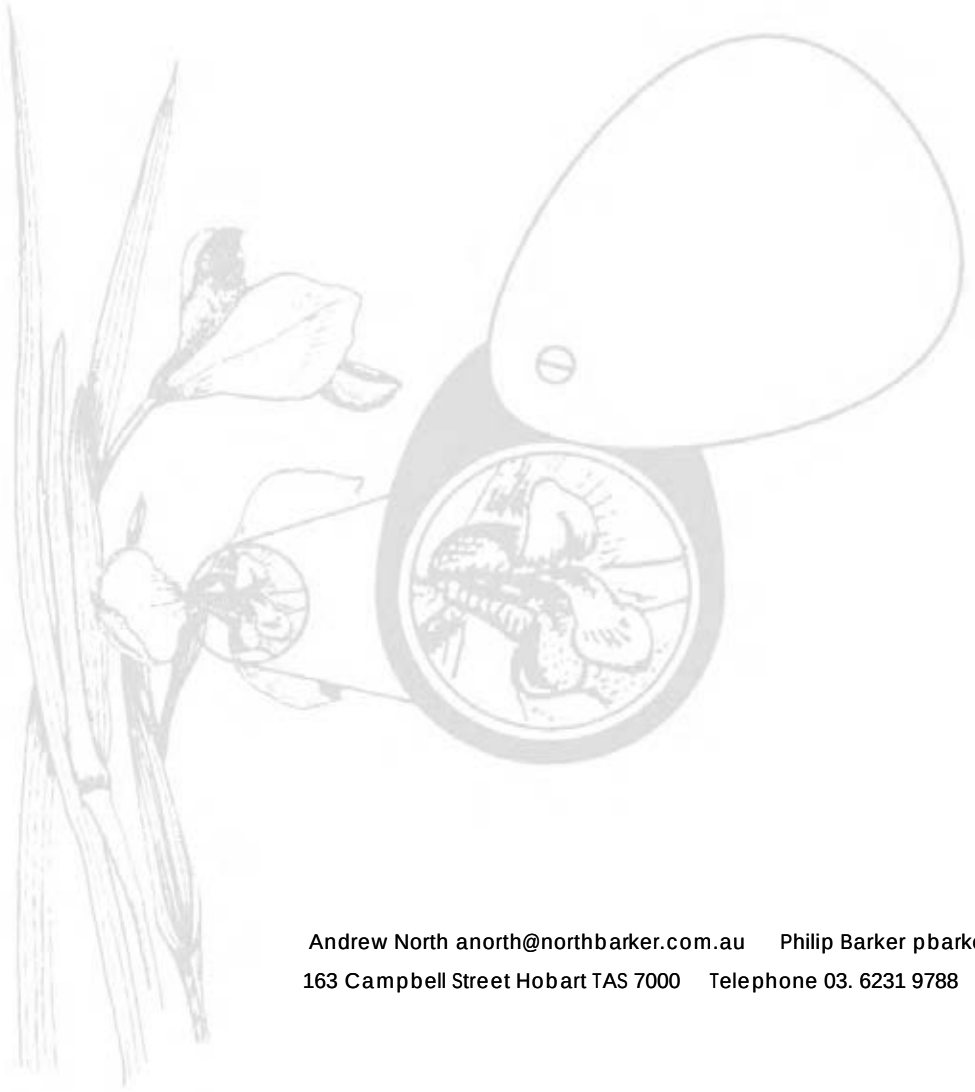
northbarker
ECOSYSTEM SERVICES

Holyman Avenue – Hobart Airport Interchange Project

Compliance Statement – Local Planning Scheme

31st July 2017

For Pitt & Sherry obo State Growth (DSG004)



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Background and aims

North Barker (NBES) have been engaged to undertake a compliance statement for the Department of State Growth's Hobart Airport interchange project (Holyman Avenue), against the Clarence Interim Planning Scheme Natural Assets Code and the Waterway and Coastal Protection Code.

Natural Assets Code E27 of the Clarence Interim Planning Scheme 2015

The proposal includes land within the area covered by the Biodiversity Protection Area (BPA) overlay and as such triggers a requirement to address the Natural Assets Code (E27) of CIPS (Figure 1[1]).

The general purpose of the provisions of E27 are to:

(a) protect identified threatened native vegetation communities and threatened flora species;

(b) conserve threatened fauna by minimising habitat clearance and managing environmental impact; and

(c) protect other native vegetation recognised as locally significant by the Planning Authority.

Specifically, the proposal must meet the standards relating to development (E27.8.1), to ensure that:

(a) Priority vegetation is adequately protected;

(b) Loss of vegetation is minimised;

(c) Long term management plans are implemented; and

(d) Impacts from construction and development activities are minimised and residual impacts appropriately managed.

Impacts are classified as either being Major, Minor or Negligible depending on their impact to 'priority vegetation'.

Priority vegetation means vegetation that has high biodiversity value because it:

(a) forms an integral part of threatened vegetation;

(b) is a threatened flora species;

(c) provides habitat for a threatened fauna species; or

(d) is otherwise identified by the Planning Authority as locally significant.

All of the native vegetation within the area of the BPA specified in Figure 1 is classified as priority vegetation, with different patches qualifying in relation to some or all criteria. Our explanations of compliance with the requirements of the scheme focus on vegetation at the community level, as in this case that also covers the presence of species values within the patches, which include threatened flora and threatened fauna habitat.

E27.6 Impact Classification

The project will not constitute a major impact as the proposed works are not likely to cause a significant impact upon priority vegetation irrespective of mitigation. Avoidance of significant impacts (in accordance with the definition in the

[1] Supporting maps are found in Figure 2 and 3

Commonwealth *Environment Protection and Biodiversity Act 1999 - EPBCA*) through redesign and mitigation was part of the natural values assessment undertaken for the proposal by NBES – see report dated 16th June 2017, available from proponent. By applying mitigation measures to reduce impact, the proposal thus constitutes a minor impact in accordance with section 27.6.

27.8 Development standards

Under section 27.8.1, there is no acceptable solution (A1) for minor impacts. The current proposal must therefore meet the performance criteria (P1).

(a) The clearance of native vegetation is the minimum extent necessary for the development (including bushfire hazard minimisation);

State Growth commissioned comprehensive environmental surveys to assess impacts of the project and inform mitigation strategies. The outcomes of the ecological assessment resulted in a redesign of the footprint to minimise the direct overlap with the critically endangered lowland native grasslands of Tasmania community. Given the road corridor available for the design of the road duplication, there were constraints on the degree to which the grasslands could be avoided. Several options were worked through to minimise impacts whilst maintaining road safety and engineering standards. Engineering measures such as altering the steepness of batters and sharpness of bends were implemented during the design refinement phase to further minimise impacts. Through this process of refining design, State Growth has reduced the area of impact to the grasslands from a potential 2.59 hectares with an earlier design (as reported in the North Barker assessment), to 0.91 hectares of direct impact. An additional 0.36 hectares of indirect impact could occur but will be mitigated. Thus, clearance of this priority vegetation was reduced to the minimum extent necessary. By reducing impacts to this community, the proponent also successfully minimised potential impacts to populations of threatened flora and potential threatened fauna habitat within the grasslands.

(b) No burning, blasting or construction works involving excavators or multiple truck movements are to occur within 500 m (or 1 km if in line-of-sight) of an active raptor nest during the breeding season between July to January inclusive.

There are no raptor nests nor suitable nest habitat within 1 km of the subject land.

(c) Additional mitigation measures are proposed to ensure that the development will satisfactorily reduce all remaining impacts on priority vegetation.

To mitigate and compensate for the impacts of fragmentation and increased edge effects, the 0.36 ha patch of priority vegetation that will be isolated from the main patch due to the proposal will be managed to maintain condition at the current level or better. This will primarily involve the control of weed invasion and prevention of the loss of herb diversity, which includes the maintenance of threatened flora populations.

In parallel, the remaining 3.7 ha of priority grassland and 5.4 ha of priority woodland will be placed under a formal management agreement. Management priorities within these areas will concentrate on the control of weeds and the invasion of woody shrubs and trees from the woodland into the grassland. Management will include regular ecological monitoring and reporting to ensure the management is effective at maintaining community condition, threatened flora populations and threatened fauna habitat viability.

The formal management agreement will be guaranteed for perpetuity under the appropriate mechanism. With this in place, the residual impacts from the direct loss of 0.91 ha are not likely to constitute a significant impact to the grassland system as a whole.

To reduce potential impacts upon habitat of the eastern barred bandicoot, new shelter sites should be made with piles of cleared native woody plants (mostly black wattle *Acacia mearnsii* from within the NBA community) placed within the areas of the new management agreements. One new shelter site will be made for every hectare of bandicoot habitat lost – totalling 6 new shelters. The constructed shelter sites will be located within or on the edges of the remaining native vegetation and will be a minimum of 2 cubic metres in size at the time of construction (they are likely to compact later). In addition, the proposal will include the installation of roadside bandicoot awareness signs to reduce potential impacts of roadkill on this species.

As part of works, a Vegetation Management Plan for the contract area will be prepared to ensure retained values are protected and appropriately managed during the period of the contract. Specifically, the contract will identify the locations of threatened values that are not permitted to be impacted and are required to be marked as exclusion zones, and will delineate areas for the storing and movement of materials and machinery that will not further impact threatened values. A Weed Management Plan will also be implemented to protect the sites natural values from weed proliferation as a result of works.

(d) Conservation outcomes and long-term security of any offset is consistent with the Guidelines for the use of Biodiversity Offsets in the local planning approval process, Southern Tasmanian Councils Authority 2013.

The Offset guidelines referred to in P1(d) include a set of principles which can be applied to the proposal. Each principle is considered below.

1. Offsets are the final component of a mitigation hierarchy

1.1 Offsets should only be pursued where all opportunities to avoid and minimise adverse effects on biodiversity values have been exhausted. This approach suggests that:

- Impacts should be avoided to obviate the need for an offset.

- The extent of impact should be limited to the maximum degree possible, thus reducing the scale of any offset.
- Opportunities for rectification and repair such as site rehabilitation following the impact should be investigated.
- Only offset the residual impact (provided that all other principle are met).

The full natural values assessment undertaken by NBES shows how the proponent have adhered to this principle. Specifically, the proposal footprint was altered from the original design to avoid priority vegetation and minimise impacts to a level where offsets only needed to be applied for unavoidable residual impacts.

1.2 The offsetting of impacts of Threatened Vegetation Communities as listed in Schedule 3A of the *Nature Conservation Act 2002* (Tas) is to be avoided in preference to no-impact except:

- The planning authority is satisfied there are 'special circumstances';
- The patch of affected vegetation is of poor or very poor condition, that despite ecological restoration works us unlikely to be viable in the long term; and
- The patch of vegetation is limited in extent in proportion to the total area remaining of that vegetation community on the site.

The proposal has limited occurrences of one community (DVC) listed under the Nature Conservation Act. Only 0.8 ha of the 1.6 ha of DVC on site will be impacted, within an area identified as being more weed infested than any other native vegetation in the area. Around 200 ha of this community is found in the Clarence Council, and examples of the community on adjacent properties such as Milford are in much higher condition, are managed much better and contain several threatened species. The impacts to the DVC are thus considered to be negligible. Instead of looking to preserve the DVC, there can be greater outcomes for conservation by targeting mitigation towards avoidance and management of the more important EPBCA listed grassland community, as has been done by the proponent.

2. Offsets must deliver a net benefit for biodiversity conservation

2.1 The impact must be properly estimated taking into account both direct and indirect impacts brought about by the action:

- Direct impact is the 'footprint of the development'.
- Indirect impact includes associated outcomes resulting from the action. For example subdivision in a residential area implies future housing development with changes to land management associated with permanent human occupancy.

The potential impacts to the threatened grassland community that have been considered during the assessments include 0.36 hectares of indirect impact and 0.91 hectares of direct impact. The indirect impacts could include increased edge effects, reduction in seed and pollen transfer, and other impacts of fragmentation and reduced patch size. A management regime has been suggested as a way to ensure that indirect impacts do not result in a decrease of values within the 0.36 ha patch. Although management of this patch is viable, it is not practical for such a small area in this location to be protected under a formal agreement.

2.2 If the offset is unlikely to result in a net positive gain then the development application should not be approved.

The offset will result in a net positive gain if the management of the larger remaining area of threatened grassland community (and associated woodland) can be formalised, ensuring degrading processes such as weeds and woody plant invasion are controlled and threatened natural values maintained. Current management

practices are informal and the cessation of management could result in a significant decline in vegetation quality. Formal management is thus a significant positive gain.

2.3 Offsets should be consistent with the State principles and policies and should aim to contribute to comprehensive, adequate and representative (CAR) reserve system.

The purpose of CAR Reserve system is to increase the extent and protection of under reserved vegetation communities. The proposed formal management of the areas of woodland and grassland remaining within the project area will contribute to CAR Reserve targets as they will be secured under an appropriate mechanism.

2.4 Use established standards (such as the Protected Areas on Private Land criteria) and reservation targets to identify where an offset can contribute to the (CAR) reserve system.

The vegetation types to be management under formal agreement represent the most significant conservation values on site and include a critically endangered community listed under the EPBCA, which supersedes all CAR standards.

2.5 Offsets should be of a size to ensure that they are ecologically viable and can be managed effectively in the long term.

All the proposed management areas for this proposal are of ecologically viable size, with all but one being over 1 ha, and the smallest site have management issues that can be effectively managed in the long term on a small scale.

2.6 To deliver a net benefit, a direct offset should exceed the impact in value of environmental service as a minimum. As a guide the offset ratio should aim for the conservation of an area:

- 1:1 of similar value for non-threatened vegetation communities;
- 3:1 to 5: 1 for threatened vegetation communities; or
- or other ecological values determined to be of significant by the planning authority within the planning area (such as threatened species habitat).

The 1:1 ratio of non-threatened communities is exceeded and threatened grassland vegetation is protected at a ratio of 4:1. Although threatened vegetation overall is only offset at a 2:1 ratio (including DVC), the site contains no practical opportunity to offset DVC in situ and contains more significant conservations values within the proposed management areas covered by the priority vegetation adjacent to the grasslands. Thus it is considered to be more beneficial to focus the offsets within this vegetation than within DVC.

Community	Impact	Offset	Target Offset ratio	Proportion of offset : Impact
Threatened vegetation Lowland grasslands of Tasmania (0.91 ha), DVC (0.8 ha)	1.71 ha	3.7 ha	3:1 to 5: 1	2:1 but 4:1 for grasslands only
Priority vegetation overall	5.3 ha	9.1 ha	-	2:1

2.7 The management of the offset is as important as the security of the offset:

- Offsets should include costed management actions which are compared with the equivalent management costs of the impacted area.
- Offset should include financial contribution or commitment to management costs for a minimum of 5 years.

The proposed offset is contingent upon formal management to be costed and informed by effective management of equivalent habitats nearby.

> 2.8 Where the planning authority believes a proposed offset has a high risk of failing to return a 'net benefit' over time due to such things as the effort and cost involved in managing the offset, consideration should be given to:
>
> - Not allowing the use or development to proceed; or
> - Incorporating multipliers that reduce the risk such as higher offset ratios that provide some redundancy or additional direct actions that are complementary to indirect offset.

There is no reason to think the offset has a high risk of failing to return a net benefit.

> 2.9 Offsets that are largely reliant upon the future success of actions may include:
>
> - Replacement of loss through additional planting and revegetation works.
> - Restoration of existing secured area that requires management actions.
> - Fencing of degraded areas to improve habitat condition.

The management agreement will cover these factors as necessary and have scope for change with changing condition and/or priorities over time.

> 2.10 An offset should include a suite of actions designed to minimise risk and create a net benefit for biodiversity conservation. These actions may be direct or indirect and include a combination of some or all of the following: protection in situ, protection offsite, restoration, rehabilitation, research, monitoring and financial contributions. When taken as a whole, the benefit of the offset actions must be greater than the scope of the adverse impacts on biodiversity value.

The suggested offset provides the most preferred mechanism of *protection in situ*, supplemented with weed management and control of degrading activities. An outcome of the proposal will be the guaranteed management of a vegetation type that is prone to degrading when unmanaged.

> 2.11 The condition of the biodiversity value(s) potentially impacted and the condition of any biodiversity value(s) proposed to be protected or enhance must be considered and compared when determining whether a proposed offset will achieve a net benefit.

The condition of the offset vegetation is very good (Figure 2) and can be improved as part of achieving a net benefit.

> 2.12 The existing vulnerability of any biodiversity value(s) proposed to be protected or enhanced must be considered when determining whether a proposed offset will achieve a net benefit.

The prescribed appropriate management of the offset will ensure net positive conservation outcome in the long term by countering areas of vulnerability, such as weed invasion.

3. Offsets must aim to be permanent

> 3.1 All proposed offset measures must be included as a condition on the permit authorising the use or development causing the impact. The condition should:
>
> - Identify the location of the offset by title reference.
> - Identify what and how values are to be conserved.
> - Identify the means to secure that offset.

The offset can be easily identified in the permit. It is located within the same titles as the subject lands. The preferred mechanism for the offset is one that provides a level of permanency.

3.2 Legally enforceable mechanisms to secure, monitor and enforce any offset must be provided. Preferred mechanism in descending order:

- Covenant under *Nature Conservation Act 2002*—subject to acceptance from State Government. and where the offset is greater than 10ha in area.
- Conservation Agreement under *Environment Protection and Biodiversity Conservation Act 1999.*
- Part 5 Agreement under *Land Use Planning and Approvals Act 1993* (where a Part 5 Agreement is used, it must be recorded on the title of the offset site).
- Condition of approval on the planning permit.
- Covenant between Council and the title holder.
- Term Management Agreement under *Nature Conservation Act 2002.*

The offset appropriate for the proposed development will be based on previous models applied in other State Growth projects, with some of the above suggested mechanisms not applicable on State Growth proposals.

3.3 Management of the offset is usually necessary to ensure it delivers a permanent conservation outcome;

- Implementation of offset should be audited by the applicant/developer and reported to those party to the offset agreement.
- Management of the offset should be subject to reporting after Year 1, 2, 5 and 10.
- Management of the offset should be available to the broader community where the land is provided for public use.

The prescribed management offset will include reporting and accountability commitments by the proponent.

3.4 Implementation and management of the offset over time must be demonstrated. This may require funding and contractual agreements to be in place prior to the approval.

This can be put in place if considered to be necessary in this scenario.

3.5 Consideration should be given to the transfer of the offset site to the Council or other public authority, where significant management measures are not required or where funding is available to the public authority to cover the cost of the required management action. Examples include:

- Acquisition of the offset site as a public open space contribution for subdivision approved under the *Local Government (Building and Miscellaneous Provisions) Act 1993*
- Incorporation of the offset site into an existing Council or State reserve or other component of an existing open space network, provided that public use of the land will not jeopardise the biodiversity value(s) intended to be protected.

The offset land will be under the control of a public authority (State Growth).

4. Offsets must aim to be 'like for like'

4.1 Offsets should generally be for the same species, habitat or vegetation community that is being impacted.

The values impacted and being used for the offset are the same or of higher conservation significance.

4.2 The Vegetation Condition Assessment Method is to be used as a basis for categorising and comparing the condition of vegetation communities.

This has been done and reported in Figure 2.

4.3 Offsets that are not 'like for like' are only appropriate where:

- No suitable offset that provides 'like for like' is available or appropriates;
- An offset will provide a net benefit for a biodiversity value of equal or greater ecological significance in the bioregion; and
- It is in accordance with a Council endorsed biodiversity conservation strategy for the planning area

The offset is like for like in the case of the grasslands. No opportunity is available for a like for like offset of DVC, but the values to be protected within the woodlands adjacent to the grasslands are considered to be more significant, containing threatened flora species, threatened fauna habitat and aiding in the ecological integrity of the grasslands.

4.4 Offsets are designed to assist in the conservation of biodiversity values. However, where consistent with this principle, consideration can be given to offsets that also conserve other 'social values' that may be impacted upon such as::

- Offsets that also conserve important skyline or hill face areas
- Offsets that conserve biodiversity values in the same neighbourhood, suburb or catchment as that within which the impact is proposed
- Offsets that provide some recreational or other open space value to the local community.

None of these apply.

4.5 Offsets that are not like for like should be subject to third party validation, by the State or other peer review body, to ensure their appropriateness.

Not applicable.

5. Indirect offsets (financial contributions) are acceptable in limited circumstances where direct offsets are unachievable

Not applicable.

6. Retention of native vegetation onsite is preferred.

6.1 Preference should be given to offsets that secure the formal protection and management of conservation values on the same property that is subject to the impact, except where a greater biodiversity benefit can be gained through an offsite offset..

The offset secures the formal protection and management of conservation values on the same property that is subject to the impact.

6.2 In circumstances where there is a limited opportunity for an adequate offset to be implemented onsite, then off-site offsetting should be pursued.

Not applicable.

6.3 Where offsite offsetting is pursued, preference is given to:

- Offsets that are contiguous with, or near to, other reserved or managed habitat; or
- Offset in the same neighbourhood, suburb or catchment as the impact.

Not applicable.

6.4 Unless the offset forms part of a package developed at the State or Federal level, the offset must be within the planning area of the relevant planning authority.

The offset falls within Clarence Council.

6.5 The location of an offset, being either onsite or offsite, is a balance between implementation and management of the offset, and the best location where conservation gains can be made within the planning area.

The chosen location for the offset provides a good opportunity to secure its implementation and management.

7. Offsets are formulated and approved in the context of the established planning system.

7.1 Recognise where native vegetation clearance is regulated by other 'authorities':

- Ensure planning schemes avoid unnecessary duplication of assessment; and
- Where there are dual assessment responsibilities between a local planning authority and other authority, avoid duplication in the development of offset packages.

The offset forms part of the development application thus complying with this principle. The proposal is also included in a voluntary submission to the Federal Department of the Environment. This clearance is not regulated though any other mechanisms.

7.2 Provided a planning scheme controls native vegetation clearance, planning authorities should regulate non-threatened native vegetation clearance based on local biodiversity values.

Regulated in this case through application of the Natural Assets Code to areas within the BPA.

7.3 Local planning authorities may set thresholds for loss of non-threatened native vegetation (where is does not contain habitat for threatened species) in some areas, or for some communities, below which approval may either not be required or may be 'permitted'.

- Offset packages should not be developed for impacts that are below these thresholds. In other words use or development subject to offset packages, are identified as 'discretionary' applications.

Not applicable.

7.4 For threatened species and significant habitat for threatened species:

- Impacts to State and Commonwealth threatened species and habitat are best addressed by the appropriate regulating authority. The proponent should inform the planning authority of the advice/determination made by the relevant authority to help inform appropriate planning decisions. The mechanisms for approval and offsetting in these instances are addressed outside of the *Land Use Planning and Approvals Act 1993*.
- Recognise however the *Threatened Species Protection Act 1995* is limited to regulating direct impacts and cannot regulate impacts to habitat.

The *Threatened Species Protection Act 1995* does not regulate impacts to threatened fauna habitat. Impacts to threatened flora will be assessed under this Act, but have also been offset due to populations within the proposed management areas.

7.5 All proposed offsets must form part of the development application resulting in the adverse impact.

The offset is part of the application.

7.6 All consents required to facilitate a proposed offset should be obtained prior to the approval of the development application.

Not relevant as the proponent of the development is the owner of the offset land.

7.7 Where an off-site offset is proposed, the development application must be treated (and advertised) as relating to both the site of the use or development and the offset site.

The offset is NOT offsite. As the offset is part of the application then it will form part of the advertised application.

In conclusion, it is considered that the proposed development meets the performance criteria of the E27 Natural Assets Code in relation to impacts to priority values within the Biodiversity Protection Area.

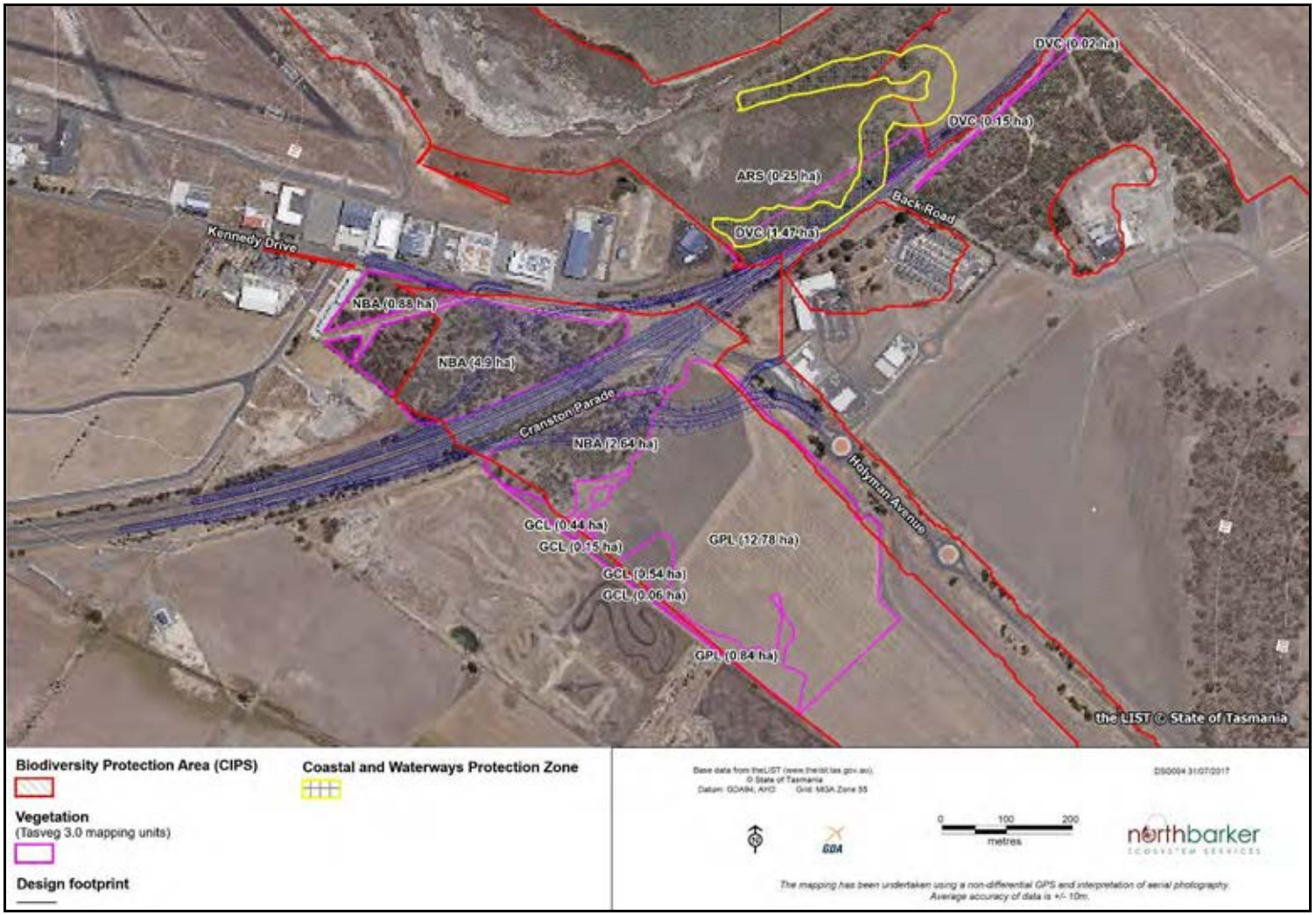

Figure 1: Extent of intersection of Biodiversity Protection Area (BPA) and Waterway and Coastal Protection Code in relation to direct footprint of proposal and distribution of TASVEG units – note the area of ARS buffered by the Coastal and Waterways Protection Zone is also subject to E11

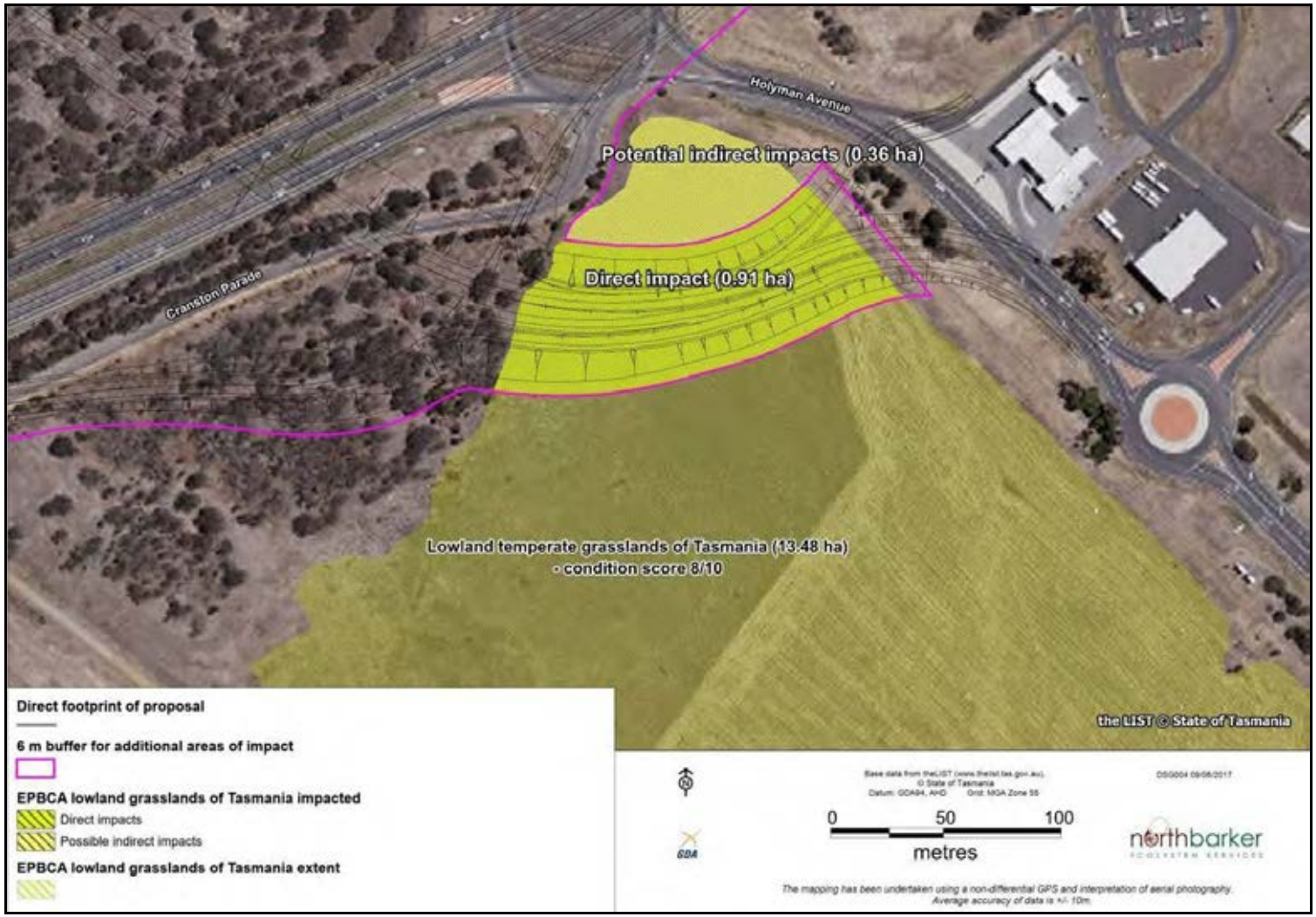

Figure 2 - Expected impacts to EPBCA lowland grasslands of Tasmania

Figure 3 - Proposed management zones to compensate for direct loss of EPBCA grassland and other priority vegetation (additional woodland management zones)

Waterway and Coastal Protection Code E11 of the Clarence Interim Planning Scheme 2015

The proposal includes land within Waterway and Coastal Protection Areas (Figure 1[2]) and thus meet the requirements of E11.

The general purpose of E11 is to manage vegetation and soil disturbance in the vicinity of wetlands, watercourses and the coastline in order to:

(a) minimise impact on water quality, natural values including native riparian vegetation, river condition and the natural ecological function of watercourses, wetlands and lakes;

(b) minimise impact on coastal and foreshore values, native littoral vegetation, natural coastal processes and the natural ecological function of the coast;

(c) protect vulnerable coastal areas to enable natural processes to continue to occur, including the landward transgression of sand dunes, wetlands, saltmarshes and other sensitive coastal habitats due to sea-level rise.

(d) minimise impact on water quality in potable water supply catchment areas.

Specifically, the proposal must meet the standards relating to development of buildings and works (E11.7.1), to ensure that buildings and works in proximity to a waterway, the coast, identified climate change refugia and potable water supply areas will not have an unnecessary or unacceptable impact on natural values.

11.7.1 Development standards for buildings and works

Under section 11.7.1, the proposal does not meet acceptable solution A1 as it is not "within a building area on a plan of subdivision approved under this planning scheme". The current proposal must therefore meet all the performance criteria P1.

a) avoid or mitigate impact on natural values;

Impacts to natural values within the Waterway and Coastal Protection Area (WCPA) are the minimum required to undertake the necessary road widening to complete the project. Avoidance of the threatened wetland habitat (the area intended to be protected by the Waterway and Coastal Protection Area) has been achieved entirely.

b) mitigate and manage adverse erosion, sedimentation and runoff impacts on natural values;

No adverse effects of this nature are anticipated within the WCPA, but an erosion and sediment control plan will be implemented if deemed necessary during works and unanticipated effects arise.

c) avoid or mitigate impacts on riparian or littoral vegetation;

No riparian or littoral vegetation will be impacted.

d) maintain natural streambank and streambed condition, (where it exists);

No such habitats exist on site.

e) maintain in-stream natural habitat, such as fallen logs, bank overhangs, rocks and trailing vegetation

No such habitats exist on site.

[2] Supporting maps are found in Figure 2 and 3

f) avoid significantly impeding natural flow and drainage;

Existing drains will be maintained so that current flow is not impeded. Additional culverts will be installed under the new road and use existing drains. Detention basins (or similar) are likely to be used to slowly release storm water off new roads into the existing drains.

g) maintain fish passage;

Not applicable.

h) avoid landfilling of wetlands;

No landfilling will be undertaken within the WCPA.

i) **works are undertaken generally in accordance with 'Wetlands and Waterways** Works Manual (DPIWE, 2003) and Tasmanian Coastal Works Manual (DPIPWE, Page and Thorp, 2010), and the unnecessary use of machinery within watercourses or wetlands is avoided.

No machinery will be used within the wetland area and it will be written into works contracts that the specified guidelines must be followed.

Acceptable solutions A2, A3, A4

Under section 11.7.1, the proposal meets acceptable solutions A2, A3 and A4 as it is not within a Future Coastal Refugia Area, or a Potable Water Supply Area, and does not involve new storm-water discharge into a watercourse, wetland or lake.

In conclusion, it is considered that the proposed development meets the performance criteria and/or acceptable solutions of the E11 Waterway and Coastal Area Protection Code.

Appendix D

Exemption from Tasmanian Heritage Council

Tasmanian Heritage Council
GPO Box 618 Hobart Tasmania 7000
103 Macquarie St, Hobart Tasmania 7000
Tel: 1300 850 332
enquiries@heritage.tas.gov.au
www.heritage.tas.gov.au

PLANNING REF: n/a
EXEMPTION NO: 1809
REGISTERED PLACE NO: 1032
FILE NO: 10-10-92 THC
APPLICANT: Department of State Growth
DATE: 05 January 2017

CERTIFICATE OF EXEMPTION

(*Historic Cultural Heritage Act 1995*)

The Place: Llanherne House, 1309 Tasman Highway, Cambridge

Thank you for your application for a Certificate of Exemption for works to the above place.

Your application has been approved by the Heritage Council under section 42(3)(a) of the *Historic Cultural Heritage Act 1995* for the following works:

Works: Upgrade of the Tasman Highway – Holyman Avenue Intersection.

Documents: Site plan indicating the location of the works in relation to Llandherne House (supplied by the applicant).

Comments: The upgrade will require the acquisition of a small area of the Hobart International Airport property immediately adjacent to the current road boundary at the intersection. The works are distantly removed from the listed property Llanherne House and its curtilage.

A copy of this certificate will be forwarded to the local planning authority for their information. A planning, building or plumbing permit from the local planning authority may be required for the works. Further advice regarding these requirements should be obtained from the local council or planning authority.

Further information on the types of work that may be eligible for a Certificate of Exemption is available in the Tasmanian Heritage Council's *Works Guidelines*. The *Guidelines* can be downloaded from www.heritage.tas.gov.au

Please contact Russell Dobie on 1300 850 332 if you require further clarification of any details contained in this certificate.

Russell Dobie
Regional Heritage Advisor – Heritage Tasmania
Under delegation of the Tasmanian Heritage Council

Appendix E

Noise Assessment

Hobart Airport Interchange
Environmental Noise Report

transport | community | mining | industrial | food & beverage | carbon & energy

Prepared for:	**Department of State Growth**
Client representative:	**Sven Meyer**
Date:	**23 February 2018** **Rev00**

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Appendices

Appendix 1: Noise Data
Appendix 2: Environmental Noise Survey Sheets
Appendix 3: Weather Data

Prepared by: Date: 23 February 2018

Linda Drummond

Reviewed by: Date: 23 February 2018

Douglas Ford

Authorised by: Date: 23 February 2018

Andy Turner

Revision History					
Rev No.	**Description**	**Prepared by**	**Reviewed by**	**Authorised by**	**Date**

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1. Introduction

The Department of State Growth has requested that **pitt&sherry** undertake a traffic noise assessment for the proposed interchange at Tasman Highway / Holyman Avenue near the Hobart International Airport in order to determine whether traffic noise from the proposed interchange could exceed the acceptable levels provided in the Tasmanian State Road Traffic Noise Management Guidelines (October 2015) and if so what noise mitigation measures may be appropriate.

The investigation has involved traffic noise measurements and computer modelling of expected traffic noise.

The existing noise environment, recommended limits and criteria for the proposed development and the modelled future traffic noise impacts with and without mitigation are discussed.

This traffic noise assessment has been conducted for the concept design.

2. Project and site description

The Holyman Avenue roundabout on the Tasman Highway provides direct access to Hobart International Airport and is a corridor connector for the growing residential area of Sorell and the Southern Beaches. The purpose of the proposed interchange is to increase the flow of traffic both to and from Hobart and Sorell / Southern Beaches and the airport.

The location and design of the proposed interchange is depicted in Figure 1.

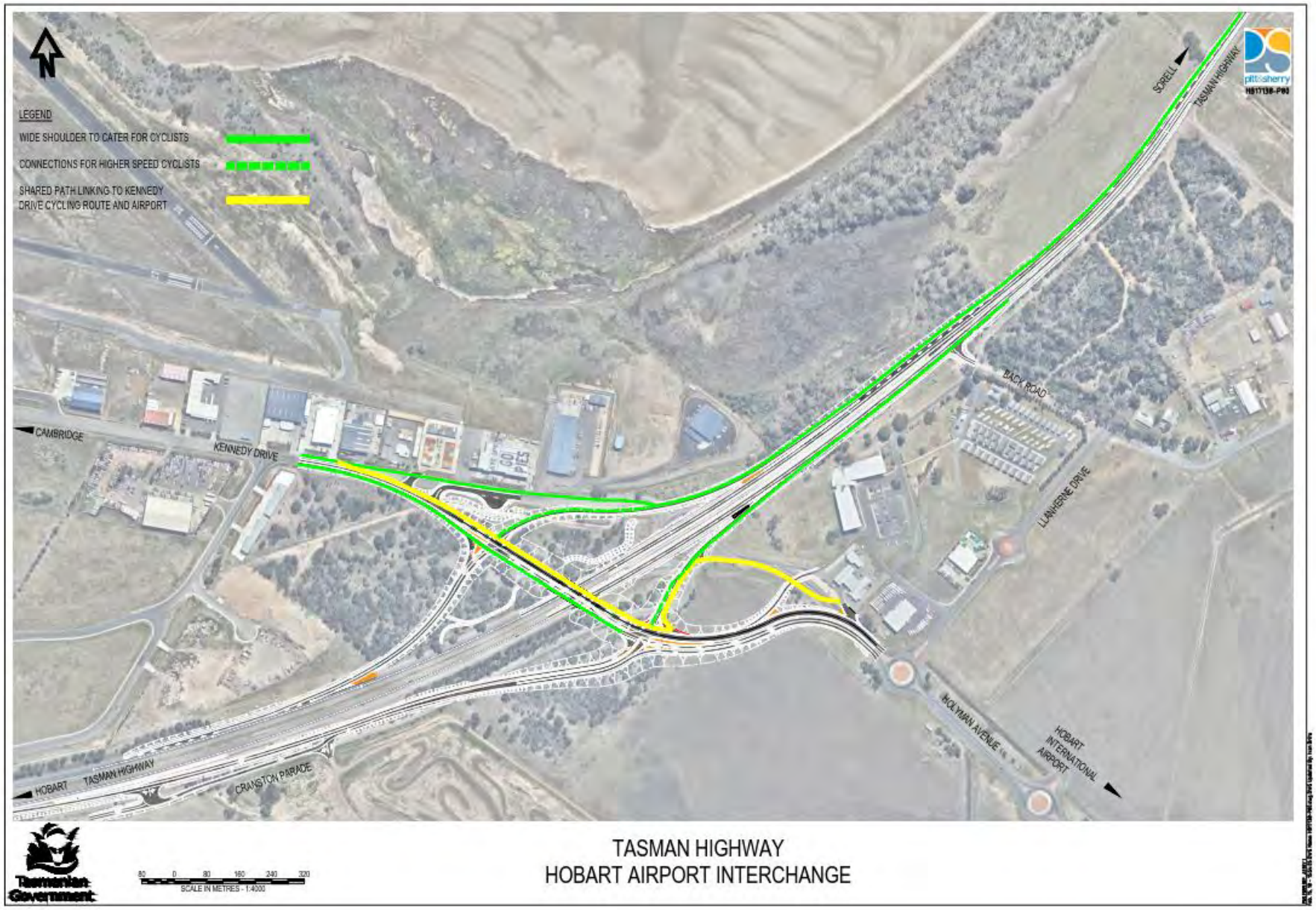


Figure 1 Proposed interchange

3. Regulatory framework and traffic noise guidelines

The regulations, policies and guidelines governing noise from the proposed road include:

- *Environmental Management and Pollution Act* 1994 – Environmental Protection Authority
- *Environmental Protection Policy (Noise)* 2009 – Environmental Protection Authority, and
- *Tasmanian Traffic Noise Management Guidelines* 2015 – Department of State Growth.

3.1 Environmental Management and Pollution Control Act 1994

The *Environmental Management and Pollution Control Act* (EMPCA) (1994) section 53(3) states:

> *Where an offence under subsection (1) or (2) is constituted by the emission of noise that is not an emission specified in an environment protection policy to be an environmental nuisance, the emission is to be taken to unreasonably interfere with a person's enjoyment of the environment if it is unreasonable having regard to:*
>
> *a) Its volume, intensity or duration; and*
>
> *b) The time, place and other circumstances in which it is emitted; and*
>
> *c) In the case of noise emitted from residential premises, whether it is, or is likely to be, audible in a habitable room in any other residential premises.*

EMPCA is the primary environment legislation in Tasmania. EMPCA calls for best practice environmental management in order to achieve an ongoing minimisation of the activity's environmental harm through cost effective measures assessed against the current relevant international and national standards.

Often, a noise increase of more than 5 dB(A) is considered to be a potential environmental nuisance. Conversely, increases of 5 dB(A) or less are generally considered to be acceptable.

3.2 Environmental Protection Policy (Noise) 2009

An Environment Protection Policy (Noise) 2009 has been established under EMPCA. The objective of this policy is to define environmental objectives with programs on how to achieve them. Part 4 (clause 11) of this policy discusses transport infrastructure. It recognizes that the operation and use of roads may prejudice the protection of environmental values but that the function is necessary for the community's economic, environmental and social wellbeing. The policy requires the planning of such infrastructure to be done in such a way to achieve an optimal balance of economic, environmental and social benefits.

The policy further states that:

> *(2) Notwithstanding sub-clause (1), it is intended that:*
>
> *(a) Transport planning initiatives for freight and passenger movement and new transport infrastructure be developed in a systematic way to achieve an optimal balance of economic, environmental and social benefits and costs with a major criterion of minimising the number of people exposed to noise levels that would prejudice protection of the environmental values; and*
>
> *(b) Where environmental values are acutely prejudiced, existing transport infrastructure noise should be reduced to the greatest extent that is reasonably practical, consistent with achieving an optimal balance of economic, environmental and social benefits and costs.*

(3) The allocation of any public resources to minimise noise impacts resulting from public roads, railways, ports or airports shall aim to achieve the most benefit for the greatest number of people exposed to those impacts.

(4) A transport noise strategy will be developed to improve transport noise outcomes, further the objectives of the Act and assist in implementation of subclauses (2) and (3).

The Department of State Growth (previously the Department of Infrastructure, Energy & Resources) accordingly has developed and published a *State Road Noise Strategy* (2011) and accompanying *Tasmanian Traffic Noise Management Guidelines* (2015), which have been endorsed by the EPA.

3.3 Tasmanian State Road Traffic Noise Management Guidelines 2015

The Guidelines approach traffic noise mitigation decision making by firstly identifying "eligible scenarios", which are scenarios where mitigation will be considered, and then identifying "eligible buildings", which are specific buildings within an eligible scenario for which mitigation will be considered.

The Guidelines also explicitly identify scenarios, such as safety upgrades, where mitigation will not be considered. This project is defined as carriageway addition to an existing road within an existing road corridor with the aim to increase traffic volumes; as such the project is deemed eligible and mitigation is being considered.

4. Traffic Noise Assessment Methodology

The assessment methodology included the following steps:

- Measure and model traffic noise for the existing (2016 pre-works) situation
- Validate the noise model
- Model the situation ten years after completion of the proposed road works (2028)
- Explore noise mitigation if necessary
- Compare the pre and post works situations.

5. Traffic Noise Measurements and Traffic Counts

5.1 Traffic Noise Measurements

Noise was measured using the unattended measurement procedure outlined in the Noise Measurement Procedures Manual 2008[1] at three locations. Noise was measured using ARL (Acoustic Research Laboratories) Type 1 and ARL Type 2 Environmental Noise Loggers. The noise measurement locations are described in Table 1 and shown in Figure 2.

Table 1: Noise measurement sites

Noise Measurement Site	Address	Easting	Northing	Measurement period
TH-1	East bound – Tasman Highway	539563	5257557	14 days
TH-2	Near entrance to tourist park – Tasman Highway	540456	5258054	14 days
TH-3	Corner Tasman Highway / Holyman Avenue	540035	5257700	14 days

[1] Tasmanian Department of Environment, Parks, Heritage and the Arts. Noise Measurement Procedures Manual. Second Edition. July 2008.

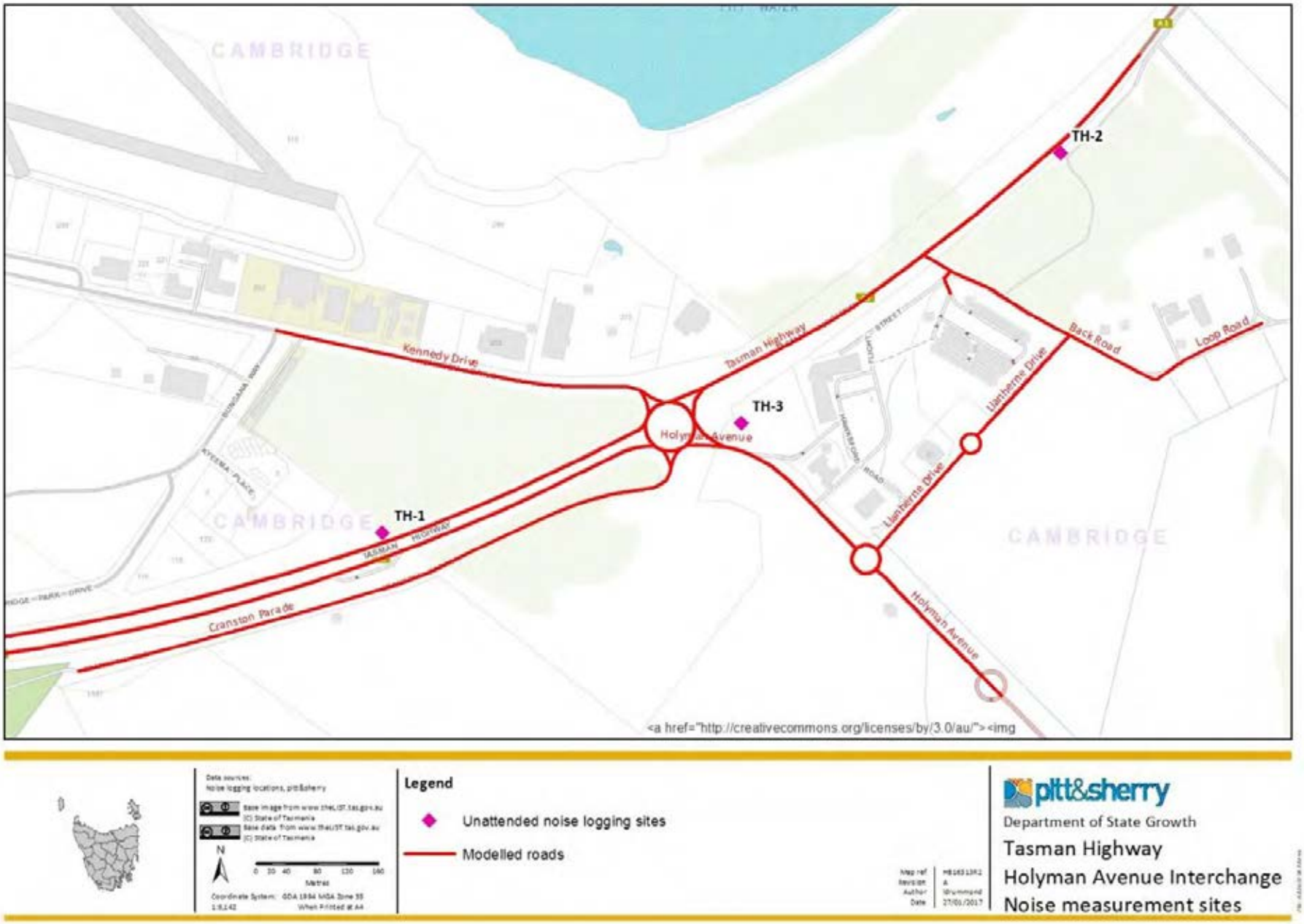


Figure 2 Noise measurement sites

At all sites noise measurements were conducted freefield.

The measured traffic noise levels are found in Appendix 1 and a summary is presented in Table 2. Environmental noise survey sheets and weather data can be found in Appendix 2 and Appendix 3 respectively.

During the measurement period there were high winds and rainfall events occurred. Traffic counts only occurred on three days of the measurement period (28/7/2016, 29/07/2016 and 31/07/2016). Friday 29/07/2016 was used to validate the model as on this date the most favourable weather conditions occurred. The daily noise measurements are summarised in Table 2.

Table 2: Measured LA10,18hr noise at sites TH-1, TH-2 and TH-3

Noise measurement site	TH-1	TH-2	TH-3
28/7/2016	75	76	63
29/07/2016	76	77	63
30/07/2016	75	76	59
31/07/2016	74	75	60
1/08/2016	74	76	60
2/08/2016	75	76	61
3/08/2016	75	77	62
4/08/2016	75	77	60
5/08/2016	75	77	60
6/08/2016	75	76	59
7/08/2016	74	75	59
8/08/2016	74	76	59
9/08/2016	74	76	62
Arithmetic Average	**75**	**76**	**61**

5.2 Traffic Counts

In order to validate the noise model, a traffic survey was taken concurrently with the noise measurements. The survey involved a combination of cameras and tube counts. The details and results of the traffic counts are summarised in Table 3 and are also shown in Figure 3.

Table 3 Summary of traffic counts Friday 29th July 2016

	Tasman Highway west of Holyman Avenue		Tasman Highway east of Holyman Avenue and west of Back Road		Tasman Highway - east of Back Road	Kennedy Drive	Holyman Avenue	Cranston Parade	Back Road
	East bound	West bound	East bound	West bound					
18 hour traffic count	10,529	11,117	8,850	9,575	18,325	3959	7,779	171	650
% heavy vehicles	3.7	3.8	3.8	3.7	3.6	5.1	2.1	60.2	8.4
Speed km/hr	110 / 80	110 / 80	80	80	80	80	60	60	40
Road seal	DGA	DGA	DGA	DGA	DGA +1	DGA	DGA	14 mm chip seal	DGA +1

Note: An additional plus 1 was given to the seal on Back Road and the Tasman Highway east of Back Road due to the large number of joins in the pavement.

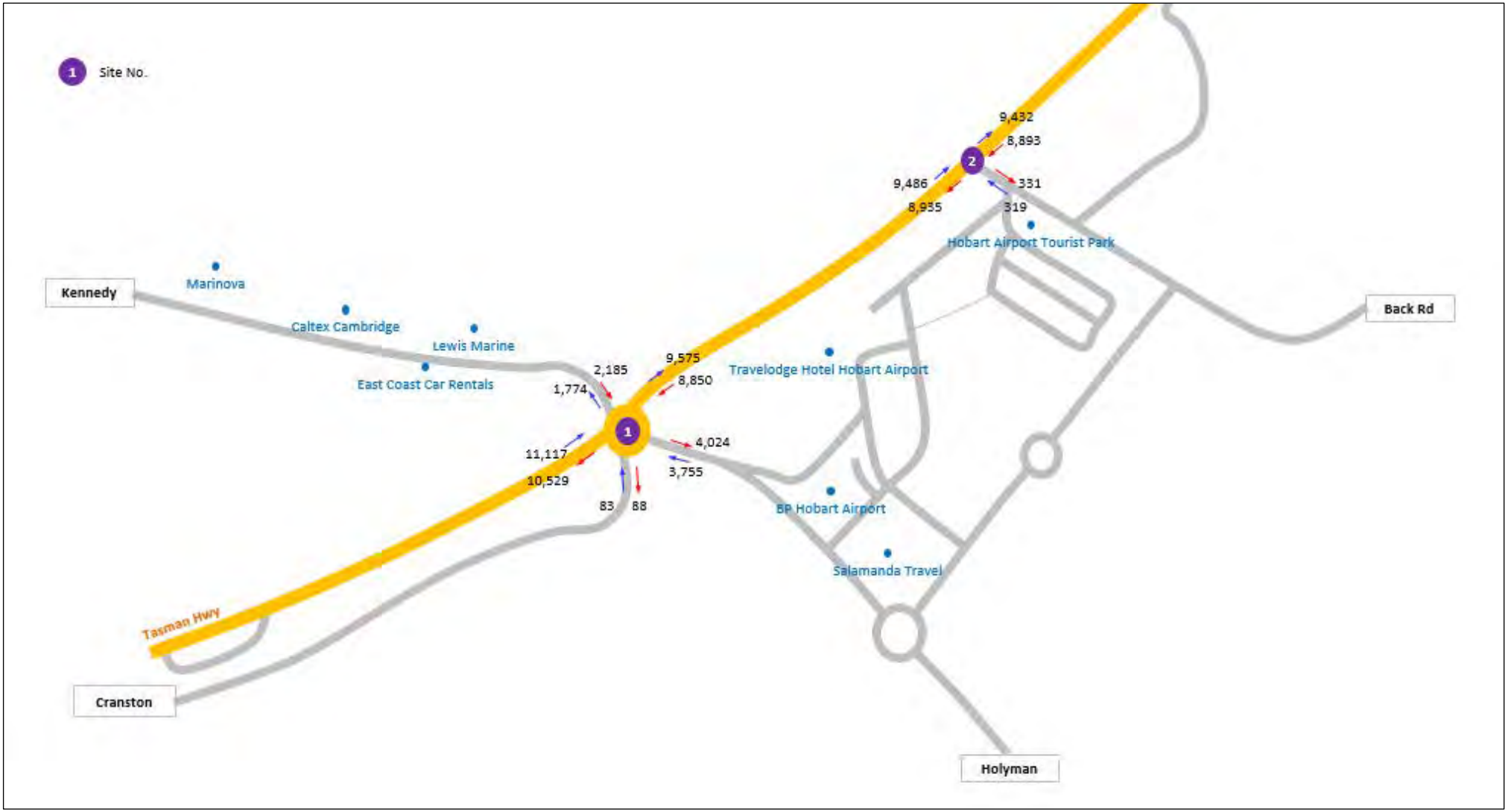


Figure 3 18 hour traffic counts Friday 29th July 2016

5.3 Noise model validation

The measured and modelled noise levels were compared to determine whether the noise model was predicting accurately.

The measured and modelled noise levels (at the logger locations) are listed in Table 4 below.

Table 4: Model validation – measured and modeled noise Friday 29 July 2016

Logger ID	Measured Noise $L_{A10,18hr}$ dB(A)	Modelled Noise $L_{A10,18hr}$ dB(A)	Arithmetic Prediction Difference
TH-1	75	74	1
TH-2	77	73	3[2]
TH-3	63	64	1

At sites TH-1 and TH-3 the measured and modelled noise is 1 dB(A). Differences of 2 dB(A) or less between modelled and measured noise are typically considered to be a good correspondence, showing that the model is predicting well.

However, at TH-2 the measured noise was 3 dB(A) higher than the modelled noise. This larger difference can be attributed to this site's proximity to the airport runway. As well as measuring road traffic noise, the logger was also measuring airport noise. On the logarithmic decibel scale, when two equal noise sources combine they raise the total level by 3 dB(A)). The 3 dB(A) higher measured noise level indicates that, at TH-2, road traffic noise and airport noise are each about 74 dB(A).

5.3.1 Airport noise

Hobart Airport noise is managed through the Commonwealth *Airports Act 1996*. As required by that Act, the Hobart Airport Master Plan 2015 presents Australian Noise Exposure Forecast (ANEF) contours for the airport and surrounds.

Guideline limits for both traffic noise and airport noise are typically based on setting the target maximum limit to be the noise level where 10% of the population would be highly annoyed[3]. The widely used road traffic noise descriptor adopted in Tasmania, L_{10}(18 hour) 63 dB(A), is based on this relationship as is the airport noise ANEF 20 contour.

Aircraft and road traffic noise have different characteristics. For example, traffic noise generally has an underlying continuous nature with occasional peaks due to noisy vehicles whereas aircraft noise is a series

[2] This value is 3, not 4 due to roundings.

[3] NSW Road Noise Policy (March 2011), p. 31 "*Based on research findings, environmental objectives for transportation-related noise sources are set approximately at the point at which 10% of residents are highly annoyed by the noise. This is the case, for example, with aircraft noise, where the 20 Australian Noise Exposure Forecast (ANEF) noise contour (below which the construction of new residences is considered 'acceptable') represents approximately the point at which 10% of residents are highly annoyed.*"

of discrete, high volume events. Noise measurements can take these fluctuating noise levels into account through the use of the Leq metric, which can conveniently be thought of as an average noise level[4]. The

ANEF is also an equal energy noise index and the empirical relationship between ANEF and Leq is generally taken[5] to be approximately ANEF = Leq – 35.

The Hobart International Airport does not have a flight curfew and it can operate 24 hours a day, seven days a week[6]. The airport's predicted ANEF contours are therefore based on a 24 hour period. To allow comparison with road traffic noise, Tasmania's L_{10}(18 hour) metric therefore first needs to be converted to a 24 hour Leq metric. This conversion can be done through the empirical relationship[7] L_{eq}(24 hour) = L_{10}(18 hour) – 3 = 63 – 3 = 60 dB(A).

Using the above relationships, the road traffic noise L_{10}(18 hour) target limit of 63 dB(A) is equivalent to an ANEF of 60 – 35 = 25. Similarly, an L_{10}(18 hour) of 68 dB(A) is equivalent to an ANEF of 68 – 3 – 35 = 30.

The 2009 Master Plan ANEF contours for 2038 are presented in Figure 4 and 2015 Master Plan ANEF contours for the ultimate airport capacity are presented in Figure 5 (the 2009 is referred to because 2015 Plan only provided an ultimate forecast and did not repeat the 2038 forecast). These figures show that the Hotel lies approximately on the ANEF 25 contour and the Tourist Park approximately on the ANEF 30 contour.

This has significant consequences for how traffic noise could be addressed, as will be discussed later.

[4] More accurately, it is the 'equivalent continuous sound level', which is the constant sound level over the measurement period that is equivalent in total sound energy to the time-varying level over the same period

[5] Department of Infrastructure and Regional Development: The Australian Noise Exposure Forecast (ANEF) System https://infrastructure.gov.au/aviation/environmental/transparent_noise/expanding/app_a.aspx

[6] Hobart International Airport Master Plan 2015

[7] Austroads (2005) Modelling, measuring and mitigating road traffic noise. AP-R277/05

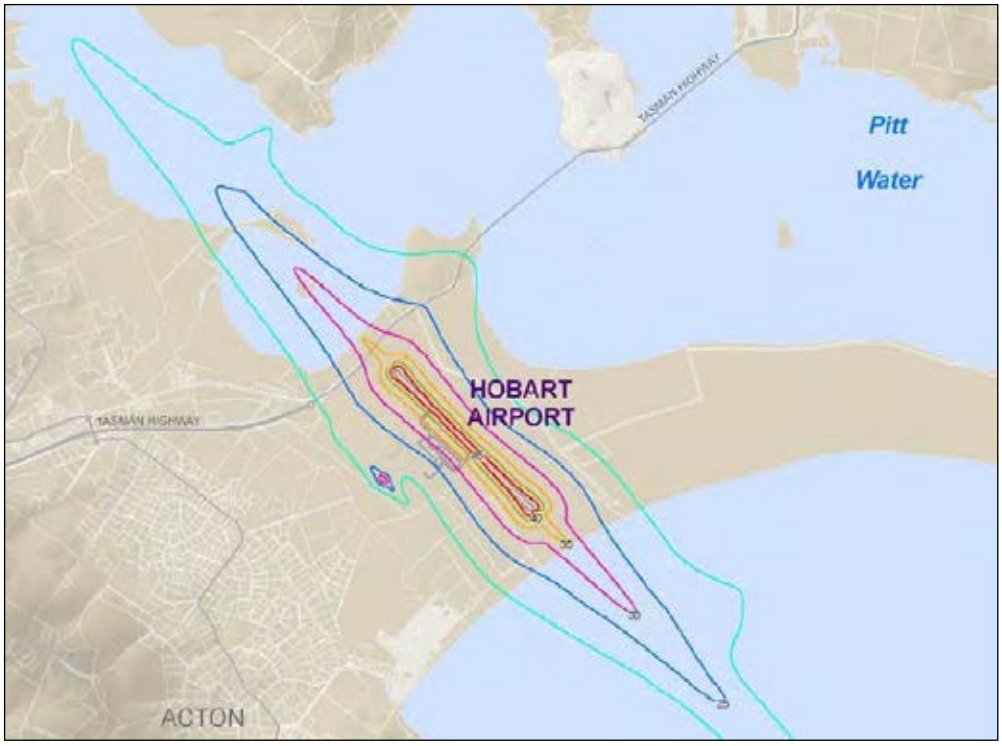


Figure 4 2009 Hobart Airport Master Plan ANEF contours for 2038 airport capacity

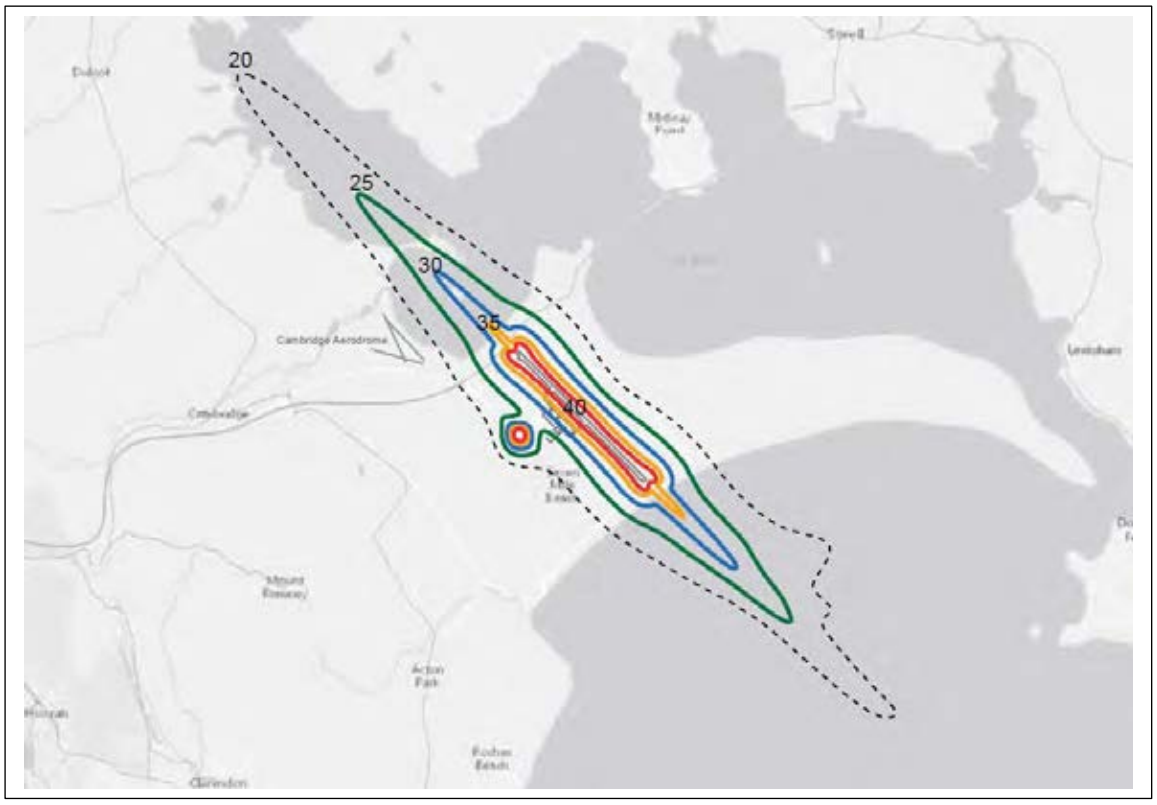


Figure 5 2015 Hobart Airport Master Plan ANEF contours for ultimate airport capacity

6. Traffic noise modelling

Traffic noise was modelled for three situations in SoundPLAN using the $L_{A10,18hr}$ noise descriptor. The situations are:

- 2016 situation using seasonally adjusted traffic counts
- Two 2028 situations using a combination of proposed road seals.

The $L_{A10,18hr}$ noise is defined as the A-weighted noise level exceeded 10% of the time over the 18-hour period between 6 am and midnight.

The $L_{A10,18hr}$ traffic noise was modelled by applying the Calculation of Road Traffic Noise (CoRTN) algorithms.

6.1 Noise Model Methodology

Traffic noise was calculated at single point receivers at the facades of houses. These receivers were set up as per the Guidelines:

- 1 m from those facades of identified sensitive use buildings that face the Tasman Highway
- 1.5 m above the ground.

The identified sensitive use buildings are:

- Hobart Airport Travelodge (1 Holyman Avenue, Cambridge)
- Hobart Airport Tourist Park (1 Holyman Avenue, Cambridge) and
- Little Bee Early Years Learning and Child Care Centre (5 Llanherne Drive, Cambridge).

2016 modelling steps

The modelling steps for the current 2016 situation were:

1. Set up a 3-dimensional terrain model using a combination of survey and LiDAR data
2. Define the modelling area (300 m either side of Tasman Highway centreline)
3. Add the Tasman Highway, Holyman Avenue, Kennedy Drive, Cranston Parade and Back Road centreline together with the traffic counts. Noise was modelled using the seasonally adjusted values for Thursday 28th July 2016
4. Define the seal types along the modelled roads. The road seal along the Tasman Highway, Holyman Avenue, Kennedy Drive and Cranston Parade varies between Dense Graded Asphalt (DGA) and 14 mm chip seal which requires plus 0 or 4 dB(A) respectively to the CoRTN standard which is dense graded asphalt.
5. Add the Identified sensitive use buildings within 300 m either side of the road to the model
6. Add single point receivers to the sensitive use buildings. The receivers were set up 1 m from the facades of houses that face the highway and set at 1.5 m above the ground.
7. Run the model to calculate the 2016 traffic noise environment.

The seasonally adjusted traffic volumes and speeds used for 2016 situation is listed are Table 5.

Table 5 Summary of seasonally adjusted traffic counts Thursday 28th July 2016.

	Tasman Highway west of Holyman Avenue		Tasman Highway east of Holyman Avenue and west of Back Road	Tasman Highway - east of Back Road	Kennedy Drive	Holyman Avenue	Cranston Parade	Back Road
	East bound	West bound						
18 hour traffic count	11,119	10,986	19064	17825	4,116	7,992	188	646
% heavy vehicles	4.3	3.6	3.7	3.6	6.6	3.5	90.9	7.9
Speed km/hr	110 then 80	110 then 80	80	80	60	60	60	60
Road seal	DGA	DGA	DGA	DGA (+1)	DGA	DGA	14 mm chip seal	DGA (+1)

The Thursday values were multiplied by 1.067%.

2028 modelling steps

Two models were setup for the future (2028) situation. Model 1 used 14 mm chip seal for all the road surfaces including the ramps and overpass on the interchange; Model 2 used dense graded asphalt for the Tasman Highway and ramps east of the interchange and for the proposed overpass. The remainder of the roads and Tasman Highway west of the interchange were modelled as 14 mm chip seal.

The modelling steps for the future (2028) situation were:

1. Set up a 3 dimensional terrain model using a combination of survey and LiDAR data
2. Define the modelling area (300 m around the proposed interchange)
3. Add the proposed interchange design
4. Set the road seal as 14 mm chip seal or dense graded asphalt depending on whether using model 1 or 2. These require a plus 4 dB(A) or 0 dB(A) respectively to the CoRTN standard which is a dense graded asphalt
5. Add the identified sensitive use buildings within 300 m either side of the road to the model
6. Add single point receivers to the sensitive use buildings. The receivers were set up 1 m from the facades of houses that face the main road and set at 1.5 m above the ground.
7. Run the model to calculate the 2028 traffic noise environment for both seal types.
8. Where necessary run the wall module to determine the length and height of a noise wall required to reduce noise levels below 68 dB(A)
9. Where necessary recalculate noise levels with the proposed noise wall in place.

Figure 6 shows the noise assessment locations used in the model. The traffic volumes and speeds used for the modelling the 2028 situations are listed in Table 6.

Figure 6 Assessment locations used in the noise model

Table 6 Modelling variables for the 2028 situation Tasman Highway / Holyman Avenue Interchange

Modelled variable	Tasman Highway - west of overpass		Tasman Highway - east of overpass		West of overpass		East of overpass		Holyman Avenue		Kennedy Drive		Overpass		Llanherne Drive	Back Road	Cranston Parade
Traffic direction	Eastbound	Westbound	Eastbound	Westbound	Off ramp	On ramp	Off ramp	On ramp	North	South	West	East	East	west	Both	Both	Both
18 hour traffic volume	10,688	12,741	14,645	14,026	6,669	7,039	1,285	3,957	9,298	8,674	2,958	3,630	4383	7773	2845	3207	291
Percentage heavy vehicles	10		10		5		5		5		5		5		5	5	50
Speed limit	110 km/hr		110 km/hr		60		60		60		60		60		60	60	60
Road seal	Model 1 and 2: 14 mm chip seal		Model 1: 14 mm chip seal Model 2: DGA		Model 1 and 2: 14 mm chip seal		Model 1: 14 mm chip seal Model 2: DGA		Model 1: 14 mm chip seal Model 2: DGA		Model 1 and 2: 14 mm chip seal		Model 1: 14 mm chip seal Model 2: DGA		Model 1 and 2: 14 mm chip seal	Model 1 and 2: 14 mm chip seal	Model 1 and 2: 14 mm chip seal

7. Predicted Traffic Noise

Traffic noise was modelled for the pre (2016) and post (2028) project situations; noise mitigation in the form of dense graded asphalt and walls was also explored. The results of this modelling are discussed below.

7.1 Predicted traffic noise levels – current (2016) situation

Predicted traffic noise levels for the current 2016 situation are listed in Table 7. While the Traffic Noise Guidelines only assess receivers on the ground floor (GF) the modelled noise levels for the receivers located on the first floor (F1) at the Travelodge have been provided also, as an indication of the different exposure of hotel levels.

Table 7 Predicted traffic noise levels – 2016 situation

Receiver		Floor	Direction	LA10,18hr dB(A)
Hobart Airport Tourist Park	Building 1	GF	NW	58
	Building 2	GF	NW	57
	Building 3	GF	NW	59
	Building 4	GF	W	63
	Building 5	GF	NW	60
	Building 6	GF	NW	62
Little Bee Early Years Learning and Child Care Centre		GF	SW	54
		GF	NW	55
		GF	SE	Not assessed
Travelodge Hotel Hobart Airport		GF	W	63
		F 1	W	65
		GF	N	63
		F 1	N	67
		GF	W	65
		F 1	W	67

At the Travelodge Hotel, the noise levels are currently modelled to be equal to or greater than 63 dB(A). Both the child care centre and the caravan park currently have noise levels less than or equal to 63 dB(A).

7.2 Predicted traffic noise levels – future (2028) situation with and without mitigation

Predicted traffic noise levels for the 2028 situation, assuming 14 mm chip seal and no mitigation, are listed in Table 8. The table also shows the categorisation that the receivers would receive under the Traffic Noise Guidelines, ignoring for the moment the complicating issue of airport noise.

While the Noise Guidelines only assesses receivers on the ground floor (GF) the modelled noise levels for the receivers located on the first floor (F1) at the Travelodge have been provided also, again as an indication of the difference in noise at different hotel levels. Note, however, that under the Noise Policy, F1 (and above) levels are ineligible for mitigation.

Table 8 Predicted traffic noise levels – 2028 situation, 14 mm chip seal

Receiver		Floor	Direction	Current (2016) traffic noise level	2028 14 mm chip seal	Noise Guideline categorisation	Hence 2028 target level
Hobart Airport Tourist Park	Building 1	GF	NW	58	67	63-plus	63
	Building 2	GF	NW	57	66	63-plus	63
	Building 3	GF	NW	59	68	63-plus	63
	Building 4	GF	W	63	71	63-plus	63
	Building 5	GF	NW	60	69	63-plus	63
	Building 6	GF	NW	62	71	63-plus	63
Little Bee Early Years Learning and Child Care Centre		GF	SW	54	62	Ineligible	Ineligible
		GF	NW	55	62	Ineligible	Ineligible
Travelodge Hotel Hobart Airport		GF	W	63	69	63-plus	63
		F 1	W	65	71	Ineligible	Ineligible
		GF	N	63	72	68-plus	68
		F 1	N	67	76	Ineligible	Ineligible
		GF	W	65	74	68-plus	68
		F 1	W	67	76	68-plus	68

Table 8 models traffic noise only, and shows that if airport noise is ignored, the Noise Guideline target noise levels for mitigation would be 63 dB(A) at the Tourist Park and 68 dB(A) at the Hotel. However, the Guidelines do not contemplate a scenario of roadworks adjacent to an airport and they cannot be directly applied to this unique situation. Project-specific targets are necessary.

When comparing adverse effects of noise from different sources, if there is a difference of 3 dB(A) or more between two sources then the highest source dominates.

The ANEF predictions (section 5.3.1) show that Tourist Park lies approximately on the ANEF 30 contour, equivalent to a traffic noise level of 68 dB(A), and the Hotel lies approximately on the ANEF 25 contour, equivalent to a traffic noise level of 63 dB(A).

At the Tourist Park attenuating road traffic noise to anything more than 3 dB(A) below 68 dB(A) (ANEF 30) would be of no amenity benefit because airport noise would dominate. The appropriate target at the Tourist Park is therefore 3 dB(A) below 68 dB(A), i.e. L_{10}(18 hour) 65 dB(A).

At the Hotel, the Guideline road noise target is 68 dB(A), while the ANEF is 25, equivalent to 63 dB(A), so traffic noise dominates. In this case, the Guideline target of 68 dB(A) is in fact appropriate.

The traffic noise targets are therefore: **Tourist Park L_{10}(18 hour) 65 dB(A); Hotel L_{10}(18 hour) 68 dB(A).**

Noise mitigation modelling targeting 68 dB(A) at the Hotel (the closest of the two to the interchange) was undertaken, assessing two options: Model 1 kept 14 mm chip seal but added a noise wall (see Figure 7 for location); Model 2 had no wall but on the eastern half of the project replaced the 14 mm chip seal with dense graded asphalt (which is 4 dB(A) quieter).

Modelling results are shown in Table 9.

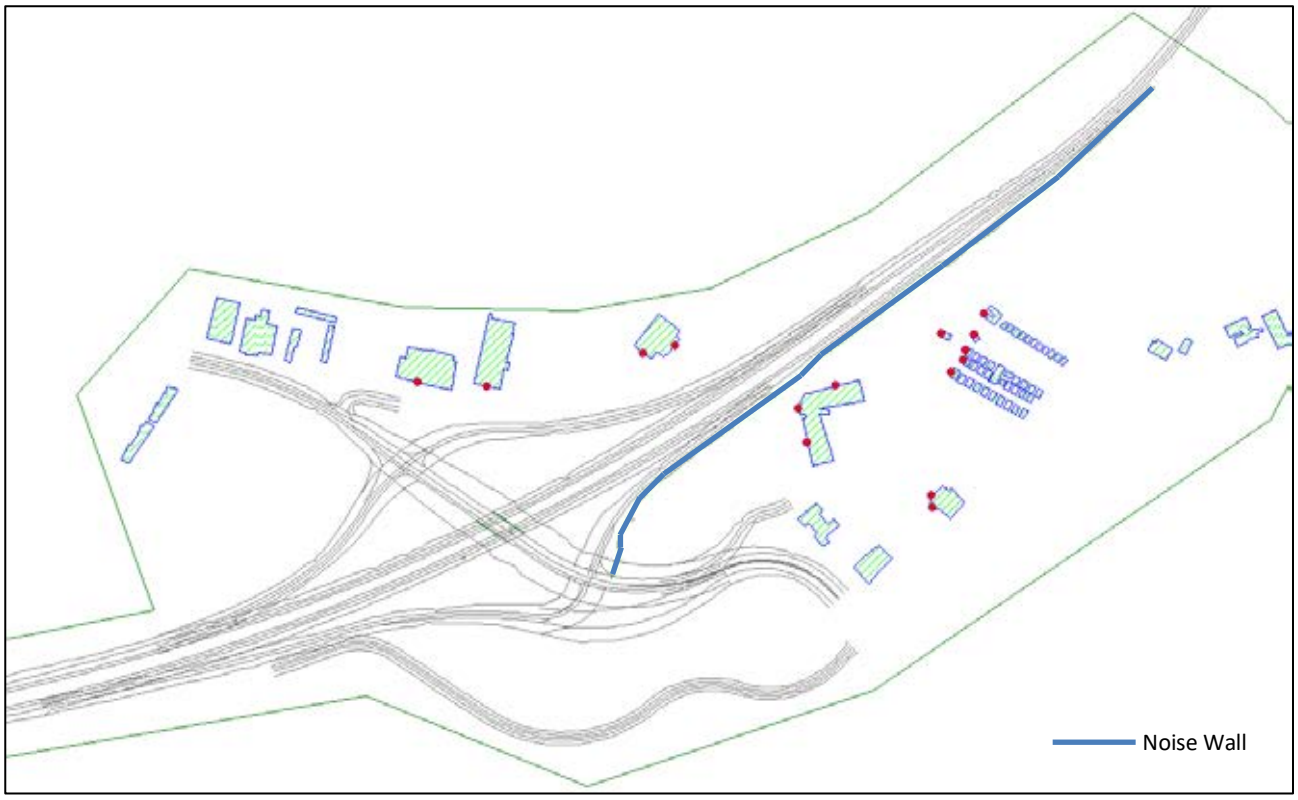


Figure 7 - Proposed Noise Wall

Table 9 Predicted traffic noise levels – 2028 situation, mitigation Models 1 and 2

Receiver		Floor	Direction	Current (2016) traffic noise level	2028 14 mm chip seal no mitigation	2028 Model 1 14 mm chip seal and wall	2028 Model 2 14 mm chip seal and dense graded asphalt
Hobart Airport Tourist Park	Building 1	GF	NW	58	67	65	63
	Building 2	GF	NW	57	66	64	63
	Building 3	GF	NW	59	68	65	64
	Building 4	GF	W	63	71	68	67
	Building 5	GF	NW	60	69	66	65
	Building 6	GF	NW	62	71	68	67
Little Bee Early Years Learning Centre		GF	SW	54	62	62	61
		GF	NW	55	62	61	58
		GF	SE	Not Assessed	67	67	67
Travelodge Hotel Hobart Airport		GF	W	63	69	67	66
		F 1	W	65	71	69	67
		GF	N	63	72	68	68
		F 1	N	67	76	71	72
		GF	W	65	74	68	70
		F 1	W	67	76	70	72

Shading indicates target not achieved

The calculated dimensions of the wall in Model 1 to achieve the above mitigated levels was 304 m long, with a total area of 1243 m^2 with a required height varying from 3.5 to 6 m. Even with this wall, as shown in Table 9, the target levels are not achieved for buildings 4 and 6, which are the two buildings closest to the highway. Their proximity to the highway is compounded by the need for there to be a gap in the wall to allow entrance to the Park. Because of the inevitability of this gap, a wall is unlikely to ever be able to achieve the targets at these buildings, regardless of the wall height.

Model 2 achieves an overall better outcome at both the Hotel and Tourist Park. Again, the targets for buildings 4 and 6 are not achieved but the exceedance is less than for Model 1. While Model 1 achieves the Hotel target at all modelled receivers, one is exceeded in Model 2. However, overall Model 2 achieves a similar outcome to Model 1.

8. Discussion and conclusion

The noise modelling of the proposed interchange indicates that if 14 mm chip seal is used traffic noise will increase by up to 9 dB(A) at the Hobart Airport Tourist Park and at the Travelodge Hotel Hobart Airport; and 8 dB(A) at Little Bee Early Years Learning and Child Care Centre.

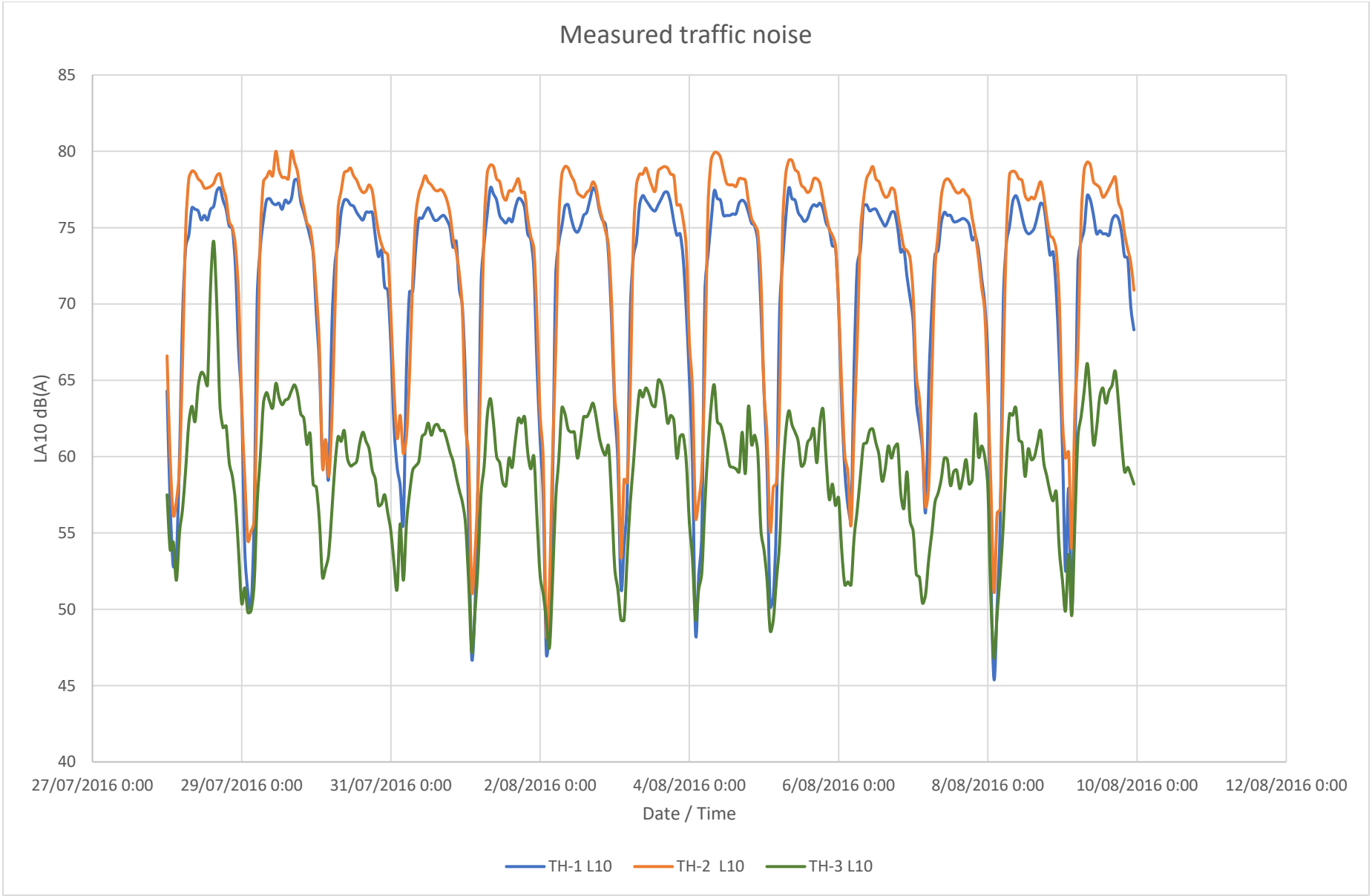
Under the Traffic Noise Guidelines, noise mitigation is warranted but the presence of the airport means that targeting 63 dB(A) would be pointless because airport noise is and will continue to be the dominant source of noise exposure, particularly for the Tourist Park. Because of this, a traffic noise target of 68 dB(A) would be appropriate.

Two options for noise mitigation to achieve 68 dB(A) were assessed. Model 1 retains the 14 mm chip seal throughout but introduces a noise wall. The required wall would be prohibitively long (304 m) and high (maximum 6 m). Model 2 avoids a wall but replaces the 14 mm chip seal with dense graded asphalt on the southern carriageway. Model 2 achieves a better mitigation outcome, with noise levels generally 1 to 2 dB(A) lower than Model 1.

Model 2 is the recommended approach.

Appendix 1

Noise Data


Measured traffic noise
LA10 dB(A)
85
80
75
70
65
60
55
50
45
40
27/07/2016 0:00
29/07/2016 0:00
31/07/2016 0:00
2/08/2016 0:00
4/08/2016 0:00
6/08/2016 0:00
8/08/2016 0:00
10/08/2016 0:00
12/08/2016 0:00
Date / Time
TH-1 L10
TH-2 L10
TH-3 L10

Appendix 2

Environmental Noise Survey Sheets

Unattended environmental noise survey sheet

Project Name: Tasman Highway / Holyman Ave Intersection	**Project Number:** HB16313
Sample period: 10 min / 15 min / **60 min** / other (please specify) _____	
Start date: 27/07/2016 **Start time:** 12:40 pm	**End date: 10/8/16** **End time: 1330**
Name of deployer: L. Drummond	**Name of collector: H Percy**

Instrumentation details:

Instrumentation	Equipment	Model	Serial No.	Reference (1000 Hz)			
					Time	**Date**	**db**
	Meter	ARL EL-315	15-203-498	START	0947	27/7	93.5
	Microphone		91856	END	1530	10/8	93.2
	Asset No		WCM-25024				

Site Description

Site Name:	TH-1	**Property Owner:** DSG	
Address	East bound – Tasman Highway	**Contact details**	BH: AH: Mob:
Coordinates (MGA)	Easting: 0539569	Northing: 5257557	
Site description:	Distance to nearest building: N/A Other possible noise sources: Tasman Highway, aircraft, nearby industrial estate Site sketch (noise sources, meter position and approximate distance to residences)		

Photos:	
Final check	**Windsock: Yes Chained and padlocked: Yes**
Notes	

Unattended environmental noise survey sheet

Project Name: Tasman Highway / Holyman Ave Intersection	**Project Number:** HB16313
Sample period: 10 min / 15 min / **60 min** / other (please specify) _____	
Start date: 27/07/2016 **End date:** 10/8/16 **Start time:** 2:30 pm **End time:** 0959	
Name of deployer: L. Drummond	**Name of collector:** H Percy

Instrumentation details:

Instrumentation	Equipment	Model	Serial No.	Calibration (1000 Hz)			
					Time	**Date**	**db**
	Meter	ARL EL-315	15-004-005	START	1015	27/7	93.5
	Microphone			END	1430	10/8	93.5
	Asset No		WCM-25007				

Site Description

Site Name:	TH-3	**Property Owner:** DSG	
Address	Corner Tasman Highway / Holyman Avenue	**Contact details**	BH: AH: Mob:
Coordinates (MGA)	Easting: 0540035	Northing: 5257700	
Site description:	Distance to nearest building: N/A Other possible noise sources: Tasman Highway, aircraft, nearby industrial estate Site sketch (noise sources, meter position and approximate distance to residences)		
Photos:			

Final check	**Windsock: Yes Chained and padlocked: Yes**
Notes	

Unattended environmental noise survey sheet

Project Name: Tasman Highway / Holyman Ave Intersection	**Project Number:** HB16313
Sample period: 10 min / 15 min / **60 min** / other (please specify) _____	
Start date: 27/07/2016 **End date:** 10/8/17 **Start time:** 2:10 pm **End time: 1400**	
Name of deployer: L. Drummond	**Name of collector: H Percy**

Instrumentation details:

Instrumentation	Equipment	Model	Serial No.	Reference (1000 Hz)			
					Time	**Date**	**db**
	Meter	ARL EL-315	15-203-514	START	0947	27/7	93.6
	Microphone			END	1506	10/8	69.4
	Asset No		WCM-25005				

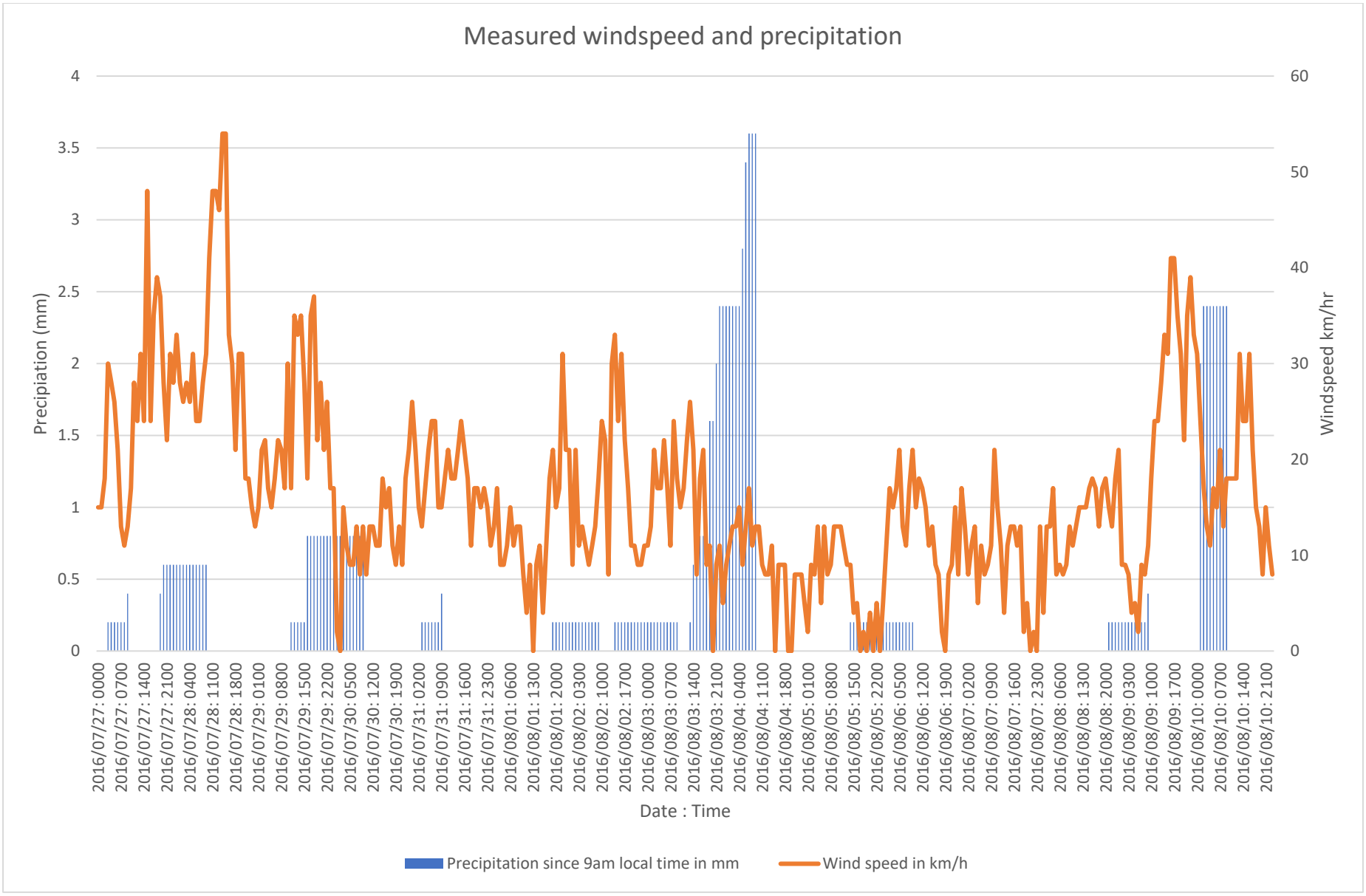
Site Description

Site Name:	TH-2	**Property Owner:** DSG	
Address	Near entrance to caravan park – Tasman Highway	**Contact details**	BH: AH: Mob:
Coordinates (MGA)	Easting: 0540456	Northing: 5258054	
Site description:	Distance to nearest building: N/A Other possible noise sources: Tasman Highway, aircraft, nearby industrial estate Site sketch (noise sources, meter position and approximate distance to residences)		
Photos:			

Final check	**Windsock: Yes Chained and padlocked: Yes**
Notes	

Appendix 3

Weather Data


Measured windspeed and precipitation
Precipiation (mm)
Windspeed km/hr
Date : Time
Precipitation since 9am local time in mm
Wind speed in km/h

Contact
Leigh Knight
0498 844 347
lknight@pittsh.com.au

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ABN 67 140 184 309

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ISO 14001 www.intlcert.com JAS-ANZ

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Appendix F

Title documents

RESULT OF SEARCH

RECORDER OF TITLES

Issued Pursuant to the Land Titles Act 1980

Tasmanian Government

SEARCH OF TORRENS TITLE

VOLUME	FOLIO
6335	1
EDITION	DATE OF ISSUE
2	07-Sep-1999

SEARCH DATE : 23-Feb-2018
SEARCH TIME : 12.02 PM

DESCRIPTION OF LAND

City of CLARENCE
Lot 1 on Plan 6335
Derivation : Part of 1,654 Acres Gtd to R Pitcairn and T Young
Prior CT 3440/81

SCHEDULE 1

A466175 THE CROWN

SCHEDULE 2

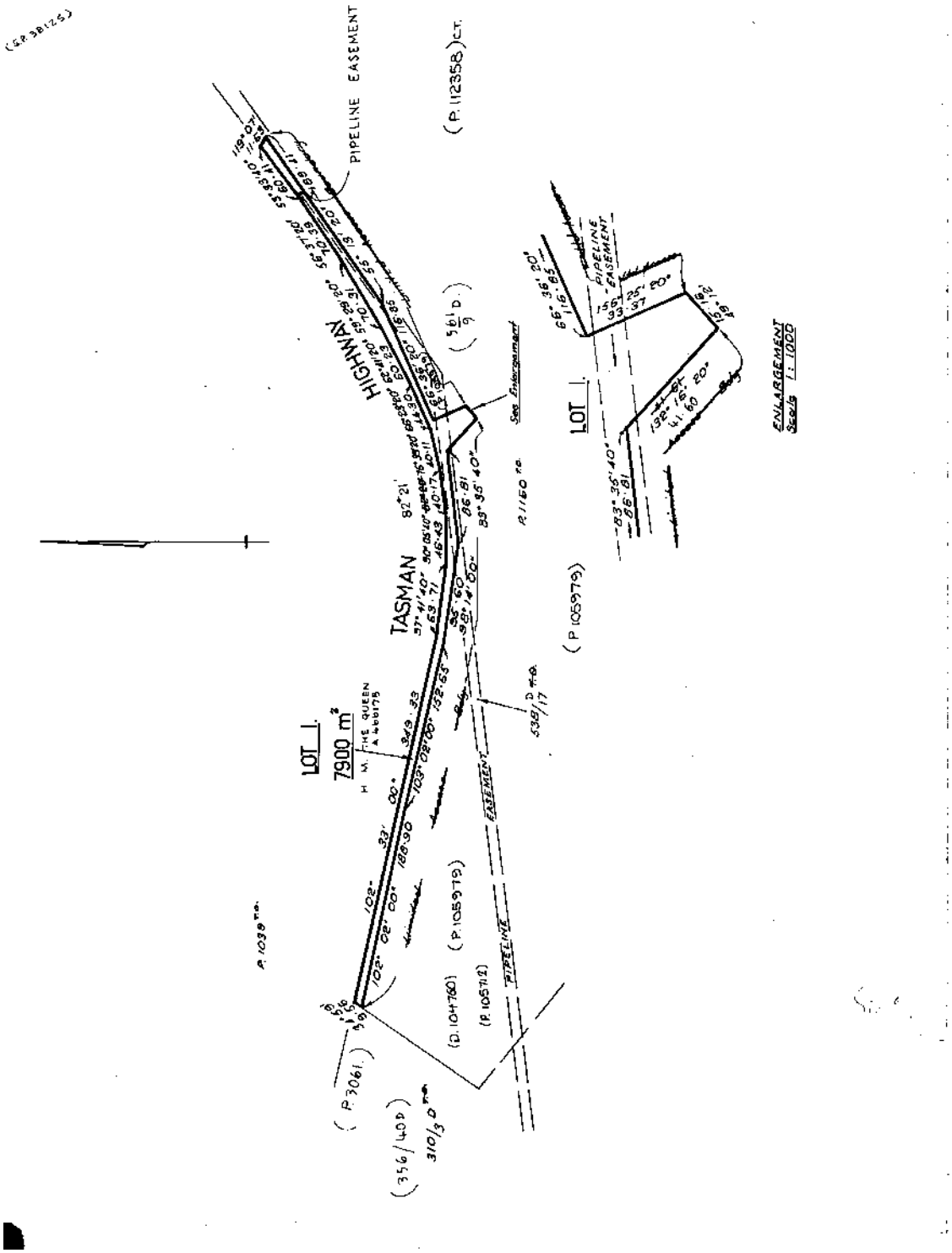
Reservations and conditions in the Crown Grant if any
A264712 BURDENING EASEMENT: Right for The Metropolitan Water Board over the Pipeline Easement on Plan No. 6335 (Subject to conditions therein)

UNREGISTERED DEALINGS AND NOTATIONS

No unregistered dealings or other notations

17/10/74 Transfer filed 6335

Owner: The Commonwealth of Australia	**PLAN OF SURVEY** by Surveyor J. J. Dwyer of land situated in the LAND DISTRICT OF MONMOUTH. PARISH OF CAMBRIDGE. Scale 1 : 3000	**Registered Number:** P6335 Effective from ..... Recorder of Titles
Title Reference: CT 2306/78		
Grantee: Part of 1654 acres granted to Ralph Pitcairn and Thos. Young.		



RESULT OF SEARCH

RECORDER OF TITLES

Issued Pursuant to the Land Titles Act 1980

SEARCH OF TORRENS TITLE

VOLUME	FOLIO
54471	1
EDITION	DATE OF ISSUE
2	27-Jul-1999

SEARCH DATE : 23-Feb-2018
SEARCH TIME : 12.03 PM

DESCRIPTION OF LAND

City of CLARENCE
Lot 1 on Diagram 54471
Derivation : part of 292 acres 2 roods 0 perches gtd. to William Wallace Fraser.
Prior CT 3798/59

SCHEDULE 1

B595434 The CROWN Registered 05-Nov-1993 at noon

SCHEDULE 2

Reservations and conditions in the Crown Grant if any
.

UNREGISTERED DEALINGS AND NOTATIONS

No unregistered dealings or other notations

Owner: Lots 1 & 2. Peter Hookway.
Lot 2. H.M. The Queen. (as lies below fifty feet from the surface C.T.3040-10)

Title Reference: Lots 1 & 2. C.T. 3798-59

Grantee: Part of 292a. 2r. 0p. Gtd to William Wallace Fraser.

PLAN OF SURVEY

by Surveyor E. Duede of
of land situated in the
DEPARTMENT OF ROADS AND TRANSPORT
10 MURRAY ST, HOBART

CITY OF CLARENCE

SCALE 1:4000 MEASUREMENTS IN METRES

REGISTERED NUMBER

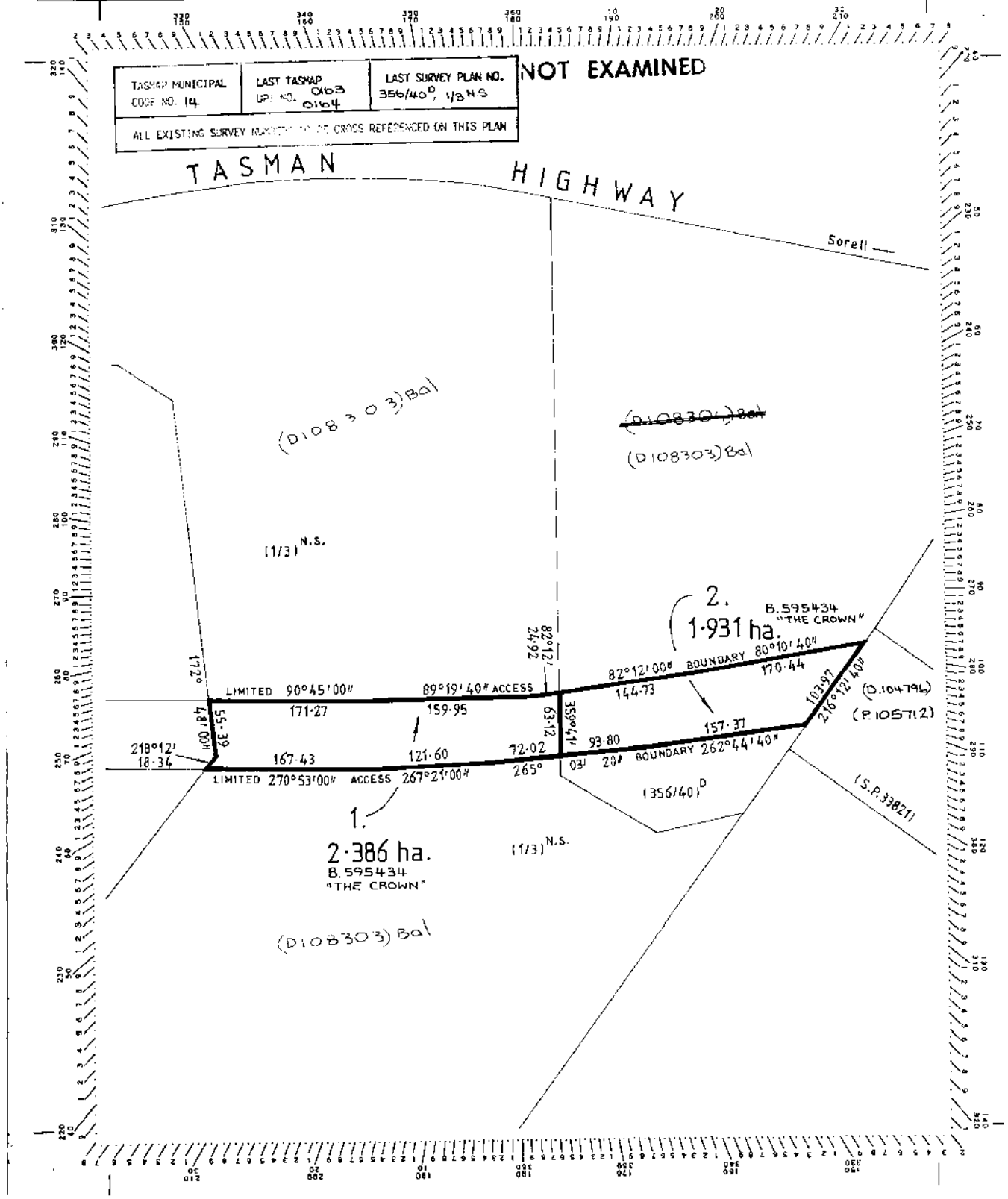
D 54471

Approved
Effective from: 23/9/92

Recorder of Titles

TASMAP MUNICIPAL CODE NO. 14	LAST TASMAP GPI NO. 0163 0164	LAST SURVEY PLAN NO. 356/40D, 1/3 N.S
ALL EXISTING SURVEY MARKS TO BE CROSS REFERENCED ON THIS PLAN		

NOT EXAMINED



RESULT OF SEARCH

RECORDER OF TITLES

Issued Pursuant to the Land Titles Act 1980

Tasmanian Government

SEARCH OF TORRENS TITLE

VOLUME	FOLIO
104760	1
EDITION	DATE OF ISSUE
2	20-May-1999

SEARCH DATE : 23-Feb-2018
SEARCH TIME : 11.36 AM

DESCRIPTION OF LAND

City of CLARENCE
Lot 1 on Diagram 104760
Derivation : Part of 60 Acres Located to J McCormac
Prior CT 50002/1

SCHEDULE 1

B691139 The CROWN Registered 02-May-1994 at noon

SCHEDULE 2

Reservations and conditions in the Crown Grant if any
.

UNREGISTERED DEALINGS AND NOTATIONS

No unregistered dealings or other notations

Owner: Lots 1,5 & 6 George Casimaty
Lots 2&7 George ~~Gregory~~ Casimaty
Lots 3&4 George Casimaty

C.T. 4782-56
Title Reference: ~~Lots 1,5 & 6 Conv. 30/8814~~
~~Lots 2&7 Conv. 28/9280~~
Lots 3&4 C.T. 3110-100

Grantee: Lots 1,2,5,6 & 7 part of 60ac located to J.Mc Cormac.
Lots 3&4 part of 1654ac Gtd. to R. Pitcairn & T. Young.

PLAN OF SURVEY

by Surveyor E. DUEDE
of land situated in the
DEPARTMENT OF ROADS AND TRANSPORT
10 MURRAY ST., HOBART

See Below

CITY OF CLARENCE

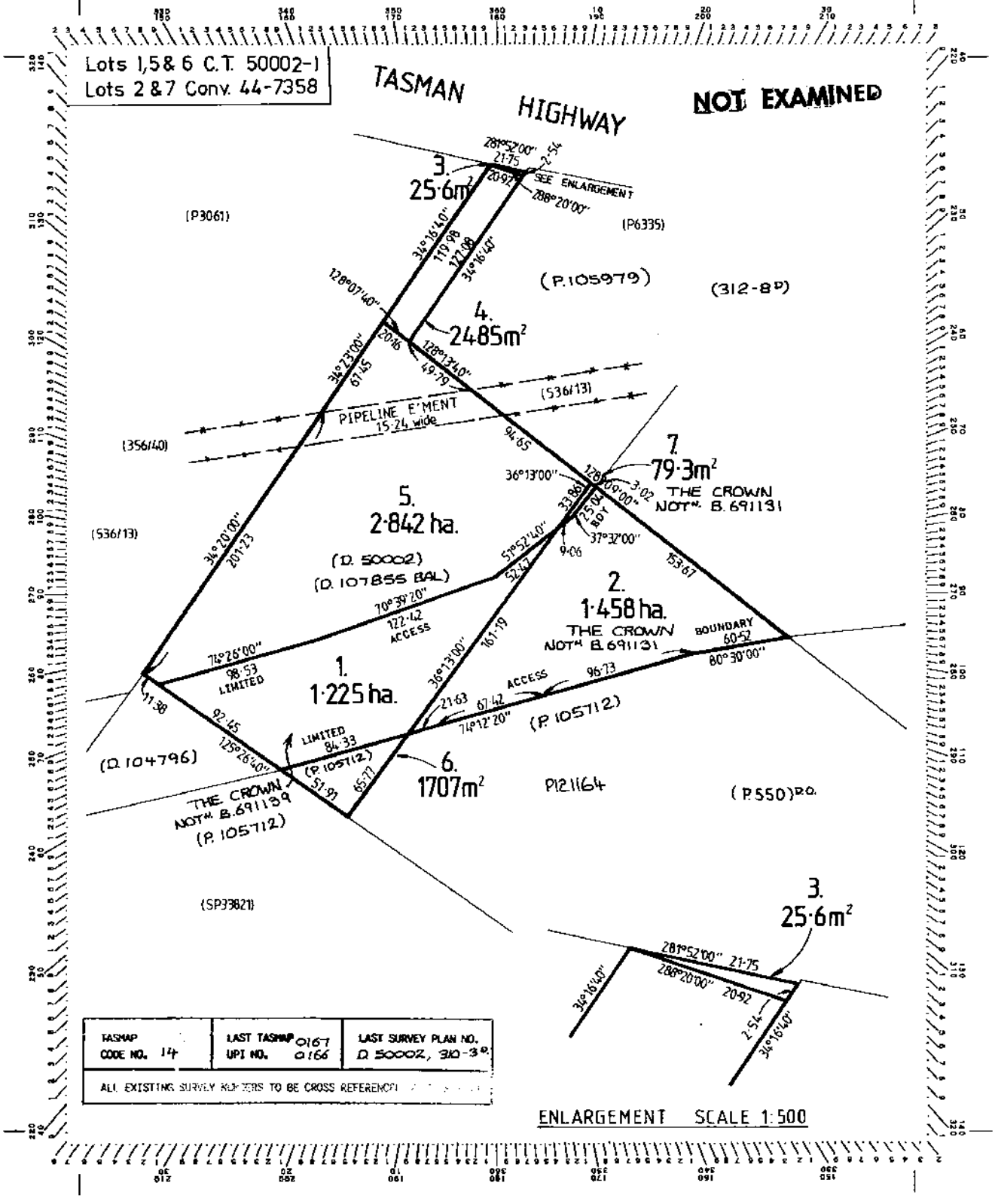
SCALE 1:2500 MEASUREMENTS IN METRES

REGISTERED NUMBER

D 104760

Approved 30 SEP 1993
Effective from:

Recorder of Titles



TASMAP CODE NO. 14	LAST TASMAP UPI NO. 0167 0166	LAST SURVEY PLAN NO. D 50002, 310-3P.
ALL EXISTING SURVEY NUMBERS TO BE CROSS REFERENCED		

RESULT OF SEARCH

RECORDER OF TITLES

Issued Pursuant to the Land Titles Act 1980

Tasmanian Government

SEARCH OF TORRENS TITLE

VOLUME	FOLIO
104796	1
EDITION	DATE OF ISSUE
1	15-Oct-1993

SEARCH DATE : 23-Feb-2018
SEARCH TIME : 11.39 AM

DESCRIPTION OF LAND

City of CLARENCE
Lot 1 on Diagram 104796
Derivation : Part of 253-0-0 Gtd. to W.& M.Garlick
Prior CT 4434/23

SCHEDULE 1

B651817 THE CROWN Registered 15-Oct-1993 at noon

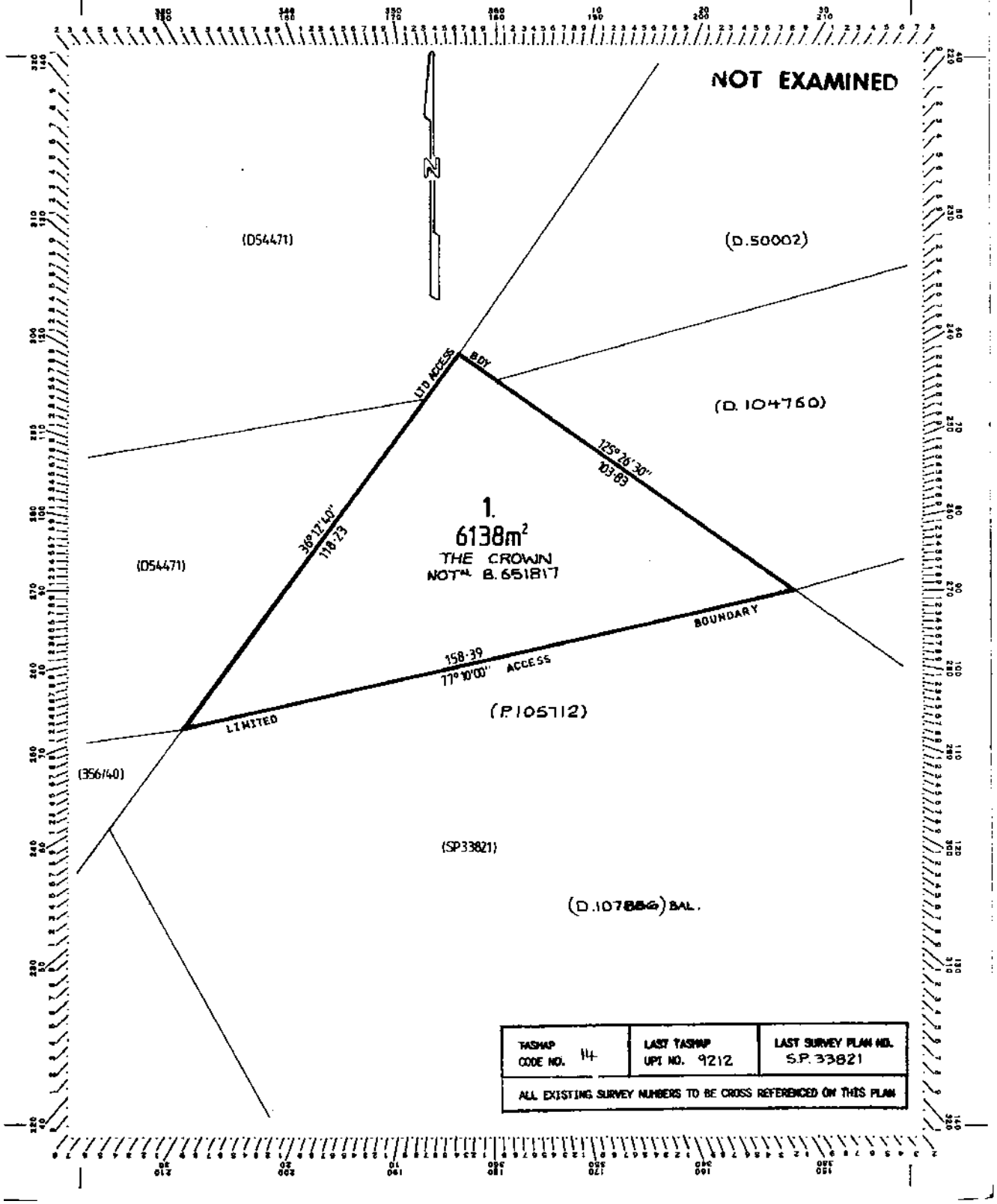
SCHEDULE 2

Reservations and conditions in the Crown Grant if any
C172488 created to hold title

UNREGISTERED DEALINGS AND NOTATIONS

No unregistered dealings or other notations

Owner: Lot 1 Robert James Thornbury	PLAN OF SURVEY by Surveyor E. DUEDE of of land situated in the DEPARTMENT OF ROADS AND TRANSPORT 10 MURRAY ST, HOBART CITY OF CLARENCE SCALE 1:1000 MEASUREMENTS IN METRES	REGISTERED NUMBER D104796 Approved ~~Effective from~~ 13 JUL 1993 Recorder of Titles
Title Reference: Lot 1 C.T. 4434-23.		
Grantee: Part of ~~Lot 3014~~ 253ac. Gtd. to W. & M. Garlick. (WILLIAM, MARGARET)		



RESULT OF SEARCH

RECORDER OF TITLES

Issued Pursuant to the Land Titles Act 1980

SEARCH OF TORRENS TITLE

VOLUME	FOLIO
105712	1
EDITION	DATE OF ISSUE
2	20-May-1999

SEARCH DATE : 23-Feb-2018
SEARCH TIME : 11.37 AM

DESCRIPTION OF LAND

City of CLARENCE
Lot 1 on Diagram 105712
Derivation : Part of Lot 3014, 253-0-0 Gtd. to William & Margaret Garlick
Prior CT 4434/23

SCHEDULE 1

B691137 THE CROWN Registered 15-Oct-1993 at noon

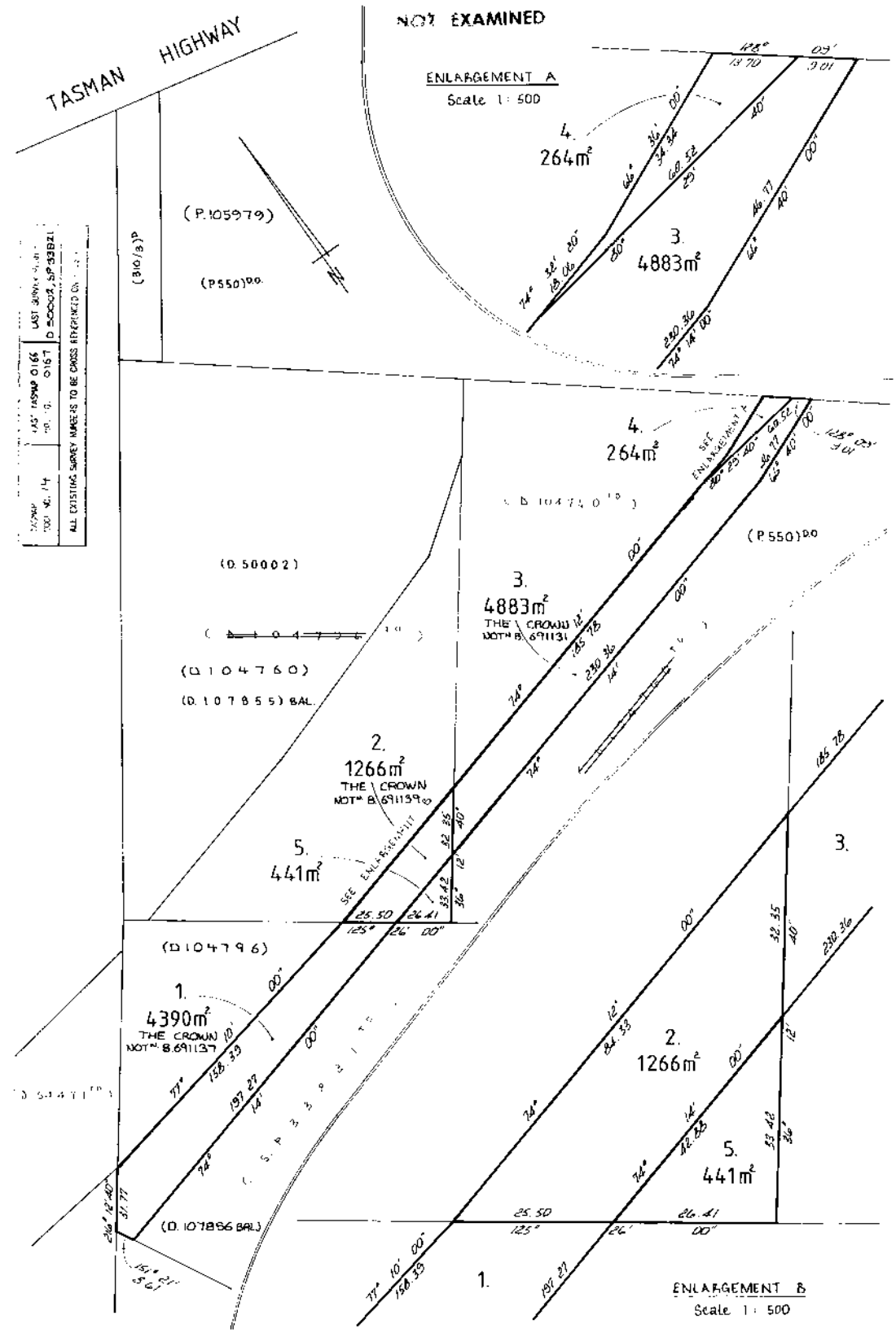
SCHEDULE 2

Reservations and conditions in the Crown Grant if any
.

UNREGISTERED DEALINGS AND NOTATIONS

No unregistered dealings or other notations

Owner: Robert James Thornbury (Lot 1) George Casimaty (Lots 2 & 5) George ~~Gregory~~ Casimaty (Lots 3 & 4)	**PLAN OF SURVEY** by Surveyor E Duede of land situated in the DEPARTMENT OF TRANSPORT & WORKS 10 MURRAY STREET, HOBART	REGISTERED NUMBER **P 105712**
Title Reference: C.T. 4434 - 23 (Lot 1) ~~C.T. 4782 - 56 (Lots 2 & 5)~~ ~~Conv. 24 / 9088 (Lots 3 & 4)~~ Conv. 44 - 1358, C.T. 50002-1 (Lots 2 & 5)	CITY OF CLARENCE	Approved Effective from
Grantee: Lot 1 part of Lot 3014 granted to W. & M. Garlick Lots 2, 3, 4 & 5 part of 60 acres located to J. McCormac.	SCALE 1 : 1500 MEASUREMENTS IN METRES	Recorder of Titles



RESULT OF SEARCH

RECORDER OF TITLES

Issued Pursuant to the Land Titles Act 1980

Tasmanian Government

SEARCH OF TORRENS TITLE

VOLUME	FOLIO
105979	1
EDITION	DATE OF ISSUE
2	20-May-1999

SEARCH DATE : 23-Feb-2018
SEARCH TIME : 12.02 PM

DESCRIPTION OF LAND

City of CLARENCE
Lot 1 on Plan 105979
Derivation : Part of 1285A-0R-30.3P acquired by The Commonwealth of Australia.
Prior CT 3440/82

SCHEDULE 1

B675487 TRANSFER to THE CROWN Registered 05-Sep-1994 at noon

SCHEDULE 2

Reservations and conditions in the Crown Grant if any
BENEFITING EASEMENT: the right for the Commonwealth its successors and assigns and the owners and occupiers for the time being of the above land FIRSTLY to pass discharge and conduct all surface percolating and other drainage waters by means of open or covered drains or line or lines of pipes through over under and along the land marked "Drainage Easement 15.24 wide" on Plan No. 112358 and together with the right for the Commonwealth its workmen servants and others to enter into or upon the said land for the purposes of excavating constructing laying cleansing amending or repairing such open or covered drains or line or lines of pipes AND SECONDLY to erect lay use and maintain an approach lighting system and lay gravel tracks through over under and along the land marked "Easement for Approach Lighting 6.10 wide" on Plan No. 112358 together with the right to enter into and upon the said land by its workmen servants and others with or without horses or other animals carts or other vehicles for the purpose of excavating erecting laying amending or repairing such approach lighting system or tracks
A264712 BURDENING EASEMENT: Pipeline Easement for the Metropolitan Water Board over the land marked "Pipeline Easement 15.24 wide" on Plan No. 105979

(Subject to conditions contained therein)

B653475 TRANSFER - granting the Right, appurtenant to the said land within described of transmitting into and across Folio of the Register 106304/1 such noise and vibration as might arise from the proper use and operation by Federal Airports Corporation of a Schedule Airport, under Section 3(1) of The Federal Airports Corporation Act 1986, of the Hobart Airport situate upon the said land within described

.

UNREGISTERED DEALINGS AND NOTATIONS

No unregistered dealings or other notations

Owners:
FEDERAL AIRPORTS CORPORATION.

Title Reference:
E.T. 3440-82

Grantee: PART OF 1285·0 30% ACQUIRED BY THE COMMONWEALTH OF AUSTRALIA
~~PART OF 1654 ac. GTD TO ROBERT PITEAIRN AND THOMAS YOUNG.~~

PLAN OF SURVEY
by Surveyor E. DUEDE of
of land situated in the DEPARTMENT OF TRANSPORT AND WORKS 10 MURRAY ST, HOBART
CITY OF CLARENCE

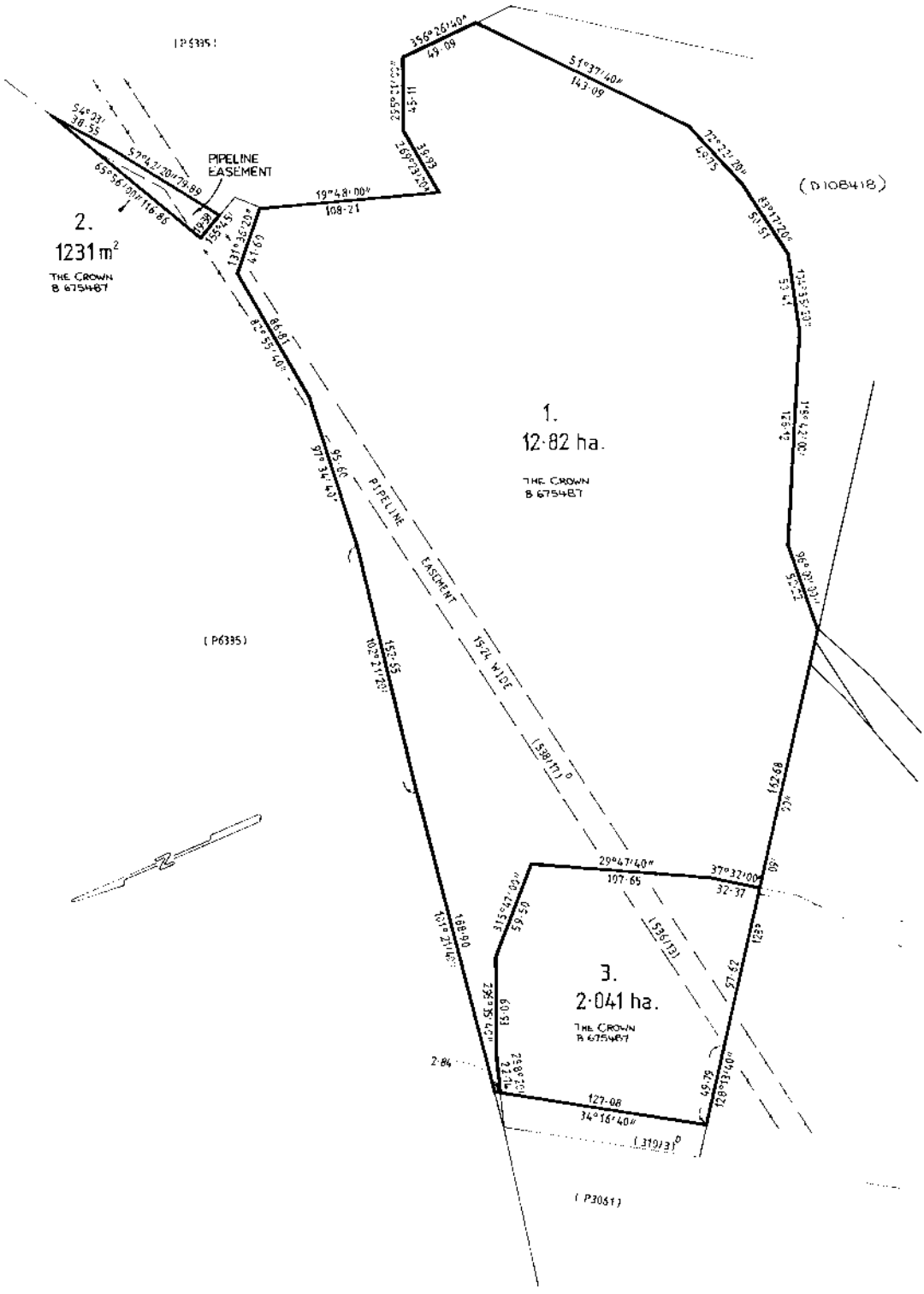
SCALE 1:2000 MEASUREMENTS IN METRES

REGISTERED NUMBER
P105979
Effective from [illegible] 1985
Recorder of Titles

14	0166	P1160

NOT EXAMINED

(P 112358) CT.



RESULT OF SEARCH

RECORDER OF TITLES

Issued Pursuant to the Land Titles Act 1980

SEARCH OF TORRENS TITLE

VOLUME	FOLIO
140647	104
EDITION	DATE OF ISSUE
4	25-Aug-2009

SEARCH DATE : 23-Feb-2018
SEARCH TIME : 12.45 PM

DESCRIPTION OF LAND

City of CLARENCE
Lot 104 on Sealed Plan 140647
Derivation : Part of 60 Acres Located to J McCormac, Part of Location to R Strachan and Part of 1200 acres Located to Anthony Williams
Prior CTs 121164/1 and 105712/5

SCHEDULE 1

C557746 TRANSFER to GREGORY JOHN CASIMATY Registered 16-Dec-2004 at noon

SCHEDULE 2

Reservations and conditions in the Crown Grant if any
SP 140647 COVENANTS in Schedule of Easements
SP 140647 FENCING PROVISION in Schedule of Easements
SP 140647 SEWERAGE AND/OR DRAINAGE RESTRICTION
C30987 PROCLAMATION under Section 52A of the Roads and Jetties Act 1935 Registered 24-Jun-1997 at noon
C928047 MORTGAGE to Commonwealth Bank of Australia Registered 25-Aug-2009 at 12.01 PM

UNREGISTERED DEALINGS AND NOTATIONS

No unregistered dealings or other notations

OWNER
T·G· & M· CASIMATY G·J· & K·J· CASIMATY
FOLIO REFERENCE
~~C·T· 138719/1 C·T· 107855/1~~ C·T· 123527/1
C·T· 121164/1 C·T· 105712/5 C·T· 211620/1
C·T· 104760/5 C·T· 230966/1 C.T. 140345/1
GRANTEE
WHOLE OF LOT 3017 (7.436Ha) GTD TO WILLIAM RUMNEY
WHOLE OF LOT 31376 (27·3·9) GTD TO G. G. CASIMATY
PART OF 1000 Ac LOC. TO WILLIAM RUMNEY
PART OF 1200 Ac LOC. TO ANTHONY WILLIAMS
PART OF 60 Ac LOC. TO J. McCORMAC
PART OF 1654 Ac LOC. TO R. PITCAIRN & T. YOUNG
PART OF LOC. TO R. STRACHAN

PLAN OF SURVEY

BY SURVEYOR CHRISTOPHER LEWIS ANDREWS
57 MT· RUMNEY ROAD, MT RUMNEY

LOCATION
CITY OF CLARENCE

C· L· ANDREWS & ASSOC· P/L
57 MT RUMNEY ROAD, MT RUMNEY

SCALE 1:3,000 LENGTHS IN METRES

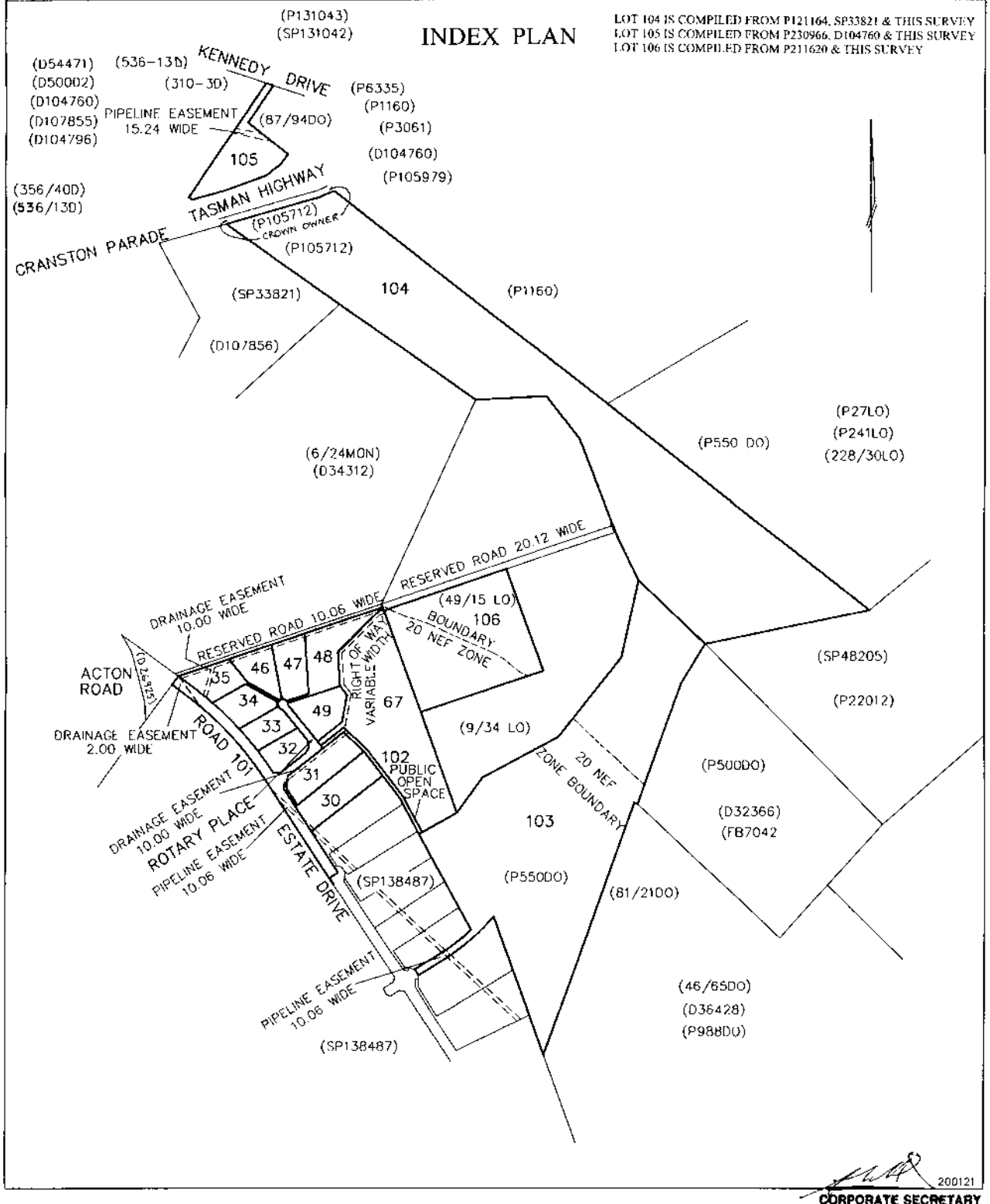
REGISTERED NUMBER
SP 140647

APPROVED
EFFECTIVE FROM 27 FEB 2004
Alice Kawa
Recorder of Titles

MAPSHEET MUNICIPAL CODE No 107 (5225 - 25,35) (5425 - 21,31)
LAST UPI No 1409214 1403100 FHX64
LAST PLAN No P140345 P121164
ALL EXISTING SURVEY NUMBERS TO BE CROSS REFERENCED ON THIS PLAN

INDEX PLAN

LOT 104 IS COMPILED FROM P121164, SP33821 & THIS SURVEY
LOT 105 IS COMPILED FROM P230966, D104760 & THIS SURVEY
LOT 106 IS COMPILED FROM P211620 & THIS SURVEY



200121
CORPORATE SECRETARY
CLARENCE CITY COUNCIL

PLAN OF SURVEY
ANNEXURE SHEET
SHEET 1 OF 2 SHEETS

OWNER SEE INDEX PLAN

FOLIO REFERENCE SEE INDEX PLAN

SCALE 1: 10,000 LENGTHS IN METRES

Registered Number

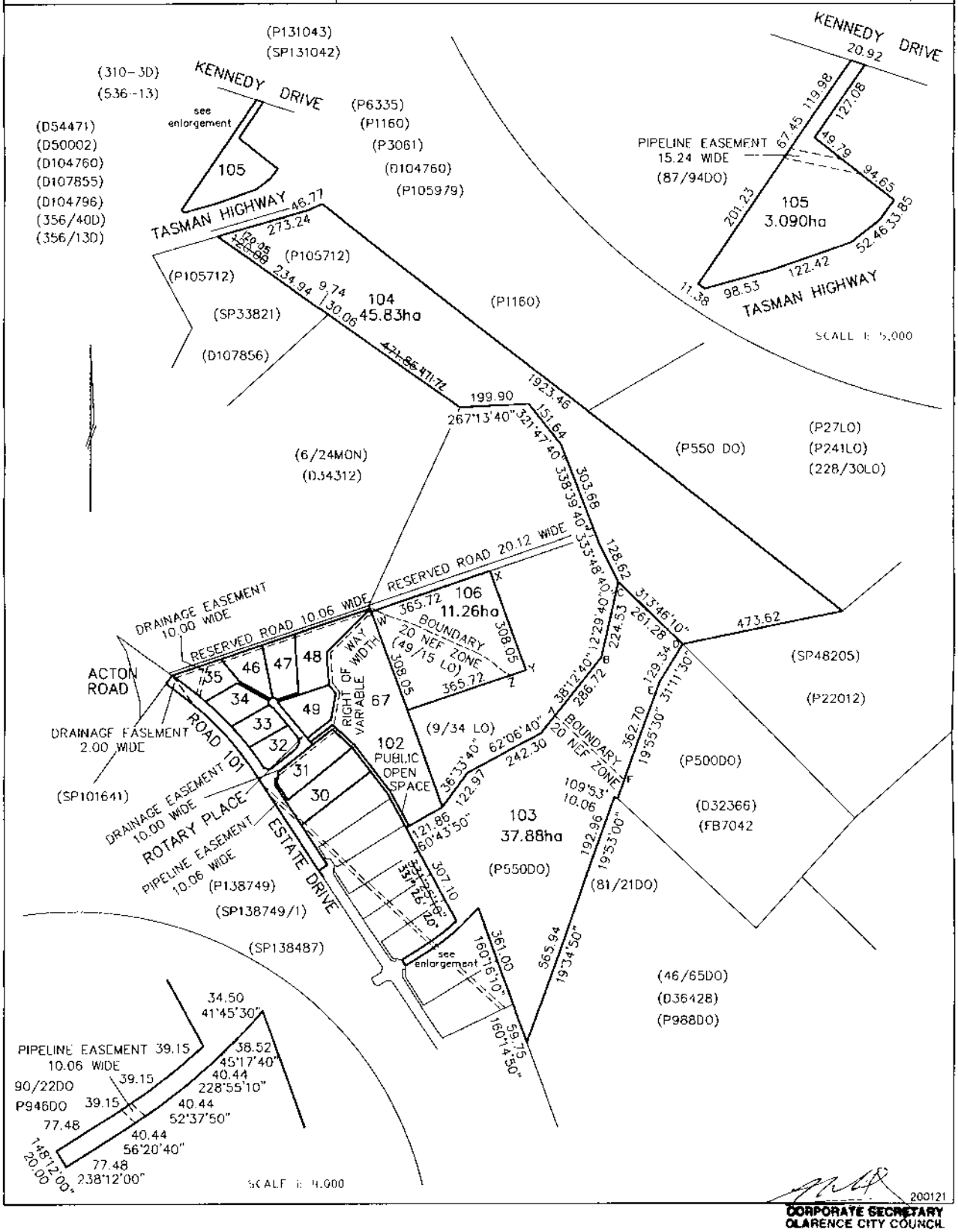
SP140647

SIGNED FOR IDENTIFICATION PURPOSES

Council General Manager

THIS ANNEXURE SHEET FORMS PART OF THE ATTACHED INDEX PLAN
THE SURVEYORS CERTIFICATE EXTENDS TO THE DETAILS ON THIS SHEETS

Registered Surveyor ..... Date 12/12/03



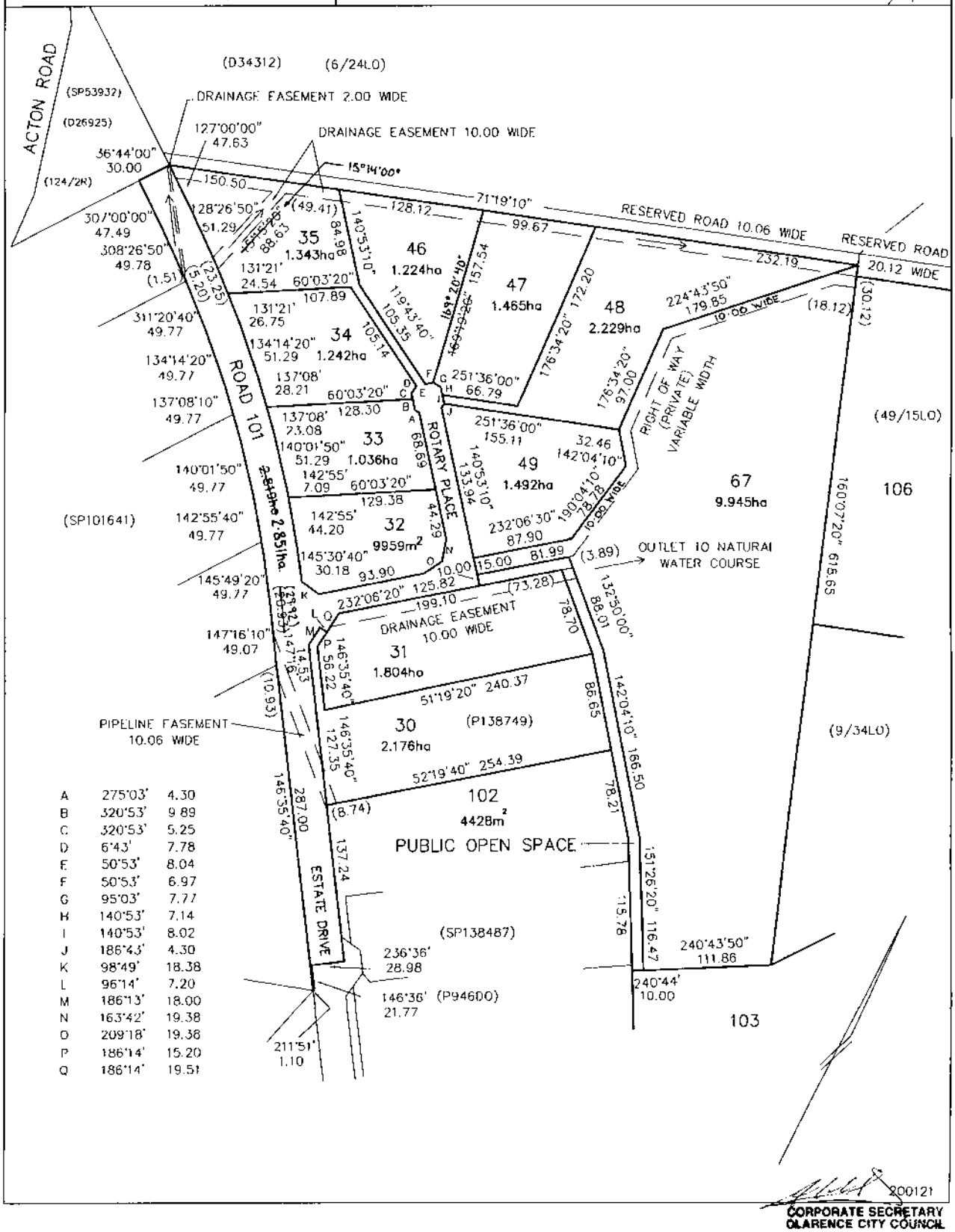
PLAN OF SURVEY
ANNEXURE SHEET
SHEET 2 OF 2 SHEETS

OWNER SEE INDEX PLAN
FOLIO REFERENCE SEE INDEX PLAN
SCALE 1:3000 LENGTHS IN METRES

Registered Number
SP140647

SIGNED FOR IDENTIFICATION PURPOSES
Council General Manager

THIS ANNEXURE SHEET FORMS PART OF THE ATTACHED INDEX PLANS
THE SURVEYORS CERTIFICATE EXTENDS TO THE DETAILS ON THIS SHEETS
Registered Surveyor ..... date 12/12/03



200121
CORPORATE SECRETARY
CLARENCE CITY COUNCIL

SEARCH OF TORRENS TITLE

VOLUME	FOLIO
152454	1
EDITION	DATE OF ISSUE
9	22-Feb-2018

SEARCH DATE : 23-Feb-2018
SEARCH TIME : 12.05 PM

DESCRIPTION OF LAND

City of CLARENCE
Lot 1 on Plan 152454
Derivation : Part of 1285A-0R-30.3/10Ps acquired by The Commonwealth of Australia.
Prior CT 138713/1

SCHEDULE 1

C124556 THE COMMONWEALTH OF AUSTRALIA Registered 05-Oct-1998 at noon

SCHEDULE 2

Reservations and conditions in the Crown Grant if any
BENEFITING EASEMENT: the right for the Commonwealth its successors and assigns and the owners and occupiers for the time being of the above land (excepting the lands marked A.B.C. and D.E.F.G. on Plan No. 152454) FIRSTLY to pass discharge and conduct all surface percolating and other drainage waters by means of open or covered drains or line or lines of pipes through over under and along the land marked Drainage Easement 15.24 Wide on P.152454 and together with the right for the Commonwealth its workmen servants and others to enter into or upon the said land for the purposes of excavating constructing laying cleansing amending or repairing such open or covered drains or line or lines of pipes AND Secondly to erect lay use and maintain an approach lightingsystem and lay gravel tracks through over under and along the land marked `Easement for Approach Lighting 6.10 Wide' on P.152454 together with the right to enter into and upon the said land by its workmen servants and others with or without horses or other animals carts or other vehicles for the purpose of excavating erecting laying amending or repairing such approach lighting system or tracks.
BURDENING EASEMENT: a right of carriageway (appurtenant to the

land comprised in Indenture of Conveyance No. 17/9515) over the "Easement 20.12 Wide" on Plan No. 152454

A264712 BURDENING EASEMENT: Pipeline Easement for the Metropolitan Water Board over the land marked "Pipeline Easement "A" (excepting thereout the land marked "Pipeline Easement "B")" on Plan No. 152454

A300536 BURDENING EASEMENT: Pipeline Easement for the Metropolitan Water Board over the land marked "Pipeline Easement "B" on Plan No. 152454 (subject to provisions contained therein)

B653475 TRANSFER - granting the Right, appurtenant to the said land within described of transmitting into and across Folio of the Register 106304/1 such noise and vibration as might arise from the proper use and operation by Federal Airports Corporation of a Schedule Airport, under Section 3 (1) of The Federal Airports Corporation Act,1986 of the Hobart Airport situate upon the said land within described

B954887 LEASE to AIRSERVICES AUSTRALIA of a leasehold estate for the term of 39 years less 5 days from 6-Jul-1995 in such part of the within land shown on the plan thereon Registered 25-Jun-1996 at noon

B954888 LEASE to AIRSERVICES AUSTRALIA of a leasehold estate for the term of 39 years less 5 days from 6-Jul-1995 in such part of the within land shown on the plan thereon Registered 25-Jun-1996 at 12.01 PM

B954889 LEASE to AIRSERVICES AUSTRALIA of a leasehold estate for the term of 39 years less 5 days from 6-Jul-1995 in such part of the within land shown on the plan thereon Registered 25-Jun-1996 at 12.02 PM

B954890 LEASE to AIRSERVICES AUSTRALIA of a leasehold estate for the term of 39 years less 5 days from 6-Jul-1995 in such part of the within land shown on the plan thereon Registered 25-Jun-1996 at 12.03 PM

B954895 LEASE to AIRSERVICES AUSTRALIA of a leasehold estate for the term of 39 years less 5 days from 6-Jul-1995 in such part of the within land shown on the plan thereon Registered 25-Jun-1996 at 12.04 PM

C30987 PROCLAMATION under Section 9A and 52A of the Roads and Jetties Act 1935 Registered 24-Jun-1997 at noon

C108891 LEASE to AIRSERVICES AUSTRALIA of a leasehold estate of portion of the said land within described as shown by diagrams on the said lease for the term of 39 years less 5 days commencing from the 6th-July-1995 Registered 22-Jul-1998 at noon

C143922 CONCURRENT LEASE to HOBART INTERNATIONAL AIRPORT PTY LIMITED of a leasehold estate for the term of 50 years from 11-June-1998 (together with an option for renewal) Registered 14-Apr-1999 at 12.01 PM

C806010 PARTIAL SURRENDER of LEASE C143922 as relates to Lot

1 on P.152445 and Lot 4 on P.152444 only. Registered 04-Sep-2007 at noon

C840761 SUB-LEASE to TASMANIAN GATEWAY PROPERTY CORPORATION PTY LTD of a leasehold estate for the term of 40 years 4 months and 10 days from 31-Jan-2008 (116.386ha as identified as Lots 3 to 9 on P155382) Registered 23-Jan-2009 at noon
Leasehold Title(s) issued: 155382/3, 155382/8, 155382/6, 155382/7, 155382/5, 155382/4 and 155382/9

D49724 MORTGAGE to BOSI Security Services Ltd of a leasehold estate created by Concurrent Lease C143922 Registered 11-Dec-2012 at 12.01 PM

E36437 RELEASE of a right of carriageway over Easement 20.12 Wide as relates to Certificates of Title 27887/1, 129786/1 and 129785/3 only on Plan 152454 Registered 01-Jun-2016 at noon

E36438 RELEASE of a right of carriageway over the Easement 20.12 Wide as relates to Certificate of Title 149853/1 only on Plan 152454 Registered 01-Jun-2016 at 12.01 PM

E36439 RELEASE of a right of carriageway over the Easement 20.12 Wide as relates to Certificate of Title 23049/1 only on Plan 152454 Registered 01-Jun-2016 at 12.02 PM

E36446 RELEASE of a right of carriageway over the Easement 20.12 wide as relates to Certificate of Title 48205/1 only on Plan 152454 Registered 06-Feb-2017 at noon

E68202 RELEASE of a right of carriageway over the Easement 20.12 wide as relates to Certificates of Title 141389/2-5, 169350/1 and 169351/1 only on Plan 152454 Registered 06-Feb-2017 at noon

E113466 RELEASE of a right of carriageway over Easement 20.12 wide as relates to Certificates of Title 48205/2, 25526/2 and 129632/5 only on Plan 152454 Registered 22-Feb-2018 at noon

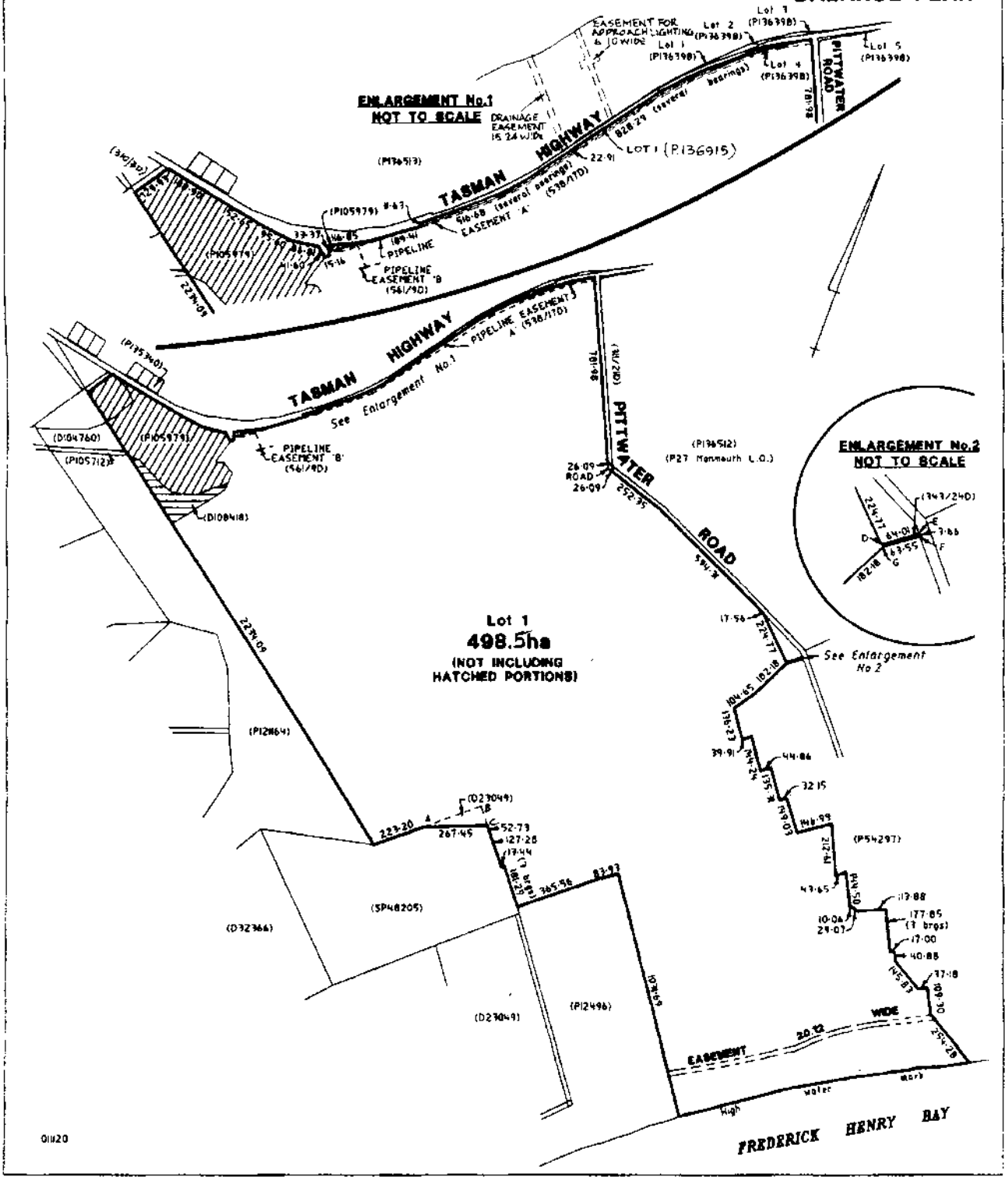
E113467 RELEASE of a right of carriageway over Easement 20.12 wide as relates to Certificate of Title 161938/1 only on Plan 152454 Registered 22-Feb-2018 at noon

UNREGISTERED DEALINGS AND NOTATIONS

No unregistered dealings or other notations

OWNER: The Commonwealth of Australia FOLIO REFERENCE: F/R136510-1 GRANTEE: Part of 1285 0 30 3/10 Acquired by the Commonwealth of Australia.	**PLAN OF TITLE** LOCATION **CITY OF CLARENCE** FIRST SURVEY PLAN No. P1160, 312/80 & 343/240 COMPILED BY OFFICE OF THE SURVEYOR-GENERAL SCALE 1: ~~no scale~~ 15000 LENGTHS IN METRES	REGISTERED NUMBER **P152454** APPROVED EFFECTIVE FROM 22 APRIL 2002 Alice Kawa Recorder of Titles

MAPSHEET MUNICIPAL CODE No 107 (5425-11)	LAST UPI No 1423296	LAST PLAN No P136510	ALL EXISTING SURVEY NUMBERS TO BE CROSS REFERENCED ON THIS PLAN



SCHEDULE OF EASEMENTS	Registered Number
NOTE: THE SCHEDULE MUST BE SIGNED BY THE OWNERS & MORTGAGEES OF THE LAND AFFECTED. SIGNATURES MUST BE ATTESTED.	SP140647

EASEMENTS AND PROFITS

Each lot on the plan is together with:-
(1) such rights of drainage over the drainage easements shown on the plan (if any) as may be necessary to drain the stormwater and other surplus water from such lot; and
(2) any easements or profits a prendre described hereunder.
Each lot on the plan is subject to:-
(1) such rights of drainage over the drainage easements shown on the plan (if any) as passing through such lot as may be necessary to drain the stormwater and other surplus water from any other lot on the plan; and
(2) any easements or profits a prendre described hereunder.
The direction of the flow of water through the drainage easements shown on the plan is indicated by arrows.

Lots 30 and 101 ~~on~~ 103 on the plan are each:-
Subject to Pipeline rights for the HOBART REGIONAL WATER BOARD (created by and more fully set forth in Sealed Plan No. 101641) over such part of the Pipeline Easement 10.06 wide shown on the plan as is within such lot.

Lot 101 on the plan is:-
Subject to a right of drainage for CLARENCE CITY COUNCIL (created by and more fully set forth in Sealed Plan No. 101641) over the drainage easement 2.00 wide shown on the plan within such lot.

Lot 67 on the plan is:-
Subject to a right of carriageway (appurtenant to lot 106 on the plan) over the Right of Way (Private) VARIABLE WIDTH shown on the plan within such lot.

Lot 106 on the plan is:-
Together with a right of carriageway over the Right of Way (Private) VARIABLE WIDTH shown on the plan within lot 67.

Lot 105 on the plan is:-
Subject to a pipeline easement for the METROPOLITAN WATER BOARD (created by and more fully set forth in Surrender No. 39/3225) over the Pipeline Easement 15.24 wide shown on the plan within such lot.

(USE ANNEXURE PAGES FOR CONTINUATION)

SUBDIVIDER: T G & M CASIMATY (AS PERSONAL REPRESENTATIVES OF G CASIMATY) FOLIO REF: Vol. 105712 Fol. 5 SOLICITOR & REFERENCE: PAGE SEAGER (AO: 00-1682)	PLAN SEALED BY: CLARENCE CITY COUNCIL DATE: 12 Jan 2004 SD 2003/24 REF NO. Council Delegate CORPORATE SECRETARY CLARENCE CITY COUNCIL
NOTE: The Council Delegate must sign the Certificate for the purposes of identification.	

ANNEXURE TO SCHEDULE OF EASEMENTS PAGE 2 OF 3 PAGES	Registered Number SP140647
SUBDIVIDER: T G & M CASIMATY (AS PERSONAL REPRESENTATIVES OF G CASIMATY) FOLIO REFERENCE: Vol. 105712 Fol. 5	

COVENANTS:-

1. The owner of each of lots 103, 104 and 106 shown on the plan covenants with the Vendor (THEODORE GABRIEL CASIMATY and MARIAN CASIMATY as personal representatives of GEORGE CASIMATY) and with the owner for the time being of every other lot shown on the plan to the intent that the burden of this covenant may run with and bind the covenantor's lot and every part thereof and that the benefit thereof shall be annexed to and devolve with each and every part of every other lot shown on the plan to observe the following stipulations:-

   1. Not – so far as relates to lots 103 and 106 respectively on the plan- to construct, erect or place on such lot any dwelling within the 20 NEF Noise Exposure Forecast within the Eastern Shore (Area 2) Planning Scheme 1986 as is marked ABCDEF within lot 103 and marked WXYZ within lot 106 on the plan.
   2. Not – so far as relates to lot 104 on the plan – to construct, erect or place on such lot any dwelling whatsoever.

2. The owner of each lot shown on the plan (except lot 104) covenants with the said Vendor (THEODORE GABRIEL CASIMATY and MARIAN CASIMATY as personal representatives of GEORGE CASIMATY) and with the owner for the time being of every other lot shown on the plan to the intent that the burden of this covenant may run with and bind the covenantors lot and every part thereof and that the benefit thereof shall be annexed to and devolve with each and every part of every other lot shown on the plan to observe the following stipulations :-

   1. Not to construct on such lot any dwelling or building with a minimum floor level below the 3.90 metre Australian Height Datum contour level. or in the case of Lot 103 below the 3.50 metre Australian Height Datum contour level..
   2. Not to establish or operate a waste disposal system below the 3.90 metre Australian Height Datum contour level.
   3. Not to erect or place on such lot any dwelling, house, building or structure using any exterior building material that contrasts with the rural environment.
   4. Not to remove any tree or trees from such lot without the prior written consent of the CLARENCE CITY COUNCIL.
   5. Not – so far as relates to lots 30, 31, 32, 33, 34, 35, 46, 47, 48 and 49 AND 67 on the plan – to:-
      (a) erect or place more than one residential building on such lot;
      (b) to further subdivide such lot,
      without the prior written consent of the CLARENCE CITY COUNCIL.

M.C.

FENCING PROVISION:-

In respect of the lots shown on the plan the Vendor (THEODORE GABRIEL CASIMATY and MARIAN CASIMATY as personal representatives of GEORGE CASIMATY) shall not be required to fence.

Covenant 2(1) hereon amended by me pursuant to Request to Amend No. C746133 made under Section 103 of Local Government (Building & Miscellaneous Provisions) Act 1993

Bruce Kava Recorder of Titles

29 / 11 / 2006

NOTE: Every annexed page must be signed by the parties to the dealing or where the party is a corporate body be signed by the persons who have attested the affixing of the seal of that body to the dealing.

ANNEXURE TO SCHEDULE OF EASEMENTS PAGE 3 OF 3 PAGES	Registered Number SP140647
SUBDIVIDER: T G & M CASIMATY (AS PERSONAL REPRESENTATIVES OF G CASIMATY) FOLIO REFERENCE: Vol. 105712 Fol. 5	

SIGNED by **THEODORE GABRIEL CASIMATY** and **MARIAN CASIMATY** (as personal representatives of **GEORGE CASIMATY**) the registered proprietors of the land in Folio of the Register Volume 105712 Folio 5, Volume 121164 Folio 1, Volume 123527 Folio 1, Volume ~~138749~~ 140365 Folio 1 and Volume 211620 Folio 1 in the presence of:

M. Casimaty

T G Casimaty

Witness: J. Haile

Name: JOHN HAILE

Address: 9 RYELAND CRT ROSEBAY 7015

Occupation: Wool Classer

SIGNED by **GREGORY JOHN CASIMATY** and **KERRIE JANE CASIMATY** the registered proprietors of the land in Folio of the Register Volume 104760 Folio 5 and Volume 230966 Folio 1 in the presence of:

Gasimaty

Kasimaty

Witness:

Name: GAYE JONES

Address: 12 ESPLANADE - MIDWAY PT

Occupation: SALES ATTENDANT

NOTE: Every annexed page must be signed by the parties to the dealing or where the party is a corporate body be signed by the persons who have attested the affixing of the seal of that body to the dealing.

Appendix G

Traffic Impact Assessment

Tasman Highway/ Holyman Avenue Intersection Upgrade Traffic Impact Assessment

transport | community | mining | industrial | food & beverage | energy

Prepared for:	Department of State Growth
Client representative:	Steven Kaczmarski
Date:	23 February 2018 Rev 02

KMH ENVIRONMENTAL

Now part of the pitt&sherry group

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Prepared by: ..... Date: 23 February 2018
Rebekah Giana

Reviewed by: ..... Date: 23 February 2018
Ross Mannering

Authorised by: ..... Date: 23 February 2018
David Conley

Revision History					
Rev No.	**Description**	**Prepared by**	**Reviewed by**	**Authorised by**	**Date**
00	Draft Traffic Impact Assessment	R. Giana	R. Mannering	D. Conley	24/10/2017
01	Final Traffic Impact Assessment	R. Giana	R. Mannering	D. Conley	15/11/2017
02	Amended following review by DSG Traffic Manager	R. Giana	R. Mannering	D. Conley	23/2/2018

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1. Introduction

The Australian and Tasmanian Governments have committed to upgrading the Tasman Highway and Holyman Avenue Interchange in Cambridge as part of the Nation Building Program. The interchange upgrade has been confirmed as a priority upgrade project with construction expected to commence in 2018.

The Department of State Growth's objectives for the project are

- To improve safety and transport efficiency at the Holyman Avenue Intersection
- To provide a long-term solution for access to Holyman Avenue and the adjoining Kennedy Drive.

The Department of State Growth engaged **pitt&sherry** to undertake a Traffic Impact Assessment (TIA) for the development.

This report has been prepared in accordance with the Department of State Growth's *Framework for Undertaking Traffic Impact Assessments* and details the findings of the assessment undertaken for the proposed development.

2. Existing Conditions

2.1 Site Location

The site of the proposed interchange is the existing Tasman Highway/ Holyman Avenue/ Kennedy Drive/ Cranston Parade roundabout. The roundabout operates at-grade with five legs, it has a single circulating lane and a large central island of approximately 50 metres in diameter.

The roundabout provides direct access to Hobart International Airport from the Tasman Highway via Holyman Avenue. Access is also provided to Kennedy Drive, which connects the Highway and Airport with the Cambridge town centre, and to several properties on Cranston Parade. The location of the interchange is shown in Figure 1.

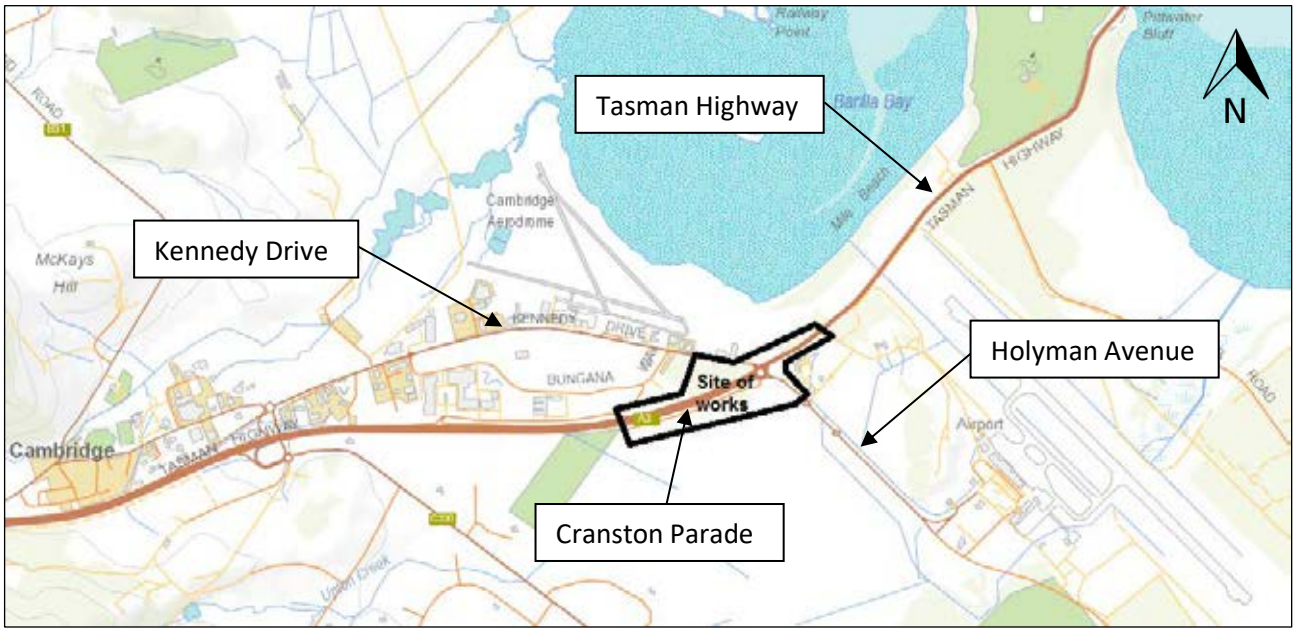


Figure 1: Locality Map (Basemap source: www.thelist.tas.gov.au)

2.2 Surrounding Road Network

The Tasman Highway is a Category 1 Trunk Road under the Tasmanian State Roads Hierarchy and is a major urban corridor into Hobart. It also provides tourist access to the Great Eastern Drive on Tasmania's East Coast. The Tasman Highway has two lanes in each direction to the west of the roundabout, reducing to one lane shortly before the roundabout. This reduction to one lane results in significant congestion at the roundabout and along the Highway.

Holyman Avenue is owned and managed by Hobart International Airport Pty Ltd (HIAPL) apart from the first 40 metres immediately east of the Tasman Highway roundabout, which is the responsibility of the Department of State Growth. It is generally one lane in each direction with short sections of two lane approach to internal roundabouts located approximately 250 metres and 500 metres from the Tasman Highway.

Kennedy Drive is a two lane undivided road with one lane in each direction and is the responsibility of Clarence City Council. It connects the Highway with the Cambridge Town Centre and several other suburbs.

Cranston Parade is a two lane undivided road with one lane in each direction and is the responsibility of Clarence City Council. It provides access for a small number of properties to the Highway.

2.3 Traffic Volumes

Traffic Volumes

Traffic data was collected for the existing Tasman Highway/ Holyman Avenue/ Kennedy Drive/ Cranston Parade roundabout for a 24 hour period on the following days:

- Thursday 28 July 2016
- Friday 29 July 2016
- Saturday 30 July 2016.

At the time of these counts, turning movement count data was also collected at the intersection of the Tasman Highway and Back Road and two-way counts were collected on Back Road and Surf Road.

Analysis of the traffic data highlighted five peak hours on the traffic network. Two of the weekday peak hours (labelled i and iv below) are peak hours including Tasman Highway volumes. The other two weekday peak hours (labelled ii and iii) below are peak hours for all the side roads not considering the Tasman Highway volumes. The Saturday peak hour is consistent for the Highway and side roads.

The peak hours were as follows:

1. Friday 28 July 2016 – 7:00am-8:00am – Weekday Highway AM Peak (affects existing layout only)
2. Thursday 28 July 2016 – 8:45am-9:45am – Weekday Side Roads AM Peak
3. Friday 29 July 2016 – 3:15pm-4:15pm – Weekday Side Roads PM Peak
4. Thursday 28 July 2016 – 4:00pm-5:00pm – Weekday Network PM Peak (affects existing layout)
5. Saturday 30 July – 11:45am-12:45pm – Saturday Peak.

The traffic volumes for each of these peak periods are included in Appendix 1.

2.4 Existing Intersection Operation

The traffic operation of the existing Tasman Highway/Holyman Avenue/Kennedy Drive/Cranston Parade roundabout and the proposed new signalised intersection have been assessed using SIDRA INTERSECTION. The intersection performance is based on the vehicle delay and the corresponding Level of Service (LOS). It is generally accepted that an intersection operates well if it is at LOS D or higher. Table 1 shows the criteria that SIDRA INTERSECTION adopts in assessing the LOS.

Table 1: SIDRA INTERSECTION Level of Service Criteria

LOS	Delay per Vehicle (secs)		
	Signals	Roundabout	Sign Control
A	10 or less	10 or less	10 or less
B	10 to 20	10 to 20	10 to 15
C	20 to 35	20 to 35	15 to 25
D	35 to 55	35 to 50	25 to 35
E	55 to 80	50 to 70	35 to 50
F	Greater than 80	Greater than 70	Greater than 50

The traffic modelling has assumed no pedestrian movements as these are expected to be low.

Table 3 presents a summary of the current operation of the existing roundabout (using 2016 volumes).

The following assumptions were made for the 2016 traffic model:

- The collected traffic volumes in July represent off-peak volumes, based on data provided from the Department of State Growth for the Tasman Highway. The July volumes have been factored up by 1.18 to predict the peak (December) volumes
- Based on the counts, 5% of all vehicles have been modelled as heavy vehicles with the exception of Kennedy Drive as 10% and Cranston Parade as 50%.

It is noted that the results are for the overall intersection performance. The DOS, delay and LOS figures represent average values for the intersection. The queue figure represents the 95th percentile queue for the worst leg of the intersection. Results for individual legs of the intersection are presented with the full results in Appendix 2.

Table 2: Existing Layout Operating Conditions – 2016 Volumes

Year	Peak	Degree of Saturation (DOS)	Average Delay (secs)	95th Percentile Queue (m)	LOS
2016	AM Network	1.01	35	389	D
	AM Side Roads	0.97	24	257	C
	PM Side Roads	1.64	102	671	F
	PM Network	1.66	82	619	F
	Saturday	0.83	18	106	B

Based on the results above the existing roundabout is not operating at a satisfactory LOS during many of the peak hours in December 2016. This is indicated by the DOS of more than 1.00 in three of the peak hours which suggests there is more traffic attempting to travel through the intersection than the intersection capacity. In addition, vehicles in the PM peak hours are experiencing large delays resulting in a LOS F which indicates unacceptable delays.

2.5 Predicted Intersection Operation in 2018 and 2038

The traffic future operation has been assessed for two years; the 2018 (post construction) and 2038 (20 years post construction) scenarios.

The assumptions made for the 2016 model are also assumed for the 2018 and 2038 models, the following assumptions have also been made for the traffic growth:

- The traffic growth rate on the Tasman Highway, Kennedy Drive and Cranston Parade has been calculated as 2.8% compounding growth per year based on data provided by the Department of State Growth for the Tasman Highway
- The traffic growth rate for all movements to/from the airport (Holyman Avenue) has been calculated as 4.7% compounding growth per year based on data sourced from the current Hobart Airport Master Plan
- The modelling includes a shift of 100% of hire cars and 50% of taxis to using Back Road after the Hobart Airport terminal upgrade (to be completed by 2018) based on information provided by HIAPL.

The traffic volumes for each scenario in each peak hour in 2018 and 2038 are provided in Appendix 3.

Table 3 presents a summary of the anticipated operation of the existing roundabout in 2018 and 2038 with full results shown in Appendix 4.

Table 3: Existing Layout Operating Conditions – 2018 and 2038 Volumes

Year	Peak	Degree of Saturation (DOS)	Average Delay (secs)	95th Percentile Queue (m)	LOS
2018	AM Network	1.08	74	740	F
	AM Side Roads	1.07	46	525	D
	PM Side Roads	1.47	128	1,097	F
	PM Network	1.59	111	824	F
	Saturday	1.12	41	349	D
2038	AM Network	3.10	1,033	7,916	F
	AM Side Roads	2.76	929	5,510	F
	PM Side Roads	2.85	1,019	7,229	F
	PM Network	2.80	931	6,816	F
	Saturday	2.75	830	4,741	F

As expected, based on the anticipated growth on the road network, the intersection will continue to operate at poorer levels with increasing delays in 2018 and 2038. The modelling gives an indication that the anticipated traffic volumes in 2038 are three times the capacity of the existing roundabout.

The assessment above indicates that upgrade of the intersection is necessary as the existing roundabout is no longer performing at an acceptable level.

3. Development Proposal

It is proposed to change the existing roundabout to a grade separated Diamond Interchange with signalised T junctions at ramp terminals and the Tasman Highway passing under Holyman Avenue. The general configuration of the proposed interchange is shown in Figure 2 with full design drawings included in Appendix A of the main Planning Report.

Figure 2: Proposed Interchange

The Highway is expected to have a speed limit of 100km/h at the interchange and the ramps and bridge will have a speed limit of 60km/h.

The connection of Cranston Parade into the road system will be achieved by making the Hobart bound on ramp a two way road for a length of approximately 600 metres from the junction with Holyman Avenue. A single access point onto the ramp will be provided for the three westernmost properties on Cranston Parade approximately 100 metres east of the existing cul-de-sac. A second access will be provided a further 230 metres to the east for the Casimaty property.

As shown in the drawings, Holyman Avenue will have two lanes in each direction at the interchange. In an eastbound direction, two lanes will extend to approximately a kilometre east of the interchange to allow for the Tasman Highway on-ramp traffic to merge with the Highway traffic safely and also allow for the Highway traffic to merge into one lane after this. In a westbound direction, the two lane carriageway will begin approximately 700 metres east of the interchange.

The bridge over the Highway will have two lanes in a southbound direction (i.e. towards Holyman Avenue) and one lane in a northbound direction (towards Kennedy Drive).

4. Transport Assessment

4.1 Vehicle Access

Access Between Highway and Interchange

Ramp terminals will be provided in a diamond arrangement as discussed in Section 3. As this is a new design, the ramp terminals have been designed in accordance with the Australian Standard requirements and all sight distances meet the Australian Standard and Austroads requirements.

Acceptable Solution A1 of Clause E5.6.2 – Road Accesses and Junctions, in the *Clarence Interim Planning Scheme 2015* states that "*No new access or junctions to roads in an area subject to a speed limit of more than 60km/h*".

The proposed new interchange does not introduce new (in the sense of additional) access or junctions onto the Tasman Highway. It redistributes traffic which currently enters and leaves the highway via a roundabout with five legs into a more efficient traffic operation system.

The P1 performance criteria of Clause E5.6.2 are as follows:

> For roads in an area subject to a speed limit of more than 60km/h, accesses and junctions must be safe and not unreasonably impact on the efficiency of the road, having regard to:
>
> (a) the nature and frequency of the traffic generated by the use;
>
> (b) the nature of the road;
>
> (c) the speed limit and traffic flow of the road;
>
> (d) any alternative access;
>
> (e) the need for the access or junction;
>
> (f) any traffic impact assessment; and
>
> (g) any written advice received from the road authority.

As discussed, the purpose of this project is to improve safety and transport efficiency at the Tasman Highway/ Holyman Avenue Intersection. Raising Holyman Avenue/Kennedy drive to pass over the Tasman Highway will provide significant safety improvements by separating high speed through traffic from turning traffic. Removing the roundabout which forces all highway vehicle to slowdown and give way will significantly enhance transport efficiency and provide greater travel reliability to and from the Airport and Hobart.

Access To/From Cranston Parade

As discussed, Cranston Parade will be incorporated into the Hobart bound on ramp with two way access along the ramp for properties in Cranston Parade. The on-ramp will have a speed limit of 60km/h for the section from Holyman Avenue to the last property in Cranston Parade.

It is noted that the proposed two way access along part of the on ramp is an unconventional arrangement and less preferred from a traffic engineering perspective as it will introduce additional conflict points over and above a one way ramp. No other suitable locations have been identified for relocation of Cranston Parade with agreement unable to be reached about a possible connection across airport land to Holyman Avenue.

Traffic modelling has been carried out for the on ramp operating as a two way road from the perspective of performance of the junctions at the ramp terminals. In each case the overall level of service at the junction was not detrimentally affected by the addition of traffic from Cranston Parade. An assessment was also carried out for the weaving length required for vehicles entering the on ramp and accessing the Casimaty property and this was found to be satisfactory.

4.2 Traffic Impacts

4.2.1 General

The existing Tasman Highway/ Holyman Avenue intersection is located on the main access route between Hobart, the Airport, the East Coast, Sorell and several other suburbs. The upgrade of the interchange to grade-separation would not be expected to increase traffic volumes as this is already the main route for the traffic travelling between these locations.

As the new intersections will be affected by side road movements, they have been assessed for the three side road peaks only (ii, iii & v from Section 2.3). The calculated traffic volumes for the peak periods are included in Appendix 5.

The assessment included the 2018 (post construction) and 2038 (20 years post construction) scenarios. The assumptions are the same as for the existing models.

The following criteria were considered in the traffic operation of the upgrades:

- Current traffic congestion at the roundabout is resolved
- Level of Service (LOS) D or better is achieved for each intersection in 2038
- Efficient and reliable access to the airport.

Table 4 presents a summary of the anticipated operation of the proposed interchange in 2018 and 2038, with full results presented in Appendix 6.

Table 4: Traffic Signals Operating Conditions

Year	Peak	Intersection	Degree of Saturation (DOS)	Average Delay (secs)	95th Percentile Queue (m)	LOS
2018	AM	Tasman/Kennedy	0.45	14	26	B
		Tasman/Holyman	0.45	6	16	A
	PM	Tasman/Kennedy	0.63	15	25	B
		Tasman/Holyman	0.30	7	13	A
	Saturday	Tasman/Kennedy	0.72	16	31	B
		Tasman/Holyman	0.35	8	15	A
2038	AM	Tasman/Kennedy	0.84	22	148	C
		Tasman/Holyman	0.78	9	94	A
	PM	Tasman/Kennedy	0.88	23	102	C
		Tasman/Holyman	0.53	7	38	A

Year	Peak	Intersection	Degree of Saturation (DOS)	Average Delay (secs)	95th Percentile Queue (m)	LOS
	Saturday	Tasman/Kennedy	0.98	24	92	C
		Tasman/Holyman	0.63	8	41	A

Based on the results above the proposed interchange is expected to operate efficiently in 2018 and 2038. There is additional capacity at the signals in 2038 and therefore it would continue to operate at a good level of service beyond the design year.

The proposed interchange satisfies the traffic operation criteria as it relieves the current traffic congestion as discussed in Section 2.5 and operates better than LOS D in 2038.

Access to the airport is reliable with average delays at the signals for vehicles travelling from Hobart of 28 seconds during the worst peak hour in 2038 (shown in the movement summary in Appendix 6).

4.2.2 Location of eastbound Merges

The merges from the eastbound on ramp onto the Tasman Highway, and the merge from two lanes to one on the highway, have been modelled using SIDRA Intersection to determine whether queues would be triggered on the Highway and the on ramp by the merges. It is important that queues on the Tasman Highway do not extend beyond the eastbound off ramp as this will cause delays to traffic accessing the airport. Similarly queues for traffic entering the Highway from the eastbound on ramp have the potential to delay traffic leaving the airport to travel east.

- In 2018 the merge from the eastbound on ramp to the left lane of the Highway would have a 95th percentile queue of 8m and an average delay of 3 seconds resulting in LOS A
- In 2018 the merge on the Highway from two lanes to one lane would have a 95th percentile queue of 355m and an average delay of 58 seconds resulting in LOS F. The merge has been located 350 metres east of the ramp merge point to minimise queuing up the ramp.

Based on the predicted traffic growth, the performance of both these merges will progressively deteriorate over time without further capacity improvements to the road system to the east of the project limits.

The scope of the Airport Interchange project extends the two eastbound lanes on the Tasman Highway a further 1 kilometre to ensure a high standard of access can be provided and maintained to the airport. Further capacity improvements on the Tasman Highway east of the airport are outside the scope of this project.

4.3 Traffic management During Construction

Construction activities will need to be carefully managed during construction to ensure that delays and disruption are minimised recognising the importance of reliable journey times to the airport. The Department of State Growth has strict performance requirements for traffic management on major arteria roads with respect to delays and an overall policy to restrict works on these roads that might delay traffic between the hours of 6.30 am - 9.30 and and 3.00 pm – 6.30 pm other than in exceptional circumstances.
The work will require multiple traffic staging with temporary detours and speed reductions being necessary and includes the complexity of building a new bridge over live traffic.

4.4 Parking

There will be no car parking required for the development.

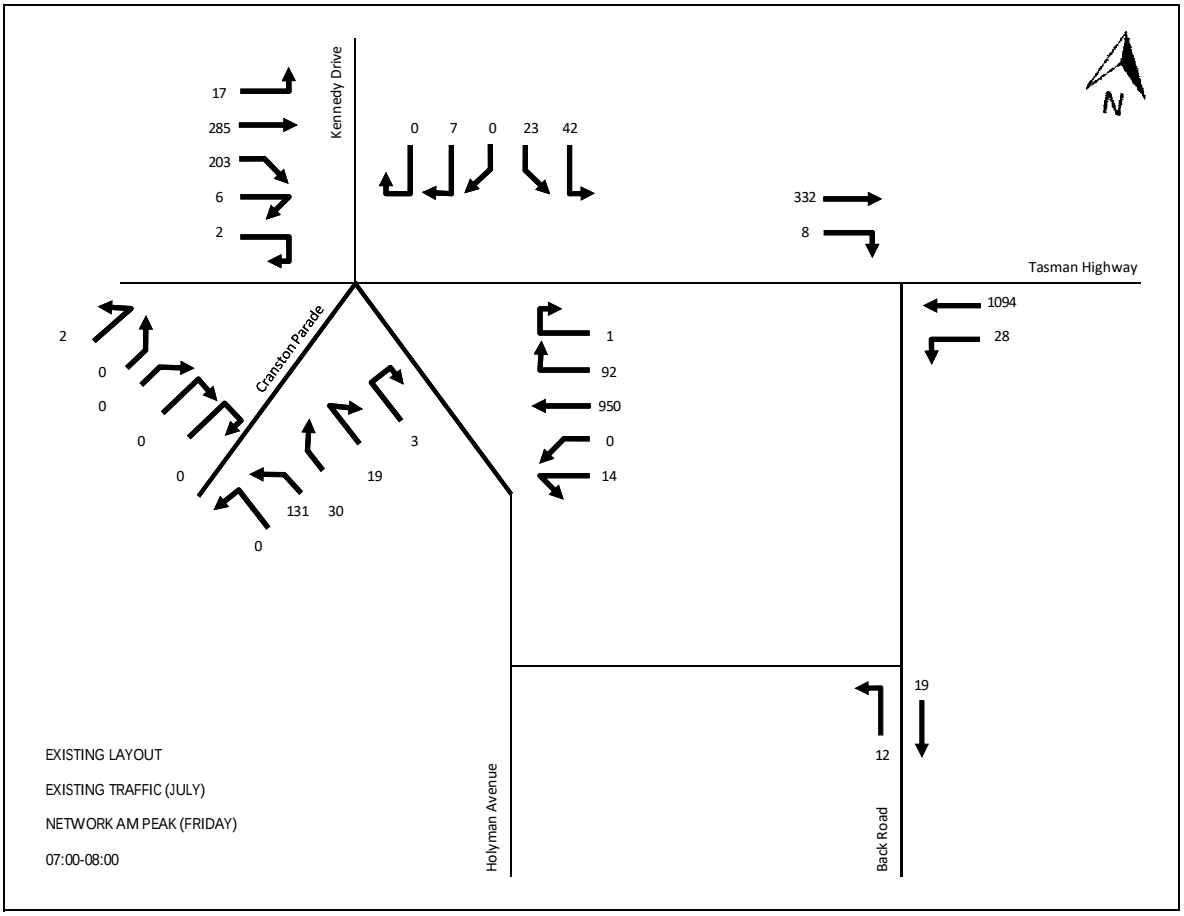
5. Conclusion

The proposed interchange upgrade at the intersection of the Tasman Highway and Holyman Avenue has been assessed in accordance with the Department of State Growth's *Framework for Undertaking Traffic Impact Assessments.* The analysis and discussions presented in this report can be summarised as follows:

- The proposed upgrade is expected to significantly reduce queues and delays at the interchange when compared with the existing layout resulting in improved traffic operation
- The interchange is expected to operate at a satisfactory level of service until at least 2038
- The proposed interchange upgrade is not expected to have any significant impact on the safety of the interchange, the reduction of queues and congestion may result in improved safety at the interchange.

Appendix 1

Traffic Volumes – Existing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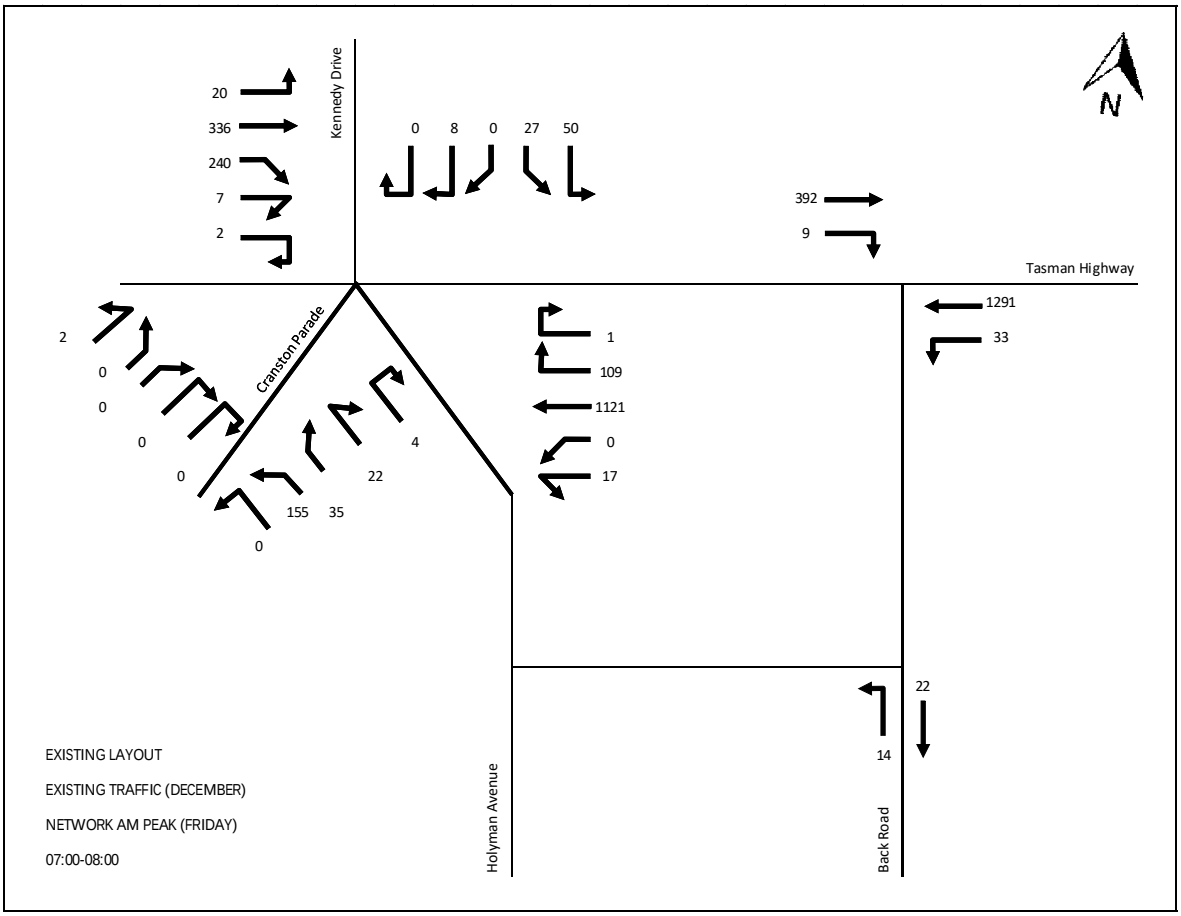
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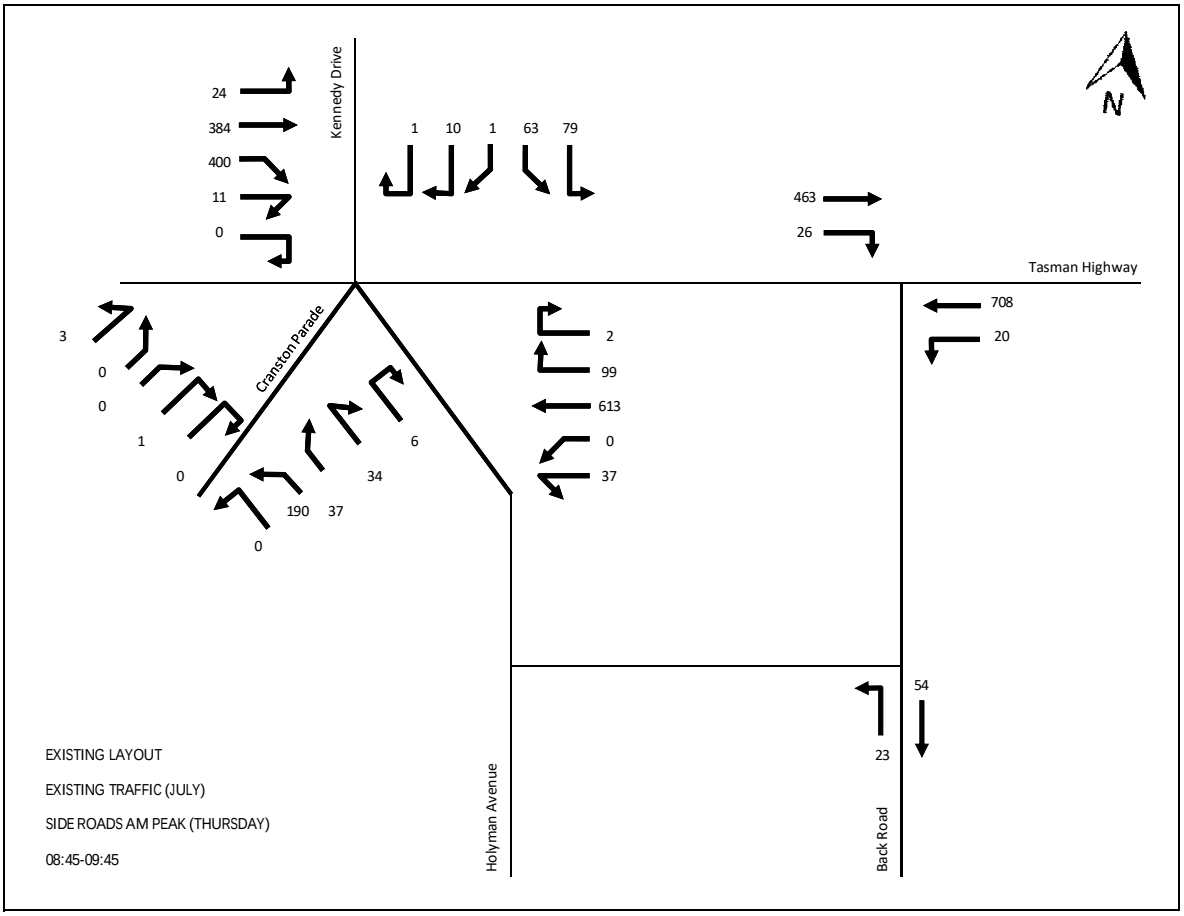
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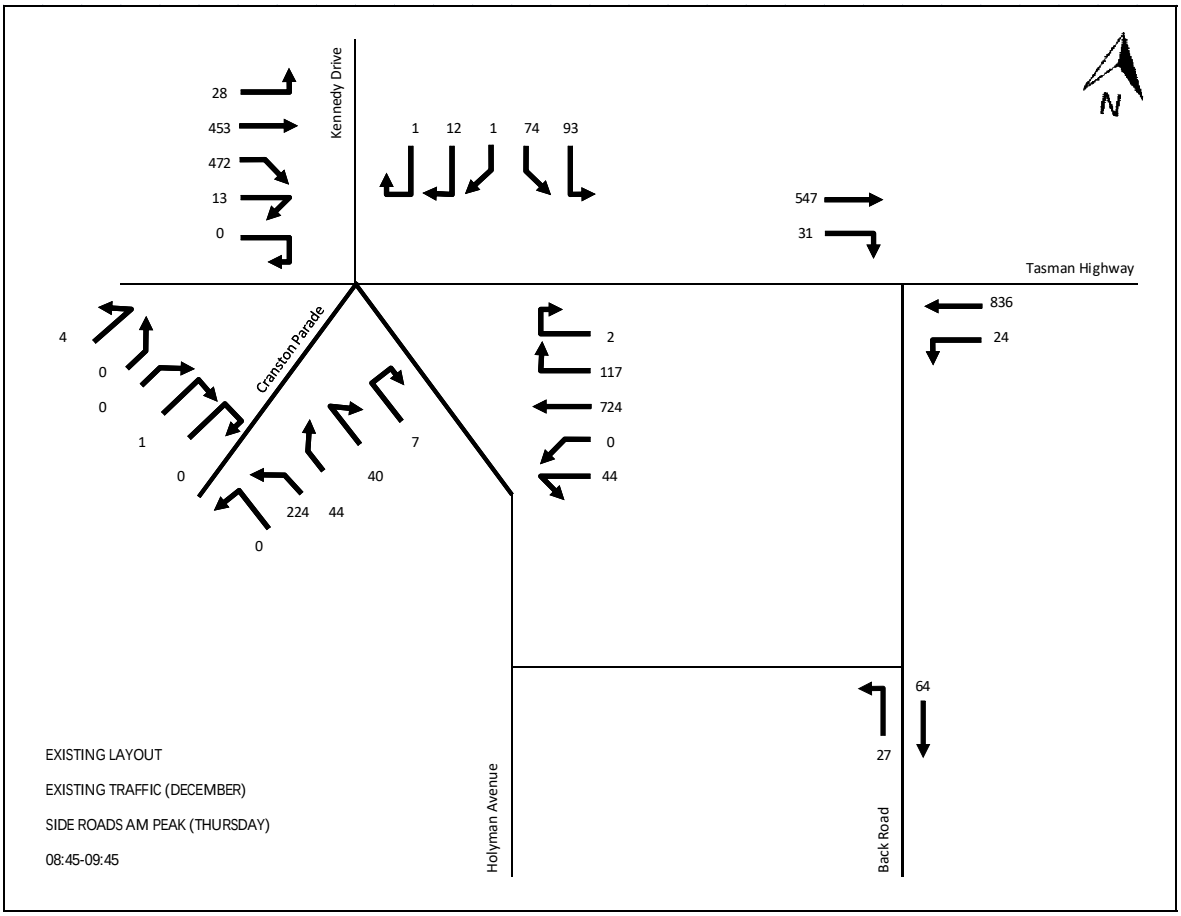
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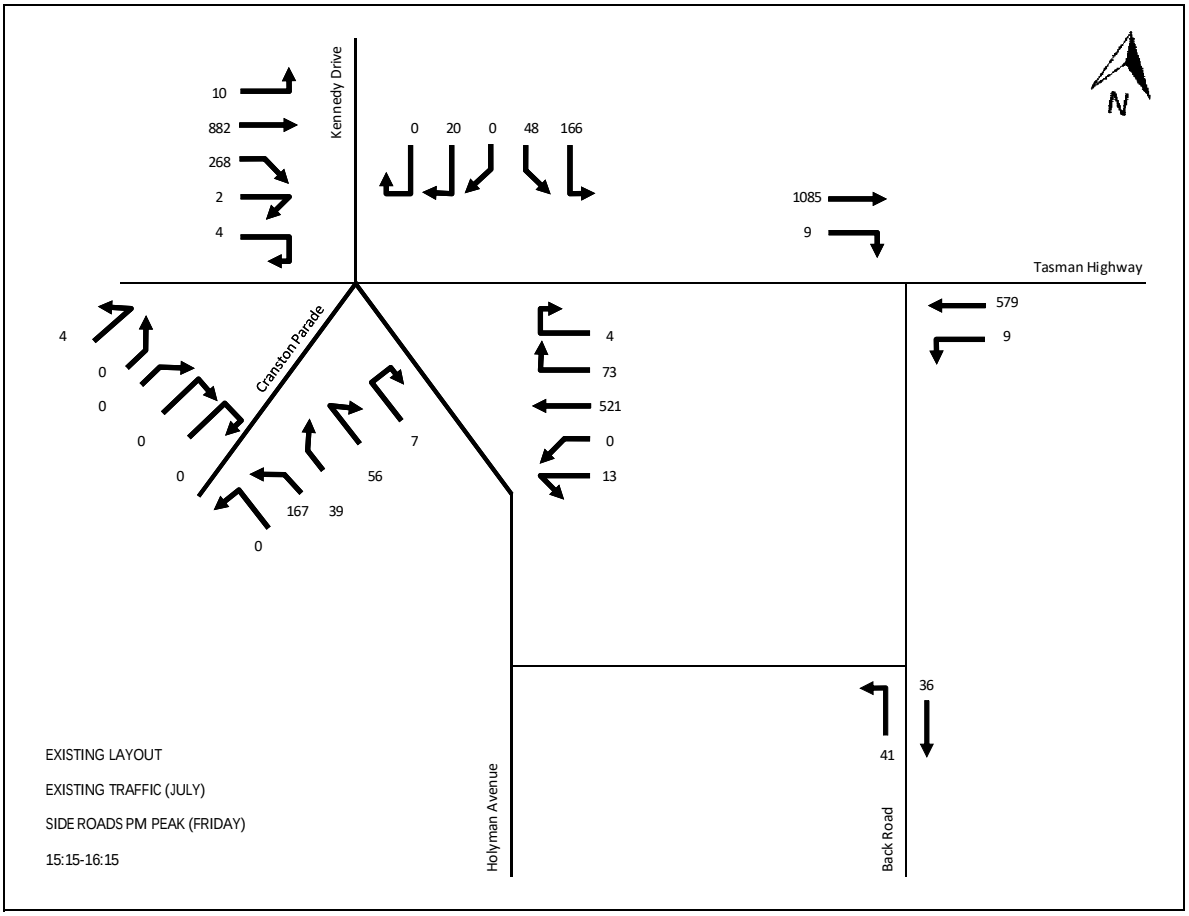
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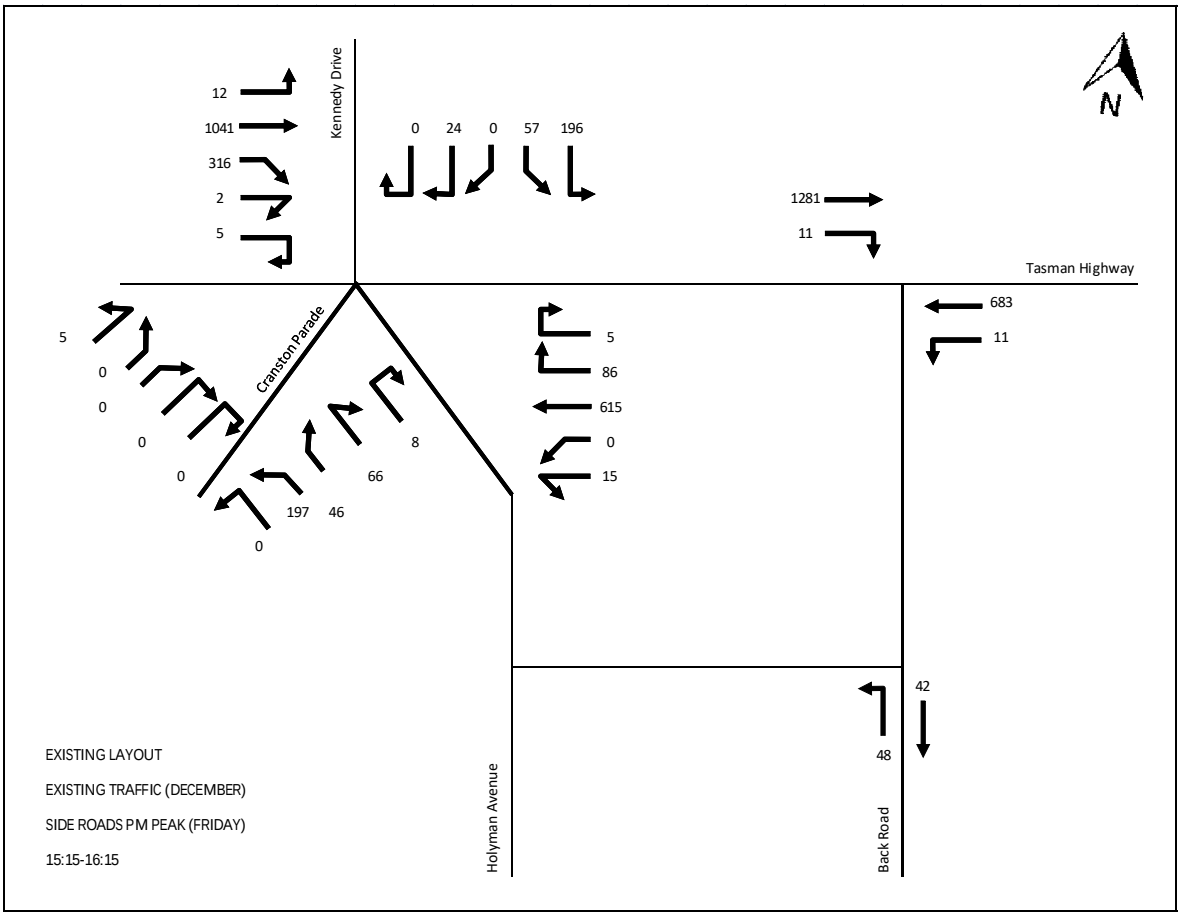
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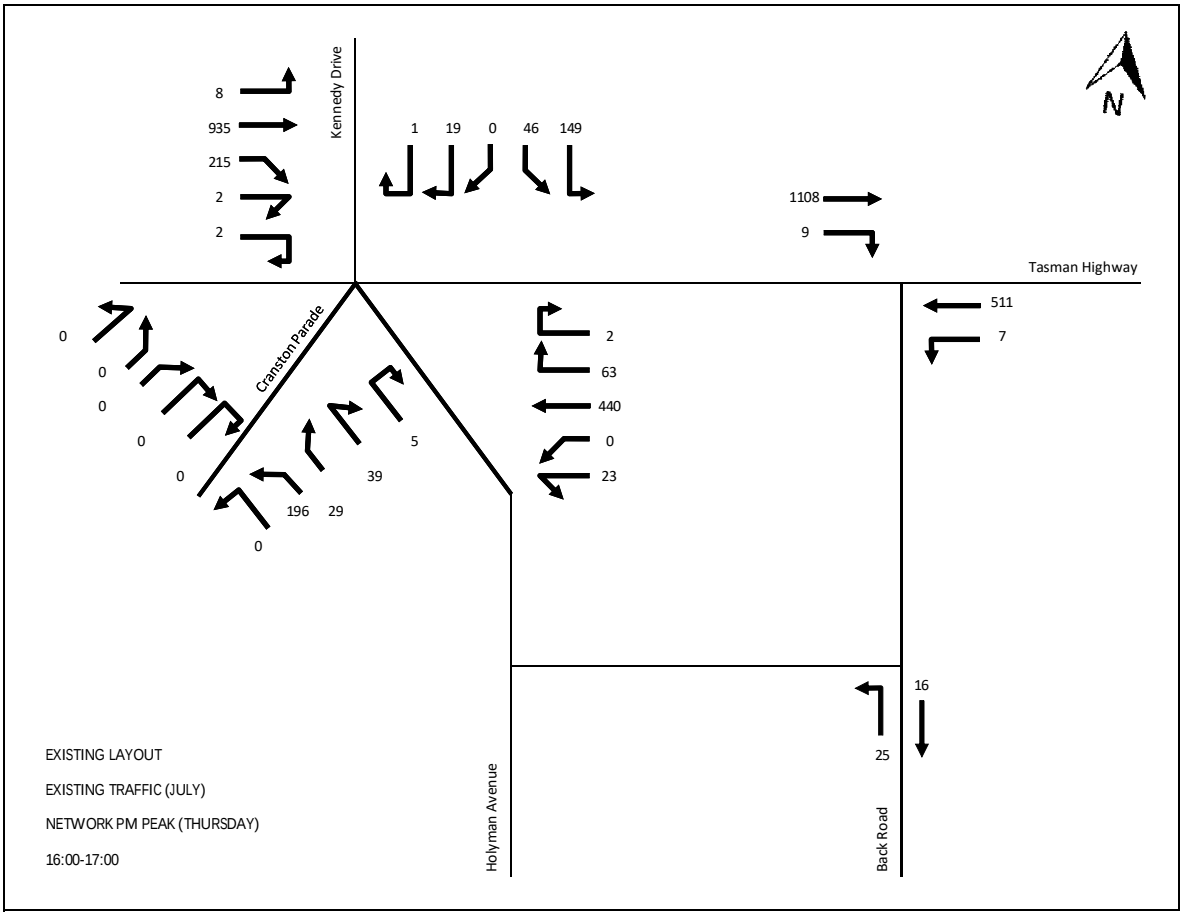
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EXISTING LAYOUT
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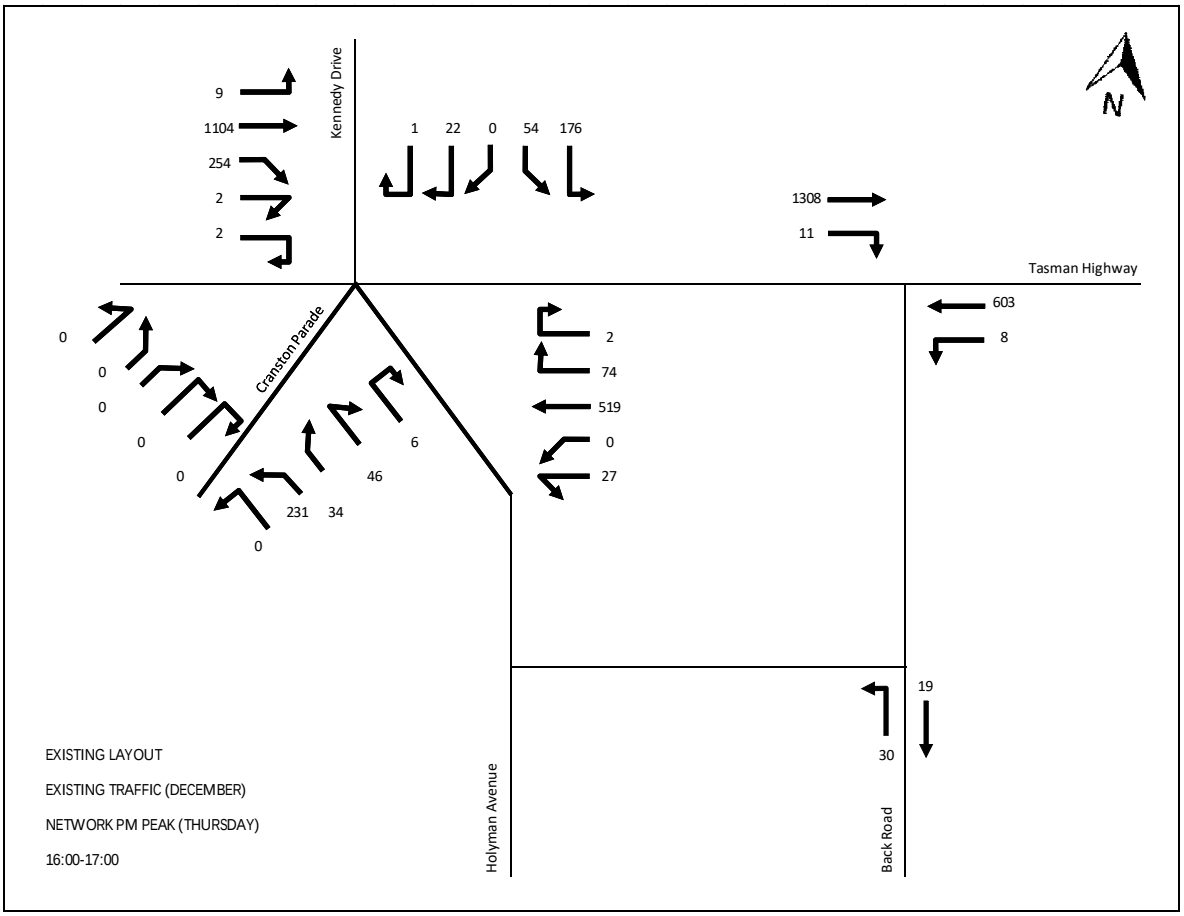
NETWORK PM PEAK (THURSDAY)
16:00-17:00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1
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1308
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Tasman Highway
603
8
Cranston Parade
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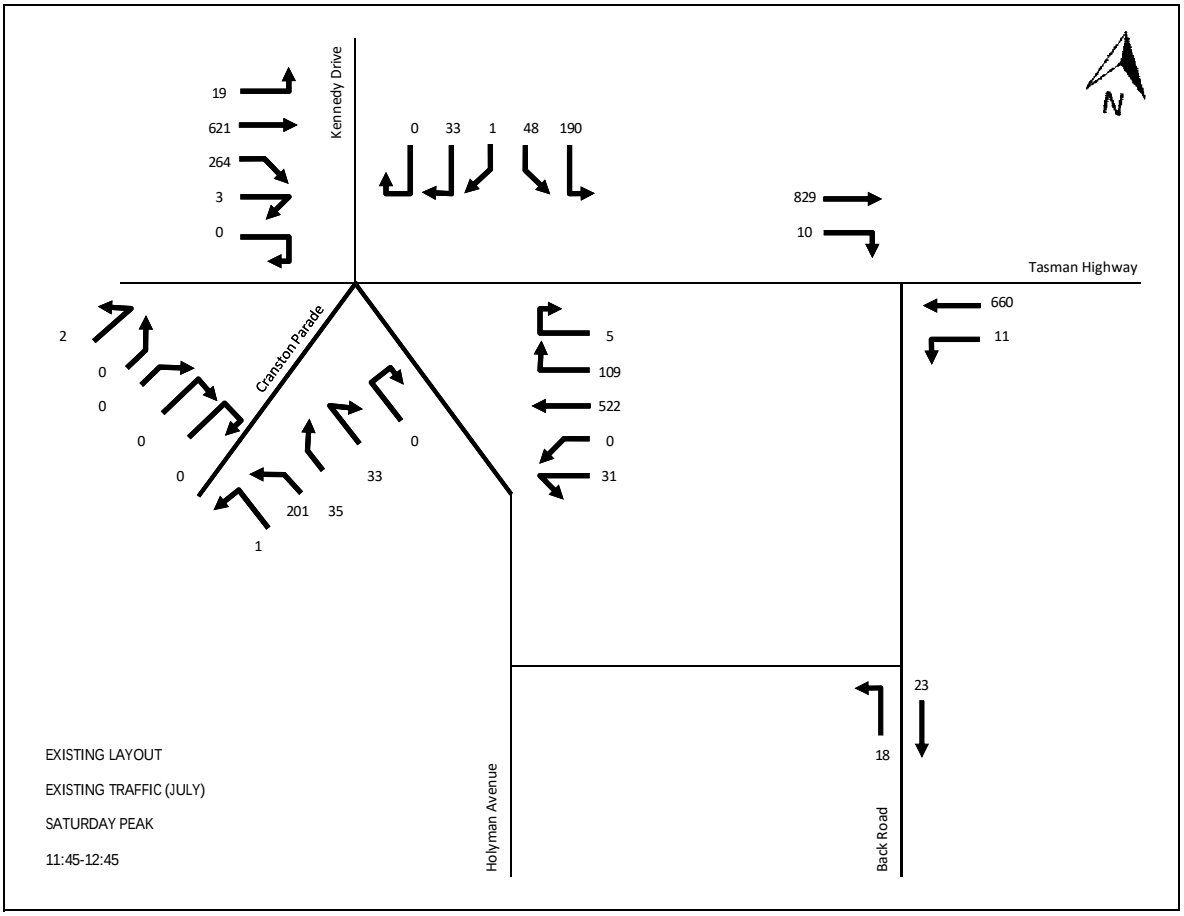
0
0
0
0
6
46
231
34
0
2
74
519
0
27
Holyman Avenue
19
30
Back Road
N
EXISTING LAYOUT
EXISTING TRAFFIC (DECEMBER)
NETWORK PM PEAK (THURSDAY)
16:00-17:00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0
0 33 1 48 190
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Tasman Highway
660
11
Cranston Parade
2
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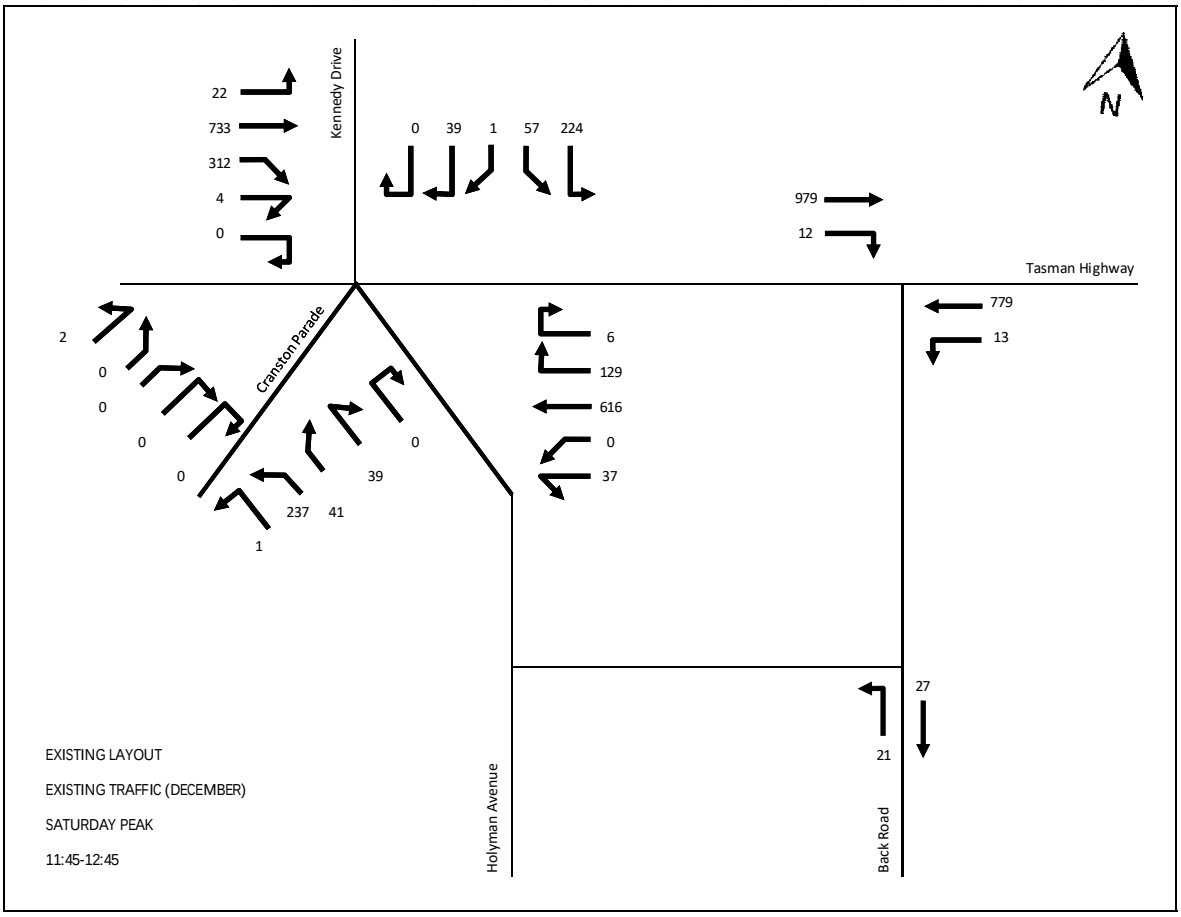
0
0
0
0
33
201 35
1
5
109
522
0
31
Holyman Avenue
23
18
Back Road
N
EXISTING LAYOUT
EXISTING TRAFFIC (JULY)
SATURDAY PEAK
11:45-12:45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13
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2
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0
0
0
39
237 41
1
6
129
616
0
37
Holyman Avenue
27
21
Back Road
N
EXISTING LAYOUT
EXISTING TRAFFIC (DECEMBER)
SATURDAY PEAK
11:45-12:45

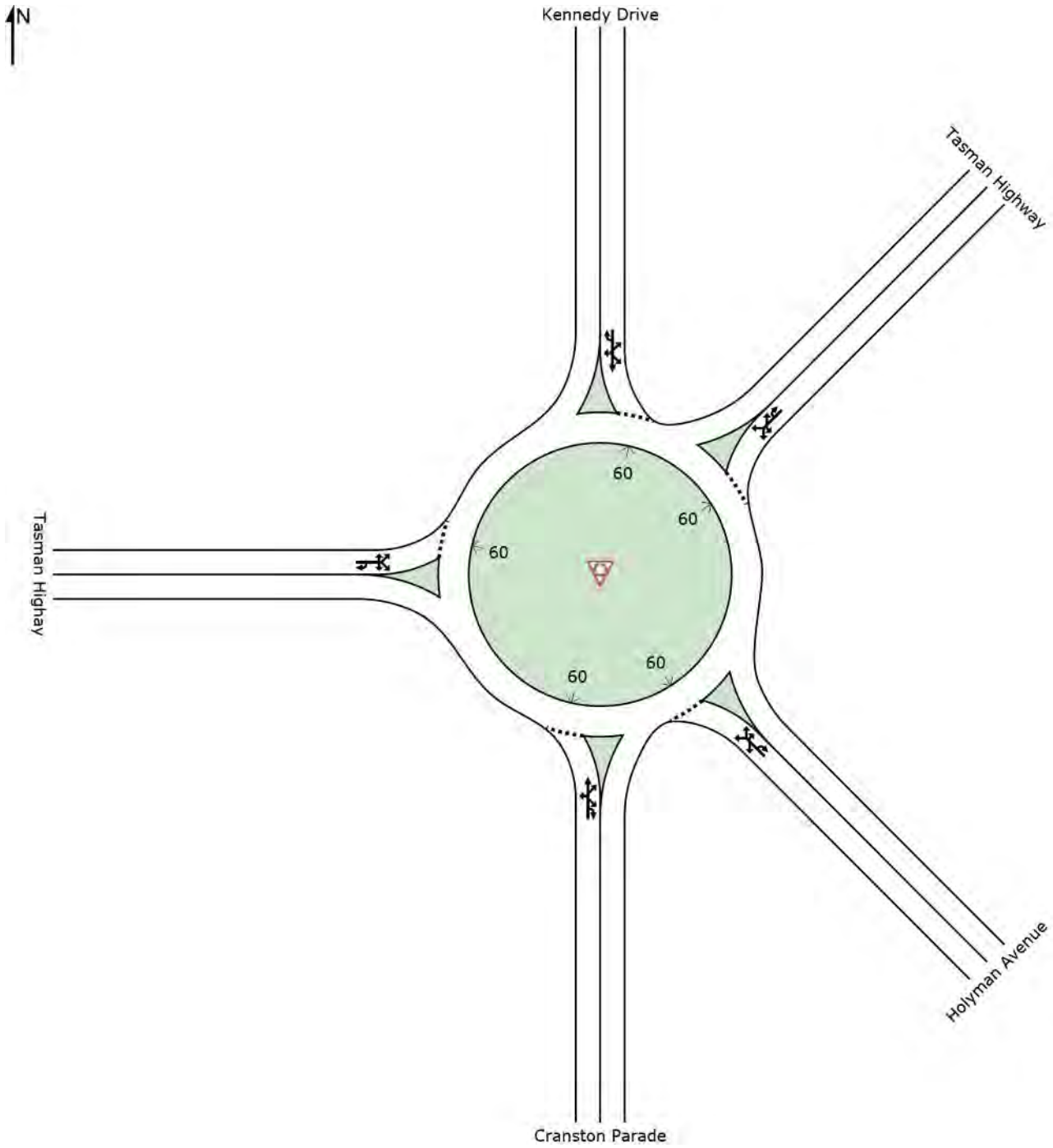
Appendix 2

SIDRA Intersection Traffic Modelling Results – Existing Conditions

SITE LAYOUT

Site: 101 [Existing Layout - 2016 Network AM Peak]

Tasman Highway/ Holyman Avenue
Friday 07:00-08:00
Roundabout



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MOVEMENT SUMMARY

Site: 101 [Existing Layout - 2016 Network AM Peak]

Tasman Highway/ Holyman Avenue
Friday 07:00-08:00
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Cranston Parade											
1	L2	2	50.0	0.054	32.0	LOS C	0.3	3.0	0.97	0.96	39.0
2	T1	1	50.0	0.054	31.8	LOS C	0.3	3.0	0.97	0.96	40.4
3a	R1	1	50.0	0.054	38.1	LOS D	0.3	3.0	0.97	0.96	40.0
3b	R3	1	50.0	0.054	40.8	LOS D	0.3	3.0	0.97	0.96	41.3
3u	U	1	50.0	0.054	42.2	LOS D	0.3	3.0	0.97	0.96	41.9
Approach		6	50.0	0.054	36.2	LOS D	0.3	3.0	0.97	0.96	40.2
SouthEast: Holyman Avenue											
21b	L3	1	5.0	0.836	83.2	LOS F	13.5	98.7	1.00	1.47	25.9
21a	L1	163	5.0	0.836	82.4	LOS F	13.5	98.7	1.00	1.47	26.5
23a	R1	37	5.0	0.836	88.7	LOS F	13.5	98.7	1.00	1.47	26.8
23	R2	23	5.0	0.836	90.1	LOS F	13.5	98.7	1.00	1.47	27.1
23u	U	4	5.0	0.836	92.9	LOS F	13.5	98.7	1.00	1.47	27.7
Approach		228	5.0	0.836	84.4	LOS F	13.5	98.7	1.00	1.47	26.6
NorthEast: Tasman Highway											
24	L2	18	5.0	1.005	35.7	LOS D	53.3	389.1	1.00	1.67	37.2
24a	L1	1	5.0	1.005	35.3	LOS D	53.3	389.1	1.00	1.67	37.9
26a	R1	1180	5.0	1.005	41.6	LOS D	53.3	389.1	1.00	1.67	38.4
26b	R3	115	5.0	1.005	44.4	LOS D	53.3	389.1	1.00	1.67	39.6
26u	U	1	5.0	1.005	45.8	LOS D	53.3	389.1	1.00	1.67	40.2
Approach		1315	5.0	1.005	41.8	LOS D	53.3	389.1	1.00	1.67	38.5
North: Kennedy Drive											
7b	L3	53	10.0	0.098	5.8	LOS A	0.6	4.8	0.69	0.63	53.8
7a	L1	28	10.0	0.098	5.0	LOS A	0.6	4.8	0.69	0.63	56.6
8	T1	1	10.0	0.098	5.3	LOS A	0.6	4.8	0.69	0.63	57.6
9	R2	8	10.0	0.098	12.8	LOS B	0.6	4.8	0.69	0.63	59.1
9u	U	1	10.0	0.098	15.5	LOS B	0.6	4.8	0.69	0.63	62.1
Approach		92	10.0	0.098	6.3	LOS A	0.6	4.8	0.69	0.63	55.3
West: Tasman Highay											
10	L2	21	5.0	0.450	5.6	LOS A	3.6	26.5	0.50	0.57	64.2
10a	L1	354	5.0	0.450	5.7	LOS A	3.6	26.5	0.50	0.57	66.2
12a	R1	253	5.0	0.450	12.4	LOS B	3.6	26.5	0.50	0.57	62.8
12	R2	7	5.0	0.450	14.2	LOS B	3.6	26.5	0.50	0.57	64.4
12u	U	2	5.0	0.450	17.7	LOS B	3.6	26.5	0.50	0.57	70.7
Approach		637	5.0	0.450	8.5	LOS A	3.6	26.5	0.50	0.57	64.7
All Vehicles		2278	5.3	1.005	35.3	LOS D	53.3	389.1	0.85	1.30	41.8

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Existing Layout - 2016 Side Roads AM Peak]

Tasman Highway/ Holyman Avenue
Thursday 08:45-09:45
Roundabout

Movement Performance - Vehicles												
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Cranston Parade											
1	L2	4	50.0	0.028	16.2	LOS B	0.2	2.1	1.00	0.78	46.5
2	T1	1	50.0	0.028	16.1	LOS B	0.2	2.1	1.00	0.78	48.6
3a	R1	1	50.0	0.028	22.3	LOS C	0.2	2.1	1.00	0.78	48.0
3b	R3	1	50.0	0.028	25.1	LOS C	0.2	2.1	1.00	0.78	49.9
3u	U	1	50.0	0.028	26.5	LOS C	0.2	2.1	1.00	0.78	50.9
Approach		8	50.0	0.028	19.4	LOS B	0.2	2.1	1.00	0.78	47.9
SouthEast: Holyman Avenue											
21b	L3	1	5.0	0.576	13.9	LOS B	6.3	46.1	1.00	1.05	48.4
21a	L1	236	5.0	0.576	13.1	LOS B	6.3	46.1	1.00	1.05	50.5
23a	R1	46	5.0	0.576	19.5	LOS B	6.3	46.1	1.00	1.05	51.5
23	R2	42	5.0	0.576	20.8	LOS C	6.3	46.1	1.00	1.05	52.5
23u	U	7	5.0	0.576	23.6	LOS C	6.3	46.1	1.00	1.05	54.8
Approach		333	5.0	0.576	15.2	LOS B	6.3	46.1	1.00	1.05	51.0
NorthEast: Tasman Highway											
24	L2	46	5.0	0.970	37.5	LOS D	35.2	257.2	1.00	1.84	36.6
24a	L1	1	5.0	0.970	37.2	LOS D	35.2	257.2	1.00	1.84	37.3
26a	R1	762	5.0	0.970	43.5	LOS D	35.2	257.2	1.00	1.84	37.8
26b	R3	123	5.0	0.970	46.2	LOS D	35.2	257.2	1.00	1.84	38.9
26u	U	2	5.0	0.970	47.6	LOS D	35.2	257.2	1.00	1.84	39.5
Approach		935	5.0	0.970	43.5	LOS D	35.2	257.2	1.00	1.84	37.9
North: Kennedy Drive											
7b	L3	98	10.0	0.360	11.1	LOS B	3.1	23.2	1.00	0.93	50.6
7a	L1	78	10.0	0.360	10.3	LOS B	3.1	23.2	1.00	0.93	53.1
8	T1	1	10.0	0.360	10.6	LOS B	3.1	23.2	1.00	0.93	53.9
9	R2	13	10.0	0.360	18.1	LOS B	3.1	23.2	1.00	0.93	55.2
9u	U	1	10.0	0.360	20.8	LOS C	3.1	23.2	1.00	0.93	57.8
Approach		191	10.0	0.360	11.3	LOS B	3.1	23.2	1.00	0.93	51.9
West: Tasman Highay											
10	L2	29	5.0	0.736	7.0	LOS A	9.1	66.5	0.76	0.67	62.3
10a	L1	477	5.0	0.736	7.1	LOS A	9.1	66.5	0.76	0.67	64.2
12a	R1	497	5.0	0.736	13.9	LOS B	9.1	66.5	0.76	0.67	61.0
12	R2	14	5.0	0.736	15.6	LOS B	9.1	66.5	0.76	0.67	62.5
12u	U	1	5.0	0.736	19.1	LOS B	9.1	66.5	0.76	0.67	68.3
Approach		1018	5.0	0.736	10.5	LOS B	9.1	66.5	0.76	0.67	62.5
All Vehicles		2484	5.5	0.970	23.7	LOS C	35.2	257.2	0.90	1.18	48.3

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Existing Layout - 2016 Network PM Peak]

Tasman Highway/ Holyman Avenue
Thursday 16:00-17:00
Roundabout

Movement Performance - Vehicles												
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Cranston Parade											
1	L2	1	50.0	0.010	9.8	LOS A	0.1	0.7	0.84	0.66	49.5
2	T1	1	50.0	0.010	9.6	LOS A	0.1	0.7	0.84	0.66	51.8
3a	R1	1	50.0	0.010	15.8	LOS B	0.1	0.7	0.84	0.66	51.2
3b	R3	1	50.0	0.010	18.6	LOS B	0.1	0.7	0.84	0.66	53.3
3u	U	1	50.0	0.010	20.0	LOS B	0.1	0.7	0.84	0.66	54.4
Approach		5	50.0	0.010	14.8	LOS B	0.1	0.7	0.84	0.66	52.0
SouthEast: Holyman Avenue											
21b	L3	1	5.0	0.364	6.3	LOS A	2.9	20.8	0.83	0.68	52.4
21a	L1	243	5.0	0.364	5.6	LOS A	2.9	20.8	0.83	0.68	54.9
23a	R1	36	5.0	0.364	11.9	LOS B	2.9	20.8	0.83	0.68	56.0
23	R2	48	5.0	0.364	13.2	LOS B	2.9	20.8	0.83	0.68	57.3
23u	U	6	5.0	0.364	16.0	LOS B	2.9	20.8	0.83	0.68	60.0
Approach		335	5.0	0.364	7.5	LOS A	2.9	20.8	0.83	0.68	55.4
NorthEast: Tasman Highway											
24	L2	28	5.0	0.536	4.3	LOS A	4.7	34.4	0.72	0.70	51.3
24a	L1	1	5.0	0.536	3.9	LOS A	4.7	34.4	0.72	0.70	52.7
26a	R1	546	5.0	0.536	10.3	LOS B	4.7	34.4	0.72	0.70	53.7
26b	R3	78	5.0	0.536	13.0	LOS B	4.7	34.4	0.72	0.70	56.0
26u	U	2	5.0	0.536	14.4	LOS B	4.7	34.4	0.72	0.70	57.2
Approach		656	5.0	0.536	10.3	LOS B	4.7	34.4	0.72	0.70	53.8
North: Kennedy Drive											
7b	L3	185	10.0	1.660	682.2	LOS F	81.5	619.6	1.00	3.37	5.0
7a	L1	57	10.0	1.660	681.5	LOS F	81.5	619.6	1.00	3.37	5.0
8	T1	1	10.0	1.660	681.7	LOS F	81.5	619.6	1.00	3.37	5.0
9	R2	23	10.0	1.660	689.2	LOS F	81.5	619.6	1.00	3.37	5.0
9u	U	1	10.0	1.660	691.9	LOS F	81.5	619.6	1.00	3.37	5.1
Approach		267	10.0	1.660	682.7	LOS F	81.5	619.6	1.00	3.37	5.0
West: Tasman Highay											
10	L2	9	5.0	0.981	18.5	LOS B	43.3	315.8	1.00	0.89	55.2
10a	L1	1162	5.0	0.981	18.7	LOS B	43.3	315.8	1.00	0.89	56.7
12a	R1	267	5.0	0.981	25.4	LOS C	43.3	315.8	1.00	0.89	54.1
12	R2	2	5.0	0.981	27.2	LOS C	43.3	315.8	1.00	0.89	55.3
12u	U	2	5.0	0.981	30.7	LOS C	43.3	315.8	1.00	0.89	59.9
Approach		1443	5.0	0.981	19.9	LOS B	43.3	315.8	1.00	0.89	56.2
All Vehicles		2706	5.6	1.660	81.5	LOS F	81.5	619.6	0.91	1.07	28.3

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Existing Layout - 2016 Side Roads PM Peak]

Tasman Highway/ Holyman Avenue
Friday 15:15-16:15
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Cranston Parade											
1	L2	5	50.0	0.023	12.2	LOS B	0.2	1.6	0.92	0.73	49.1
2	T1	1	50.0	0.023	12.1	LOS B	0.2	1.6	0.92	0.73	51.4
3a	R1	1	50.0	0.023	18.3	LOS B	0.2	1.6	0.92	0.73	50.7
3b	R3	1	50.0	0.023	21.1	LOS C	0.2	1.6	0.92	0.73	52.9
3u	U	1	50.0	0.023	22.5	LOS C	0.2	1.6	0.92	0.73	54.0
Approach		9	50.0	0.023	15.0	LOS B	0.2	1.6	0.92	0.73	50.4
SouthEast: Holyman Avenue											
21b	L3	1	5.0	0.436	7.7	LOS A	3.8	27.7	0.95	0.83	51.4
21a	L1	207	5.0	0.436	6.9	LOS A	3.8	27.7	0.95	0.83	53.7
23a	R1	48	5.0	0.436	13.2	LOS B	3.8	27.7	0.95	0.83	54.8
23	R2	69	5.0	0.436	14.6	LOS B	3.8	27.7	0.95	0.83	56.0
23u	U	8	5.0	0.436	17.4	LOS B	3.8	27.7	0.95	0.83	58.6
Approach		335	5.0	0.436	9.7	LOS A	3.8	27.7	0.95	0.83	54.4
NorthEast: Tasman Highway											
24	L2	16	5.0	0.657	6.2	LOS A	7.5	55.1	0.85	0.83	50.7
24a	L1	1	5.0	0.657	5.8	LOS A	7.5	55.1	0.85	0.83	52.1
26a	R1	647	5.0	0.657	12.1	LOS B	7.5	55.1	0.85	0.83	53.0
26b	R3	91	5.0	0.657	14.9	LOS B	7.5	55.1	0.85	0.83	55.3
26u	U	5	5.0	0.657	16.3	LOS B	7.5	55.1	0.85	0.83	56.5
Approach		760	5.0	0.657	12.3	LOS B	7.5	55.1	0.85	0.83	53.2
North: Kennedy Drive											
7b	L3	206	10.0	1.642	666.9	LOS F	88.4	671.9	1.00	3.49	5.1
7a	L1	60	10.0	1.642	666.1	LOS F	88.4	671.9	1.00	3.49	5.1
8	T1	1	10.0	1.642	666.4	LOS F	88.4	671.9	1.00	3.49	5.1
9	R2	25	10.0	1.642	673.8	LOS F	88.4	671.9	1.00	3.49	5.1
9u	U	1	10.0	1.642	676.6	LOS F	88.4	671.9	1.00	3.49	5.2
Approach		294	10.0	1.642	667.3	LOS F	88.4	671.9	1.00	3.49	5.1
West: Tasman Highay											
10	L2	13	5.0	1.038	53.7	LOS E	75.5	551.2	1.00	1.65	36.6
10a	L1	1096	5.0	1.038	53.8	LOS E	75.5	551.2	1.00	1.65	37.2
12a	R1	333	5.0	1.038	60.6	LOS E	75.5	551.2	1.00	1.65	36.1
12	R2	2	5.0	1.038	62.4	LOS E	75.5	551.2	1.00	1.65	36.6
12u	U	5	5.0	1.038	65.9	LOS E	75.5	551.2	1.00	1.65	38.6
Approach		1448	5.0	1.038	55.5	LOS E	75.5	551.2	1.00	1.65	36.9
All Vehicles		2846	5.7	1.642	101.6	LOS F	88.4	671.9	0.95	1.52	24.7

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Existing Layout - 2016 Saturday Peak]

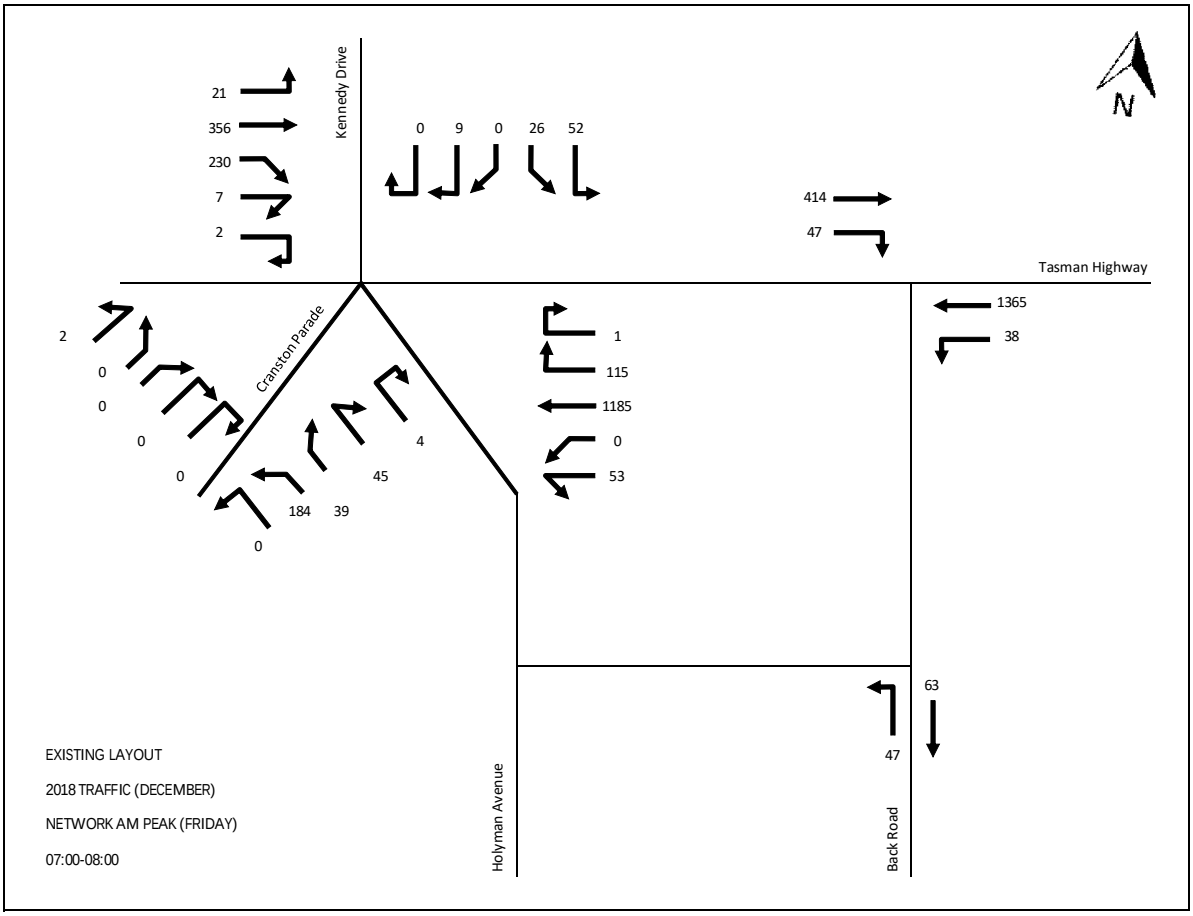
Tasman Highway/ Holyman Avenue
Saturday 11:45-12:45
Roundabout

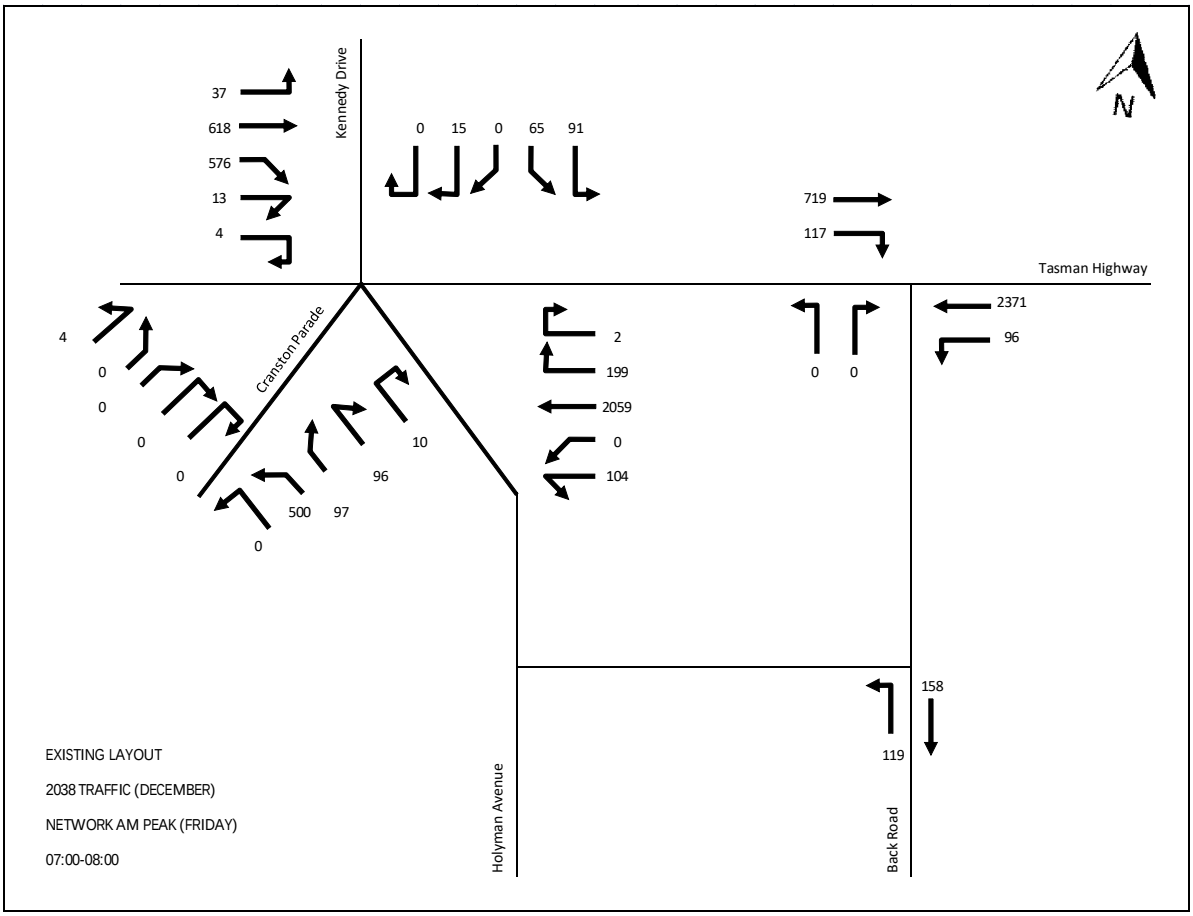
Movement Performance - Vehicles												
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Cranston Parade											
1	L2	2	50.0	0.018	14.0	LOS B	0.1	1.2	0.95	0.73	47.4
2	T1	1	50.0	0.018	13.8	LOS B	0.1	1.2	0.95	0.73	49.5
3a	R1	1	50.0	0.018	20.1	LOS C	0.1	1.2	0.95	0.73	48.9
3b	R3	1	50.0	0.018	22.9	LOS C	0.1	1.2	0.95	0.73	50.8
3u	U	1	50.0	0.018	24.2	LOS C	0.1	1.2	0.95	0.73	51.9
Approach		6	50.0	0.018	18.2	LOS B	0.1	1.2	0.95	0.73	49.3
SouthEast: Holyman Avenue											
21b	L3	1	5.0	0.492	9.7	LOS A	4.7	34.7	1.00	0.97	51.3
21a	L1	249	5.0	0.492	9.0	LOS A	4.7	34.7	1.00	0.97	53.7
23a	R1	43	5.0	0.492	15.3	LOS B	4.7	34.7	1.00	0.97	54.7
23	R2	41	5.0	0.492	16.7	LOS B	4.7	34.7	1.00	0.97	55.9
23u	U	1	5.0	0.492	19.4	LOS B	4.7	34.7	1.00	0.97	58.5
Approach		336	5.0	0.492	10.8	LOS B	4.7	34.7	1.00	0.97	54.1
NorthEast: Tasman Highway											
24	L2	39	5.0	0.735	8.4	LOS A	10.1	73.8	0.92	0.93	49.9
24a	L1	1	5.0	0.735	8.0	LOS A	10.1	73.8	0.92	0.93	51.3
26a	R1	648	5.0	0.735	14.3	LOS B	10.1	73.8	0.92	0.93	52.2
26b	R3	136	5.0	0.735	17.0	LOS B	10.1	73.8	0.92	0.93	54.4
26u	U	6	5.0	0.735	18.4	LOS B	10.1	73.8	0.92	0.93	55.5
Approach		831	5.0	0.735	14.5	LOS B	10.1	73.8	0.92	0.93	52.4
North: Kennedy Drive											
7b	L3	236	10.0	0.830	51.0	LOS E	14.0	106.8	1.00	1.48	32.7
7a	L1	60	10.0	0.830	50.2	LOS E	14.0	106.8	1.00	1.48	33.7
8	T1	1	10.0	0.830	50.5	LOS E	14.0	106.8	1.00	1.48	34.0
9	R2	41	10.0	0.830	57.9	LOS E	14.0	106.8	1.00	1.48	34.5
9u	U	1	10.0	0.830	60.7	LOS E	14.0	106.8	1.00	1.48	35.6
Approach		339	10.0	0.830	51.7	LOS E	14.0	106.8	1.00	1.48	33.1
West: Tasman Highay											
10	L2	23	5.0	0.819	8.6	LOS A	13.5	98.2	0.87	0.73	62.2
10a	L1	772	5.0	0.819	8.7	LOS A	13.5	98.2	0.87	0.73	64.1
12a	R1	328	5.0	0.819	15.5	LOS B	13.5	98.2	0.87	0.73	61.0
12	R2	4	5.0	0.819	17.2	LOS B	13.5	98.2	0.87	0.73	62.5
12u	U	1	5.0	0.819	20.8	LOS C	13.5	98.2	0.87	0.73	68.4
Approach		1128	5.0	0.819	10.7	LOS B	13.5	98.2	0.87	0.73	63.1
All Vehicles		2640	5.7	0.830	17.2	LOS B	14.0	106.8	0.92	0.92	52.6

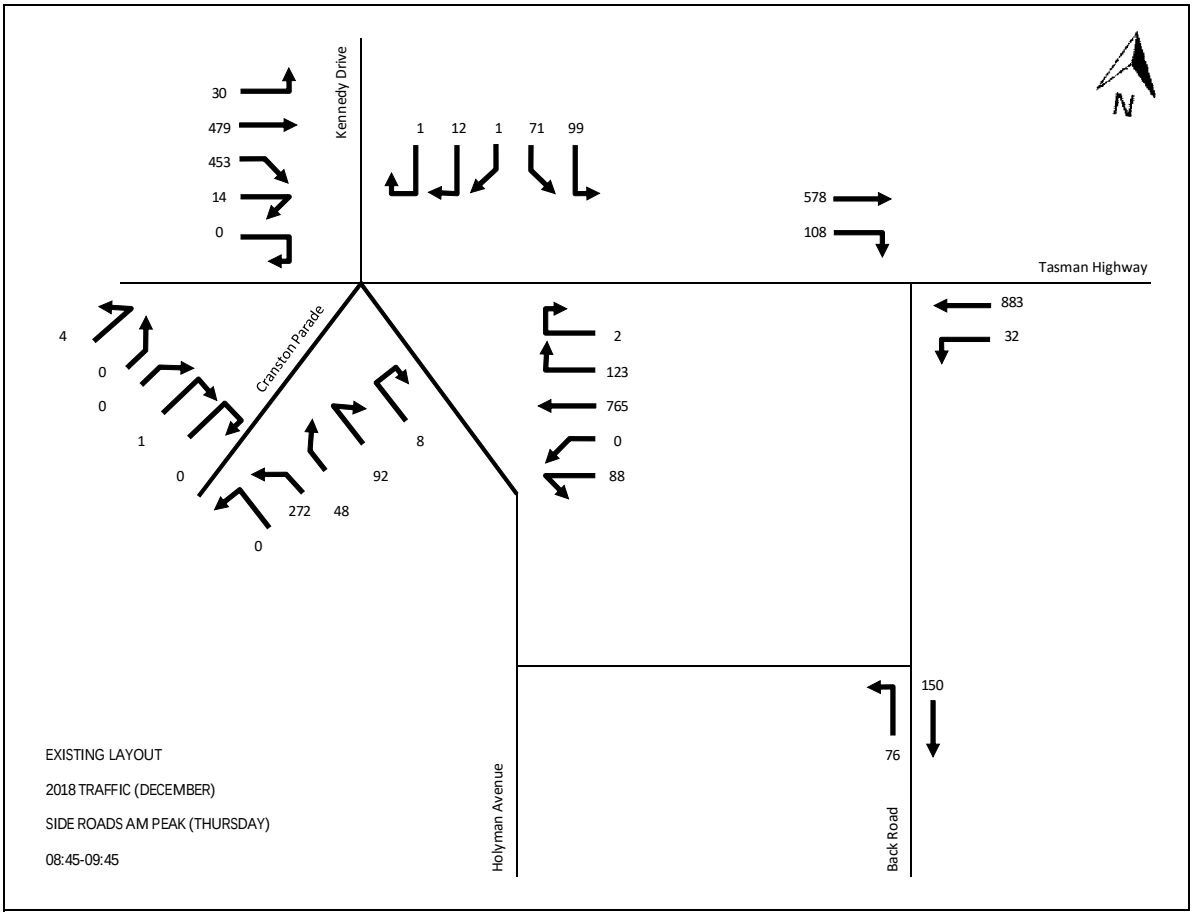
Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

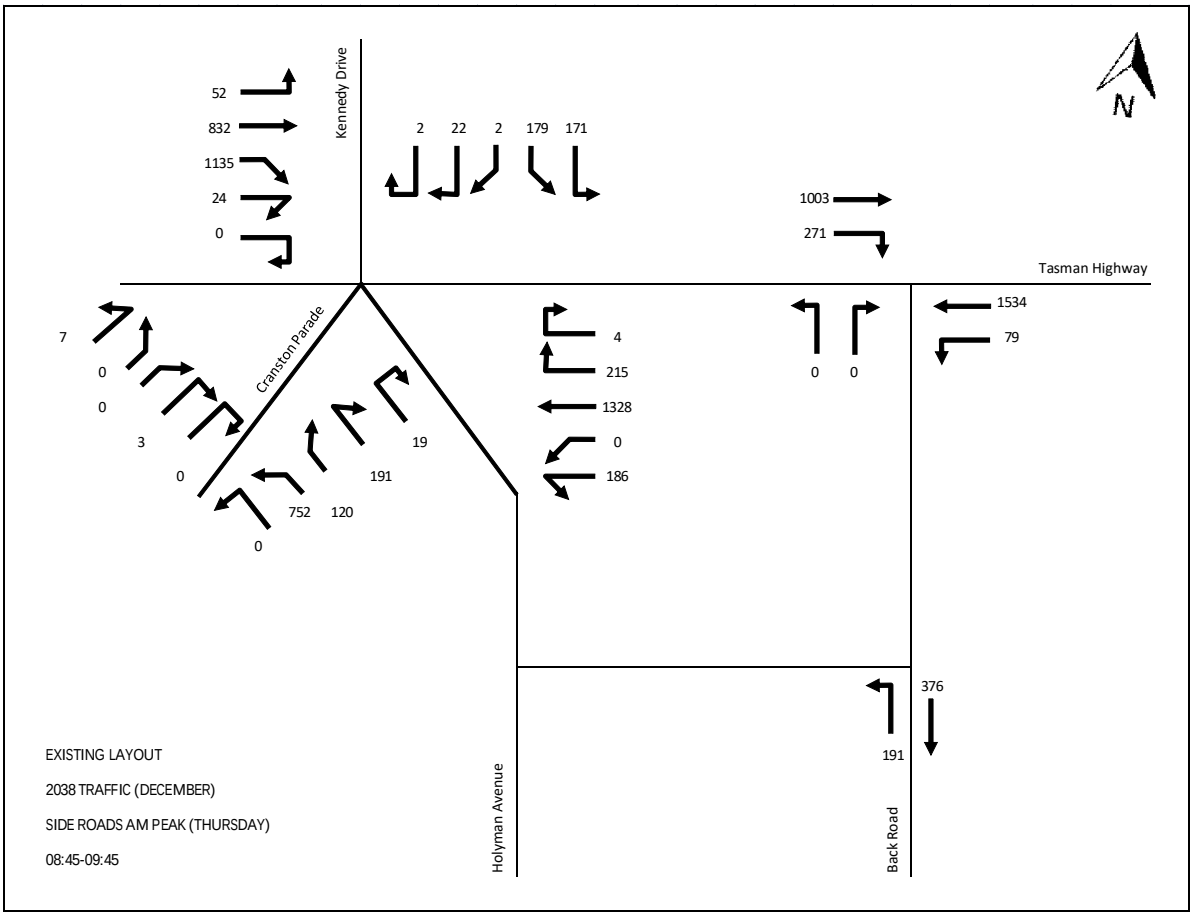
Appendix 3

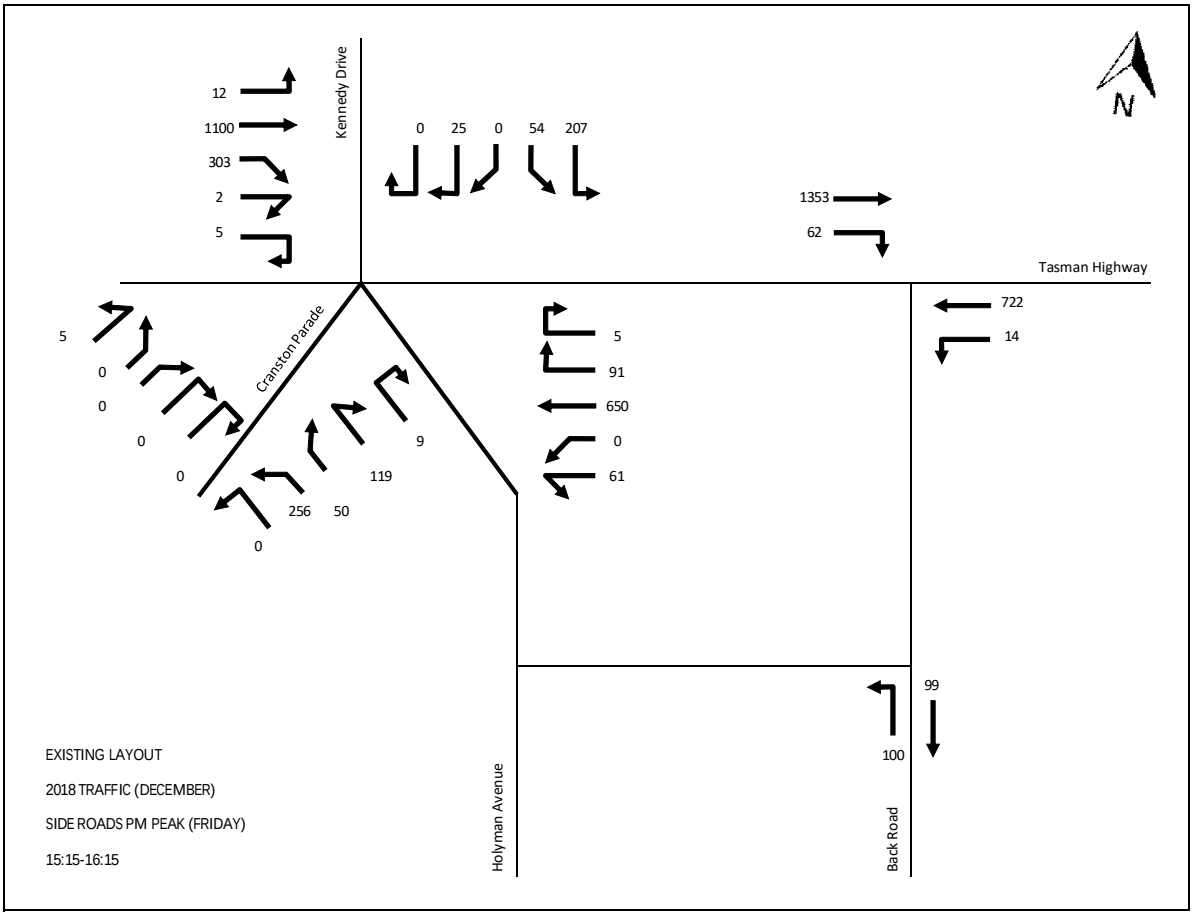
Traffic Volumes – Existing Layout, 2018 and 2038

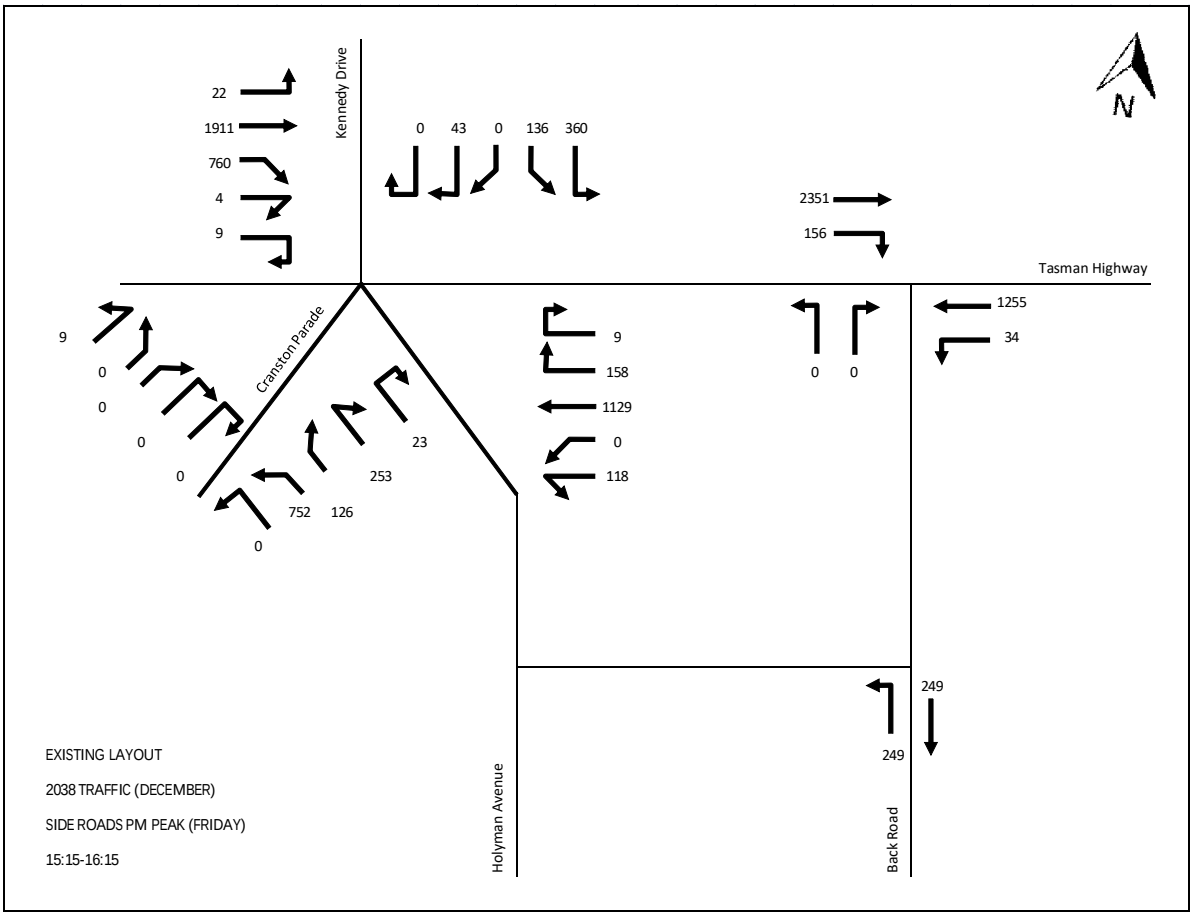

Kennedy Drive
21
356
230
7
2
0 9 0 26 52
414
47
Tasman Highway
1365
38
Cranston Parade
2
0
0
0
0
0
184 39
45
4
1
115
1185
0
53
Holyman Avenue
47
63
Back Road
N
EXISTING LAYOUT
2018 TRAFFIC (DECEMBER)
NETWORK AM PEAK (FRIDAY)
07:00-08:00

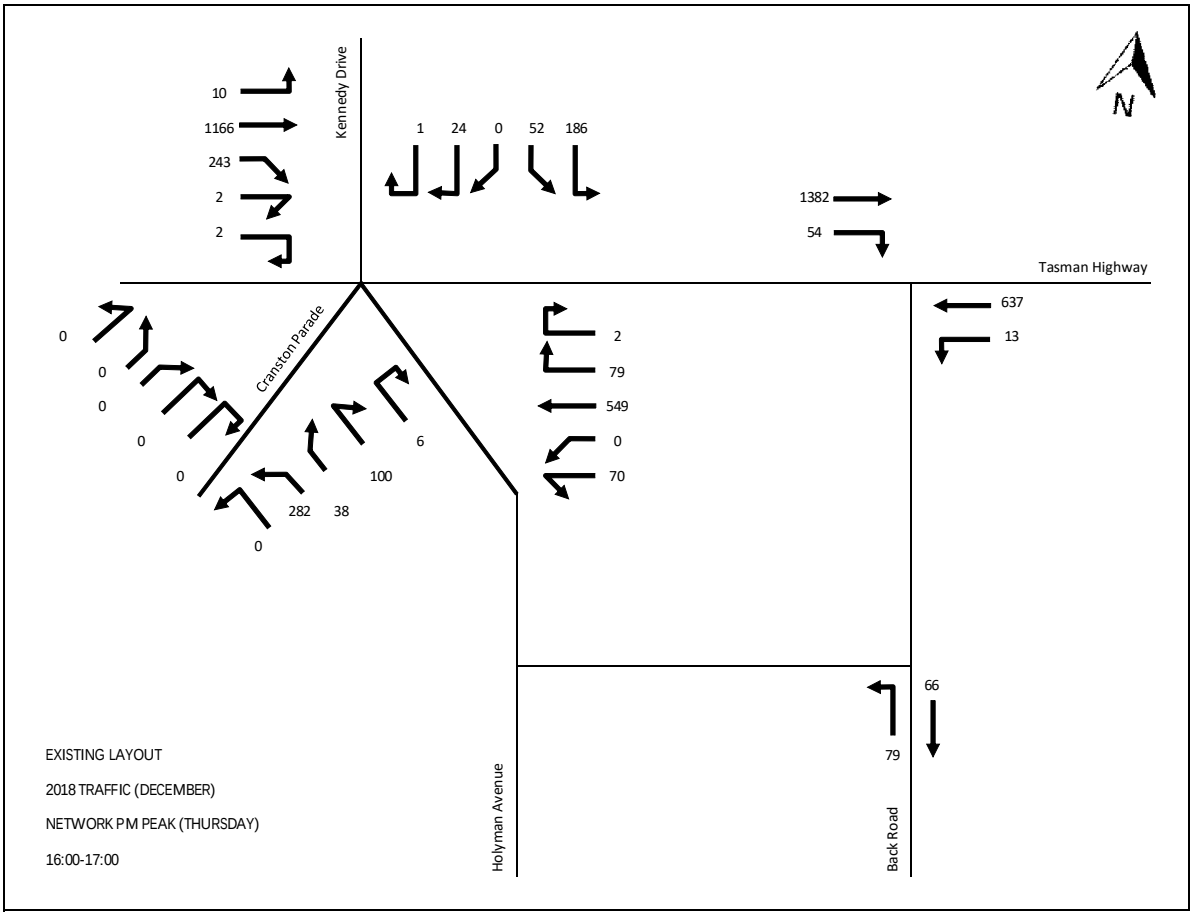

Kennedy Drive
37
618
576
13
4
0 15 0 65 91
719
117
Tasman Highway
2371
96
0 0
Cranston Parade
4
0
0
0
0
0
500 97
96
10
2
199
2059
0
104
Holyman Avenue
119
158
Back Road
N
EXISTING LAYOUT
2038 TRAFFIC (DECEMBER)
NETWORK AM PEAK (FRIDAY)
07:00-08:00

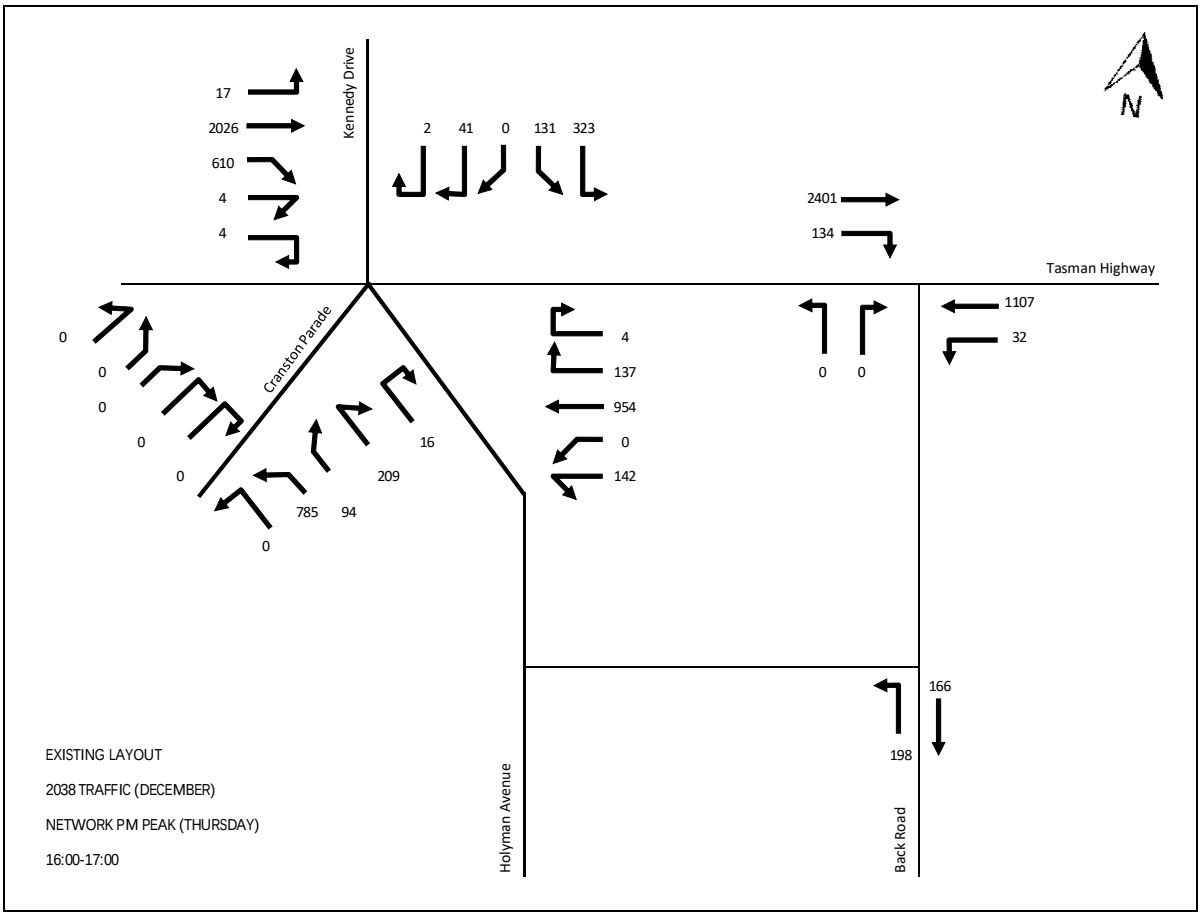

Kennedy Drive
30
479
453
14
0
1
12
1
71
99
578
108
Tasman Highway
883
32
Cranston Parade
4
0
0
1
0
92
8
272
48
0
2
123
765
0
88
Holyman Avenue
150
76
Back Road
N
EXISTING LAYOUT
2018 TRAFFIC (DECEMBER)
SIDE ROADS AM PEAK (THURSDAY)
08:45-09:45

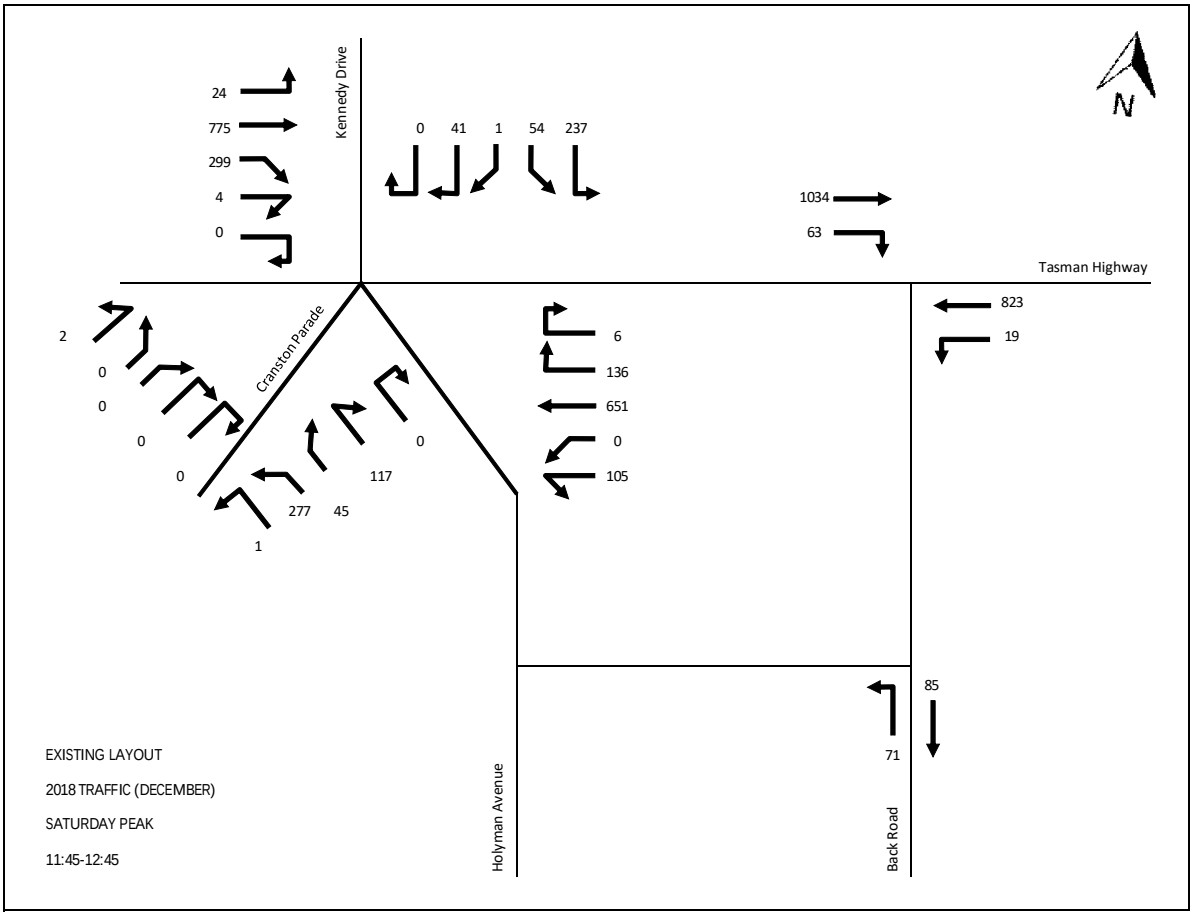

Kennedy Drive
52
832
1135
24
0
2
22
2
179
171
1003
271
Tasman Highway
1534
79
0
0
Cranston Parade
7
0
0
3
0
191
19
752
120
0
4
215
1328
0
186
Holyman Avenue
376
191
Back Road
N
EXISTING LAYOUT
2038 TRAFFIC (DECEMBER)
SIDE ROADS AM PEAK (THURSDAY)
08:45-09:45

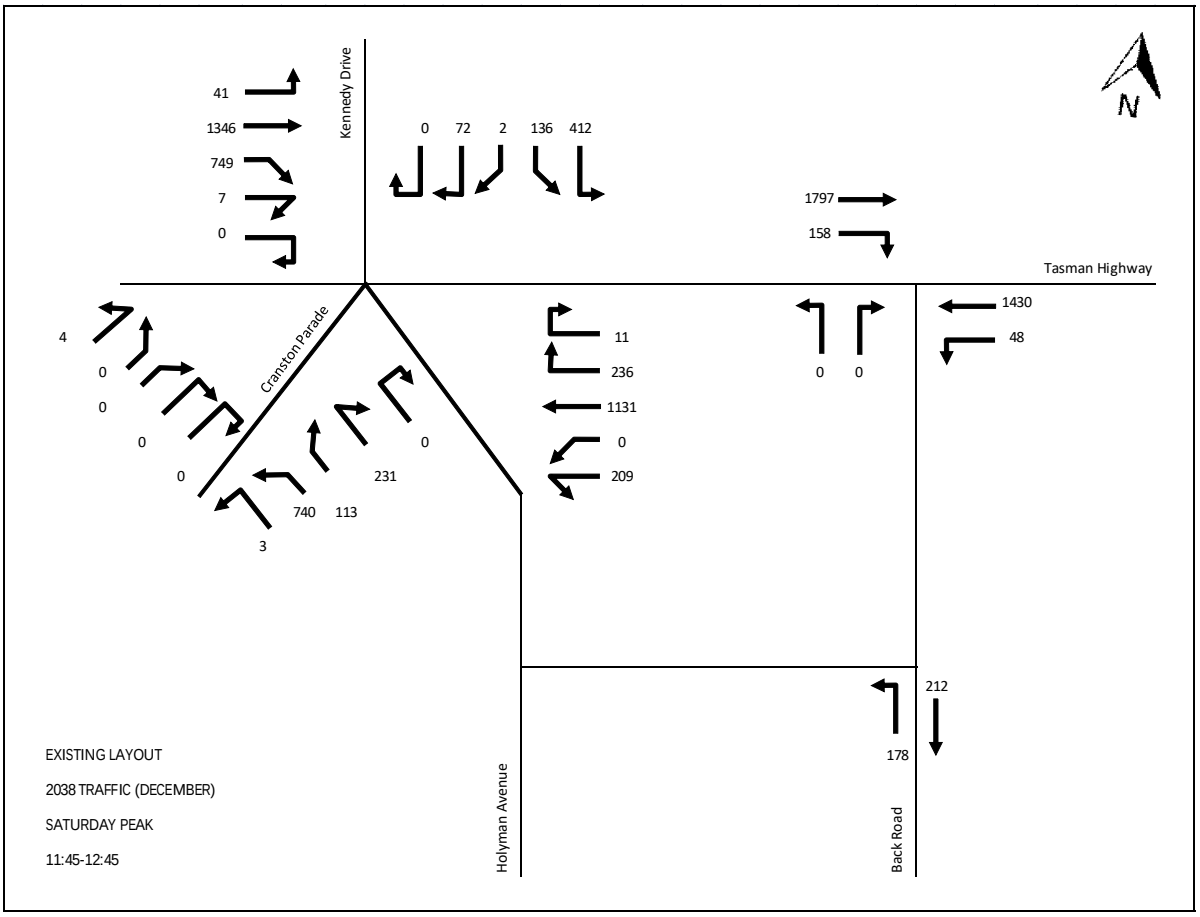

Kennedy Drive
12
1100
303
2
5
0 25 0 54 207
1353
62
Tasman Highway
722
14
Cranston Parade
5
0
0
0
0
9
119
256 50
0
5
91
650
0
61
Holyman Avenue
100
99
Back Road
N
EXISTING LAYOUT
2018 TRAFFIC (DECEMBER)
SIDE ROADS PM PEAK (FRIDAY)
15:15-16:15


Kennedy Drive
22
1911
760
4
9
0 43 0 136 360
2351
156
Tasman Highway
1255
34
Cranston Parade
9
0
0
0
0
23
253
752 126
0
9
158
1129
0
118
0 0
Holyman Avenue
249
249
Back Road
N
EXISTING LAYOUT
2038 TRAFFIC (DECEMBER)
SIDE ROADS PM PEAK (FRIDAY)
15:15-16:15


Kennedy Drive
10
1166
243
2
2
1
24
0
52
186
1382
54
Tasman Highway
637
13
Cranston Parade
0
0
0
0
0
6
100
282
38
0
2
79
549
0
70
Holyman Avenue
79
66
Back Road
N
EXISTING LAYOUT
2018 TRAFFIC (DECEMBER)
NETWORK PM PEAK (THURSDAY)
16:00-17:00


Kennedy Drive
17
2026
610
4
4
2
41
0
131
323
2401
134
Tasman Highway
1107
32
Cranston Parade
0
0
0
0
0
16
209
785
94
0
4
137
954
0
142
0
0
Holyman Avenue
198
166
Back Road
N
EXISTING LAYOUT
2038 TRAFFIC (DECEMBER)
NETWORK PM PEAK (THURSDAY)
16:00-17:00


Kennedy Drive
24
775
299
4
0
0 41 1 54 237
1034
63
Tasman Highway
823
19
Cranston Parade
2
0
0
0
0
0
117
277 45
1
6
136
651
0
105
Holyman Avenue
85
71
Back Road
N
EXISTING LAYOUT
2018 TRAFFIC (DECEMBER)
SATURDAY PEAK
11:45-12:45


Kennedy Drive
41
1346
749
7
0
0 72 2 136 412
1797
158
Tasman Highway
1430
48
Cranston Parade
4
0
0
0
0
0
231
740 113
3
11
236
1131
0
209
0 0
Holyman Avenue
212
178
Back Road
N
EXISTING LAYOUT
2038 TRAFFIC (DECEMBER)
SATURDAY PEAK
11:45-12:45

Appendix 4

SIDRA Intersection Traffic Modelling – Existing Layout, 2018 and 2038

MOVEMENT SUMMARY

Site: 101 [Existing Layout - 2018 Network AM Peak]

Tasman Highway/ Holyman Avenue
Friday 07:00-08:00
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Cranston Parade											
1	L2	2	50.0	0.064	35.1	LOS D	0.3	3.1	0.95	0.97	37.8
2	T1	1	50.0	0.064	34.9	LOS C	0.3	3.1	0.95	0.97	39.1
3a	R1	1	50.0	0.064	41.2	LOS D	0.3	3.1	0.95	0.97	38.8
3b	R3	1	50.0	0.064	43.9	LOS D	0.3	3.1	0.95	0.97	40.0
3u	U	1	50.0	0.064	45.3	LOS D	0.3	3.1	0.95	0.97	40.6
Approach		6	50.0	0.064	39.3	LOS D	0.3	3.1	0.95	0.97	39.0
SouthEast: Holyman Avenue											
21b	L3	1	5.0	1.002	143.6	LOS F	26.6	194.3	1.00	1.96	18.5
21a	L1	194	5.0	1.002	142.9	LOS F	26.6	194.3	1.00	1.96	18.8
23a	R1	41	5.0	1.002	149.2	LOS F	26.6	194.3	1.00	1.96	18.9
23	R2	47	5.0	1.002	150.6	LOS F	26.6	194.3	1.00	1.96	19.0
23u	U	4	5.0	1.002	153.3	LOS F	26.6	194.3	1.00	1.96	19.3
Approach		287	5.0	1.002	145.2	LOS F	26.6	194.3	1.00	1.96	18.8
NorthEast: Tasman Highway											
24	L2	56	5.0	1.081	88.6	LOS F	101.4	740.3	1.00	2.90	24.9
24a	L1	1	5.0	1.081	88.2	LOS F	101.4	740.3	1.00	2.90	25.2
26a	R1	1247	5.0	1.081	94.5	LOS F	101.4	740.3	1.00	2.90	25.4
26b	R3	121	5.0	1.081	97.3	LOS F	101.4	740.3	1.00	2.90	25.9
26u	U	1	5.0	1.081	98.6	LOS F	101.4	740.3	1.00	2.90	26.2
Approach		1426	5.0	1.081	94.5	LOS F	101.4	740.3	1.00	2.90	25.5
North: Kennedy Drive											
7b	L3	55	10.0	0.104	6.1	LOS A	0.7	5.2	0.72	0.65	53.6
7a	L1	27	10.0	0.104	5.3	LOS A	0.7	5.2	0.72	0.65	56.4
8	T1	1	10.0	0.104	5.6	LOS A	0.7	5.2	0.72	0.65	57.4
9	R2	9	10.0	0.104	13.0	LOS B	0.7	5.2	0.72	0.65	58.8
9u	U	1	10.0	0.104	15.8	LOS B	0.7	5.2	0.72	0.65	61.8
Approach		94	10.0	0.104	6.7	LOS A	0.7	5.2	0.72	0.65	55.0
West: Tasman Highay											
10	L2	22	5.0	0.467	5.7	LOS A	3.7	27.2	0.53	0.58	64.1
10a	L1	375	5.0	0.467	5.8	LOS A	3.7	27.2	0.53	0.58	66.2
12a	R1	242	5.0	0.467	12.6	LOS B	3.7	27.2	0.53	0.58	62.8
12	R2	7	5.0	0.467	14.4	LOS B	3.7	27.2	0.53	0.58	64.4
12u	U	2	5.0	0.467	17.9	LOS B	3.7	27.2	0.53	0.58	70.6
Approach		648	5.0	0.467	8.5	LOS A	3.7	27.2	0.53	0.58	64.8
All Vehicles		2462	5.3	1.081	74.3	LOS F	101.4	740.3	0.87	2.09	29.5

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Existing Layout - 2038 Network AM Peak]

Tasman Highway/ Holyman Avenue
Friday 07:00-08:00
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Cranston Parade											
1	L2	4	50.0	0.045	29.5	LOS C	0.3	2.8	0.99	0.89	40.2
2	T1	1	50.0	0.045	29.3	LOS C	0.3	2.8	0.99	0.89	41.7
3a	R1	1	50.0	0.045	35.6	LOS D	0.3	2.8	0.99	0.89	41.3
3b	R3	1	50.0	0.045	38.3	LOS D	0.3	2.8	0.99	0.89	42.7
3u	U	1	50.0	0.045	39.7	LOS D	0.3	2.8	0.99	0.89	43.4
Approach		8	50.0	0.045	32.6	LOS C	0.3	2.8	0.99	0.89	41.2
SouthEast: Holyman Avenue											
21b	L3	1	5.0	1.066	103.3	LOS F	57.9	422.7	1.00	2.83	22.9
21a	L1	526	5.0	1.066	102.6	LOS F	57.9	422.7	1.00	2.83	23.3
23a	R1	102	5.0	1.066	108.9	LOS F	57.9	422.7	1.00	2.83	23.5
23	R2	101	5.0	1.066	110.2	LOS F	57.9	422.7	1.00	2.83	23.7
23u	U	11	5.0	1.066	113.0	LOS F	57.9	422.7	1.00	2.83	24.2
Approach		741	5.0	1.066	104.6	LOS F	57.9	422.7	1.00	2.83	23.4
NorthEast: Tasman Highway											
24	L2	109	5.0	3.103	1902.3	LOS F	1084.4	7916.4	1.00	14.88	2.0
24a	L1	1	5.0	3.103	1901.9	LOS F	1084.4	7916.4	1.00	14.88	2.0
26a	R1	2167	5.0	3.103	1908.2	LOS F	1084.4	7916.4	1.00	14.88	2.0
26b	R3	209	5.0	3.103	1911.0	LOS F	1084.4	7916.4	1.00	14.88	2.0
26u	U	2	5.0	3.103	1912.4	LOS F	1084.4	7916.4	1.00	14.88	2.0
Approach		2489	5.0	3.103	1908.2	LOS F	1084.4	7916.4	1.00	14.88	2.0
North: Kennedy Drive											
7b	L3	96	10.0	0.774	83.9	LOS F	11.0	83.6	1.00	1.40	25.5
7a	L1	68	10.0	0.774	83.1	LOS F	11.0	83.6	1.00	1.40	26.1
8	T1	1	10.0	0.774	83.4	LOS F	11.0	83.6	1.00	1.40	26.3
9	R2	16	10.0	0.774	90.8	LOS F	11.0	83.6	1.00	1.40	26.6
9u	U	1	10.0	0.774	93.6	LOS F	11.0	83.6	1.00	1.40	27.2
Approach		182	10.0	0.774	84.2	LOS F	11.0	83.6	1.00	1.40	25.8
West: Tasman Highay											
10	L2	39	5.0	0.998	32.7	LOS C	50.3	367.2	1.00	1.33	45.0
10a	L1	651	5.0	0.998	32.8	LOS C	50.3	367.2	1.00	1.33	46.0
12a	R1	606	5.0	0.998	39.6	LOS D	50.3	367.2	1.00	1.33	44.3
12	R2	14	5.0	0.998	41.3	LOS D	50.3	367.2	1.00	1.33	45.1
12u	U	4	5.0	0.998	44.9	LOS D	50.3	367.2	1.00	1.33	48.1
Approach		1314	5.0	0.998	36.1	LOS D	50.3	367.2	1.00	1.33	45.2
All Vehicles		4735	5.3	3.103	1033.0	LOS F	1084.4	7916.4	1.00	8.69	3.6

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Existing Layout - 2018 Side Roads AM Peak]

Tasman Highway/ Holyman Avenue
Thursday 08:45-09:45
Roundabout

Movement Performance - Vehicles												
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Cranston Parade											
1	L2	4	50.0	0.033	21.1	LOS C	0.2	2.5	1.00	0.80	44.0
2	T1	1	50.0	0.033	20.9	LOS C	0.2	2.5	1.00	0.80	45.8
3a	R1	1	50.0	0.033	27.2	LOS C	0.2	2.5	1.00	0.80	45.3
3b	R3	1	50.0	0.033	30.0	LOS C	0.2	2.5	1.00	0.80	47.0
3u	U	1	50.0	0.033	31.4	LOS C	0.2	2.5	1.00	0.80	47.9
Approach		8	50.0	0.033	24.2	LOS C	0.2	2.5	1.00	0.80	45.2
SouthEast: Holyman Avenue											
21b	L3	1	5.0	0.758	22.3	LOS C	11.0	80.6	1.00	1.23	43.6
21a	L1	286	5.0	0.758	21.6	LOS C	11.0	80.6	1.00	1.23	45.3
23a	R1	51	5.0	0.758	27.9	LOS C	11.0	80.6	1.00	1.23	46.0
23	R2	97	5.0	0.758	29.3	LOS C	11.0	80.6	1.00	1.23	46.9
23u	U	8	5.0	0.758	32.0	LOS C	11.0	80.6	1.00	1.23	48.7
Approach		443	5.0	0.758	24.2	LOS C	11.0	80.6	1.00	1.23	45.8
NorthEast: Tasman Highway											
24	L2	93	5.0	1.065	88.8	LOS F	72.0	525.7	1.00	3.01	24.9
24a	L1	1	5.0	1.065	88.4	LOS F	72.0	525.7	1.00	3.01	25.2
26a	R1	805	5.0	1.065	94.7	LOS F	72.0	525.7	1.00	3.01	25.4
26b	R3	129	5.0	1.065	97.4	LOS F	72.0	525.7	1.00	3.01	25.9
26u	U	2	5.0	1.065	98.8	LOS F	72.0	525.7	1.00	3.01	26.2
Approach		1031	5.0	1.065	94.5	LOS F	72.0	525.7	1.00	3.01	25.4
North: Kennedy Drive											
7b	L3	104	10.0	0.419	13.7	LOS B	3.8	28.9	1.00	0.98	48.9
7a	L1	75	10.0	0.419	13.0	LOS B	3.8	28.9	1.00	0.98	51.1
8	T1	1	10.0	0.419	13.2	LOS B	3.8	28.9	1.00	0.98	52.0
9	R2	13	10.0	0.419	20.7	LOS C	3.8	28.9	1.00	0.98	53.2
9u	U	1	10.0	0.419	23.4	LOS C	3.8	28.9	1.00	0.98	55.6
Approach		194	10.0	0.419	13.9	LOS B	3.8	28.9	1.00	0.98	50.0
West: Tasman Highay											
10	L2	32	5.0	0.782	8.9	LOS A	11.7	85.1	0.86	0.78	61.4
10a	L1	504	5.0	0.782	9.0	LOS A	11.7	85.1	0.86	0.78	63.2
12a	R1	477	5.0	0.782	15.8	LOS B	11.7	85.1	0.86	0.78	60.1
12	R2	15	5.0	0.782	17.5	LOS B	11.7	85.1	0.86	0.78	61.6
12u	U	1	5.0	0.782	21.1	LOS C	11.7	85.1	0.86	0.78	67.3
Approach		1028	5.0	0.782	12.3	LOS B	11.7	85.1	0.86	0.78	61.7
All Vehicles		2704	5.5	1.065	45.7	LOS D	72.0	525.7	0.95	1.72	37.9

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Existing Layout - 2038 Side Roads AM Peak]

Tasman Highway/ Holyman Avenue
Thursday 08:45-09:45
Roundabout

Movement Performance - Vehicles												
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Cranston Parade											
1	L2	7	50.0	0.112	35.4	LOS D	0.6	5.5	0.94	0.97	37.8
2	T1	1	50.0	0.112	35.2	LOS D	0.6	5.5	0.94	0.97	39.1
3a	R1	1	50.0	0.112	41.5	LOS D	0.6	5.5	0.94	0.97	38.8
3b	R3	3	50.0	0.112	44.3	LOS D	0.6	5.5	0.94	0.97	40.0
3u	U	1	50.0	0.112	45.7	LOS D	0.6	5.5	0.94	0.97	40.6
Approach		14	50.0	0.112	38.7	LOS D	0.6	5.5	0.94	0.97	38.7
SouthEast: Holyman Avenue											
21b	L3	1	5.0	1.363	343.9	LOS F	212.2	1549.3	1.00	6.74	9.4
21a	L1	792	5.0	1.363	343.2	LOS F	212.2	1549.3	1.00	6.74	9.5
23a	R1	126	5.0	1.363	349.5	LOS F	212.2	1549.3	1.00	6.74	9.6
23	R2	201	5.0	1.363	350.9	LOS F	212.2	1549.3	1.00	6.74	9.6
23u	U	20	5.0	1.363	353.6	LOS F	212.2	1549.3	1.00	6.74	9.7
Approach		1140	5.0	1.363	345.4	LOS F	212.2	1549.3	1.00	6.74	9.5
NorthEast: Tasman Highway											
24	L2	196	5.0	2.759	1595.2	LOS F	754.8	5510.1	1.00	12.32	2.4
24a	L1	1	5.0	2.759	1594.9	LOS F	754.8	5510.1	1.00	12.32	2.4
26a	R1	1398	5.0	2.759	1601.2	LOS F	754.8	5510.1	1.00	12.32	2.4
26b	R3	226	5.0	2.759	1603.9	LOS F	754.8	5510.1	1.00	12.32	2.4
26u	U	4	5.0	2.759	1605.3	LOS F	754.8	5510.1	1.00	12.32	2.4
Approach		1825	5.0	2.759	1600.9	LOS F	754.8	5510.1	1.00	12.32	2.4
North: Kennedy Drive											
7b	L3	180	10.0	1.674	690.9	LOS F	121.2	920.8	1.00	4.05	5.0
7a	L1	188	10.0	1.674	690.2	LOS F	121.2	920.8	1.00	4.05	5.0
8	T1	2	10.0	1.674	690.4	LOS F	121.2	920.8	1.00	4.05	5.0
9	R2	23	10.0	1.674	697.9	LOS F	121.2	920.8	1.00	4.05	5.0
9u	U	2	10.0	1.674	700.6	LOS F	121.2	920.8	1.00	4.05	5.0
Approach		396	10.0	1.674	691.0	LOS F	121.2	920.8	1.00	4.05	5.0
West: Tasman Highay											
10	L2	55	5.0	1.782	712.9	LOS F	615.0	4489.8	1.00	9.48	5.1
10a	L1	876	5.0	1.782	713.0	LOS F	615.0	4489.8	1.00	9.48	5.1
12a	R1	1195	5.0	1.782	719.8	LOS F	615.0	4489.8	1.00	9.48	5.1
12	R2	25	5.0	1.782	721.5	LOS F	615.0	4489.8	1.00	9.48	5.1
12u	U	1	5.0	1.782	725.0	LOS F	615.0	4489.8	1.00	9.48	5.1
Approach		2152	5.0	1.782	716.9	LOS F	615.0	4489.8	1.00	9.48	5.1
All Vehicles		5526	5.5	2.759	928.7	LOS F	754.8	5510.1	1.00	9.44	4.0

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Existing Layout - 2018 Network PM Peak]

Tasman Highway/ Holyman Avenue
Thursday 16:00-17:00
Roundabout

Movement Performance - Vehicles												
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Cranston Parade											
1	L2	1	50.0	0.012	12.9	LOS B	0.1	0.8	0.90	0.69	47.7
2	T1	1	50.0	0.012	12.7	LOS B	0.1	0.8	0.90	0.69	49.8
3a	R1	1	50.0	0.012	19.0	LOS B	0.1	0.8	0.90	0.69	49.2
3b	R3	1	50.0	0.012	21.7	LOS C	0.1	0.8	0.90	0.69	51.1
3u	U	1	50.0	0.012	23.1	LOS C	0.1	0.8	0.90	0.69	52.1
Approach		5	50.0	0.012	17.9	LOS B	0.1	0.8	0.90	0.69	49.9
SouthEast: Holyman Avenue											
21b	L3	1	5.0	0.510	7.9	LOS A	4.8	34.8	0.91	0.87	51.5
21a	L1	297	5.0	0.510	7.2	LOS A	4.8	34.8	0.91	0.87	53.9
23a	R1	40	5.0	0.510	13.5	LOS B	4.8	34.8	0.91	0.87	55.0
23	R2	105	5.0	0.510	14.9	LOS B	4.8	34.8	0.91	0.87	56.2
23u	U	6	5.0	0.510	17.6	LOS B	4.8	34.8	0.91	0.87	58.8
Approach		449	5.0	0.510	9.7	LOS A	4.8	34.8	0.91	0.87	54.6
NorthEast: Tasman Highway											
24	L2	74	5.0	0.584	4.3	LOS A	5.4	39.5	0.72	0.69	51.5
24a	L1	1	5.0	0.584	3.9	LOS A	5.4	39.5	0.72	0.69	53.0
26a	R1	578	5.0	0.584	10.2	LOS B	5.4	39.5	0.72	0.69	54.0
26b	R3	83	5.0	0.584	12.9	LOS B	5.4	39.5	0.72	0.69	56.3
26u	U	2	5.0	0.584	14.3	LOS B	5.4	39.5	0.72	0.69	57.6
Approach		738	5.0	0.584	9.9	LOS A	5.4	39.5	0.72	0.69	54.0
North: Kennedy Drive											
7b	L3	196	10.0	1.585	618.3	LOS F	79.8	606.2	1.00	3.38	5.5
7a	L1	55	10.0	1.585	617.5	LOS F	79.8	606.2	1.00	3.38	5.5
8	T1	1	10.0	1.585	617.8	LOS F	79.8	606.2	1.00	3.38	5.5
9	R2	25	10.0	1.585	625.2	LOS F	79.8	606.2	1.00	3.38	5.5
9u	U	1	10.0	1.585	628.0	LOS F	79.8	606.2	1.00	3.38	5.5
Approach		278	10.0	1.585	618.8	LOS F	79.8	606.2	1.00	3.38	5.5
West: Tasman Highay											
10	L2	11	5.0	1.090	96.2	LOS F	112.9	824.5	1.00	2.42	26.1
10a	L1	1227	5.0	1.090	96.3	LOS F	112.9	824.5	1.00	2.42	26.4
12a	R1	256	5.0	1.090	103.0	LOS F	112.9	824.5	1.00	2.42	25.8
12	R2	2	5.0	1.090	104.8	LOS F	112.9	824.5	1.00	2.42	26.1
12u	U	2	5.0	1.090	108.3	LOS F	112.9	824.5	1.00	2.42	27.1
Approach		1498	5.0	1.090	97.5	LOS F	112.9	824.5	1.00	2.42	26.3
All Vehicles		2968	5.5	1.585	111.1	LOS F	112.9	824.5	0.92	1.84	23.2

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Existing Layout - 2038 Network PM Peak]

Tasman Highway/ Holyman Avenue
Thursday 16:00-17:00
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Cranston Parade											
1	L2	1	50.0	0.036	30.6	LOS C	0.2	2.1	0.98	0.90	39.3
2	T1	1	50.0	0.036	30.4	LOS C	0.2	2.1	0.98	0.90	40.8
3a	R1	1	50.0	0.036	36.7	LOS D	0.2	2.1	0.98	0.90	40.4
3b	R3	1	50.0	0.036	39.4	LOS D	0.2	2.1	0.98	0.90	41.7
3u	U	1	50.0	0.036	40.8	LOS D	0.2	2.1	0.98	0.90	42.3
Approach		5	50.0	0.036	35.6	LOS D	0.2	2.1	0.98	0.90	40.9
SouthEast: Holyman Avenue											
21b	L3	1	5.0	2.571	1436.9	LOS F	472.6	3450.1	1.00	8.74	2.6
21a	L1	826	5.0	2.571	1436.1	LOS F	472.6	3450.1	1.00	8.74	2.6
23a	R1	99	5.0	2.571	1442.4	LOS F	472.6	3450.1	1.00	8.74	2.6
23	R2	220	5.0	2.571	1443.8	LOS F	472.6	3450.1	1.00	8.74	2.6
23u	U	17	5.0	2.571	1446.6	LOS F	472.6	3450.1	1.00	8.74	2.6
Approach		1163	5.0	2.571	1438.3	LOS F	472.6	3450.1	1.00	8.74	2.6
NorthEast: Tasman Highway											
24	L2	149	5.0	1.116	120.3	LOS F	114.0	832.1	1.00	3.67	20.7
24a	L1	1	5.0	1.116	119.9	LOS F	114.0	832.1	1.00	3.67	21.0
26a	R1	1004	5.0	1.116	126.3	LOS F	114.0	832.1	1.00	3.67	21.1
26b	R3	144	5.0	1.116	129.0	LOS F	114.0	832.1	1.00	3.67	21.5
26u	U	4	5.0	1.116	130.4	LOS F	114.0	832.1	1.00	3.67	21.7
Approach		1303	5.0	1.116	125.9	LOS F	114.0	832.1	1.00	3.67	21.1
North: Kennedy Drive											
7b	L3	340	10.0	2.799	1681.9	LOS F	236.4	1796.8	1.00	4.96	2.1
7a	L1	138	10.0	2.799	1681.1	LOS F	236.4	1796.8	1.00	4.96	2.1
8	T1	1	10.0	2.799	1681.4	LOS F	236.4	1796.8	1.00	4.96	2.1
9	R2	43	10.0	2.799	1688.9	LOS F	236.4	1796.8	1.00	4.96	2.1
9u	U	2	10.0	2.799	1691.6	LOS F	236.4	1796.8	1.00	4.96	2.1
Approach		524	10.0	2.799	1682.3	LOS F	236.4	1796.8	1.00	4.96	2.1
West: Tasman Highay											
10	L2	18	5.0	2.051	955.2	LOS F	933.8	6816.5	1.00	10.62	3.8
10a	L1	2133	5.0	2.051	955.3	LOS F	933.8	6816.5	1.00	10.62	3.8
12a	R1	642	5.0	2.051	962.1	LOS F	933.8	6816.5	1.00	10.62	3.8
12	R2	4	5.0	2.051	963.9	LOS F	933.8	6816.5	1.00	10.62	3.8
12u	U	4	5.0	2.051	967.4	LOS F	933.8	6816.5	1.00	10.62	3.8
Approach		2801	5.0	2.051	956.9	LOS F	933.8	6816.5	1.00	10.62	3.8
All Vehicles		5797	5.5	2.799	931.4	LOS F	933.8	6816.5	1.00	8.16	3.9

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Existing Layout - 2018 Side Roads PM Peak]

Tasman Highway/ Holyman Avenue
Friday 15:15-16:15
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Cranston Parade											
1	L2	5	50.0	0.030	17.6	LOS B	0.2	2.1	0.98	0.78	45.9
2	T1	1	50.0	0.030	17.4	LOS B	0.2	2.1	0.98	0.78	48.0
3a	R1	1	50.0	0.030	23.7	LOS C	0.2	2.1	0.98	0.78	47.4
3b	R3	1	50.0	0.030	26.4	LOS C	0.2	2.1	0.98	0.78	49.3
3u	U	1	50.0	0.030	27.8	LOS C	0.2	2.1	0.98	0.78	50.2
Approach		9	50.0	0.030	20.3	LOS C	0.2	2.1	0.98	0.78	47.1
SouthEast: Holyman Avenue											
21b	L3	1	5.0	0.636	12.8	LOS B	7.5	55.0	1.00	1.07	48.6
21a	L1	269	5.0	0.636	12.1	LOS B	7.5	55.0	1.00	1.07	50.7
23a	R1	53	5.0	0.636	18.4	LOS B	7.5	55.0	1.00	1.07	51.6
23	R2	125	5.0	0.636	19.8	LOS B	7.5	55.0	1.00	1.07	52.7
23u	U	9	5.0	0.636	22.5	LOS C	7.5	55.0	1.00	1.07	54.9
Approach		458	5.0	0.636	15.1	LOS B	7.5	55.0	1.00	1.07	51.4
NorthEast: Tasman Highway											
24	L2	64	5.0	0.707	6.4	LOS A	9.0	65.5	0.86	0.82	50.9
24a	L1	1	5.0	0.707	6.1	LOS A	9.0	65.5	0.86	0.82	52.3
26a	R1	684	5.0	0.707	12.4	LOS B	9.0	65.5	0.86	0.82	53.3
26b	R3	96	5.0	0.707	15.1	LOS B	9.0	65.5	0.86	0.82	55.6
26u	U	5	5.0	0.707	16.5	LOS B	9.0	65.5	0.86	0.82	56.8
Approach		851	5.0	0.707	12.2	LOS B	9.0	65.5	0.86	0.82	53.4
North: Kennedy Drive											
7b	L3	218	10.0	1.471	524.1	LOS F	78.9	599.4	1.00	3.33	6.3
7a	L1	57	10.0	1.471	523.3	LOS F	78.9	599.4	1.00	3.33	6.4
8	T1	1	10.0	1.471	523.6	LOS F	78.9	599.4	1.00	3.33	6.4
9	R2	26	10.0	1.471	531.0	LOS F	78.9	599.4	1.00	3.33	6.4
9u	U	1	10.0	1.471	533.8	LOS F	78.9	599.4	1.00	3.33	6.4
Approach		303	10.0	1.471	524.6	LOS F	78.9	599.4	1.00	3.33	6.3
West: Tasman Highay											
10	L2	13	5.0	1.147	146.2	LOS F	150.3	1097.0	1.00	3.36	19.5
10a	L1	1158	5.0	1.147	146.3	LOS F	150.3	1097.0	1.00	3.36	19.6
12a	R1	319	5.0	1.147	153.1	LOS F	150.3	1097.0	1.00	3.36	19.3
12	R2	2	5.0	1.147	154.8	LOS F	150.3	1097.0	1.00	3.36	19.5
12u	U	5	5.0	1.147	158.3	LOS F	150.3	1097.0	1.00	3.36	20.0
Approach		1497	5.0	1.147	147.8	LOS F	150.3	1097.0	1.00	3.36	19.6
All Vehicles		3118	5.6	1.471	127.6	LOS F	150.3	1097.0	0.96	2.32	21.2

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Existing Layout - 2038 Side Roads PM Peak]

Tasman Highway/ Holyman Avenue
Friday 15:15-16:15
Roundabout

Movement Performance - Vehicles												
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Cranston Parade											
1	L2	9	50.0	0.094	31.6	LOS C	0.5	5.5	0.97	0.98	39.5
2	T1	1	50.0	0.094	31.4	LOS C	0.5	5.5	0.97	0.98	41.1
3a	R1	1	50.0	0.094	37.7	LOS D	0.5	5.5	0.97	0.98	40.6
3b	R3	1	50.0	0.094	40.4	LOS D	0.5	5.5	0.97	0.98	42.0
3u	U	1	50.0	0.094	41.8	LOS D	0.5	5.5	0.97	0.98	42.7
Approach		14	50.0	0.094	33.5	LOS C	0.5	5.5	0.97	0.98	40.1
SouthEast: Holyman Avenue											
21b	L3	1	5.0	2.572	1436.4	LOS F	492.8	3597.4	1.00	9.05	2.6
21a	L1	792	5.0	2.572	1435.6	LOS F	492.8	3597.4	1.00	9.05	2.6
23a	R1	133	5.0	2.572	1441.9	LOS F	492.8	3597.4	1.00	9.05	2.6
23	R2	266	5.0	2.572	1443.3	LOS F	492.8	3597.4	1.00	9.05	2.6
23u	U	24	5.0	2.572	1446.1	LOS F	492.8	3597.4	1.00	9.05	2.6
Approach		1216	5.0	2.572	1438.2	LOS F	492.8	3597.4	1.00	9.05	2.6
NorthEast: Tasman Highway											
24	L2	124	5.0	1.365	339.6	LOS F	272.3	1987.6	1.00	7.47	9.7
24a	L1	1	5.0	1.365	339.2	LOS F	272.3	1987.6	1.00	7.47	9.7
26a	R1	1188	5.0	1.365	345.5	LOS F	272.3	1987.6	1.00	7.47	9.7
26b	R3	166	5.0	1.365	348.3	LOS F	272.3	1987.6	1.00	7.47	9.8
26u	U	9	5.0	1.365	349.7	LOS F	272.3	1987.6	1.00	7.47	9.9
Approach		1489	5.0	1.365	345.4	LOS F	272.3	1987.6	1.00	7.47	9.7
North: Kennedy Drive											
7b	L3	379	10.0	2.853	1730.6	LOS F	258.9	1967.6	1.00	5.16	2.1
7a	L1	143	10.0	2.853	1729.9	LOS F	258.9	1967.6	1.00	5.16	2.1
8	T1	1	10.0	2.853	1730.1	LOS F	258.9	1967.6	1.00	5.16	2.1
9	R2	45	10.0	2.853	1737.6	LOS F	258.9	1967.6	1.00	5.16	2.1
9u	U	1	10.0	2.853	1740.3	LOS F	258.9	1967.6	1.00	5.16	2.1
Approach		569	10.0	2.853	1731.0	LOS F	258.9	1967.6	1.00	5.16	2.1
West: Tasman Highay											
10	L2	23	5.0	2.159	1052.2	LOS F	990.3	7229.1	1.00	11.31	3.5
10a	L1	2012	5.0	2.159	1052.3	LOS F	990.3	7229.1	1.00	11.31	3.5
12a	R1	800	5.0	2.159	1059.1	LOS F	990.3	7229.1	1.00	11.31	3.5
12	R2	4	5.0	2.159	1060.8	LOS F	990.3	7229.1	1.00	11.31	3.5
12u	U	9	5.0	2.159	1064.3	LOS F	990.3	7229.1	1.00	11.31	3.5
Approach		2848	5.0	2.159	1054.3	LOS F	990.3	7229.1	1.00	11.31	3.5
All Vehicles		6137	5.6	2.853	1018.8	LOS F	990.3	7229.1	1.00	9.33	3.6

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Existing Layout - 2018 Saturday Peak]

Tasman Highway/ Holyman Avenue
Saturday 11:45-12:45
Roundabout

Movement Performance - Vehicles												
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Cranston Parade											
1	L2	2	50.0	0.024	21.2	LOS C	0.2	1.8	1.00	0.77	43.6
2	T1	1	50.0	0.024	21.0	LOS C	0.2	1.8	1.00	0.77	45.4
3a	R1	1	50.0	0.024	27.2	LOS C	0.2	1.8	1.00	0.77	44.9
3b	R3	1	50.0	0.024	30.0	LOS C	0.2	1.8	1.00	0.77	46.5
3u	U	1	50.0	0.024	31.4	LOS C	0.2	1.8	1.00	0.77	47.4
Approach		6	50.0	0.024	25.3	LOS C	0.2	1.8	1.00	0.77	45.2
SouthEast: Holyman Avenue											
21b	L3	1	5.0	0.751	20.3	LOS C	10.8	79.2	1.00	1.22	44.6
21a	L1	292	5.0	0.751	19.6	LOS B	10.8	79.2	1.00	1.22	46.3
23a	R1	47	5.0	0.751	25.9	LOS C	10.8	79.2	1.00	1.22	47.1
23	R2	123	5.0	0.751	27.3	LOS C	10.8	79.2	1.00	1.22	48.0
23u	U	1	5.0	0.751	30.0	LOS C	10.8	79.2	1.00	1.22	49.9
Approach		464	5.0	0.751	22.3	LOS C	10.8	79.2	1.00	1.22	46.8
NorthEast: Tasman Highway											
24	L2	111	5.0	0.828	10.7	LOS B	14.9	108.8	1.00	1.02	48.7
24a	L1	1	5.0	0.828	10.3	LOS B	14.9	108.8	1.00	1.02	50.0
26a	R1	685	5.0	0.828	16.6	LOS B	14.9	108.8	1.00	1.02	50.9
26b	R3	143	5.0	0.828	19.4	LOS B	14.9	108.8	1.00	1.02	53.0
26u	U	6	5.0	0.828	20.8	LOS C	14.9	108.8	1.00	1.02	54.1
Approach		946	5.0	0.828	16.4	LOS B	14.9	108.8	1.00	1.02	50.9
North: Kennedy Drive											
7b	L3	249	10.0	1.122	208.2	LOS F	46.0	349.2	1.00	2.63	13.7
7a	L1	57	10.0	1.122	207.4	LOS F	46.0	349.2	1.00	2.63	13.9
8	T1	1	10.0	1.122	207.7	LOS F	46.0	349.2	1.00	2.63	14.0
9	R2	43	10.0	1.122	215.1	LOS F	46.0	349.2	1.00	2.63	14.1
9u	U	1	10.0	1.122	217.9	LOS F	46.0	349.2	1.00	2.63	14.2
Approach		352	10.0	1.122	208.9	LOS F	46.0	349.2	1.00	2.63	13.8
West: Tasman Highay											
10	L2	25	5.0	0.911	15.7	LOS B	23.4	170.9	1.00	1.01	57.1
10a	L1	816	5.0	0.911	15.8	LOS B	23.4	170.9	1.00	1.01	58.7
12a	R1	315	5.0	0.911	22.5	LOS C	23.4	170.9	1.00	1.01	56.0
12	R2	4	5.0	0.911	24.3	LOS C	23.4	170.9	1.00	1.01	57.3
12u	U	1	5.0	0.911	27.8	LOS C	23.4	170.9	1.00	1.01	62.2
Approach		1161	5.0	0.911	17.6	LOS B	23.4	170.9	1.00	1.01	57.9
All Vehicles		2929	5.7	1.122	40.9	LOS D	46.0	349.2	1.00	1.24	39.9

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Existing Layout - 2038 Saturday Peak]

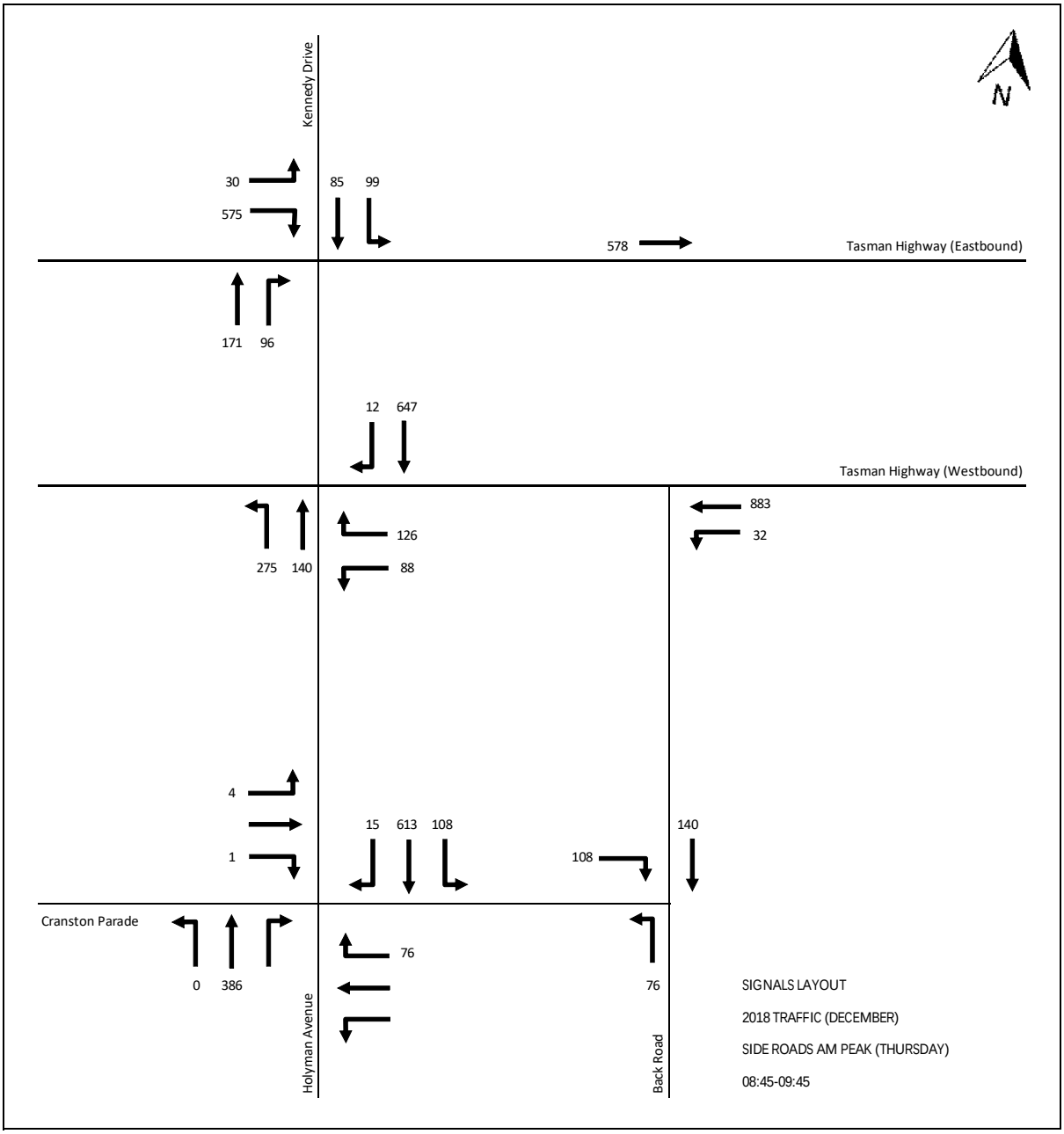
Tasman Highway/ Holyman Avenue
Saturday 11:45-12:45
Roundabout

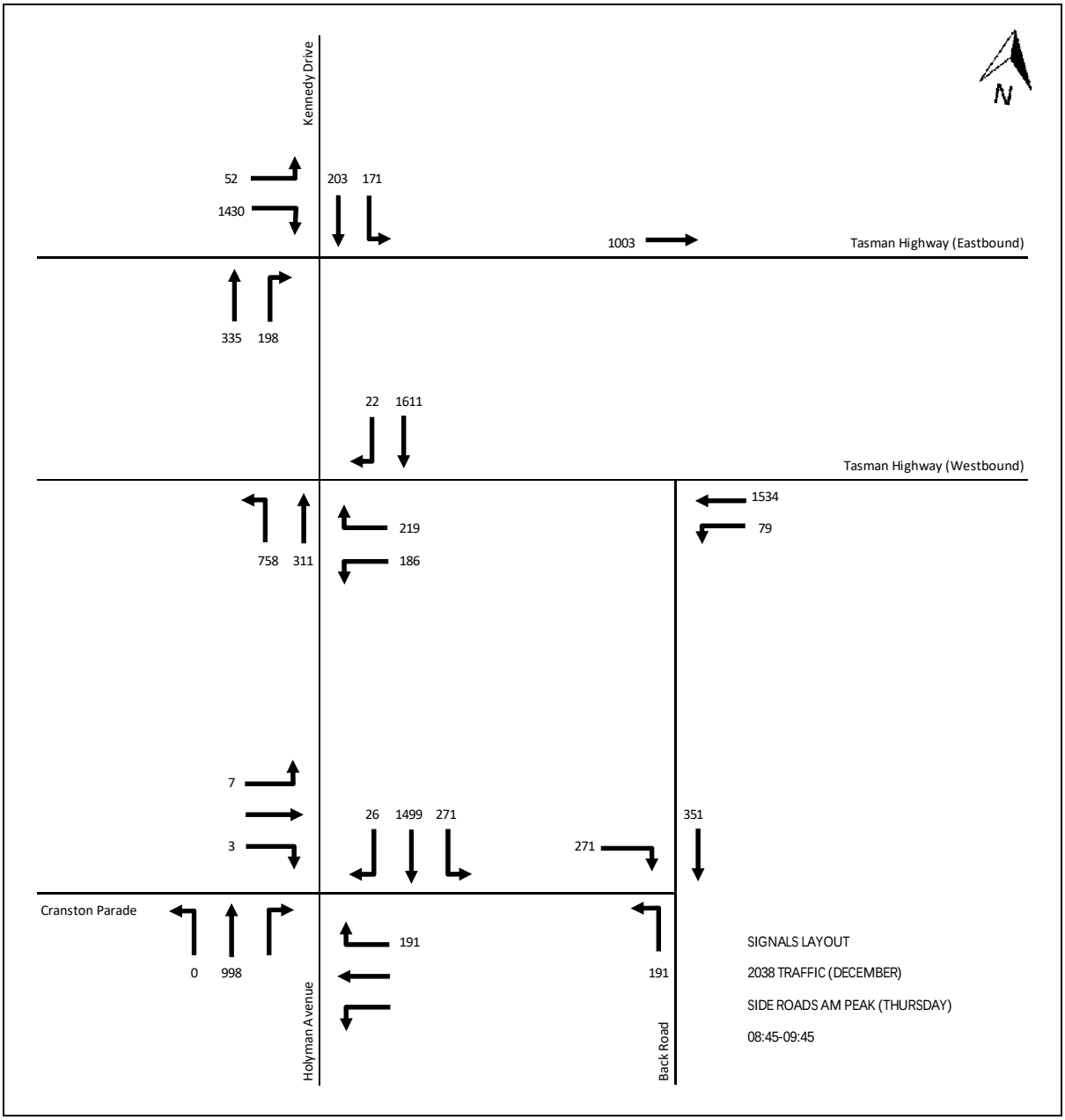
Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Cranston Parade											
1	L2	4	50.0	0.053	30.9	LOS C	0.3	3.1	0.97	0.93	39.6
2	T1	1	50.0	0.053	30.8	LOS C	0.3	3.1	0.97	0.93	41.1
3a	R1	1	50.0	0.053	37.0	LOS D	0.3	3.1	0.97	0.93	40.6
3b	R3	1	50.0	0.053	39.8	LOS D	0.3	3.1	0.97	0.93	42.0
3u	U	1	50.0	0.053	41.2	LOS D	0.3	3.1	0.97	0.93	42.7
Approach		8	50.0	0.053	34.1	LOS C	0.3	3.1	0.97	0.93	40.5
SouthEast: Holyman Avenue											
21b	L3	1	5.0	1.982	903.3	LOS F	378.1	2760.0	1.00	8.82	4.0
21a	L1	779	5.0	1.982	902.6	LOS F	378.1	2760.0	1.00	8.82	4.0
23a	R1	119	5.0	1.982	908.9	LOS F	378.1	2760.0	1.00	8.82	4.0
23	R2	243	5.0	1.982	910.3	LOS F	378.1	2760.0	1.00	8.82	4.0
23u	U	1	5.0	1.982	913.0	LOS F	378.1	2760.0	1.00	8.82	4.0
Approach		1143	5.0	1.982	904.9	LOS F	378.1	2760.0	1.00	8.82	4.0
NorthEast: Tasman Highway											
24	L2	220	5.0	1.660	604.5	LOS F	438.2	3198.9	1.00	10.36	5.9
24a	L1	1	5.0	1.660	604.1	LOS F	438.2	3198.9	1.00	10.36	5.9
26a	R1	1191	5.0	1.660	610.4	LOS F	438.2	3198.9	1.00	10.36	5.9
26b	R3	248	5.0	1.660	613.2	LOS F	438.2	3198.9	1.00	10.36	5.9
26u	U	12	5.0	1.660	614.6	LOS F	438.2	3198.9	1.00	10.36	5.9
Approach		1672	5.0	1.660	610.1	LOS F	438.2	3198.9	1.00	10.36	5.9
North: Kennedy Drive											
7b	L3	434	10.0	2.747	1630.2	LOS F	290.8	2210.0	1.00	5.59	2.2
7a	L1	143	10.0	2.747	1629.4	LOS F	290.8	2210.0	1.00	5.59	2.2
8	T1	2	10.0	2.747	1629.7	LOS F	290.8	2210.0	1.00	5.59	2.2
9	R2	76	10.0	2.747	1637.1	LOS F	290.8	2210.0	1.00	5.59	2.2
9u	U	1	10.0	2.747	1639.9	LOS F	290.8	2210.0	1.00	5.59	2.2
Approach		656	10.0	2.747	1630.8	LOS F	290.8	2210.0	1.00	5.59	2.2
West: Tasman Highay											
10	L2	43	5.0	1.791	721.7	LOS F	649.5	4741.2	1.00	9.65	5.0
10a	L1	1417	5.0	1.791	721.8	LOS F	649.5	4741.2	1.00	9.65	5.0
12a	R1	788	5.0	1.791	728.6	LOS F	649.5	4741.2	1.00	9.65	5.0
12	R2	7	5.0	1.791	730.3	LOS F	649.5	4741.2	1.00	9.65	5.0
12u	U	1	5.0	1.791	733.8	LOS F	649.5	4741.2	1.00	9.65	5.0
Approach		2257	5.0	1.791	724.2	LOS F	649.5	4741.2	1.00	9.65	5.0
All Vehicles		5736	5.6	2.747	829.6	LOS F	649.5	4741.2	1.00	9.22	4.4

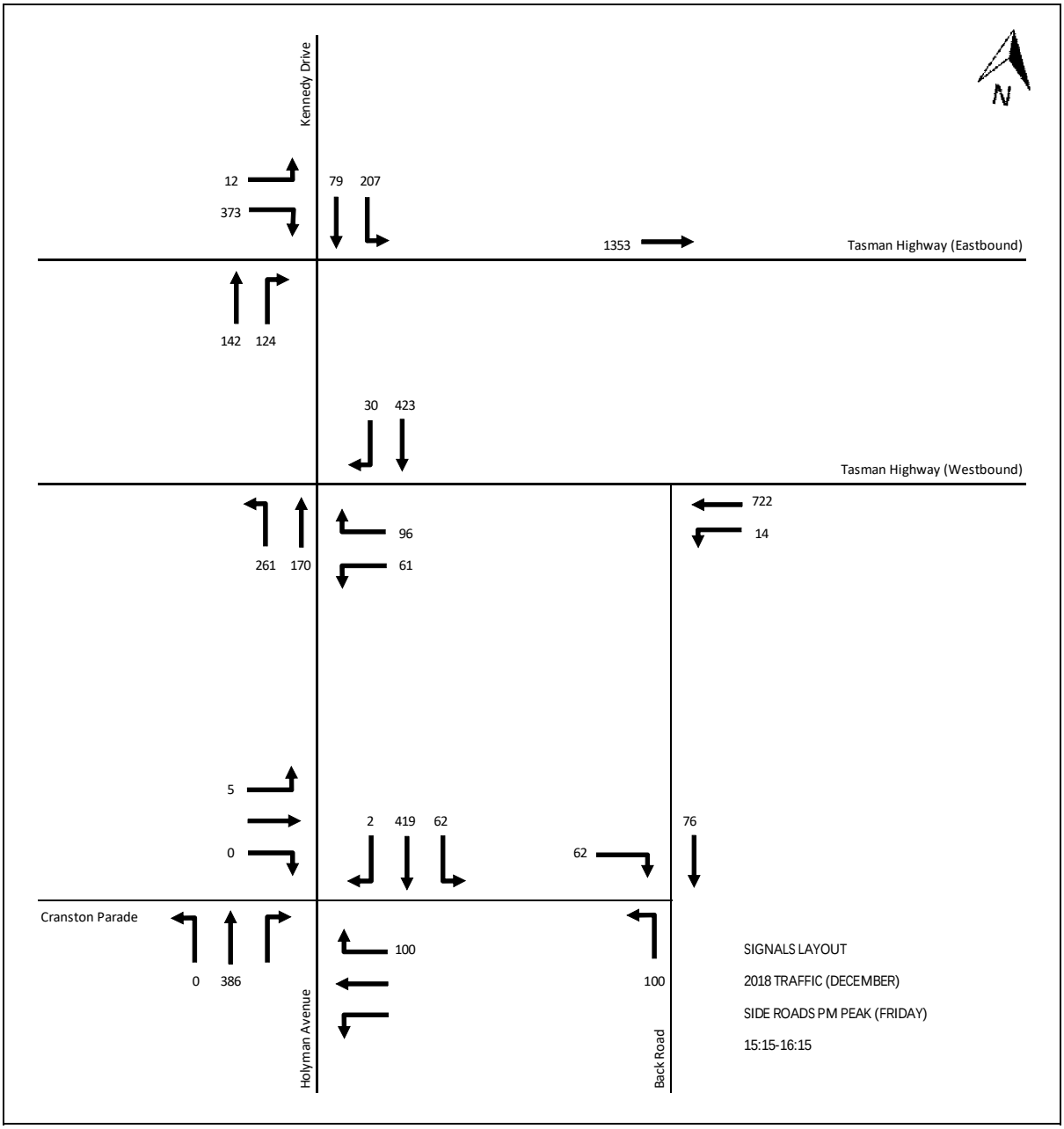
Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

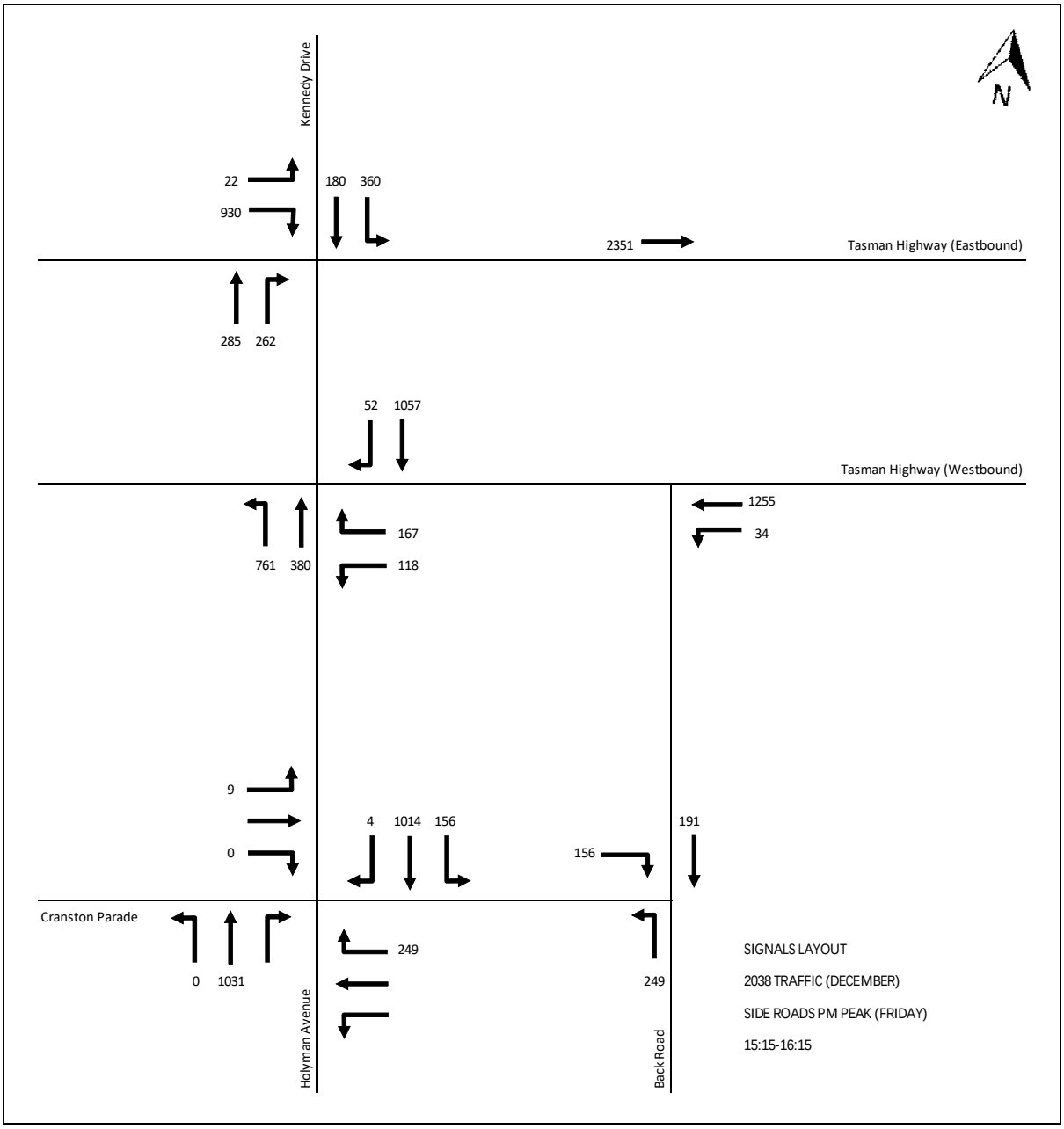
Appendix 5

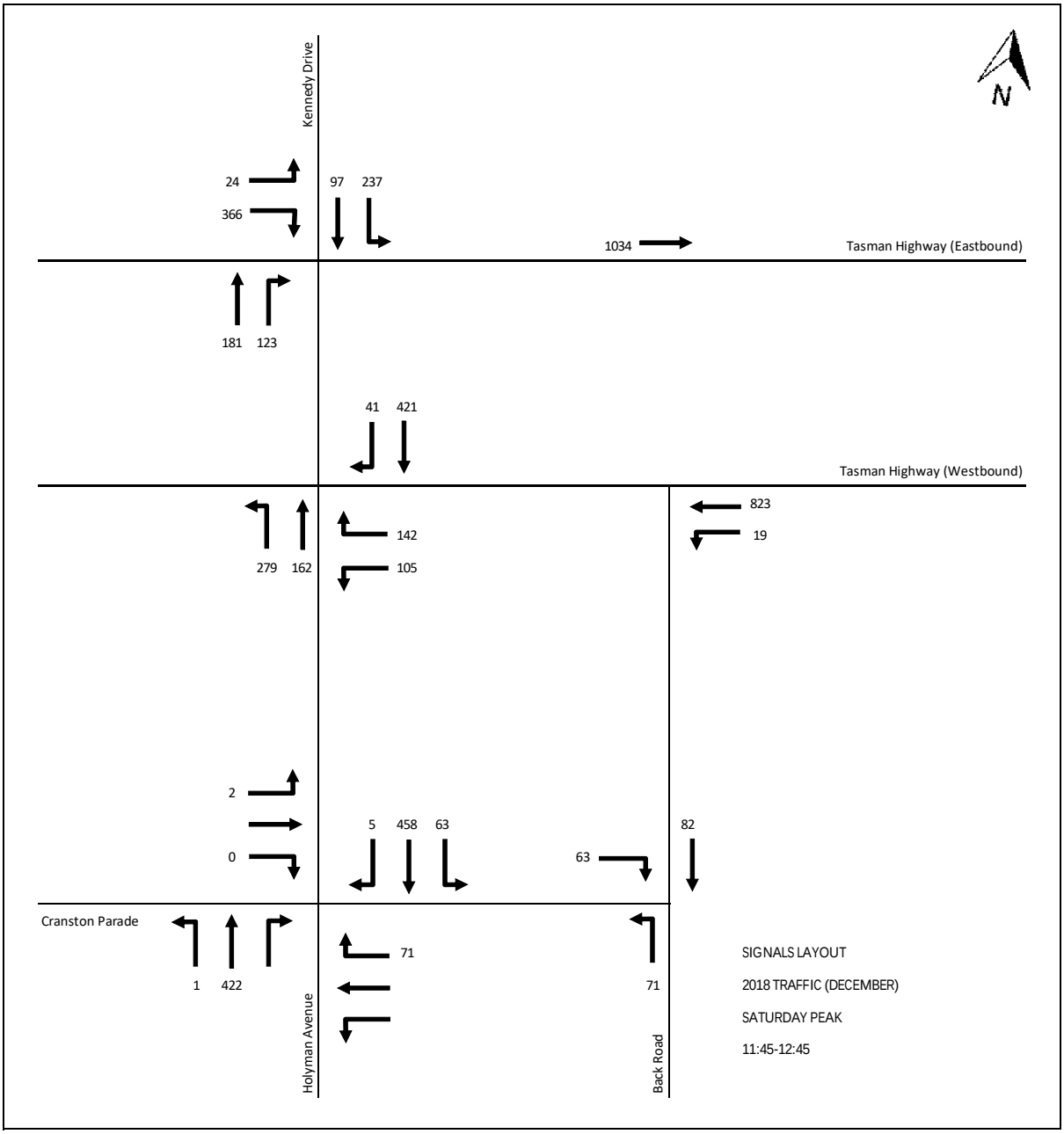
Traffic Volumes – Proposed Interchange, 2018 and 2038

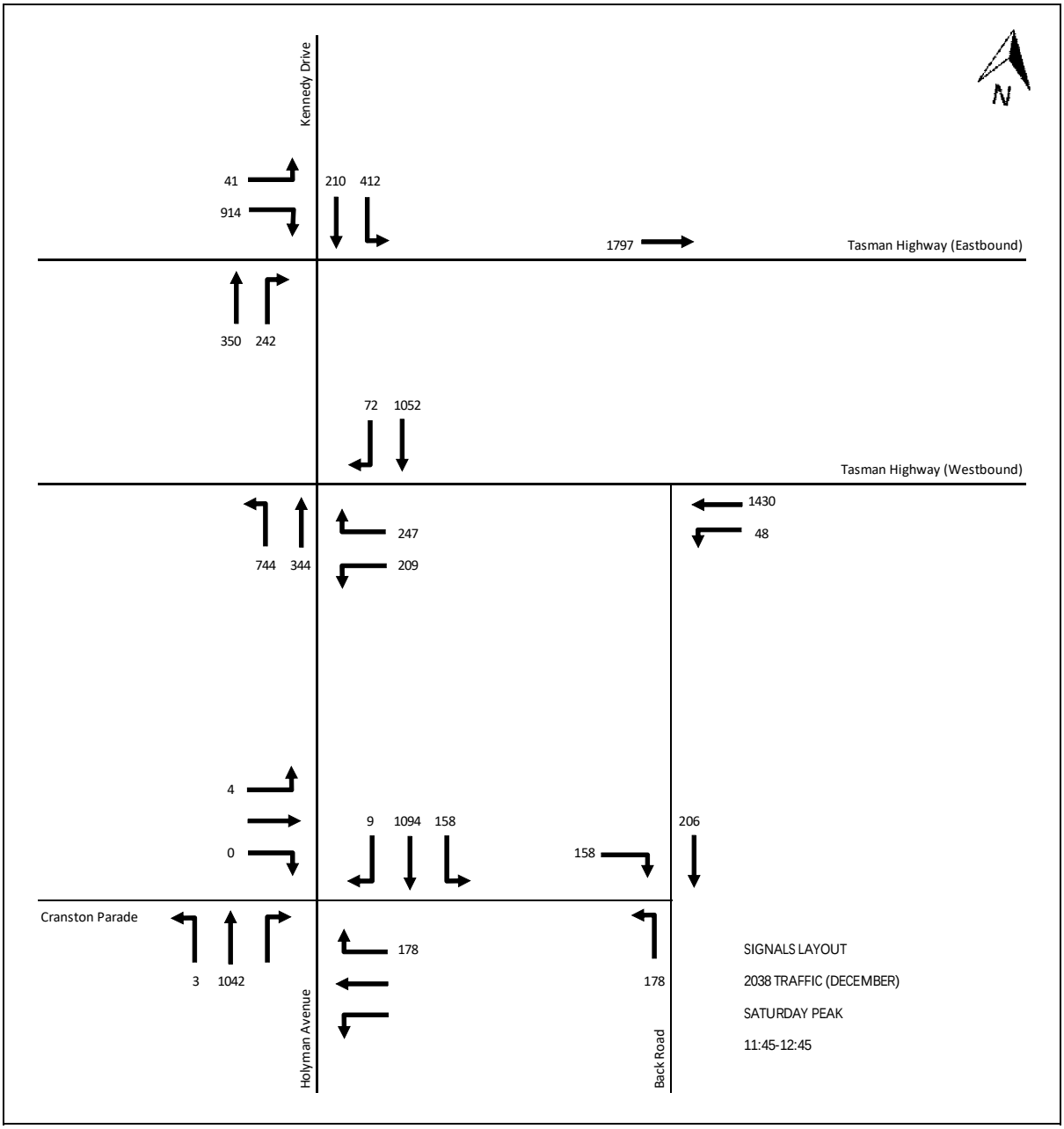

Kennedy Drive
30
575
85
99
578
Tasman Highway (Eastbound)
171
96
12
647
Tasman Highway (Westbound)
883
32
275
140
126
88
4
1
15
613
108
108
140
Cranston Parade
0
386
76
76
Holyman Avenue
Back Road
SIGNALS LAYOUT
2018 TRAFFIC (DECEMBER)
SIDE ROADS AM PEAK (THURSDAY)
08:45-09:45


Kennedy Drive
52
1430
203
171
1003
Tasman Highway (Eastbound)
335
198
22
1611
Tasman Highway (Westbound)
1534
79
758
311
219
186
7
3
26
1499
271
271
351
Cranston Parade
0
998
191
191
Holyman Avenue
Back Road
SIGNALS LAYOUT
2038 TRAFFIC (DECEMBER)
SIDE ROADS AM PEAK (THURSDAY)
08:45-09:45


Kennedy Drive
12
373
79
207
1353
Tasman Highway (Eastbound)
142
124
30
423
Tasman Highway (Westbound)
722
14
261
170
96
61
5
0
2
419
62
62
76
Cranston Parade
0
386
100
100
Holyman Avenue
Back Road
SIGNALS LAYOUT
2018 TRAFFIC (DECEMBER)
SIDE ROADS PM PEAK (FRIDAY)
15:15-16:15


Kennedy Drive
22
930
180
360
2351
Tasman Highway (Eastbound)
285
262
52
1057
Tasman Highway (Westbound)
761
380
167
118
1255
34
9
0
4
1014
156
156
191
Cranston Parade
0
1031
249
249
Holyman Avenue
Back Road
SIGNALS LAYOUT
2038 TRAFFIC (DECEMBER)
SIDE ROADS PM PEAK (FRIDAY)
15:15-16:15


Kennedy Drive
N
24
366
97
237
1034
Tasman Highway (Eastbound)
181
123
41
421
Tasman Highway (Westbound)
279
162
142
105
823
19
2
0
5
458
63
63
82
Cranston Parade
1
422
71
71
Holyman Avenue
Back Road
SIGNALS LAYOUT
2018 TRAFFIC (DECEMBER)
SATURDAY PEAK
11:45-12:45


Kennedy Drive
41
914
210
412
1797
Tasman Highway (Eastbound)
350
242
72
1052
Tasman Highway (Westbound)
744
344
247
209
1430
48
4
0
9
1094
158
158
206
Cranston Parade
3
1042
178
178
Holyman Avenue
Back Road
N
SIGNALS LAYOUT
2038 TRAFFIC (DECEMBER)
SATURDAY PEAK
11:45-12:45

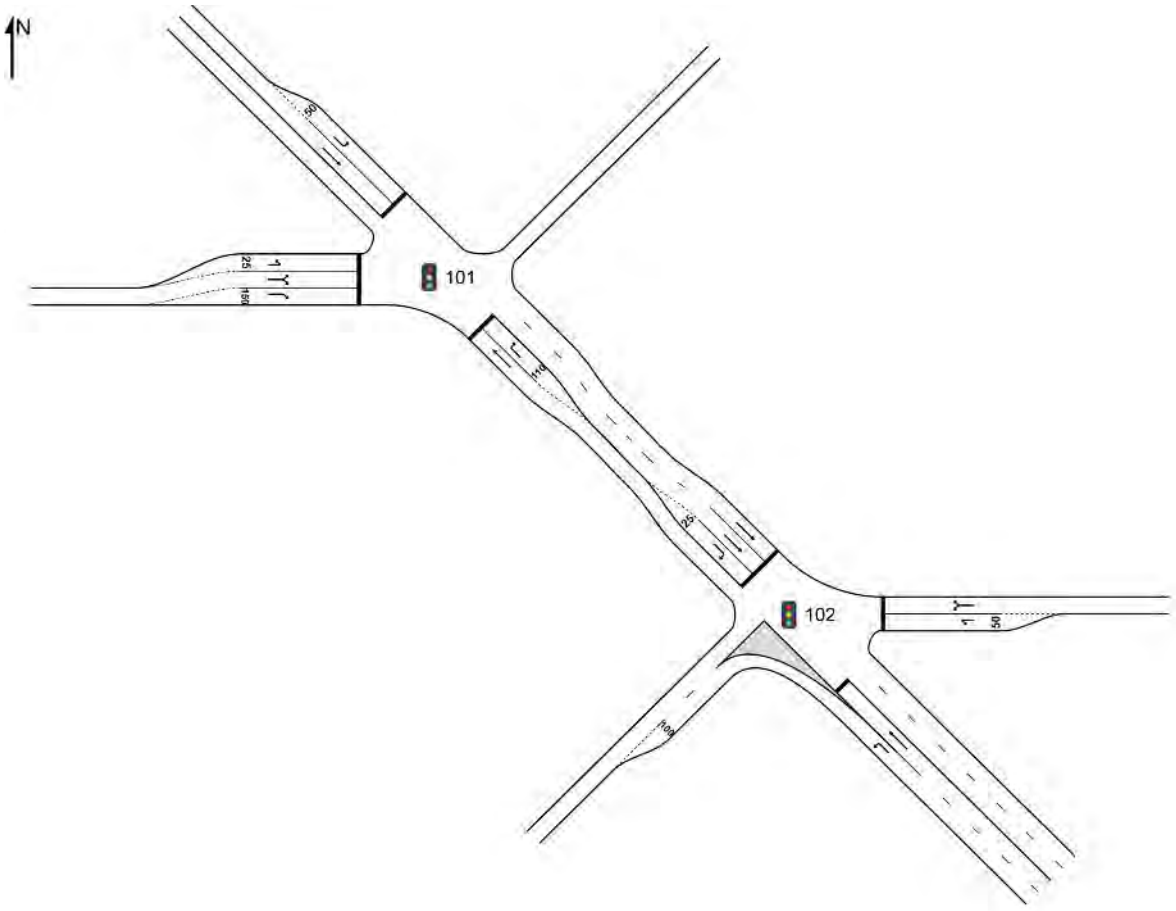
Appendix 6

SIDRA Intersection Traffic Modelling – Proposed Interchange, 2018 and 2038

NETWORK LAYOUT

Network: N101 [Tasman Highway/ Holyman Avenue/ Kennedy Drive Signals - 2018 AM Peak]

New Network



SITES IN NETWORK	
Site ID	**Site Name**
101	Tasman Highway/ Kennedy Drive Signals - 2018 AM Peak
102	Tasman Highway/ Holyman Avenue Signals - 2018 AM Peak

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MOVEMENT SUMMARY

Site: 101 [Tasman Highway/ Kennedy Drive Signals - 2018 AM Peak]

Network: N101 [Tasman Highway/ Holyman Avenue/ Kennedy Drive Signals - 2018 AM Peak]

Tasman Highway/ Kennedy Drive
Friday 07:00-08:00
Signals - Fixed Time Coordinated Cycle Time = 30 seconds (Network Cycle Time - Program)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	Demand Flows HV %	Arrival Flows Total veh/h	Arrival Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
SouthEast: Connection													
22	T1	180	5.0	180	5.0	0.408	13.9	LOS B	2.7	20.0	1.00	0.80	45.4
23	R2	101	5.0	101	5.0	0.286	19.8	LOS B	1.6	11.4	1.00	0.77	39.7
Approach		281	5.0	281	5.0	0.408	16.0	LOS B	2.7	20.0	1.00	0.79	43.2
NorthWest: Kennedy Drive													
27	L2	104	10.0	104	10.0	0.258	16.6	LOS B	1.3	10.2	0.85	0.75	45.9
28	T1	89	10.0	89	10.0	0.209	10.7	LOS B	1.1	8.6	0.84	0.65	44.4
Approach		194	10.0	194	10.0	0.258	13.9	LOS B	1.3	10.2	0.85	0.70	45.5
West: Tasman Highway (From Hobart)													
10b	L3	32	5.0	32	5.0	0.055	13.4	LOS B	0.3	2.3	0.67	0.69	48.3
10a	L1	1	5.0	1	5.0	0.448	12.8	LOS B	3.6	26.0	0.80	0.78	48.2
12a	R1	605	5.0	605	5.0	0.448	12.8	LOS B	3.6	26.0	0.80	0.78	42.4
Approach		638	5.0	638	5.0	0.448	12.8	LOS B	3.6	26.0	0.80	0.77	42.9
All Vehicles		1113	5.9	1113	5.9	0.448	13.8	LOS B	3.6	26.0	0.86	0.77	43.5

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Network Model Accuracy Level (largest change in degree of saturation for any lane): 0.0 %
Number of Iterations: 3 (maximum specified: 10)

MOVEMENT SUMMARY

Site: 102 [Tasman Highway/ Holyman Avenue Signals - 2018 AM Peak]

Network: N101 [Tasman Highway/ Holyman Avenue/ Kennedy Drive Signals - 2018 AM Peak]

Tasman Highway/ Holyman Avenue
Friday 07:00-08:00
Signals - Fixed Time Coordinated Cycle Time = 30 seconds (Network Cycle Time - Program)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	Demand Flows HV %	Arrival Flows Total veh/h	Arrival Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
SouthEast: Holyman Avenue													
21	L2	289	5.0	289	5.0	0.161	5.7	LOS A	0.0	0.0	0.00	0.53	54.7
22	T1	147	5.0	147	5.0	0.195	6.6	LOS A	1.5	10.7	0.68	0.55	49.4
Approach		437	5.0	437	5.0	0.195	6.0	LOS A	1.5	10.7	0.23	0.53	53.6
East: Tasman Highway (From Sorell)													
4b	L3	93	5.0	93	5.0	0.294	18.6	LOS B	1.3	9.3	0.89	0.76	45.2
4a	L1	1	5.0	1	5.0	0.362	16.7	LOS B	1.8	13.5	0.90	0.76	46.1
6a	R1	133	5.0	133	5.0	0.362	16.8	LOS B	1.8	13.5	0.90	0.76	38.8
Approach		226	5.0	226	5.0	0.362	17.5	LOS B	1.8	13.5	0.90	0.76	42.3
NorthWest: Connection													
28	T1	681	5.0	681	5.0	0.451	2.4	LOS A	2.2	15.9	0.31	0.26	56.9
29	R2	13	5.0	13	5.0	0.023	6.8	LOS A	0.0	0.1	0.11	0.64	49.1
Approach		694	5.0	694	5.0	0.451	2.4	LOS A	2.2	15.9	0.31	0.27	56.7
All Vehicles		1357	5.0	1357	5.0	0.451	6.1	LOS A	2.2	15.9	0.38	0.44	52.8

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Network Model Accuracy Level (largest change in degree of saturation for any lane): 0.0 %
Number of Iterations: 3 (maximum specified: 10)

MOVEMENT SUMMARY

Site: 101 [Tasman Highway/ Kennedy Drive Signals - 2038 AM Peak]

Network: N101 [Tasman Highway/ Holyman Avenue/ Kennedy Drive Signals - 2038 AM Peak]

Tasman Highway/ Kennedy Drive
Friday 07:00-08:00
Signals - Fixed Time Coordinated Cycle Time = 50 seconds (Network Cycle Time - Program)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	Demand Flows HV %	Arrival Flows Total veh/h	Arrival Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
SouthEast: Connection													
22	T1	353	5.0	353	5.0	0.718	20.1	LOS C	8.7	63.6	0.98	0.88	40.9
23	R2	208	5.0	208	5.0	0.811	32.3	LOS C	5.9	43.1	1.00	0.94	33.3
Approach		561	5.0	561	5.0	0.811	24.7	LOS C	8.7	63.6	0.99	0.91	37.7
NorthWest: Kennedy Drive													
27	L2	180	10.0	180	10.0	0.399	22.9	LOS C	3.8	28.9	0.87	0.78	42.5
28	T1	214	10.0	214	10.0	0.449	17.4	LOS B	4.6	34.7	0.88	0.73	38.2
Approach		394	10.0	394	10.0	0.449	19.9	LOS B	4.6	34.7	0.88	0.75	40.8
West: Tasman Highway (From Hobart)													
10b	L3	55	5.0	55	5.0	0.070	13.6	LOS B	0.7	5.1	0.54	0.70	48.2
10a	L1	1	5.0	1	5.0	0.837	22.4	LOS C	18.8	137.5	0.89	0.96	42.8
12a	R1	1505	5.0	1505	5.0	0.837	22.5	LOS C	20.3	147.9	0.91	0.96	34.6
Approach		1561	5.0	1561	5.0	0.837	22.2	LOS C	20.3	147.9	0.90	0.95	35.3
All Vehicles		2516	5.8	2516	5.8	0.837	22.4	LOS C	20.3	147.9	0.91	0.91	36.9

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Network Model Accuracy Level (largest change in degree of saturation for any lane): 0.0 %
Number of Iterations: 3 (maximum specified: 10)

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MOVEMENT SUMMARY

Site: 102 [Tasman Highway/ Holyman Avenue Signals - 2038 AM Peak]

Network: N101 [Tasman Highway/ Holyman Avenue/ Kennedy Drive Signals - 2038 AM Peak]

Tasman Highway/ Holyman Avenue
Friday 07:00-08:00
Signals - Fixed Time Coordinated Cycle Time = 50 seconds (Network Cycle Time - Program)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
SouthEast: Holyman Avenue													
21	L2	798	5.0	798	5.0	0.445	5.7	LOS A	0.0	0.0	0.00	0.53	54.7
22	T1	327	5.0	327	5.0	0.289	5.2	LOS A	3.9	28.4	0.52	0.44	51.2
Approach		1125	5.0	1125	5.0	0.445	5.6	LOS A	3.9	28.4	0.15	0.50	54.1
East: Tasman Highway (From Sorell)													
4b	L3	196	5.0	196	5.0	0.778	33.1	LOS C	5.4	39.4	1.00	0.95	38.4
4a	L1	1	5.0	1	5.0	0.784	30.7	LOS C	6.3	46.1	1.00	0.95	39.1
6a	R1	231	5.0	231	5.0	0.784	30.8	LOS C	6.3	46.1	1.00	0.95	29.9
Approach		427	5.0	427	5.0	0.784	31.8	LOS C	6.3	46.1	1.00	0.95	34.8
NorthWest: Connection													
28	T1	1696	5.0	1696	5.0	0.748	4.6	LOS A	12.9	94.3	0.43	0.42	54.2
29	R2	23	5.0	23	5.0	0.039	9.2	LOS A	0.1	1.0	0.24	0.66	46.9
Approach		1719	5.0	1719	5.0	0.748	4.7	LOS A	12.9	94.3	0.43	0.42	54.1
All Vehicles		3272	5.0	3272	5.0	0.784	8.5	LOS A	12.9	94.3	0.41	0.52	50.6

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Network Model Accuracy Level (largest change in degree of saturation for any lane): 0.0 %
Number of Iterations: 3 (maximum specified: 10)

MOVEMENT SUMMARY

Site: 101 [Tasman Highway/ Kennedy Drive Signals - 2018 PM Peak]

Network: N101 [Tasman Highway/ Holyman Avenue/ Kennedy Drive Signals - 2018 PM Peak]

Tasman Highway/ Kennedy Drive
Friday 07:00-08:00
Signals - Fixed Time Coordinated Cycle Time = 30 seconds (Network Cycle Time - Program)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	Demand Flows HV %	Arrival Flows Total veh/h	Arrival Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
SouthEast: Connection													
22	T1	149	5.0	149	5.0	0.396	14.8	LOS B	2.3	17.0	1.00	0.79	44.7
23	R2	131	5.0	131	5.0	0.533	22.5	LOS C	2.1	15.6	1.00	0.78	38.1
Approach		280	5.0	280	5.0	0.533	18.4	LOS B	2.3	17.0	1.00	0.78	41.4
NorthWest: Kennedy Drive													
27	L2	218	10.0	218	10.0	0.628	19.3	LOS B	3.3	25.3	0.96	0.86	44.4
28	T1	83	10.0	83	10.0	0.227	11.7	LOS B	1.1	8.4	0.87	0.67	43.4
Approach		301	10.0	301	10.0	0.628	17.2	LOS B	3.3	25.3	0.94	0.81	44.2
West: Tasman Highway (From Hobart)													
10b	L3	13	5.0	13	5.0	0.020	12.6	LOS B	0.1	0.8	0.62	0.66	48.9
10a	L1	1	5.0	1	5.0	0.266	11.4	LOS B	2.0	14.8	0.71	0.74	49.1
12a	R1	393	5.0	393	5.0	0.266	11.4	LOS B	2.0	14.8	0.71	0.74	43.8
Approach		406	5.0	406	5.0	0.266	11.5	LOS B	2.0	14.8	0.70	0.74	44.1
All Vehicles		987	6.5	987	6.5	0.628	15.2	LOS B	3.3	25.3	0.86	0.77	43.3

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Network Model Accuracy Level (largest change in degree of saturation for any lane): 0.0 %
Number of Iterations: 3 (maximum specified: 10)

MOVEMENT SUMMARY

Site: 102 [Tasman Highway/ Holyman Avenue Signals - 2018 PM Peak]

Network: N101 [Tasman Highway/ Holyman Avenue/ Kennedy Drive Signals - 2018 PM Peak]

Tasman Highway/ Holyman Avenue
Friday 07:00-08:00
Signals - Fixed Time Coordinated Cycle Time = 30 seconds (Network Cycle Time - Program)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	Demand Flows HV %	Arrival Flows Total veh/h	Arrival Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
SouthEast: Holyman Avenue													
21	L2	275	5.0	275	5.0	0.153	5.7	LOS A	0.0	0.0	0.00	0.53	54.7
22	T1	179	5.0	179	5.0	0.237	6.7	LOS A	1.8	13.3	0.70	0.57	49.2
Approach		454	5.0	454	5.0	0.237	6.1	LOS A	1.8	13.3	0.28	0.54	53.3
East: Tasman Highway (From Sorell)													
4b	L3	64	5.0	64	5.0	0.204	18.3	LOS B	0.9	6.3	0.87	0.74	45.4
4a	L1	1	5.0	1	5.0	0.276	16.4	LOS B	1.4	10.0	0.88	0.75	46.2
6a	R1	101	5.0	101	5.0	0.276	16.5	LOS B	1.4	10.0	0.88	0.75	39.0
Approach		166	5.0	166	5.0	0.276	17.2	LOS B	1.4	10.0	0.88	0.74	42.4
NorthWest: Connection													
28	T1	445	5.0	445	5.0	0.295	3.1	LOS A	1.5	11.3	0.35	0.29	56.0
29	R2	32	5.0	32	5.0	0.060	7.6	LOS A	0.1	0.6	0.18	0.65	48.4
Approach		477	5.0	477	5.0	0.295	3.4	LOS A	1.5	11.3	0.34	0.31	55.4
All Vehicles		1097	5.0	1097	5.0	0.295	6.6	LOS A	1.8	13.3	0.40	0.47	52.2

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Network Model Accuracy Level (largest change in degree of saturation for any lane): 0.0 %
Number of Iterations: 3 (maximum specified: 10)

MOVEMENT SUMMARY

Site: 101 [Tasman Highway/ Kennedy Drive Signals - 2038 PM Peak]

Network: N101 [Tasman Highway/ Holyman Avenue/ Kennedy Drive Signals - 2038 PM Peak]

Tasman Highway/ Kennedy Drive
Friday 07:00-08:00
Signals - Fixed Time Coordinated Cycle Time = 50 seconds (Network Cycle Time - Program)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	Demand Flows HV %	Arrival Flows Total veh/h	Arrival Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
SouthEast: Connection													
22	T1	300	5.0	300	5.0	0.361	10.2	LOS B	4.6	33.3	0.65	0.55	48.5
23	R2	276	5.0	276	5.0	0.883	33.6	LOS C	8.4	61.7	0.97	1.04	32.7
Approach		576	5.0	576	5.0	0.883	21.4	LOS C	8.4	61.7	0.80	0.79	39.4
NorthWest: Kennedy Drive													
27	L2	379	10.0	379	10.0	0.497	16.7	LOS B	6.8	51.7	0.76	0.79	45.8
28	T1	189	10.0	189	10.0	0.235	9.6	LOS A	2.9	22.3	0.66	0.54	45.7
Approach		568	10.0	568	10.0	0.497	14.4	LOS B	6.8	51.7	0.73	0.71	45.8
West: Tasman Highway (From Hobart)													
10b	L3	23	5.0	23	5.0	0.046	19.4	LOS B	0.4	2.9	0.72	0.69	44.8
10a	L1	1	5.0	1	5.0	0.839	28.3	LOS C	13.5	98.5	0.98	1.00	40.0
12a	R1	979	5.0	979	5.0	0.839	28.3	LOS C	13.9	101.5	0.99	1.00	31.2
Approach		1003	5.0	1003	5.0	0.839	28.1	LOS C	13.9	101.5	0.98	1.00	31.7
All Vehicles		2147	6.3	2147	6.3	0.883	22.7	LOS C	13.9	101.5	0.87	0.86	37.8

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Network Model Accuracy Level (largest change in degree of saturation for any lane): 0.0 %
Number of Iterations: 3 (maximum specified: 10)

MOVEMENT SUMMARY

Site: 102 [Tasman Highway/ Holyman Avenue Signals - 2038 PM Peak]

Network: N101 [Tasman Highway/ Holyman Avenue/ Kennedy Drive Signals - 2038 PM Peak]

Tasman Highway/ Holyman Avenue
Friday 07:00-08:00
Signals - Fixed Time Coordinated Cycle Time = 50 seconds (Network Cycle Time - Program)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	Demand Flows HV %	Arrival Flows Total veh/h	Arrival Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
SouthEast: Holyman Avenue													
21	L2	801	5.0	801	5.0	0.447	5.7	LOS A	0.0	0.0	0.00	0.53	54.7
22	T1	400	5.0	400	5.0	0.365	6.1	LOS A	5.3	38.4	0.57	0.49	50.0
Approach		1201	5.0	1201	5.0	0.447	5.8	LOS A	5.3	38.4	0.19	0.51	53.7
East: Tasman Highway (From Sorell)													
4b	L3	124	5.0	124	5.0	0.438	27.6	LOS C	2.9	21.2	0.93	0.78	40.7
4a	L1	1	5.0	1	5.0	0.532	25.9	LOS C	4.2	30.4	0.95	0.79	41.3
6a	R1	176	5.0	176	5.0	0.532	25.9	LOS C	4.2	30.4	0.95	0.79	32.5
Approach		301	5.0	301	5.0	0.532	26.6	LOS C	4.2	30.4	0.94	0.79	36.9
NorthWest: Connection													
28	T1	1113	5.0	1113	5.0	0.508	2.8	LOS A	4.1	29.8	0.29	0.25	56.3
29	R2	55	5.0	55	5.0	0.108	13.0	LOS B	0.6	4.5	0.46	0.70	43.9
Approach		1167	5.0	1167	5.0	0.508	3.3	LOS A	4.1	29.8	0.29	0.27	55.6
All Vehicles		2669	5.0	2669	5.0	0.532	7.1	LOS A	5.3	38.4	0.32	0.44	51.9

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Network Model Accuracy Level (largest change in degree of saturation for any lane): 0.0 %
Number of Iterations: 3 (maximum specified: 10)

MOVEMENT SUMMARY

Site: 101 [Tasman Highway/ Kennedy Drive Signals - 2018 Saturday Peak]

Network: N101 [Tasman Highway/ Holyman Avenue/ Kennedy Drive Signals - 2018 Saturday Peak]

Tasman Highway/ Kennedy Drive
Friday 07:00-08:00
Signals - Fixed Time Coordinated Cycle Time = 30 seconds (Network Cycle Time - Program)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	Demand Flows HV %	Arrival Flows Total veh/h	Arrival Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
SouthEast: Connection													
22	T1	191	5.0	191	5.0	0.504	14.8	LOS B	3.0	21.6	1.00	0.80	44.7
23	R2	129	5.0	129	5.0	0.499	22.3	LOS C	2.1	15.3	1.00	0.77	38.2
Approach		320	5.0	320	5.0	0.504	17.8	LOS B	3.0	21.6	1.00	0.79	41.8
NorthWest: Kennedy Drive													
27	L2	249	10.0	249	10.0	0.720	20.5	LOS C	4.1	30.8	0.98	0.92	43.8
28	T1	102	10.0	102	10.0	0.279	11.9	LOS B	1.4	10.5	0.88	0.68	43.2
Approach		352	10.0	352	10.0	0.720	18.0	LOS B	4.1	30.8	0.95	0.85	43.7
West: Tasman Highway (From Hobart)													
10b	L3	25	5.0	25	5.0	0.040	12.7	LOS B	0.2	1.7	0.63	0.68	48.8
10a	L1	1	5.0	1	5.0	0.261	11.4	LOS B	2.0	14.5	0.71	0.74	49.1
12a	R1	385	5.0	385	5.0	0.261	11.4	LOS B	2.0	14.5	0.71	0.74	43.8
Approach		412	5.0	412	5.0	0.261	11.5	LOS B	2.0	14.5	0.70	0.73	44.3
All Vehicles		1083	6.6	1083	6.6	0.720	15.5	LOS B	4.1	30.8	0.87	0.79	43.3

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Network Model Accuracy Level (largest change in degree of saturation for any lane): 0.0 %
Number of Iterations: 3 (maximum specified: 10)

MOVEMENT SUMMARY

Site: 102 [Tasman Highway/ Holyman Avenue Signals - 2018 Saturday Peak]

Network: N101 [Tasman Highway/ Holyman Avenue/ Kennedy Drive Signals - 2018 Saturday Peak]

Tasman Highway/ Holyman Avenue
Friday 07:00-08:00
Signals - Fixed Time Coordinated Cycle Time = 30 seconds (Network Cycle Time - Program)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	Demand Flows HV %	Arrival Flows Total veh/h	Arrival Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
SouthEast: Holyman Avenue													
21	L2	294	5.0	294	5.0	0.164	5.7	LOS A	0.0	0.0	0.00	0.53	54.7
22	T1	171	5.0	171	5.0	0.246	7.5	LOS A	1.8	13.3	0.73	0.59	48.2
Approach		464	5.0	464	5.0	0.246	6.3	LOS A	1.8	13.3	0.27	0.55	53.1
East: Tasman Highway (From Sorell)													
4b	L3	111	5.0	111	5.0	0.301	17.7	LOS B	1.5	10.6	0.86	0.76	45.8
4a	L1	1	5.0	1	5.0	0.349	15.7	LOS B	2.0	14.5	0.87	0.76	46.7
6a	R1	149	5.0	149	5.0	0.349	15.8	LOS B	2.0	14.5	0.87	0.76	39.6
Approach		261	5.0	261	5.0	0.349	16.6	LOS B	2.0	14.5	0.87	0.76	43.1
NorthWest: Connection													
28	T1	443	5.0	443	5.0	0.320	3.7	LOS A	1.7	12.6	0.40	0.33	55.3
29	R2	43	5.0	43	5.0	0.088	9.8	LOS A	0.2	1.8	0.38	0.67	46.4
Approach		486	5.0	486	5.0	0.320	4.2	LOS A	1.7	12.6	0.40	0.36	54.4
All Vehicles		1212	5.0	1212	5.0	0.349	7.7	LOS A	2.0	14.5	0.45	0.52	51.1

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Network Model Accuracy Level (largest change in degree of saturation for any lane): 0.0 %
Number of Iterations: 3 (maximum specified: 10)

MOVEMENT SUMMARY

Site: 101 [Tasman Highway/ Kennedy Drive Signals - 2038 Saturday Peak]

Network: N101 [Tasman Highway/ Holyman Avenue/ Kennedy Drive Signals - 2038 Saturday Peak]

Tasman Highway/ Kennedy Drive
Friday 07:00-08:00
Signals - Fixed Time Coordinated Cycle Time = 40 seconds (Network Cycle Time - Program)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	Demand Flows HV %	Arrival Flows Total veh/h	Arrival Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
SouthEast: Connection													
22	T1	368	5.0	368	5.0	0.488	10.0	LOS A	5.1	37.4	0.73	0.62	48.7
23	R2	265	5.0	265	5.0	0.975	47.4	LOS D	8.8	64.5	1.00	1.30	27.9
Approach		634	5.0	634	5.0	0.975	25.7	LOS C	8.8	64.5	0.84	0.91	37.1
NorthWest: Kennedy Drive													
27	L2	434	10.0	434	10.0	0.625	16.7	LOS B	7.2	54.5	0.85	0.83	45.9
28	T1	221	10.0	221	10.0	0.302	9.1	LOS A	3.0	23.1	0.72	0.60	46.2
Approach		655	10.0	655	10.0	0.625	14.1	LOS B	7.2	54.5	0.81	0.75	45.9
West: Tasman Highway (From Hobart)													
10b	L3	43	5.0	43	5.0	0.091	17.8	LOS B	0.6	4.6	0.75	0.71	45.7
10a	L1	1	5.0	1	5.0	0.883	28.8	LOS C	12.1	88.1	1.00	1.11	39.8
12a	R1	962	5.0	962	5.0	0.883	28.8	LOS C	12.6	91.7	1.00	1.11	30.9
Approach		1006	5.0	1006	5.0	0.883	28.4	LOS C	12.6	91.7	0.99	1.10	31.8
All Vehicles		2295	6.4	2295	6.4	0.975	23.5	LOS C	12.6	91.7	0.90	0.94	37.5

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Network Model Accuracy Level (largest change in degree of saturation for any lane): 0.0 %
Number of Iterations: 3 (maximum specified: 10)

MOVEMENT SUMMARY

Site: 102 [Tasman Highway/ Holyman Avenue Signals - 2038 Saturday Peak]

Network: N101 [Tasman Highway/ Holyman Avenue/ Kennedy Drive Signals - 2038 Saturday Peak]

Tasman Highway/ Holyman Avenue
Friday 07:00-08:00
Signals - Fixed Time Coordinated Cycle Time = 40 seconds (Network Cycle Time - Program)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	Demand Flows HV %	Arrival Flows Total veh/h	Arrival Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
SouthEast: Holyman Avenue													
21	L2	783	5.0	783	5.0	0.437	5.7	LOS A	0.0	0.0	0.00	0.53	54.7
22	T1	373	5.0	373	5.0	0.415	7.6	LOS A	4.9	35.7	0.70	0.59	48.1
Approach		1156	5.0	1156	5.0	0.437	6.3	LOS A	4.9	35.7	0.22	0.55	53.3
East: Tasman Highway (From Sorell)													
4b	L3	220	5.0	220	5.0	0.621	23.4	LOS C	4.3	31.4	0.95	0.85	42.7
4a	L1	1	5.0	1	5.0	0.628	21.1	LOS C	5.0	36.8	0.95	0.85	43.6
6a	R1	260	5.0	260	5.0	0.628	21.2	LOS C	5.0	36.8	0.95	0.85	35.5
Approach		481	5.0	481	5.0	0.628	22.2	LOS C	5.0	36.8	0.95	0.85	39.7
NorthWest: Connection													
28	T1	1107	5.0	1107	5.0	0.617	3.8	LOS A	5.7	41.4	0.46	0.41	55.1
29	R2	76	5.0	76	5.0	0.173	14.9	LOS B	0.9	6.3	0.58	0.72	42.5
Approach		1183	5.0	1183	5.0	0.617	4.5	LOS A	5.7	41.4	0.47	0.43	54.1
All Vehicles		2820	5.0	2820	5.0	0.628	8.3	LOS A	5.7	41.4	0.45	0.55	50.8

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Network Model Accuracy Level (largest change in degree of saturation for any lane): 0.0 %
Number of Iterations: 3 (maximum specified: 10)

Contact
Rebekah Giana
(03) 6210 1402
rgiana@pittsh.com.au

transport | community | mining | industrial | food & beverage | energy

Brisbane
Level 2
276 Edward Street
Brisbane QLD 4000
T: (07) 3221 0080
F: (07) 3221 0083

Devonport
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35 Oldaker Street
PO Box 836
Devonport TAS 7310
T: (03) 6424 1641
F: (03) 6424 9215

Hobart
199 Macquarie Street
GPO Box 94
Hobart TAS 7001
T: (03) 6210 1400
F: (03) 6223 1299

Launceston
Level 4
113 Cimitiere Street
PO Box 1409
Launceston TAS 7250
T: (03) 6323 1900
F: (03) 6334 4651

Melbourne
Level 1, HWT Tower
40 City Road
Southbank VIC 3006
PO Box 259
South Melbourne VIC 3205
T: (03) 9682 5290
F: (03) 9682 5292

Newcastle
Level 1
81 Hunter Street
Newcastle NSW 2300
T: (02) 4910 3600

Sydney
Suite 902, Level 9,
1-5 Railway Street
Chatswood NSW 2067
PO Box 5487
West Chatswood NSW 1515
T: (02) 9468 9300

E: info@pittsh.com.au
W: www.pittsh.com.au

incorporated as
Pitt & Sherry (Operations) Pty Ltd
ABN 67 140 184 309

END OF APPENDIX

KMH ENVIRONMENTAL
Now part of the pitt&sherry group

pitt&sherry

Appendix H

Compliance with Obstacle Limitation Surface

AIRPORT SURVEYS

Airport Surveys Pty Ltd
ABN 95 605 087 698
ACN 605 087 698
PO Box 306
Chirnside Park VIC 3116
Ph/Fax: (03) 9739 4517
Mobile: 0407 360 008
Email: bryan@airportsurveys.com.au

12th October 2016

Mr. David Conley
Pitt &Sherry (Operations) Pty Ltd
PO Box 1409
Launceston
TAS 7250

OBSTACLE LIMITATION CHART – HOBART AIRPORT INTERSECTION

Dear David,

Please find attached our Autocad Drawing No. MHB005. This drawing depicts the section of the Obstacle Limitation Surfaces for both Hobart and Cambridge aerodromes covering the area of reconstruction involved in the upgrade of the Tasman Highway and Holyman Avenue Intersection.

These surfaces have been edited and combined so that the AHD Reduced levels shown on this plan represent the maximum AHD height allowed for any structure before it becomes an obstruction to any of the Obstacle Limitation Surfaces for either aerodrome.

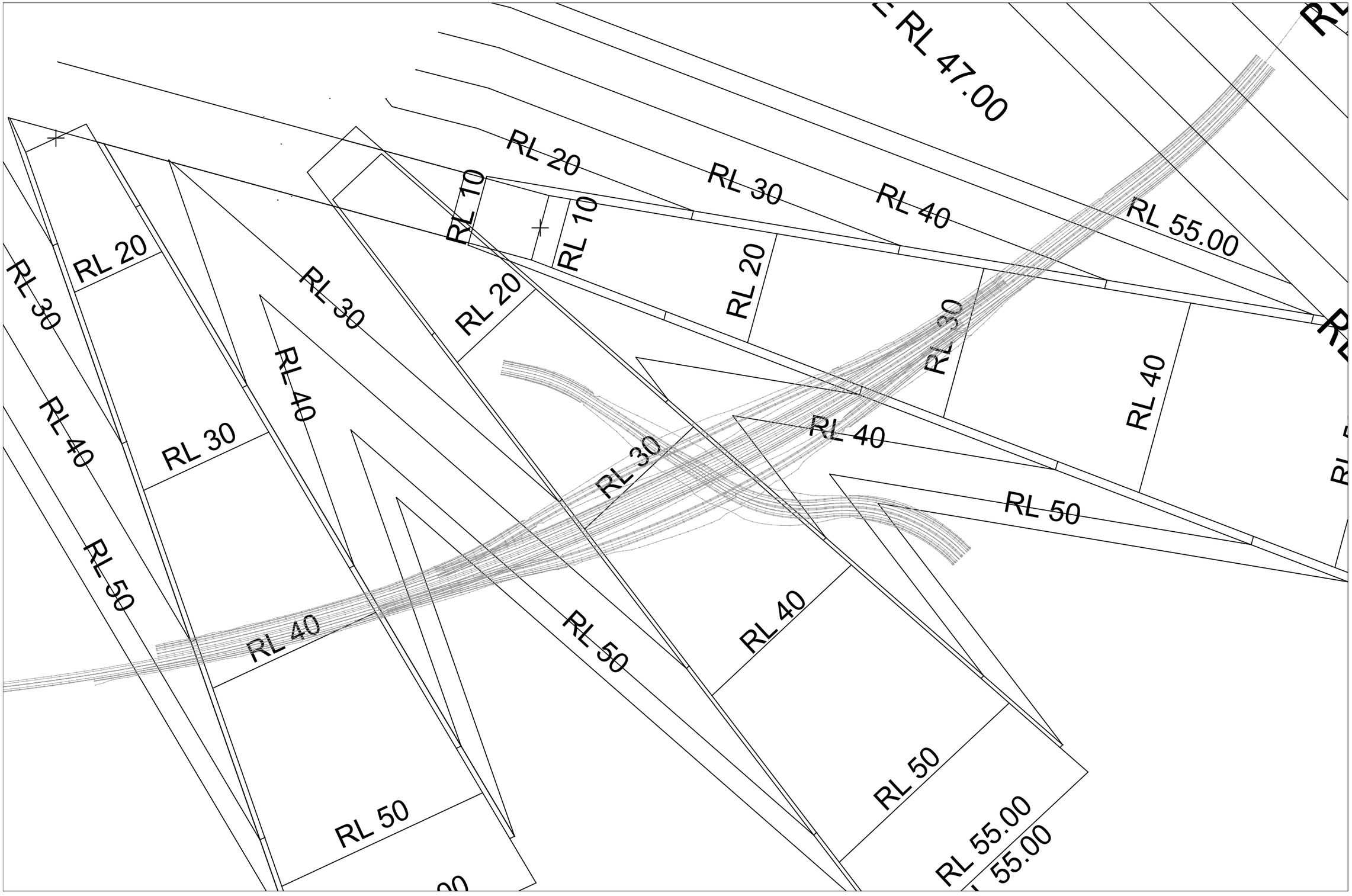
If there is any proposal to infringe these surfaces it will be necessary to consult directly with the relevant aerodrome to determine whether the proposed infringement can be allowed and if it can, what requirements would need to be placed on the infringement in terms of marking and lighting of the obstructions. If there is no proposal to infringe these surfaces there is no requirement for further consultation with the aerodromes.

Prior to preparing this drawing we have consulted both Hobart and Cambridge Aerodromes to ensure that the Obstacle Limitation Surfaces depicted will protect the aerodrome for any proposed upgrades or extensions to the runways that may be contemplated.

Please call if any additional information is required.

Yours Faithfully,

Bryan Fitzgerald.



DRAWN	B.FITZGERALD
DATE	11.10.2016
SURVEYED	P.FITZGERALD
DATE	04.10.2016
ARCHIVED	
DRAWING No.	MHB/005
	Sheet 1 of 1 Sheets

NOTE:

- LEVELS ARE TO AUSTRALIAN HEIGHT DATUM (AHD)
- CO-ORDINATES ARE MGA94 ZONE 55
- DUE TO THE VARIABLE NATURE OF THE TRANSITIONAL SURFACE, OBJECTS LOCATED WITHIN IT SHOULD BE CHECKED BY GROUND SURVEY FOR CLEARANCE

HOLMAN AVENUE INTERSECTION UPGRADE

AIRPORT SURVEYS
0409 230 650
paul@airportsurveys.com.au

HOBART AND CAMBRIDGE AERODROME - OBSTACLE LIMITATION SURFACES

Meters
40 0 40 80
1:2000

AMENDMENTS		
DATE	AMENDMENT	SIGNED

Tasmanian Government

Department of State Growth

GPO Box 536
Hobart TAS 7001 Australia

Phone: 1800 030 688
Email: info@stategrowth.tas.gov.au
Web: www.stategrowth.tas.gov.au

Appendix E

Permit to take threatened flora

Department of Primary Industries Parks, Water and Environment
NATURAL AND CULTURAL HERITAGE DIVISION
Hobart GPO Box 44, Hobart TAS 7001
www.dpipwe.tas.gov.au

Tasmania

Enquiries : Annika Everaardt
Phone : 03 6165 4384
Email : annika.everaardt@dpipwe.tas.gov.au
Our Ref : M438036

16 April 2019

Miss Mia Potter
Department of State Growth
GPO Box 536
Hobart TAS 7001

Dear Miss Potter

PERMIT TO TAKE THREATENED SPECIES

I refer to your recent application for a permit to take threatened flora associated with the Tasman Highway Hobart International Airport Interchange Project in Cambridge.

I have enclosed a permit to take issued in accordance with the *Threatened Species Regulations 2016*. Please review the maps of the approved take locations and read the conditions of the permit carefully prior to commencing any of the relevant activities under the permit and ensure you understand and are able to meet all of the conditions. It is also your responsibility to ensure that any employees or subcontractors that are acting on behalf of a person named in the permit are also aware of and comply with the permit conditions.

As previously discussed with staff from the Department of State Growth, including at our meeting on 3 April 2019, one of the conditions of the permit is that an order under Section 8 of the *Crown Lands Act 1976* must be entered into and registered on title to reserve the specified offset areas for conservation purposes as an offset for the significant take of *Calocephalus citreus* plants associated with your project. As also discussed, a Management Plan endorsed by the Policy and Conservation Advice Branch will also be required.

Please note that in accordance with Regulation (5)(2) of the *Threatened Species Protection Regulations 2016* the Secretary may amend or revoke a permit after giving notice to the permit holder of the intention to do so.

If you have any queries, please contact the officer nominated at the head of this letter.

Yours sincerely

Andrew Crane
Manager, Policy and Conservation Advice Branch
Department of Primary Industries, Parks, Water and Environment

Encl. Permit DA 19063

Tasmania

DEPARTMENT of PRIMARY INDUSTRIES, PARKS, WATER and ENVIRONMENT

PERMIT TO TAKE THREATENED FLORA

Permit No. DA 19063

Issued in accordance with Regulation 4 of the Threatened Species Protection Regulations 2016

Miss Mia Potter
Department of State Growth
Level 2, 4 Salamanca Place
Hobart TAS 7000

Inquiries : Andrew Crane
Phone : 61654395
Our Ref. : M438036
Email : Andrew.Crane@dpipwe.tas.gov.au

is authorised to take

Austrostipa scabra, *Calocephalus citreus*, *Haloragis heterophylla*, *Juncus amabilis*, *Ranunculus pumilio* var *pumilio* and *Senecio squarrosus* plants

from

within the specified take area as shown in Schedule 3

for

works associated with the Tasman Highway Hobart International Airport Interrchange Project in Cambridge.

subject to the conditions in Schedule 1 (overleaf)

This authority is valid only from 1/11/2019 to 31/10/2022

Issued by:

..... Date: 17/4/19

Andrew Crane
Delegate of the Secretary of the Department of Primary Industries, Parks, Water and Environment

Tasmania

DEPARTMENT of PRIMARY INDUSTRIES, PARKS, WATER and ENVIRONMENT

PERMIT TO TAKE THREATENED FLORA

Permit No. DA 19063

Issued in accordance with Regulation 4 of the Threatened Species Protection Regulations 2016

SCHEDULE 1 Conditions of Permit

1. This permit must be carried while taking the specified threatened flora and shown to an authorised officer on request.

2. Only the permit holder and those persons listed on Schedule 2 are authorised to take the specified threatened flora.

3. Where relevant, permission must be obtained from the land owners or land managers prior to entering their land to take the specified threatened flora. This permit does not constitute permission to enter land.

4. All known threatened flora locations outside of, but adjacent to, the permitted take and works area must be taped or fenced off by a suitably qualified person to the extent necessary to prevent incursion by machinery or personnel.

5. Vegetation clearance must be kept to the minimum necessary. Mechanical disturbance, dumping of fill, alteration of drainage patterns and soil compaction on sites known or likely to support the specified threatened flora must be avoided where practicable.

6. Topsoil from areas known to contain the specified threatened flora must be stockpiled and used for rehabilitation on site, where practicable.

7. In order to minimise impact on the specified threatened flora, measures to control the introduction, spread and movement of disease and weeds by equipment or by on ground operations must be undertaken in accordance with the DPIPWE (2015) *Weed and Disease Planning and Hygiene Guidelines - Preventing the spread of weeds and diseases in Tasmania* as relevant.

8. To offset for the take of *Calocephalus citreus* plants authorised under this permit, the two offset areas shown in Schedule 3 must be reserved for conservation purposes by an order made under Section 8 of the *Crown Lands Act 1976,* subject to the agreement of the Minister responsible for administering the Act. In addition to the order, a management plan describing the natural values and their condition, threats, proposed infrastructure and activties, and planned management (including timing and frequency of management activities) of the reserved areas must be completed and implemented. A draft of the management plan must be provided to the Policy and Conservation Advice Branch (PCAB), Department of Primary Industries, Parks, Water and Environment, for review and written endorsement. The objective of the management plan must be to maintain or improve the current extent and condition of the natural values in these areas. The order must be issued and the management plan finalised, before 31 October 2020. If the Minister responsible for administering the Act does not agree to issue an order made under Section 8 of the *Crown Lands Act 1976*, an alternative reservation mechanism must be used (or an alternative offset of equivalent value provided), which must be agreed to in writing by PCAB.

9. The Policy and Conservation Advice Branch (PCAB), Department of Primary Industries, Parks, Water and the Environment must be notified in writing within 30 days of the completion of the activity authorised under this permit or expiration of the permit, whichever is the sooner. Details of individual plants taken, or the area of population taken, along with the date and location of the works undertaken that directly impacted the threatened species must be entered into the Permit Activity Report Form (the form) attached in Schedule 4, and the form returned to PCAB.

Tasmania

DEPARTMENT of PRIMARY INDUSTRIES, PARKS, WATER and ENVIRONMENT

PERMIT TO TAKE THREATENED FLORA

Permit No. DA 19063

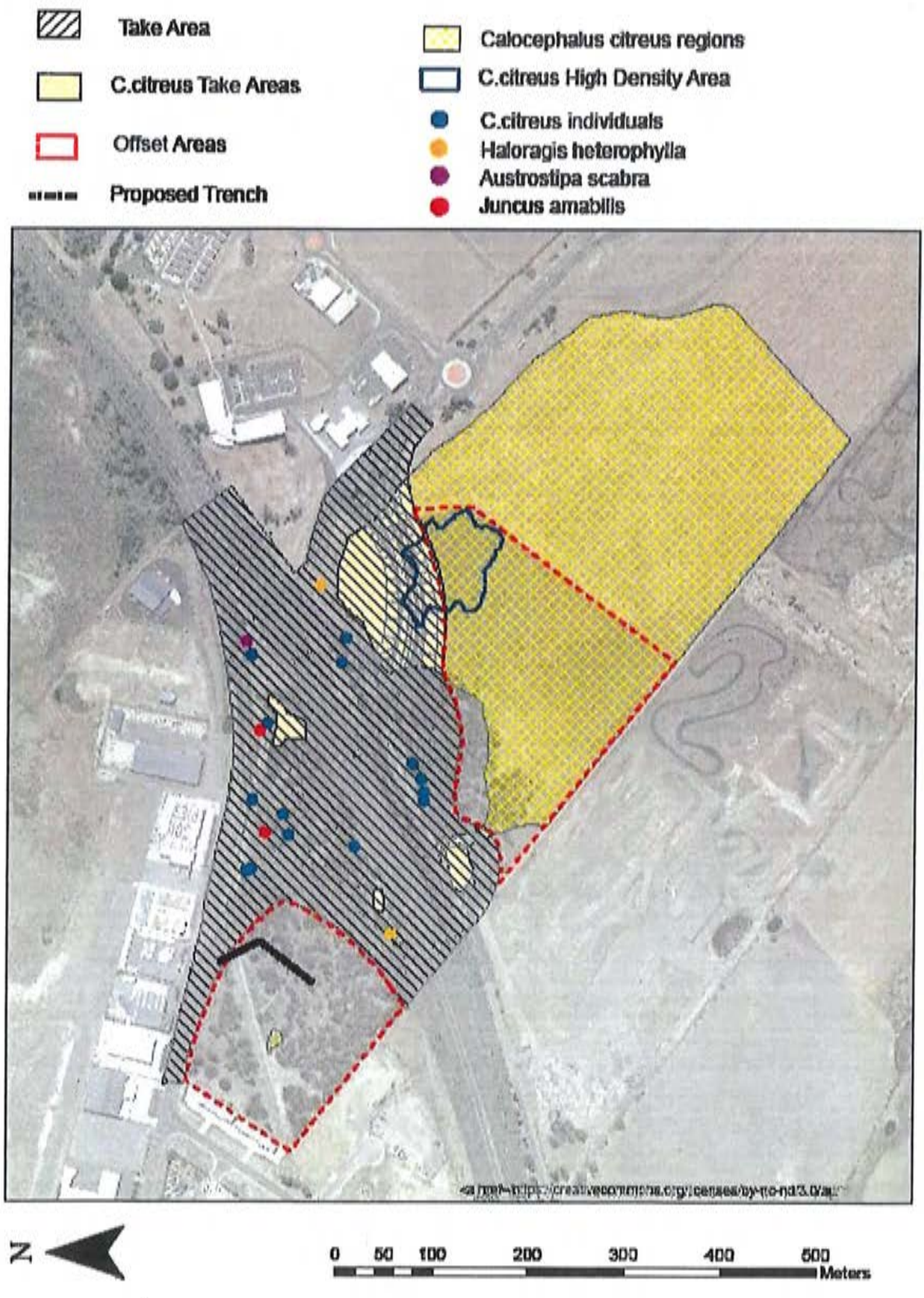
Issued in accordance with Regulation 4 of the Threatened Species Protection Regulations 2016

SCHEDULE 2 The following people are joint holders of this permit

Mr Shane Gregory
General Manager, State Roads Division
Department of State Growth
Level 2, 4 Salamanca Place
Hobart TAS 7000

Any employees or subcontractors of a person named in this permit acting on that persons behalf on their written authority.

Schedule 3. DA 19063 Location of permitted take area and required offset areas, near the Hobart International Airport in Cambridge, Tasmania.



Schedule 4. DA 19063 Permit Activity Report Form

Department of Primary Industries, Parks, Water and Environment
Policy and Conservation Advice Branch

Tasmania
Explore the possibilities

Permit number | **Permit expiry date**

Permit holder details:

Surname | **Given name/s** | **Title**

Business/Organisation name

Phone number/s | **Email**

Location of 'take' (Address and PID or Land Title Number)

Signature of permit holder (or approved delegate) | **Date**

Please ensure you have completed the impact table overleaf before submitting

Completed forms can be e-mailed or posted to:
Conservation Assessment Section, Natural and Cultural Heritage Division
Department of Primary Industries, Parks, Water and Environment, GPO Box 44 Hobart, TAS 7001
ConservationAssessments@dpipwe.tas.gov.au Phone 03 6165 4381

1. Personal information will be collected from you for the purpose of managing Tasmania's natural values and will be used by DPIPWE for assessing, considering, advising upon, managing and/or determining the relevant application and may be used for other purposes permitted by the *Crown Lands Act 1976, National Parks and Reserves Management Act 2002, Nature Conservation Act 2002, Threatened Species Protection Act 1995* and *Wellington Park Act 1993* and regulations made under these Acts.
2. You are required to provide this information by the *Crown Lands Act 1976, National Parks and Reserves Management Act 2002, Nature Conservation Act 2002, Threatened Species Protection Act 1995* and *Wellington Park Act 1993* and regulations made under these Acts. Completing this form is a permit requirement.
3. Your basic personal information may be disclosed to other public sector bodies where necessary, for the efficient storage and use of the information
4. Personal information will be managed in accordance with the *Personal Information Protection Act 2004* and may be accessed by the individual to whom it relates on request to DPIPWE.

Permit Number: _____

Impact table

Species scientific name	Date(s) of 'take'	Number or estimate (including +/- range) of individuals taken	Area of population taken (in m^2)	GPS Easting (GDA 94 format)	GPS Northing (GDA 94 format)	GPS position accuracy (in m)	Impact type (e.g. vegetation clearance, burning)	Any additional information (e.g. likelihood of survival of specimens taken)

Any other comments

Appendix F

Weed Management Field Manual (HIAPL)

Weed Management Field Notes

Hobart Airport

May 2017

Table of Contents

African boxthorn

African lovegrass

Blackberry

Boneseed

Broomrape

Californian thistle

Crow Garlic

Cumbungi (Bullrush)

Canary grass

Cut-leaf nightshade

English broom

Fennel

Gorse

Serrated tussock

Slender thistle

Spanish heath

Tree lupin

This Field Manual has been developed by HIAPL for Contractor use on site to assist in the iden ca weed species and most appropriate herbicide use for eradica n and control.

Informa provided on recommended herbicides is based on the most recent informa on provided by the State Government of Tasmania. Informa is reviewed on an annual basis by HIAPL and updated accordingly.

African Boxthorn— *Lycium ferocissimum*

Description: A woody shrub reaching up to 4 metres in height with glossy leaves and an extensive root system. Trunk and branches are light brown and smooth when young, turning darker brown or grey with age. Twigs end in a hard, sharp spike or thorn. Oblong berries turning from green to bright orange-red when ripe. Reproduc mainly from seed which is spread by birds, root fragments le he soil or soil on machinery.

Status: Declared weed in Tasmania.

Recommended control:

- Washdown procedures apply for vehicles and equipment where African Boxthorn is present
- Hand pull or dig up small bushes and use machinery to remove larger bushes
- Re-visit the site for follow up removal of any regrowth
- Follow up treatment is essen to avoid re-infesta
- Cul a he soil breaks up any roots remaining in the soil and brings root fragments to the surface to dry out
- A number of herbicides are e ec on this weed (see overleaf). er treatment this wee en loses its leaves and appears to have died but then produces new foliage. Re-treatment under these situa required.

African Boxthorn— *Lycium ferocissimum*

Chemical control: www.dpipwe.tas.gov.au

Stage of Growth	Herbicide (active ingredient)	Example of commercial product (concentration of active ingredient)	Application rate of commercial product	Comments
Actively growing to mature	Glyphosate 360 g/L (where product has an aquatic registration)	Weedmaster Duo 360 g/L Roundup Biactive® 360 g/L	knapsack 100 mL - 150 mL in 15 L or high volume 700 mL -1000 mL / 100 L of water	Non agricultural areas (refer label). Use lower rate on young bushes. Spray to wet all foliage. Do not spray during hot, dry conditions.
	Glyphosate * 360 g/L (where product has an aquatic registration)	Weedmaster Duo 360 g/L Roundup Biactive® 360 g/L	10-13 ml/L	Non cropping and bushland in accordance with APVMA Permit **PER8949** Spot spraying Use adjuvants in accordance with label as required. Use lower rate on young bushes. Spray to wet all foliage. Do not spray during hot, dry conditions.
	Glyphosate	Roundup Power Max® 540 g/L	470 - 660 mL/L of Water	Non agricultural areas (around buildings, commercial and industrial areas, domestic and public service areas, rights-of-ways) Apply as a thorough foliage spray when bushes are in full leaf and actively growing Do not apply to drought stressed plants.
	Triclopyr, Picloram**	Conqueror (300 g/L, 100 g/L)	Foliar spray 500 mL/ 100 L of water	Agricultural non-crop areas, commercial and industrial areas, fence lines, forestry, pastures and rights-of-way. Use on plants less than 2 m tall. Apply when bushes have good leaf cover, growth and no leaf fall.
	Triclopyr, Picloram**, Aminopyralid	Grazon Extra (300 g/L, 100 g/L, 8 g/L.)	Foliar spray 500 mL/ 100L of water	Agricultural non-crop areas, commercial and industrial areas, fence lines, forestry, pastures and rights-of-way. Use on plants Less than 2 m tall. Apply when bushes have good leaf cover, growth and no leaf fall.
	Triclopyr	Garlon 600® (600 g/L)	170 mL/ in 100L of water	Agricultural non-crop areas, commercial and industrial areas, fence lines, forestry, pastures and rights-of-way. Use on plants Less than 2 m tall. Apply when bushes have good leaf cover, growth and no leaf fall.
	Metsulfuron-methyl,	Associate, Brush-off 600 g/Kg	As per existing Registrations or if weed not recorded on label: 10-15 g/100 L	Non cropping and bushland In accordance with APVMA Permit **PER8949** Spot spraying, knapsack
	Metsulfuron-methyl + glyphosate	Various concentrations	As per existing registrations or if weed not recorded on label: consistent with range of label rates	Non cropping and bushland in accordance with APVMA Permit **PER8949** Spot spraying, knapsack

** Picloram remains ac e in the soil for extended periods and may leach into groundwater

African Boxthorn— *Lycium ferocissimum*

Drill axe, cut stump and basal bark application: www.dpipwe.tas.gov.au

Stage of Growth	Herbicide (active ingredient)	Example of commercial product (concentration of active ingredient)	Application rate of commercial product	Withholding period	Comments
Actively growing to mature	Glyphosate 360 g/L (where product has an aquatic registration)	Weedmaster Duo 360 g/L Roundup Biactive® 360 g/L	**drill axe** 2 ml undiluted per hole/cut		Non cropping and bushland In accordance with APVMA Permit **PER8949**
	Glyphosate 360 g/L (where product has an aquatic registration)	Weedmaster Duo 360 g/L Roundup Biactive® 360 g/L	**cut stump** 1:5 - undiluted.		Non cropping and bushland In accordance with APVMA Permit **PER8949** Trees and shrubs generally undiluted for blackberry, bulbs and hard to kill weeds.
Mature	Triclopyr	Garlon 600® (600 g/L)	**Basal bark and Cut stump** 1:30 with diesel distillate		Agricultural non-crop areas, commercial and industrial areas, forests, pastures and rights-of-way. Basal bark method: Plants with stems up to 5 cm basal diameter. Cut stump method: Plants up to and in excess of basal bark size. Apply immediately after cut is made.
	Triclopyr 240 g/L, Picloram ** 120 g/L.	Access	**Basal bark and Cut stump** 1 litre per 60 litres diesel distillate		Agricultural non-crop areas, commercial and industrial areas, forests, pastures and rights-of-way. Basal bark method: plants with stems up to 5 cm basal diameter. Cut stump plants up to and in excess of basal bark size. Apply immediately after cut is made.

** Picloram remains ac e in the soil for extended periods and may leach into groundwater

African Lovegrass— *Eragrostis curvula*

Description: A na e to South Africa, this species is a densely t ed, perennial grass growing from 30-120 cm high. The leaves are dark green to blue-green, narrow and 25-35cm long. owering stems rise above the t d leaves and carry a loose fanlike grey-gre ower head. Leaf s are en curly. Seeds germinate in spring and autumn. Growth slows or ceases in winter and plants re-sprout the following spring as temperatures rise. Flowering begins in early summer and ripe seeds are present from January to March. Seeds can be spread by wind, animals and via mud on vehicles. The distribu of this species is known from a few loca s within the State one of which is the Hobart Airport.

Status: Declared weed in Tasmania

Recommended control:

- There is a Statutory Weed Management Plan for African lovegrass
- Single or small numbers of plants can be removed by hoeing
- Glyphosat propanate products can be used in Tasmania
- Avoid using soil or gravel from an infested area
- Clean all machinery used in an infested area before moving to clean areas

African Lovegrass— *Eragrostis curvula*

Chemical control: Spot Spray Application

www.dpipwe.tas.gov.au

Stage of Growth	Herbicide (active ingredient)	Example of commercial product (concentration of active ingredient)	Application rate of commercial product	Withholding period	Comments
While actively growing	*Flupropanate	Frenock®, Taskforce® (745 g/Kg)	20 - 30 ml/10 L	14 days	Apply at any e of the year. Autumn / winter appli n provides b control and helps reduce seed produ n in the following season. Use lower rates on light soils. Only gre ely growing African love grass is to be sprayed. Appli n to dormant weeds will result in li le or no control. Very slow g; results may not be evident for several months er applic on. Do not reapply product less than the minimum retreatment interval of 90 days.
	Glyphosate	Round-Up Biac®, Weedmaster Duo® (360 g/L)	100 ml/10 L	nil	Suitable for use near waterways. Non-selec ve and will damage or kill trees and grasses that come into contact with spray.
		Roundup PowerMAX® (540 g/L)	47 - 66 ml/10 L	nil	Non-selec ve and will damage or kill trees and grasses that come into contact with spray. Control of established infes ns is best obtained when plants are at the seed head stage.

*These products are not registered for this use in Tasmania and will not be men on products labels, however a permit (number-PER 10741) issued by the Australian P es & Veterinary Medicines Authority allows this speci c use. If using this method and herbicide you will require to copy of this permit. For further informa n permit details visit the APVMA website at www.apvma.gav.au.

Blackberry— *Rubus fruticosus* aggregate

Description: A highly invasive environmental and agricultural weed. Spiny, perennial shrubs with trailing stems which can produce dense thickets. Canes may be erect, arching or trailing and can reach 6 metres in length. Once established, blackberry thickets can reach two or more metres in height and cover large areas. Blackberry fruits are eaten by birds and animals which spread the seed. The seeds survive in animal droppings and can be transported large distances. Seed can also be spread by water in creeks and rivers. Canes are able to send out roots at t where they touch the ground, allowing uncontrolled patches of blackberries to cover large areas. They will grow from root suckers and root fragments.

Status: Weed of Na Signi ance (WoNS) and a Declared weed in Tasmania

Recommended control:

- Physical removal by repeated slashing may limit the spread but is not an e ec e method when used alone
- Large infesta can be removed by burning, however follow up treatment is required
- Herbicide spraying works best when carried out in the period from petal fall to leaf fall (December—May)
- Complete coverage of all canes and leaves is esse including suckers growing away from the parent bush
- Goats and sheep are capable of destroying and/or controlling large infesta
- Regrowth a er slashing, burning or grazing should be at least 50cm high before herbicide applica

Blackberry— *Rubus fruticosus* aggregate

Chemical control: www.dpipwe.tas.gov.au

Stage of Growth/ time of application	Herbicide (active ingredient)	Example of commercial product (concentration of active ingredient)	Application rate of commercial product	Withholding period	Comments
Late spring – early autumn	Triclopyr + Picloram	Grass-up™ (300 g/L + 100 g/L	35 – 50 ml/10 L	nil	Use the high rates on plants which have been damaged by grazing stock or on known difficult to kill blackberry. Where herbicides other than Group I herbicides have been used, allow 2 seasons regrowth to occur before respraying.
	Triclopyr	Garlon™600 (600 g/L)	17 ml/10 L	nil	Where herbicides other than Group I herbicides have been used, allow 2 seasons regrowth to occur before respraying.
	Triclopyr + Picloram + Aminopyralid	Grazon ™ Extra (300 g/L + 100g/L+ 8 g/L)	35–50 ml/10 L	nil	Use the high rates on plants which have been damaged by grazing stock or on known difficult to kill blackberry. Where herbicides other than Group I herbicides have been used, allow 2 seasons regrowth to occur before respraying.
Actively growing	Metsulfuron-methyl	Brush-Off® (600 g/kg)	1 g/10 L	nil	Thoroughly wet all foliage and canes.
	Metsulfuron-methyl + glyphosate	Brush-Off® (600 g/kg) + Glyphosate (360 g/L) Cut-out® (63.2 g/kg Metsulfuron-methyl + 760.5 g/kg glyphosate)	1 g/10 L + 20 ml 1 measured pack (95 g) per 100 L of water	nil	Thoroughly wet all foliage and canes.
	Glyphosate	Roundup PowerMAX™ (540 g/L) Glyphosate (360 g/L) Roundup ™ Biactive (360 g/L)	100 ml-140 ml /15 L 100-150 ml/15 L 100–150 ml/15 L	nil	Use higher rate on old dense infestations greater than 2 m high. Non-selective and will affect grasses, clovers and most broadleaf plants. Suitable for use near water.
	Picloram	Vigalant® Herbicide Gel (45 g/kg)	3–5 mm thick	nil	Cut Stump: Cut stems 20 mm above ground level, immediately apply gel over cut surface. For multi-stemmed plants treat at least 80 percent of stems including all main stems.
	Hexazinone	Velpar® L (250 g/L)	4 ml per spot	nil	Bushes up to 1 m. Apply neat base of crown.

Boneseed— *Chrysanthemoides monilifera*

Description: An evergreen owering shrub with glossy round leaves. Spread by birds and animals which eat the fruit, digest t eshy part and then pass the seed unharmed through the diges e system. Ants can also carry the fruits to their nests where they eat th esh and discard the seeds. Boneseed fruits and seed are also spread in moving water. Seed can be spread in gravel or topsoil collected from areas infested with boneseed. The inappropriate dumping of seeding plants a er removal can also lead to spread of the weed.

Status: Declared weed in Tasmania and a Weed of Na onal Signi ance (WONS).

Recommended control:

- Washdown procedures apply for vehicles and equipment where Boneseed is present
- Slashing or mowing will not eradicate boneseed
- Ground disturbance may s te seed germina Follow up treatment is required
- Small plants can be hand pulled and larger plants should be treated by cut-stump herbicide treatment
- Minimise soil disturbance where possible
- Fire can be used to control dense infesta but s ulates germina ed in the soil. Regrowth needs to be treated by hand pulling or with herbicide.

Boneseed— *Chrysanthemoides monilifera*

Chemical control: www.dpipwe.tas.gov.au

Stage of Growth	Herbicide (active ingredient)	Example of commercial product (concentration of active ingredient)	Application rate of commercial product	Withholding period	Comments
Seedlings	Bromoxynil		160 mL per 100 L water Plus adjuvants in accordance with label as required	14 days	**Pastures, Roadsides and Rights-of-Way** Seedlings only Apply when actively growing. Ensure an overall spray coverage
Actively growing to mature	Glyphosate 360 g/L	Roundup® 360 g/L	Knapsack 75 mL or 150 mL in 15 L or **high volume** 500 mL or 1000 mL / 100 L of water		**Non agricultural areas** (refer label). Spray to wet all foliage. Use higher rate on bushes over 1.5m tall. Do not spray during periods of drought. Best treated at peak flowering during winter.
	Glyphosate * 360 g/L (where product has an aquatic registration)	Weedmaster Duo ® 360 g/L **Roundup Biactive®** 360 g/L	10-13 ml/L Plus adjuvants in accordance with label as required		**Non-cropping and bushland** In accordance with APVMA Permit **PER8949** Spot spraying Use lower rate on young bushes. Spray to wet all foliage. Do not spray during hot, dry conditions.
	Glyphosate	Roundup Power Max® 540 g/L	330 - 660m L/L of Water		**Non agricultural areas** (around buildings, commercial and industrial areas, domestic and public service areas, rights-of-ways) Higher rate to bushes over 1.5 m. Apply as a thorough foliage spray when bushes are in full leaf and actively growing
	Metsulfuron-methyl,	Associate®, Brush-off ® 600 g/Kg	10 g in 100 L water		**Native pastures, rights of way, commercial and industrial areas** Legumes in the pasture will be damaged Add surfactant/ wetting agent in accordance with product label Apply to point of run-off. Minimise contact with desirable plants.
	Metsulfuron-methyl, *	Associate®, Brush-off ® 600 g/Kg	10 g in 100 L water		**Non cropping and bushland** In accordance with APVMA Permit **PER8949** Spot spraying / knapsack Add surfactant/ wetting agent in accordance with product label
	Metsulfuron- methyl + glyphosate*	various concentrations	10g Metsulfuron-methyl & 200mL Glyphosate 360 per 100 L		**Non cropping and bushland** In accordance with APVMA Permit **PER8949** Spot spraying / knapsack Add surfactant/ wetting agent in accordance with product label
	Triclopyr, * Picloram **	Conqueror® (300 g/L, 100 g/L)	Foliar spray 350 - 500 mL/ 100 L of water		**Non cropping and bushland** Spot spray / knapsack application In accordance with APVMA Permit **PER8949**
	Triclopyr*	Garlon 600 (600 g/L)	170 mL/ in 100 L of water		**Non cropping and bushland** Spot spray / knapsack application In accordance with APVMA Permit **PER8949**

Boneseed— *Chrysanthemoides monilifera*

Drill axe, cut stump and basal bark application: www.dpipwe.tas.gov.au

Stage of Growth	Herbicide (active ingredient)	Example of commercial product (concentration of active ingredient)	Application rate of commercial product	Withholding period	Comments
Actively growing to mature	Glyphosate * 360 g/L (where product has an aquatic registration)	Weedmaster® Duo 360 g/L Roundup Biactive® 360 g/L	drill axe 2 ml undiluted per hole/cut		**Non cropping and bushland** In accordance with APVMA Permit **PER8949**
	Glyphosate* 360 g/L (where product has an aquatic registration)	Weedmaster® Duo 360 g/L Roundup Biactive® 360 g/L	cut stump 1:5 - undiluted.		**Non cropping and bushland** In accordance with APVMA Permit **PER8949** trees and shrubs generally Undiluted for blackberry, bulbs and hard to kill weeds.
	Picloram ** 43g/kg.	Vigilant® Herbicide gel	cut stump Direct application of gel as per label		**Home use: native vegetation, conservation areas, gullies, reserves and parks** Do not use if rain likely to fall within 12 hours of application. Avoid use over or near desirable plants, or in areas where their roots may extend or where the chemical may be washed or moved to their roots.
	Triclopyr*	Garlon 600® (600 g/L)	cut stump 1:60 with diesel distillate		**Non cropping and bushland** In accordance with APVMA Permit **PER8949** Cut stump method: Apply immediately after cut is made.
	Triclopyr * 24 0g/L, Picloram ** 120g/L.	Access	cut stump 1 litre per 60 litres diesel distillate		**Non cropping and bushland** In accordance with APVMA Permit **PER8949** Cut stump method: Apply immediately after cut is made.

Broomrape— *Orobanche* species

Description: A parasi hort-lived herb growing 20cm High. The plant itself has no green growth. Stems are yellow-brown and branched from the base with dense woolly hairs on the upper parts. Leave are reduced to a few brown scales. Flowers are pale blue, tubular and two-lipped with the lower lip three-lobed and the upper lip shallowly two-lobed. An erect spike of owers appears in spring and summer. Seeds are pepper like, with up to 40,000 seeds per plant. Seedlings need to a ach to a host plant root in order to grow which grows underground for about 6 weeks before emergence. Flowers set seed within two weeks of emerging then dies, however the dried plant may remain visible for several months. Spreads by seed which can remain viable for ten years.

Status: Declared weed in Tasmania

Recommended control:

- A Statutory Weed Management Plan exists for this weed species
- The Regional Weed Management Officer within DPIPWE must be d of broomrape occurrences who will advise as to the best methods of disposal
- If something is suspected to be contaminated with broomrape, it is not to be moved, treated, disturbed or disposed of prior to making contact with the Regional Weed Management cer

Californian thistle— *Cirsium arvense*

Description: A perennial plant that survives year to year by an e root system which spread through the soil. In spring the roots produce rose s close to the ground which send up a branched stem which can reach 1 metre in height. The stems are usually hairless. T ower heads are green with purpl s. Each ower head contains a large number of rose-purple to lavender rets which smell strongly of honey. Thistle seed can be spread by wind for over a kilometre.

Status: Declared weed in Tasmania

Recommended control:

- Eradicate new infesta fore the plants reach the owering stage
- Apply herbicides early. Once seeding occurs, control becomes more difficult and expensive
- Don't allow thistle's t ower and set seed before treatment
- Applica erbicide should be coordinated to ensure best results i.e. before seed heads appear
- Ensure machinery and equipment is washed down between sites or prior to leaving the site
- Revisit sites of previous infesta o inspect and follow up with herbicides where necessary
- A control program for this species may span 2-3 years as established infesta annot be eliminated in one season
- Follow up for this species is essen

Californian thistle— *Cirsium arvense*

Chemical control: Spot Spray Application (www.dpipwe.tas.gov.au)

Stage of Growth	Herbicide (active ingredient)	Example of commercial product (concentration of active ingredient)	Application rate of commercial product	Withholding period	Comments
From early bud to owering	MCPA	(500 g/L)	20 mL- 40 ml/10 L water	7 days	The higher rate will improve control but will increase clover damage in pasture situ ns.
Seedlings	2,4-DB	(400 g/L)	5 ml/L	7 days	THIS PRODUCT MAY ONLY BE USED FROM 15 APRIL TO 15 SEPTEMBER UNLESS PERMITTED BY THE CHEMICAL REGISTRAR- DPIPWE.
From early bud to owering	Clopyralid	Lontrel® 750 SG (750 g/L)	10 g/10L water	28 days	Add on of adjuvant required in accordance with label. Retreatment of growth in the year following treatment, will usually be necessary to achieve a high level control. Clovers and medics will be eliminated for at least 12 months.
Flowering	Glyphosate	Roundup PowerMAX™ (540 g/L) (360 g/L)	7 L/ha 10 ml/L	1 day (allow seven days for improved control)	Non-sele ve and will damage or kill trees and grasses that come into contact with spray d Visible symptoms of treatment may take from 3-7 days to develop. To ensure maximum shoot emergence the area should NOT be cu vated prior to spraying. Re-treatment and/or pasture improvement may be necessary to restrict seedling re-establishment.
		Roundup® Biac-e™ (360 g/L)	3 L/ha	1 day (allow seven days for improved control)	Suitable for use near waterways. Non-sele ve and will damage or kill trees and grasses that come into contact with spray d Visible symptoms of treatment may take from 3-7 days to develop. To ensure maximum shoot emergence the area should NOT be cu vated prior to spraying. Re-treatment and/or pasture improvement may be necessary to restrict seedling re-establishment.

Californian thistle— *Cirsium arvense*

Chemical control: Boom Spray Application (www.dpipwe.tas.gov.au)

Stage of Growth	Herbicide (active ingredient)	Example of commercial product (concentration of active ingredient)	Application rate of commercial product	Withholding period	Comments
Seedlings	MCPA sodium	(250 g/L)	4.5 L/ha	7 days	Consult your agronomist for tolerance levels for legumes should any be present.
From early bud to owering	MCPA amine	(500 g/L)	2.2L	7 days	The use of MCPA is preferred to 2,4-D (amine and ester) in situ ons where legumes are undersown in the crop.
Seedlings	2,4-DB	(500 g/L)	3.5 L/ha	7 days	Use in lucerne, or in areas where clover damage must be minimal, 2,4-DB gives reasonable short-term control. For clover, apply from rst to eighth trifoliate leaf stage. THIS PRODUCT MAY ONLY BE USED FROM 15 APRIL TO 15 SEPTEMBER UNLESS PERMITTED BY THE CHEMICAL REGISTRAR- DPIPWE.
	2, 4-D amine	Amicide® 625 (625 g/L)	2.7 L	7 days	Repeated appli ns may be necessary. The use of MCPA is preferred to 2,4-D (amine and ester) in situ ons where legumes are undersown in the crop. THIS PRODUCT MAY ONLY BE USED FROM 15 APRIL TO 15 SEPTEMBER UNLESS PERMITTED BY THE CHEMICAL REGISTRAR- DPIPWE.

Californian thistle— *Cirsium arvense*

Chemical control: Boom Spray Application continued

(www.dpipwe.tas.gov.au)

Stage of Growth	Herbicide (active ingredient)	Example of commercial product (concentration of active ingredient)	Application rate of commercial product	Withholding period	Comments
From early bud to owering	Clopyralid	Lontrel® 750 SG (750 g/L)	800 g/ha	28 days	Add on of adjuvant required in accordance with label. Retreatment of growth in the year following treatment, will usually be necessary to achieve a high level control. Clovers and medics will be eliminated for at least 12 months.
vely growing/ Flowering	Glyphosate	Roundup PowerMAX™ (540 g/L) (360 g/L)	7 L/ha 3 L/ha	1 day (allow seven days for improved control)	Non-selec ve and will damage or kill trees and grasses that come into contact with spray dri . Visible symptoms of treatment may take from 3-7 days to develop. To ensure maximum shoot emergence the area should NOT be cul vated prior to spraying. Re-treatment and/or pasture improvement may be necessary to restrict seedling re-establishment.
		Roundup® Biac-™ (360 g/L)	3 L/ha	1 day (allow seven days for improved control)	Suitable for use near waterways. Non-selec ve and will damage or kill trees and grasses that come into contact with spray dri . Visible symptoms of treatment may take from 3-7 days to develop. To ensure maximum shoot emergence the area should NOT be cu vated prior to spraying. Re-treatment and/or pasture improvement may be necessary to restrict seedling re-establishment.

Crow garlic— *Allium vineale*

Description: Crow garlic is a declared weed in Tasmania and a weed of crops and pastures. Is also known as wild garlic. It can occur in two forms, a plant that produces leaves only and another that produces leaves and a stem bearing th ower head. Th owering plants are larger and produce 4 or 5 leaves and a single stem up to 1 m in height. Th ower head appears in summer which bursts open to reveal t ower or bulbils (or a mixture of the two). In Tasmani wers are rarely produced. There is a Statutory Weed Management Plan for Crow garlic and within the Clarence municipality there are known to be isolated occurrences. The management measure that applies in Clarence is to implement an integrated control program for eradica and to prevent future occurrences.

Status: Declared weed

Recommended control:

- Once established in heavy soils it is p ularly persistent
- Germina starts in autumn and vegeta e growth con slowly through to spring when the growth rate increases
- Spread to new areas occurs from bulbs and bulbils being sca ered by a mud on equipment/machinery or bulbils being carried by heavy rains
- Control programs include a range of op s such as cul a d herbicides and most e ec e is a combina he two
- Cul a should extend from winter through to spring
- Later a eplaced with a herbicide.

Crow garlic— *Allium vineale*

Chemical control: Spot Spray Application continued (www.dpipwe.tas.gov.au)

Stage of Growth	Herbicide (active ingredient)	Example of commercial product (concentration of active ingredient)	Application rate of commercial product	Withholding period	Comments
Pre bulb and wering	Dicamba	Dicamba 500 (500 g/L)	60 ml/10L	7 days	Apply during spring prior to bulb and owering. Add on of adjuvant required in accordance with label. Repeat applic n may be necessary if dormant bulbs start shoo ng.
Bulb exhaus	*Metsulfuron-methyl	Brush- ®	1 - 1.5 g/10L	nil	.In accordance with APVMA Permit PER8949. Will severely damage clovers and other broadleaved plants, including surrounding trees, if contacted by the spray. Soil-residual, hindering the re-establishment of clovers and other broadleaved plants for 6-12 months. Add on of adjuvant required in accordance with label.

Crow garlic— *Allium vineale*

Chemical control: Boom Spray Application (www.dpipwe.tas.gov.au)

Stage of Growth	Herbicide (active ingredient)	Example of commercial product (concentration of active ingredient)	Application rate of commercial product	Withholding period	Comments
Pre bulb formation and flowering	Dicamba	Dicamba 500 (500 g/L)	8.8 L/ha	7 days	Apply during spring prior to bulb formation and flowering. Add on of adjuvant required in accordance with label. Repeat applic n may be necessary if dormant bulbs start shoo Dicamba at this rate is non sele ve and not suitable for use in pasture or crops
Bulb exhaus	Metsulfuron-methyl	Brush- ® (600 g/Kg)	15 g/ha	nil	Will severely damage clovers and other broadleaved plants, including surrounding trees, if contacted by the spray. Can cause severe damage to young perennial and annual ryegrass pastures. Soil-residual, hindering the re-establishment of clovers and other broadleaved plants for 6-12 months. Add on of adjuvant required in accordance with label.

Cumbungi (Bullrush)— *Typha latifolia*

Description: There are two na e species of Cumbungi which are not classi- *Typha latifolia* is semi-aqua found growing in lakes, dams, irriga channels, marshes and rivers where water s slow and dis- solved nutrient levels are high. Grass like leaves are thick and spongy and are borne on either side of a stout, cane-like stem growing to 2.5 m high. Flower head is produced in summer with each head producing one ower head divided into an upper spike of mal owers, and below this a cylindri- cal spike of female owers. The introduced Cumbungi can be dis guished from the other two na e species by the colour and size of t ower head. The introduced species female part of th ower head is blackish-brown in colour 100-200 mm long and 15-30mm in diameter.

Status: Environmental weed

Recommended control:

- Hand removal is ideal for small plants only where the e e root system can be removed
- Cut leaves 50-150mm below water level and repeatedly at 4-6 week intervals. First cut at advance owering stage (around January). Most plants will die in th rst year. A second year of treatment shoul ny plants which survive the rst year of treatment
- Ensure machinery and equipment is washed down between sites
- Eradicate before plants reach owering stage as once seeded control becomes more difficult and expensive
- Larger infesta can be removed by mechanical excava
- Excavated material should be dumped well away from water at the site
- Ensure follow up is undertaken and retreat as required

Cumbungi (Bullrush)— *Typha latifolia*

Chemical control: Waterways

Type of application	Herbicide (active ingredient)	Example of commercial product (concentration of active ingredient)	Application rate of commercial product	Comments
Foliar Spray	Glyphosate	Roundup e® (360 g/L)	13 ml/L	DO NOT add extra Surfactant/ unless it is approved for use in aqu situ ns. Apply to a vely growing plants at the early head to full head stage. Summer to Autumn. Re-treatment may be required to restrict seedling re-establishment. Complete coverage of all foliage is essen- void spraying to run-o stage). Avoid run-o or spray d ntering water. Plants with more than one-third of stems below water may not be killed. Where pra cable, lower water level to give the maximum plant exposure, and kept down for at least 12 hours a r application.

www.dpipwe.tas.gov.au

Cumbungi (Bullrush)— *Typha latifolia*

Chemical control: Away from waterways

Type of application	Herbicide (active ingredient)	Example of commercial product (concentration of active ingredient)	Application rate of commercial product	Comments
Foliar Spray	Glyphosate	(360 g/L) Sickle™ 540 (540 g/L)	13 ml/1L	Apply to ely growing plants at the early head to full head stage. Summer to Autumn. Follow up applic ons a er 4 to 6 weeks may be necessary Complete coverage of all foliage is essen al (avoid spraying to run-stage)
	2,2-DPA	Propon Systema c Grasskiller (740 g/kg)	2k g/100L	For use in on channels, drains and bore drains. Ensure channels and drains are dry prior to spraying or at most have no more than 5-8cm of water. Re-treatment may be required to restrict seedling re-establishment.
	Amitrole + Ammonium thiocyanate	Amitrole T (Amitrole 250 g/L + ammonium thiocyante 220 g/L)	2.3 L/100L	Apply during wering period between January and May. Re-treatment may be required to restrict seedling re-establishment.

Canary grass— *Phalaris canariensis*

Description ve to northern Africa, the Madeira Islands, southern Europe and western Asia, this species has become widely naturalised in southern and eastern Australia. The species is widely cul vated as a pasture grass in the temperate regions of Australia. en occurring as a weed in pastures, grasslands, open woodlands, roadsides, waste areas, disturbed sites, creek banks, riparian vegeta d dplains. A hairless, tu ed, leafy annual grass growing to 150-1200 mm tall with dense egg shaped to oblong seed heads (2-7cm) that have spikelets with white and green stripes. Flowers annually. Seed germinates in autumn and grows over winter owering in spring to early summer.

Status: Environmental weed

Recommended control:

- Spray topping is useful to reduce infesta pastures
- Apply glyphosate in winter and repeat in late spring if necessary, each year for several years

Cut-leaf Nightshade— *Solanum triflorum*

Description: A sprawling non-woody plant growing from 30-100cm high and spreading to 50-100cm. Stems are lobed, toothed leaves are sparsely hairy and without spines. Flowers are white to pale purple, en in clusters of three on short stalks. Fruits are a marbled green berry about 10 cm in diameter. Flowers in summer, extending from summer through to autumn with seeds ripe by early autumn. Germina occurs in autumn and winter. Occurs in the Seven Mile Beach area and prefers sunny posi s with well drained soil. Found growing on dunes, recrea al areas and along road-sides. Spreads by seed and can remain viable in the soil for up to 9 years. Roo g from the nodes can result in localised spreading. Seed spread by animals (although toxic), machinery, vehicles and contaminated soils and sand.

Status: Declared weed in Tasmania

Recommended control:

- There is a Statutory Management Plan for this weed species
- Dispose of removed material carefully to avoid new plants ger ng
- Ensure all vehicles and machinery that have been in infested areas are thoroughly cleaned down before moving to a clean area
- Individual plants can be dug out, however ensure frui plants are bagged and buried
- Herbicides can be used to control this weed species

Cut-leaf Nightshade— *Solanum triflorum*

Chemical control: Spot spray application (www.dpipwe.tas.gov.au)

Stage of Growth	Herbicide (active ingredient)	Example of commercial product (concentration of active ingredient)	Application rate of commercial product	Withholding period	Comments
While actively growing	*Triclopyr+ Picloram	Grass-up™ (300 g/L + 100 g/L)	3.5 - 5 ml/L	nil	In accordance with APVMA Permit PER8949. Will not ct grasses, will severely damage clovers and other broadleaved plants, including surrounding trees, if contacted by the spray. Soil-residual, hindering the re-establishment of clovers and other broadleaved plants for 6-12 months. Picloram remains ac e in the soil for extended periods and may leach into groundwater.
	*Triclopyr	Garlon® 600 (600 g/L)	1.7 ml/L	nil	In accordance with APVMA Permit PER8949. Thoroughly spray foliage. Less vola e and preferred to triclopyr +picloram in urban or ho ultural areas. Will not ct grasses, will severely damage clovers and other broadleaved plants, including surrounding trees, if contacted by the spray.
	*Metsulfuron methyl	Brush- ®, Associate ® (600 g/Kg)	0.1 - 0.15 g/L	nil	In accordance with APVMA Permit PER8949. Will not ct grasses, will severely damage clovers and other broadleaved plants, including surrounding trees, if contacted by the spray. Soil-residual, hindering the re-establishment of clovers and other broadleaved plants for 6-12 months.
	*Glyphosate	Roundup® ve™ (360 g/L)	10 - 13 ml/L	nil	In accordance with APVMA Permit PER8949. Suitable for use near waterways. Non-sele ve and will damage or kill trees and grasses that come into contact with spray d Add on of adjuvant required in accordance with label.

* These products are not registered for this use on broom in Tasmania and will not be m oned on product labels, however Permit Number - PER8949 issued by the Australian P es & Veterinary Medicines Authority has been issued for this spe use.

For further inform on on permit details visit the APVMA website at www.apvma.gov.au.

English Broom— *Cytisus scoparius*

Description: Erect, semi-woody shrubs growing to 2-3 m high. Leaves are trifoliate (3 lea ets) with the central lea t being longer than the outer two lea ts. Broom ers are bright yellow, so with reddish-brown markings, the top petal notched. Normall owers in late spring producing seeds in pods which have hairs along the margin. When the seeds are mature and s l a ached to the parent plant, the pods open explosively to eject the seed up to 3 metres. Seeds may also be spread by wind and ants. Seeds are not buoyant in water but can be carried in the bed load of rivers and streams, resul g in long distance dispersal. Seed movement can also occur via vehicles, dispersed via mud on tyres, footwear, sand and gravel.

Status: Declared weed in Tasmania

Recommended control:

- There is a Statutory Weed Management Plan for English broom
- Ensure machinery and equipment is washed down between sites
- Eradicate new infesta before the plants reach owering stage as once plants begin seeding, control becomes more difficult
- Time herbicide use for the most e e e results
- Re-visit and regularly inspect the site and ensure follow up is undertaken. empt at removal may not be sufficient
- Use a combina of di erent control methods
- Small plants can be pulled or grubbed in spring when the ground is s
- dlings when they are 5-10cm high can provide e ec e control
- Larger shrubs can be cut close to the ground and stumps painted with herbicide

English Broom— *Cytisus scoparius*

Chemical control: Foliar leaf application (www.dpipwe.tas.gov.au)

Stage of Growth	**Herbicide (active ingredient)**	**Example of commercial product (concentration of active ingredient)**	**Application rate of commercial product**	**Withholding period**	**Comments**
Spring to mid summer (prior to pod form n)	Triclopyr+ Picloram	Grass-up™ (300 g/L + 100 g/L)	2.5 ml/L	nil	Where thorough coverage of the plants can be achieved, one applic n will usually give complete control with no regrowth. Treated bushes should be checked twelve months a r the herbicide applic n and any regrowth treated. Will not ct grasses, will severely damage clovers and other broadleaved plants, including surrounding trees, if contacted by the spray. Soil-residual, hindering the re-establishment of clovers and other broadleaved plants for 6-12 months.
	Triclopyr	Garlon® 600 (600 g/L)	1.7 ml/L	nil	Thoroughly spray foliage. Less vola e and preferred to triclopyr+picloram in urban or ho ultural areas. Will not ct grasses, will severely damage clovers and other broadleaved plants, including surrounding trees, if contacted by the spray.
	Triclopyr + Picloram+ Aminopyralid	Grazon™ Extra (300 g/L + 100 g/L + 8 g/L)	Spring to Mid Summer 2.5 ml/L Autumn to Winter 3.5 ml/L	nil	Where thorough coverage of the plants can be achieved, one applic n will usually give complete control with no regrowth. Treated bushes should be checked twelve months a r the herbicide applic n and any regrowth treated.
	*Metsulfuron methyl	Brusho ® (600 g/Kg)	0.1 - 0.15 g/L	nil	APVMA O -Label permit - PER8949. Will not ct grasses, will severely damage clovers and other broadleaved plants, including surrounding trees, if contacted by the spray. Soil-residual, hindering the re-establishment of clovers and other broadleaved plants for 6-12 months.

English Broom— *Cytisus scoparius*

Chemical control: Foliar leaf application continued

Stage of Growth	Herbicide (active ingredient)	Example of commercial product (concentration of active ingredient)	Application rate of commercial product	Withholding period	Comments
	*Glyphosate	(360 g/L)	10-13 ml/L	nil	APVMA O -Label permit - PER8949. Add on of adjuvant required in accordance with label. Non-sele ve and will damage or kill trees and grasses that come into contact with spray d
		Roundup® ve™ (360 g/L)	10-13 ml/L		Suitable for use near waterways. Non-sele ve and will damage or kill trees and grasses that come into contact with spray d

English Broom— *Cytisus scoparius*

Chemical control: Basal bark and cut stump application

Stage of Growth	Herbicide (active ingredient)	Example of commercial product (concentration of active ingredient)	Application rate of commercial product	Withholding period	Comments
Use when plants are ely growing	Triclopyr	Garlon® 600 (600 g/L)	20 ml per litre of diesel dis late	nil	Basal Bark: Use for plants with a basal diameter up to 50mm without removing top growth. Spray or paint bark from ground level to a minimum height of 30 cm, we g thoroughly to runo . Cut Stump: Apply immediately (within 15 seconds) a r top growth removal.
	Picloram	Vigilant®-Herbicide Gel (43 g/kg)	3-5 mm thick	nil	Cut Stump: Cut stems 20mm above ground level, immediately apply gel over cut surface. For mu - stemmed plants treat at least 80 percent of stems including all main stems.
	*Triclopyr+ Picloram	Access ™ (240 g/L + 120 g/L)	1 part to 60 parts of diesel dis late	nil	APVMA O -Label permit - PER8949. Basal Bark: Use for plants with a basal diameter up to 50mm without removing top growth. Spray or paint bark from ground level to a minimum height of 30 cm, we g thoroughly to runo . Cut Stump: Apply immediately (within 15 seconds) a r top growth removal.
	*Glyphosate	(360 g/L)	Undiluted	nil	APVMA O -Label permit - PER8949. Cut Stump: Apply immediately (within 15 seconds) a r top growth removal.
		Roundup ® Biac- e ™ (360 g/L)			APVMA O -Label permit - PER8949. Suitable for use near waterways. Cut Stump: Apply immediately (within 15 seconds) a r top growth removal.

* These products are not registered for this use on broom in Tasmania and will not be men oned on product labels, however Permit Number - PER8949 issued by the Australian P es & Veterinary Medicines Authority has been issued for this speci c use.

For further inform on on permit details visit the APVMA website at www.apvma.gov.au.

Fennel— *Foeniculum vulgare*

Description: A perennial herb with a stout branched taproot, jointed stems and feathery leaves that smell like aniseed. Grows between 1.5-2 metres high. Flowering stems are produced from the centre of the plant each spring, bearing an umbrella of small greenish yellow ow-ers. Aroma eeds replace the small owers at the ends of th owering stems in summer and autumn. Is a common roadside weed and i en found along creek lines and streams. Once established, excludes most other plants, likely due to the plant's unusual chemical proper s. Is spread by seed, usually where seed falls to the ground very near to the parent plant. Long distance movement occurs via machinery, animals and clothing. Seeds can also be dispersed via water in drainage lines.

Status: Declared weed in Tasmania

Recommended control:

- Apply herbicides early. Once seeding occurs, control becomes more difficult and expensive
- Applica of herbicide should be coordinated to ensure best results i.e. before seed heads appear
- Ensure machinery and equipment is washed down between sites or prior to leaving the site
- Revisit sites of previous infesta o inspect and follow up with herbicides where necessary
- Use a combina of di erent control methods and do not rely on one control method alone
- Re grows from the crown and root fragments which can be spread by machinery

Fennel— *Foeniculum vulgare*

Chemical control: Boom Spray Application

Stage of Growth	Herbicide (active ingredient)	Example of commercial product (concentration of active ingredient)	Application rate of commercial product	Withholding period	Comments
Prior to wering	Amitrole + Ammonium Thiocyanate	Amitrole T ® (250 g/L + 220 g/L)	1.1 L/100 L water	nil	Apply when weeds are actively growing, immediately prior to wering.
1-2 m tall	Triclopyr	Garlon™ 600 (600 g/L)	1.7 L/100 L	nil	Apply when weeds are actively growing, immediately prior to wering
Young Stage	MCPA	Agritone® 750 (750 g/L)	1.8 L/100 L	7 days	Apply at young stage The use of MCPA is preferred to 2,4-D (amine and ester) in situ ons where legumes are undersown in

Chemical control: Spot Spray Application

Stage of Growth	Herbicide (active ingredient)	Example of commercial product (concentration of active ingredient)	Application rate of commercial product	Withholding period	Comments
Prior to wering	Amitrole + Ammonium Thiocyanate	Amitrole T ® (250 g/L + 220g/L)	280 ml/ 15 L water	nil	Apply when weeds are ac vely growing, immediately prior to wering.
Young Stage	MCPA	Agritone® 750 (750 g/L)	13 ml/ 10 L water	7 days	Apply at young stage The use of MCPA is preferred to 2,4-D (amine and ester) in situ ons where legumes are undersown in the crop.

Gorse— *Ulex europaeus*

Description: A serious agricultural and environmental weed which is a threat to many natural environments. A prickly evergreen shrub which can grow to a height and diameter of 3 metres. All stems and leaves end in a sharp spine. Gorse owers are bright yellow pea like ers which cover the plant. Buds develop during February and March, althoug owering tends to occur in spring and autumn. Seed pods are grey and hairy, producing large quan s of brown to black seed.

Status: Weed of Na Signi ance (WoNS) and a Declared weed in Tasmania

Recommended control:

- Mechanical clearing is the ideal methods of controlling large infesta- , that is later sown with a compe e pasture grass. This treatment may require targeted herbicide spraying of regrowth and a second sowing of pasture grass
- Avoid unnecessary disturbance to the soil and avoid using heavy machinery along creeks and rivers
- Follow up management is vital, including establishment of vigorous pasture, grazing of gorse seedlings and herbicide use
- Burning will lead to increased germina of seed and should only be used in conjun n with other control methods. If used, seedlings to be re-sprayed the following year to reduce seed bank in soil

Gorse— *Ulex europaeus*

Chemical control: Foliar Spray Application (www.dpipwe.tas.gov.au)

Herbicide (active ingredient)	**Commercial products (content of active ingredient)**	**Rate of commercial product per litre of water**	**Withholding period**	**Comments**
Triclopyr+ Picloram + Aminopyralid	Grazon Extra(300 g/L + 100 g/L + 8g/L)	2.5 ml (bushes 1 - 1.5 m tall) 3.5 ml (bushes > 1.5 m tall) 5 ml	nil	Use in spring to early summer treatments only. Add a 100% concentrate non-ionic surfactant at 1ml per litre of water for best results. Autumn Treatment. Add a 100% concentrate non-ionic surfactant at 1ml per litre of water for best results. Winter treatment only. Brownout may not be complete un summer. Add a 100% concentrate non-ionic surfactant at 1ml per litre of water for best results. Picloram is soil-residual, hindering the re-establishment of clovers and other broadleaved plants for up to twelve months In dense stands, access paths should be cleared to allow complete coverage Regrowth needs to be around 50 - 100 cm high before follow-up treatment Does not ect grasses, will damage clovers and other broadleaved plants including surrounding trees
Triclopyr + Picloram	Grass-up™ (300g/L + 100g/L)	2.5 ml (bushes 1 - 1.5 m tall) 3.5 ml (bushes > 1.5 m tall) 5 ml	nil	Use in spring to early summer treatments only. Add a 100% concentrate non-ionic surfactant at 1ml per litre of water for best results. Autumn Treatment. Add a 100% concentrate non-ionic surfactant at 1ml per litre of water for best results. Winter treatment only. Brownout may not be complete un summer. Add a 100% concentrate non-ionic surfactant at 1ml per litre of water for best results. Picloram is soil-residual, hindering the re-establishment of clovers and other broadleaved plants for up to twelve months In dense stands, access paths should be cleared to allow complete coverage Regrowth needs to be around 50 - 100 cm high before follow-up treatment Does not ect grasses, will damage clovers and other broadleaved plants including surrounding trees

Gorse— *Ulex europaeus*

Chemical control: Foliar Spray Application (www.dpipwe.tas.gov.au)

Herbicide (active ingredient)	**Commercial products (content of active ingredient)**	**Rate of commercial product per litre of water**	**Withholding period**	**Comments**
Triclopyr	Garlon 600 (600 g/L)	1.7 ml - 3.4 ml	nil	Apply from spring to mid-summer Does not ect grasses, will damage clovers and other broadleaved plants including surrounding trees Use the higher rate on older plants Preferred to triclopyr + picloram mixture in urban or ho ultural areas, and near waterways/ wetlands
Metsulfuron-methyl	Brush- (600 g/Kg)	0.1 - 0.15 g	nil	(APVMA O -Label permit - PER8949 Suitable for bushes up to 2 m tall Does not ect grasses, will damage clovers and other broadleaved plants including surrounding trees Metsulfuron-methyl is soil-residual, hindering the re-establishment of clovers and other broad-leaved plants for up to twelve months
Glyphosate	Roundup Biac- e (360 g/L) Glyphosate 360 (360 g/L)	10 - 15 ml	1 day	Apply all year round but only if a vely growing Non-sele ve and will a ect grasses, clovers and most broadleaf plants
Ammonium thiocya-nate	Amitrole T® (220 g/L)	20 ml	Orchards and vines - 56 days Other areas - nil	Apply during summer or before fu wering Non-sele ve and will a ect grasses, clovers and most broadleaf plants Use in restricted spraying areas Apply to bushes up to 2 m tall Respraying will be necessary
Glypho-sate+Metsulfuron-methyl	Trounce® (835 g/L + 10 g/ L)	1.7 g	nil	vely growing (except spring) Use in restricted spraying areas. Use surfactant as directed by label.

Gorse— *Ulex europaeus*

Chemical control: Cut-stump Application (www.dpipwe.tas.gov.au)

Herbicide (active ingredient)	Commercial products (content of active ingredient)	Rate of commercial product per litre of water	Withholding period for use in pasture	Comments
Glyphosate	Roundup Biactive (360 g/L) Glyphosate 360 (360 g/L)	1 litre	nil	Use when plants are vely growing Apply immediately (within 15 seconds) er top growth removal
Triclopyr	Garlon 600 (600 g/L)	1:60 in diesel	nil	For cut-stump treatment Apply immediately (within 15 seconds) er top growth removal (APVMA -Label permit - PER8949)
Picloram	Vigilant® Herbicide Gel 43 g/kg	3 - 5 mm thick layer 5 mm	nil	Stems up 20 mm diameter Stems greater than 20 mm diameter In the case of mul -stem plants treat at least 80% of stems including main stems

Kangaroo Apple

Solanum lacinatum

Description: A na ve plant to eastern Australia, forms an erect shrub up to 3 m high. Flowers are (30-50mm) across and deep purplish-blue in colour. Berries are egg shaped and mature to orange-yellow. Flowers through spring and summer and found in disturbed sites. A fast growing species and hardy in most soil types and condi ns, with the exce on of salt spray. Early colonisers of disturbed areas, p arly road ways. Rela ely short-lived 5-6 years. Seeds spread by birds and mammals. First fruit and seed is produced when 2 years old or more, therefore removal of juvenile plants is ideal to reduce the seed store in the soil. Seed longevity in the soil is long.

Status: A na e species to eastern Australia, but introduced to Tasmania (not endemic). Considered a weed in disturbed areas.

Recommended control:

- A general herbicide provides good control of the plants.
- Apply a mixture of 100 mL Access® in 6 L diesel to the lower 500 mm of trunk of trees. Young ely growing seedlings can be overall sprayed with 1 L/ha Starane® or hand sprayed with 20 mL Starane® in 10 L water in late spring. Seedlings and young plants can also be hand pulled. Grazing and mowing usually provide control. Kangaroo Apples tend t ourish in areas that have been recently fenced nd in new planta

Serrated Tussock— *Nassella trichotoma*

Description: A perennial tussock forming grass with a deep root system. Flower stalks usually appear in spring and presents a dis ctly purple appearance due to the large number of purpl orets. Serrated tussock is similar to several of Tasmania's na e tussock grasses and can en be overlooked. In summer this species retains its bright green colour, except for t s which are bleached. Seeds are spread by the wind and as seeds mature, the ower head becomes bri and can result in the whole seed head breaking and release of seeds for a considerable distance. Seeds can also be transported via vehicle tyres or livestock. Seed may remain dormant for several years before regenera g when soil is later disturbed.

Status: Weed of Na Signi ance (WoNS) and a Declared weed in Tasmania

Recommended control:

- Spot spraying and chipping to isolate small patches before the tussocks set seed
- Spot spray or boom spray with herbicides registered for Serrated tussock— opanate and glyphosate
- Spray to completely wet the plant and cause r
- Flupropanate is slo nd can take 12-18 months to kill serrated tussock but will kill seeds that germinate soon a er spraying
- Once removed, replace with improved pasture or there is a risk the weed will re-invade
- Con l follow up to ensure that Serrated tussock does not return or re-germinate.

Serrated Tussock— *Nassella trichotoma*

Chemical control: Foliar Spray Application (www.dpipwe.tas.gov.au)

Stage of Growth	Herbicide (active ingredient)	Example of commercial product (concentration of active ingredient)	Application rate of commercial product	Withholding period	Comments
While actively growing	Fluropanate	Frenock®, Taskforce® (745 g/Kg)	2 ml/L	14 days	Ensure that spray completely wets all leaf surfaces. Very slow ac g; results may not be evident for several months a er applica Adequate ground moisture is required to transport chemical into root zone for uptake . Will kill annual grasses and some na e grasses.
	Glyphosate	Round-Up Biactive®, Weedmaster Duo® (360 g/L)	7 - 13 ml/L	nil	May to October. Suitable for use near waterways. Non-selec e and will damage or kill trees and grasses that come into contact with spray.
		Round-up (360 g/L)			May to October. Non-selec e and will damage or kill trees and grasses that come into contact with spray.

Serrated Tussock— *Nassella trichotoma*

Chemical control: Boom Spray Application (www.dpipwe.tas.gov.au)

Stage of Growth	Herbicide (active ingredient)	Example of commercial product (concentration of active ingredient)	Application rate of commercial product	Withholding period	Comments
While - ly growing	Flupropanate	Frenock®, Taskforce® (745 g/Kg)	2 L/ha	4 months	Spray between October and February.Boom spray in summer when improved grasses are dormant (to reduce pasture damage). Ensure that spray completely wets all leaf surfaces. Ver g; results may not be evident for several months er applic on.
	Glyphosate	Round-Up (360 g/L)	4 - 6 L/ha	nil	May to October. Non-selec ve and will damage or kill trees and grasses that come into contact with spray. Add on of a w ng agent may improve control. Use lower rate on serrated tussock regrowth a er and higher rate on slashed plants where some residual dead foliage remains.
		PowerMax® (540 g/L)	2.7 - 4L/ha		

Slender thistle— *Carduus pycnocephalus*

Description: A spiny, erect herb that grows between 60-100 cm high. Mature thistles are upright plants that may branch considerably or be unbranched. The stems are covered in white cobwebby hairs while th ower heads form a cluster on the end of the stem. Slender thistles form a r close to the ground over winter and produc owering stem during late spring. Flowering and seed produ n occur in early summer and the life cycle is usually completed by the end of the year. Spread by seed which are well equipped for wind dispersal and can be carried more than 100 metres by wind. Seeds can also be dispersed by animals and transported by water.

Status: Declared weed in Tasmania

Recommended control:

- Eradicate new infesta fore the plants set seed in summer
- Apply herbicides early. Once seeding occurs, control becomes more difficult and expensive
- Applica erbicide should be coordinated to ensure best results i.e. before seed heads appear
- Ensure machinery and equipment is washed down between sites or prior to leaving the site
- Revisit sites of previous infesta o inspect and follow up with herbicides where necessary
- A control program for this species may span 2-3 years as established infesta annot be eliminated in one season
- Follow up for this species is essen

Slender thistle— *Carduus pycnocephalus*

Chemical control: Spot Spray Application (www.dpipwe.tas.gov.au)

Stage of Growth	Herbicide (active ingredient)	Example of commercial product (concentration of active ingredient)	Application rate of commercial product	Withholding period	Comments
Seedlings	MCPA sodium salt	(250 g/L)	350 ml per 15L water	7 days	Thorough coverage is essen l. 15L of solu cient to cover 150m^2.
	MCPA amine	(500 g/L)	30 mL/10L water	7 days	The use of MCPA is preferred to 2,4-D (amine and ester) in situa where legumes are undersown in the crop.
		Agritone® 750 750 g/L	20 mL/10 L water		
	2, 4-D amine	Amicide® 625 625 g/L	14 mL/10 L water	7 days	Suppression only. The use of MCPA is preferred to 2,4-D (amine and ester) in situa where legumes are undersown in the crop. THIS PRODUCT MAY ONLY BE USED FROM 15 APRIL TO 15 SEPTEMBER UNLESS PERMITTED BY THE CHEMICAL REGISTRAR- DPIPWE.
Ro e	2, 4-D ester	Estercide® Xtra 680 (680 g/L)	8 mL - 33 mL/10 L water	7 days	Use when thistles have started to shoot and become more resistant to other herbicides. The use of MCPA is preferred to 2,4-D (amine and ester) in situa where legumes are undersown in the crop. THIS PRODUCT MAY ONLY BE USED FROM 15 APRIL TO 15 SEPTEMBER UNLESS PERMITTED BY THE CHEMICAL REGISTRAR- DPIPWE.
Seedling - young ro- e	MCPA + Dicamba	Kamba® M (340 g/L MCPA+ 80 g/L Dicamba)	60 mL - 80 mL/15 L water	7 days	Use higher rate on larger weeds.
Early ower- ing plants	Clopyralid	Lontrel® 750 SG (750 g/L)	10 g/10 L water	7 days	Can be used on early owering plants to reduce seed for- m on. Top 10 - 20 cm of sprayed plants collapse within 12-24 hours of treatment, allowing missed plants to be located and treated.

Slender thistle— *Carduus pycnocephalus*

Chemical control: Boom Spray Application (www.dpipwe.tas.gov.au)

Stage of Growth	Herbicide (active ingredient)	Example of commercial product (concentration of active ingredient)	Application rate of commercial product	Withholding period	Comments
Seedlings	MCPA sodium salt	(250 g/L)	4.5 L/ha	7 days	Apply to mature grasses. Consult your agronomist for tolerance levels for legumes should any be present.
	MCPA amine	(500 g/L)	3 L/ha	7 days	The use of MCPA is preferred to 2,4-D (amine and ester) in situa- s where legumes are undersown in the crop.
		Agritone® 750 (750 g/L)	2 L/ha	7 days	
	2, 4-D amine	Amicide® 625 (625 g/L)	1.4 L/ha	7 days	Suppression only. The use of MCPA is preferred to 2,4-D (amine and ester) in situa- s where legumes are undersown in the crop. THIS PRODUCT MAY ONLY BE USED FROM 15 APRIL TO 15 SEPTEM- BER UNLESS PERMITTED BY THE CHEMICAL REGISTRAR- DPIPWE.
Rose e	2, 4-D ester	Estercide® Xtra 680 (680 g/L)	800ml - 3.3 L/ha	7 days	Use when thistles have started to shoot and become more resistant to other herbicides. User higher rates on larger plants. The use of MCPA is preferred to 2,4-D (amine and ester) in situa- s where legumes are undersown in the crop. THIS PRODUCT MAY ONLY BE USED FROM 15 APRIL TO 15 SEPTEM- BER UNLESS PERMITTED BY THE CHEMICAL REGISTRAR- DPIPWE.
Seedling -young rose e	MCPA + Dicamba	Kamba® M (340 g/L MCPA+ 80 g/L Dicamba)	2.8 - 4.0 L/ha	7 days	Use higher rate on larger weeds.
Rose e stage prior to stem elon	Clopyralid	Lontrel® 750 SG (750 g/L)	20 or 28 g/ha + 1 - 1.5L/ha MCPA amine (500 g/L)	7 days	Spray during a ve growth. Use higher rates on mu crowned plants or large rose es. Clovers and medics will be eliminated for at least 12 months.

Spanish Heath— *Erica lusitanica*

Description: A woody evergreen perennial shrub growing to a height of 1.5-2 metres. Stems are woody and bri d leaves ar ny, pointed and clustered densely on the stem. Flowers from late autumn to early spring with white—pi owers occurring in loose groups towards the end of the stems. Each er produces hundreds of y, dust like seeds which are released when owering. Roots are ous and the plant readily break near the base, en regrowing quickly from the broken stump.

Status: Declared weed in Tasmania.

Recommended control:

- Do not sla owering plants as this will spread the seed and worsen the infesta
- Burning will not eradicate Spanish heath but worsen the infesta
- Follow up control is essen for the management of Spanish heath
- Spanish heath reproduces by seed and stem layering and seed is dispersed by wind and water, slashing and in soil and mud
- Layering occurs where stems contact moist soil and send down roots
- Spanish heath is also capable of shoo from broken stems and roots
- Seedlings or small plants can be hand pulled or dug out taking care to remove as much of the root system as possible
- Material should be disposed of safely either by burning or piling where plants cannot layer
- When plants are in ower care should be taken to prevent accidental seed dispersal during disposal
- Slashing can reduce the amount of seed produced if undertaken prior t owering but can result in more root development and low growth.

Spanish Heath— *Erica lusitanica*

Chemical control: www.dpipwe.tas.gov.au

Stage of Growth	Herbicide (active ingredient)	Example of commercial product (concentration of active ingredient)	Application rate of commercial product	Withholding period	Comments
While actively growing	*Glyphosate	Round-Up Biactive®, Weedmaster Duo® (360 g/L)	100 - 130 ml/10L	nil	In accordance with APVMA Permit PER8949. Suitable for use near waterways. Non-selective and will damage or kill trees and grasses that come into contact with spray.
	*Triclopyr + picloram**	Grass-up™ (300 g/L + 100 g/L)	35 – 50 ml/10L	nil	In accordance with APVMA Permit PER8949. Will not affect grasses, will severely damage clovers and other broadleaved plants, including surrounding trees, if contacted by the spray. Soil-residual, hindering the re-establishment of clovers and other broadleaved plants for 6-12 months.
	*Triclopyr	Triclopyr 600®, Garlon 600® (600 g/L)	17 ml/10 L	nil	In accordance with APVMA Permit PER8949. Will not affect grasses, will severely damage clovers and other broadleaved plants, including surrounding trees, if contacted by the spray.
	*Metsulfuron-methyl	Brush-Off®, Associate® (600 g/Kg)	1 - 1.5 g/10 L	nil	In accordance with APVMA Permit PER8949. Will not affect grasses, will severely damage clovers and other broadleaved plants, including surrounding trees, if contacted by the spray. Soil-residual, hindering the re-establishment of clovers and other broadleaved plants for 6-12 months.
	*Metsulfuron-methyl + glyphosate	Trounce®, Cut-Out® (various formulations)	Refer to label	nil	In accordance with APVMA Permit PER8949. Non-selective and will damage or kill trees and grasses that come into contact with spray. Soil-residual, hindering the re-establishment of clovers and other broadleaved plants for 6-12 months.

Spanish Heath— *Erica lusitanica*

Cut and paint, drill and frill: www.dpipwe.tas.gov.au

Stage of Growth	Herbicide (active ingredient)	Example of commercial product (concentration of active ingredient)	Dose	Withholding period	Comments
While actively growing	*Glyphosate	Round-Up Biactive®, Weedmaster Duo® (360 g/L)	Undiluted to 1:5 with water	Nil	In accordance with APVMA Permit PER8949. Cut and paint: Make the cuts as close to the ground as possible, particularly if there is a risk of tripping or other damage occurring post-treatment. Apply immediately (within 15 seconds) after cut. Scraping some of the bark on the remaining stump may improve the effectiveness of this technique
			2 ml per hole/cut		In accordance with APVMA Permit PER8949. Drill and fill is useful for very large plants with thick stems. Drill holes into crown at 10 cm intervals. Drill holes on an angle so that the herbicide does not drain out. Keep the holes clean of soil, as any mixing with soil will reduce the effectiveness of the herbicide. It is not necessary to plug the hole.
	*Triclopyr + picloram	Access® (240 g/L + 120 g/L)	1:60 of diesel	Nil	Cut and paint: apply to cut stump.
	*Triclopyr	Triclopyr 600®, Garlon 600® (600 g/L)	1:60 of diesel	nil	In accordance with APVMA Permit PER8949. Cut and paint: apply to cut stump. Apply immediately (within 15 seconds) after cut.
	Picloram	Vigilant® Herbicide Gel (43 g/kg)	3-5 mm thick layer 5 mm thick layer	Nil	Stems up to 20 mm diameter. Stems greater than 20 mm diameter. In the case of multi-stem plants treat at least 80% of stems including main stems.

Tree lupin— *Lupinus arboreus*

Description: A short lived perennial shrub 2-3 m high with a deep taproot and tough, branching stems that are silky-hairy when young an -woody as they mature. Pale yellow owers are sweetly scented and pea like, appearing from October through to May and are followed by stout y hairy seed pods that are y a ached to the plant. The pods split explosively to disperse , dark brown seeds that are long lived. Seeds are spread by explosive pods, water and soil movement.

Status: Environmental weed in Tasmania.

Recommended control:

- Slash tall plants close to the ground (all year round) and leave on site to rot down
- Hand pull or dig small plants (all year round)
- Cut down and paint stumps (all year round)
- Weed wipe (all year round) with preferred herbicide
- Spray during th e growing period
- To prevent this weed from growing back, cut stumps that re-sprout and con o weed wipe or pull out small plants that regenerate from the persistent seed bank.

Chemical Control

- Cut and paint: Glyphosate (200ml/L), Triclopyr 600 EC (100ml/L), Yates Hydrocotyle killer (500ml/L) or Vigilant
- Weed wipe: Glyphosate (333ml/L), Triclopyr 600 EC (200ml/L), Yates Hydrocotyle killer (undiluted)
- Spray: Clopyralid (50ml/10L), Triclopyr 600 EC (15ml/10L), Yates Hydrocotyle killer (75ml/10L)

Appendix G

Hobart Airport Weed Management Plan

Hobart Airport

Weed Management Plan

June 2019

Hobart Airport
6 Hinkler Rd
Cambridge, Tasmania
Australia 7170

03 6216 1600

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for the good

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1 Introduction

The Hobart Airport is a diverse environment with a range of vegetation types, including vegetation communities which have both state and commonwealth significance. The airport is surrounded by a range of land use types, predominantly rural residential areas, semi-industrial areas and coastal environments. Combined with the nature of activities on airport land and the level of maintenance and disturbance required, the airport is susceptible to weed invasion and potential infestation of species that exist within the surrounding land areas.

A weed species is classified as any plant that requires some form of action to reduce its effect on the economy, the environment, human health and amenity[1]. Weeds can be an introduced species or native species that colonise and persist in an ecosystem where it did not previously exist and are capable of inhabiting all environments. Some weeds that are prolific in the environment and are problematic to manage are listed under commonwealth and/or state legislation. Weeds of National Significance (WONS) are those species listed at the Commonwealth level, and have been identified due to their invasiveness, impacts on the environment and potential for spread and socioeconomic impacts. Declared weeds are those listed at a state level in Tasmania under the *Weed Management Act* 1999, and environmental weeds comprise all other weed species.

Weed management at the airport is an ongoing maintenance task, required for both operational and environmental reasons. Without effective control measures in place, weed species can rapidly dominate and degrade natural areas. The airport is committed to managing, controlling and, where possible, eradicating weed species on airport land. It is a requirement under the *Airports (Environment Protection) Regulations* 1997 that Airports demonstrate continual environmental improvement, including maintaining biodiversity values. In order to achieve this, a diligent approach to weed management is critical in these areas. The airport considers that the management of weed infestations can be substantially improved using a strategic approach, and where possible, undertake a collaborate approach to weed management with neighbouring land owners.

It is important to note that the weed management plan for the airport is comprised of a series of practical documents that support the overall weed management objective. These documents require review on an annual basis and are to be updated accordingly.

1.1 Objective

The objective of this weed management plan is to provide context to controlling the extent and spread of existing weed infestations and prevent new infestations from occurring on airport land. This can only be done by adopting a strategic approach, and is further defined using the following steps:

1. Defining the airport's goals for weed management
2. Identifying significant weeds on airport land and prioritising their management
3. Undertake weed mapping so that the extent of infestations is known
4. Undertake research on the weed species of concern so that control measures can be adapted, and a better understanding of the weed life cycle is gained
5. Set the priorities for specific weed species

[1] Australian Government Biodiversity website

6. Determine the best approach to manage individual weed species as not all weed species will respond to the same method of control
7. Ensure that the airport has the appropriate tools and resources for effective weed control
8. Implement the weed management plan
9. Monitor weed infestations so that population and extent can be recorded over time
10. Ensure ongoing monitoring and maintenance occurs through comprehensive work plans
11. Encourage a collaborative approach to weed management with neighbouring land owners and volunteer groups/organisations.

2 Approach

The following steps outline the Hobart Airport's approach to weed management and provide the foundation for the weed management plan.

2.1 Goal

The Hobart Airport's goal for weed management is to ensure that targeted weed species are controlled in such a manner that ensures continuity of operations and meets the requirements of both commonwealth and state weed management legislation. Additional goals for the airport above and beyond the minimum are to implement control measures that are aimed at controlling and, where possible, eradicating weed infestations through education and knowledge transfer to landscaping contractors.

2.2 Weed Identification

A comprehensive weed survey of the airport site, airside and landside, was undertaken in 2011. A weed map was prepared as a result of the survey and provides baseline information on weed species and infestations that exist on site, their current status, distribution and extent. This information has provided the foundation on which weed management priorities and management approaches have been developed. Since that time, weed monitoring has occurred on an annual basis, and targeted programs adapted in accordance with changes in weed distribution and species.

A weed management identification manual has been developed by the airport to assist contractors in the accurate identification of weed species on airport grounds. The manual includes photographic references to WONS, state declared weeds and environmental weeds that require ongoing management and that are known to occur on airport land. The identification manual is updated as new weed species are found to occur on Airport land or methods of treatment change.

The weed management manual is provided to contractors as a series of laminated field notes which are reviewed and updated on an annual basis. The manual includes background information on the weed species, recommendations for control and eradication and weed maps for targeted species.

An electronic version of the manual is located at Weed field notes Dec 2016.pub An example of the field notes are provided in **Appendix A**.

All projects require an Environmental Management Plan (EMP), including the provision of control measures that aim to mitigate the spread of weeds or the introduction of new weeds to the site. Weed Management requirements are also included in the Hobart Airport Construction Environmental Management Plan (CEMP) Guidelines (January 2016) which are provided to contractors prior to any works commencing on airport land.

2.3 Weed Mapping

Larger infestations of weed species have been mapped on airport land and are updated on an annual basis to assess any changes in infestation size and the effectiveness of current weed control measures. Weed maps are included in the weed management manual field notes and are updated and replaced as required.

Weed mapping is targeted in terms of priority i.e. those weed infestations that are persistent and/or have the potential to cause operational concerns. All other weed species are targeted in order of significance and as resources or climatic conditions allow.

An example of the most recent weed mapping that has been undertaken for the Lupin infestation on Seven Mile Beach is provided in Appendix B. This area is a focus area for the Airport with the aim to improve the environmental value for this conservation area.

Additional weed mapping occurs as part of routine site investigations and projects occurring on airport land.

2.4 Weed Knowledge

The weed management identification manual provides information on not only the physical attributes of individual weed species, but also includes information on flowering, seeding and how each weed can spread across a site. This information is then used in order to schedule in the most appropriate timing for control and ongoing management. A weed management timeline schedule or 'calendar' has also been prepared based on this information for contractor use. The airport requires contractors to schedule in weed management activities specific to the manual's recommendations and apply control measures that are most effective for the species.

2.5 Weed Control Priorities

Weed management and control at the airport has been prioritised based on the following:

1. Weed species that have the potential to impact on airport operations (e.g. encourage bird species through seeding or breeding habitat, are large enough to dislodge and impact on aircraft, affect visibility)
2. Weeds of National Significance (WONS) that are a legislative requirement
3. State Declared Weeds that are a legislative requirement under the *Weed Management Act* 1999
4. Other environmental weed infestations.

Where possible the airport's goal is to eradicate areas of weed infestation, or if eradication is not possible, then manage to a level that does not increase the time and costs to control the species. Successful eradication is dependent on targeting weeds in a coordinated manner by applying herbicide or removing the plants prior to flowering and seed dispersion. The timing of this differs between species and therefore having adequate weed knowledge is critical to the success of the weed control program.

2.6 Weed Management Approaches

Weed management approaches vary depending on the weed being targeted for eradication and/or control. The airport plans to coordinate weed control using a combination of timing and recommended herbicides and/or mechanical removal where required. This information is contained within the weed management manual and field notes.

2.7 Tools and Resources

The Hobart Airport engages landscaping contractors to undertake all weed control and management activities. The primary aim of developing a weed management manual with field notes is to provide contractors with consistent information and tools to assist in meeting the Airport's weed management objectives.

2.8 Implementation

The implementation of weed management strategies and defined schedules is outlined in the Grounds Maintenance Regimes for airside and landside areas. These regimes are supported by relevant Site Management Procedures (SMPs):

- HIAPL SMP04 Waste Management
- HIAPL SMP07 Protection of Environmentally Significant Areas
- HIAPL SMP08 Vegetation Management
- HIAPL SMP10 Weed Control
- HIAPL SMP11 Burning
- HIAPL SMP13 Site Environmental Awareness
- HIAPL SMP15 Environmental Monitoring

The weed management actions outlined in the Grounds Maintenance Regimes for landside and airside areas are located at ..\..\..\..\Facilities Management\Services\02 Job Plans.

Relevant SMPs are located at.\..\..\Regulatory\Procedures\Environment Procedures_Current.

The application of herbicides on targeted weed species is supported by information provided in the field note sheets and the timeline schedule. The timeline schedule is provided in Appendix C.

2.9 Weed Monitoring

Weed monitoring of targeted weed species is undertaken on an annual basis at the same time as the previous year. Weed mapping also occurs annually and maps of individual species are updated accordingly. Maps are compared to previous years where the extent and distribution of weed species is assessed from year to year. This information is translated into the effectiveness of existing weed management strategies and amended where required with the aim to improve overall results. Photo

records of the site are also taken in order to establish trends over time and are taken from the same location each year.

Weed monitoring is targeted for areas of weed infestation and individual weed species that have an operational and/or legislative priority. Additional environmental weed species will be monitored if required and/or if infestations become an operational or environmental issue.

Maps outlining the objectives for Environmentally Sensitive Areas (ESAs) have been developed for contractors. These maps highlight the target species and priorities for weed management in protected areas. These are provided in Appendix D.

2.10 Maintenance

Ongoing monitoring and maintenance is critical to the success of weed management and control at the airport and facilitates an awareness of new infestations or new weed incursions. Follow up treatment is critical to overall weed management success and is the most common cause of unsuccessful weed management strategies[2].

A combination of annual weed monitoring and ongoing maintenance will ensure that priority weed species remain controlled or eradicated where possible. Information provided in the weed management field notes, weed control timelines and grounds maintenance regimes provide the supporting tools necessary for successful weed management.

[2] Land for Wildlife Queensland

3 References

- Australian Government Biodiversity website [date accessed 06/05/2014],< http://www.environment.gov.au/biodiversity/invasive/weeds/weeds/what.html>

- HIAPL Weed Management Manual and field notes for contractors, Developed by HIAPL, May 2014.

- Land for Wildlife Queensland: Note EW1, *Developing a Weed Management Plan*, date unknown.

APPENDIX A – Example of Weed Field Notes – Contractor Use

Weed Management Field Notes

Hobart Airport

April 2014

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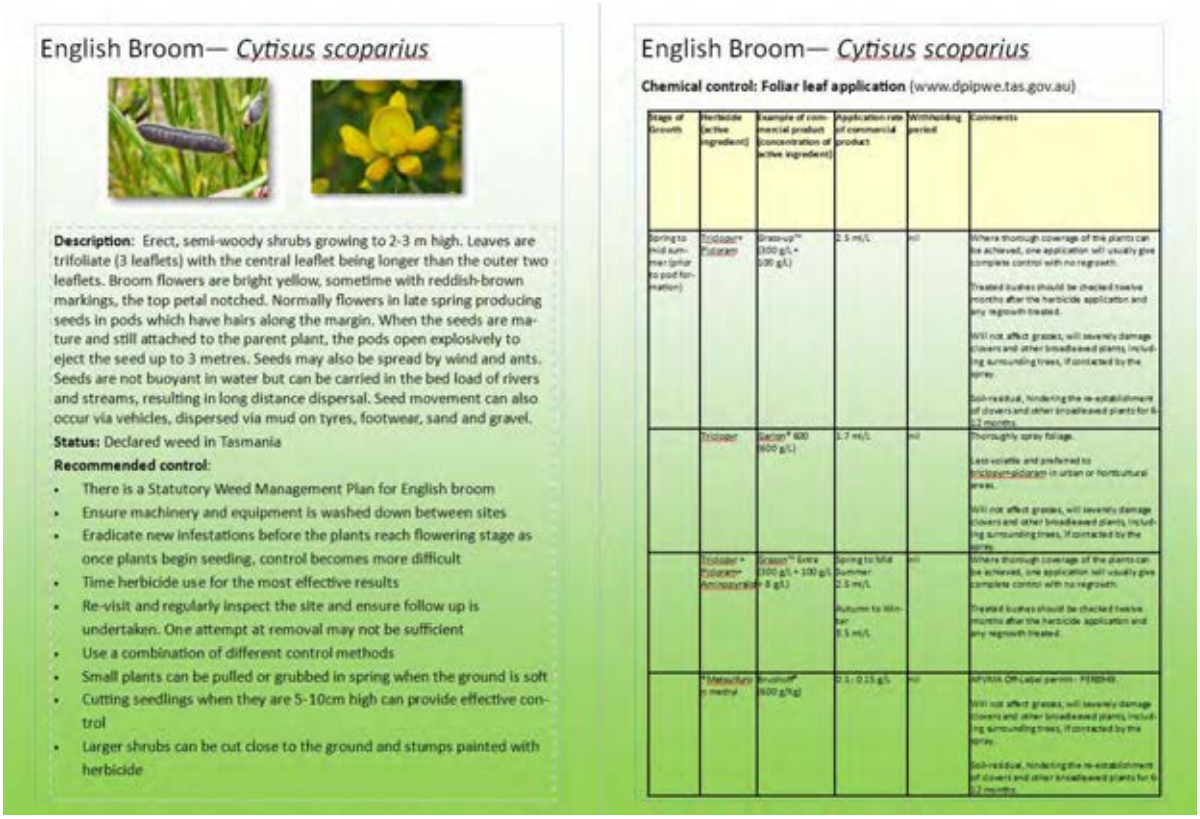
African boxthorn
African lovegrass
Blackberry
Boneseed
Broomrape
Californian thistle
Cumbungi (Bullrush)
Cut-leaf nightshade
English broom
Fennel
Gorse
Serrated tussock
Slender thistle
Spanish heath
Tree lupin

This Field Manual has been developed by HIAPL for Contractor use on site to assist in the identification of weed species and most appropriate herbicide use for eradication and control.

Information provided on recommended herbicides is based on the most recent information provided by the State Government of Tasmania. Information is reviewed on an annual basis by HIAPL and updated accordingly.



English Broom— *Cytisus scoparius*

Description: Erect, semi-woody shrubs growing to 2-3 m high. Leaves are trifoliate (3 leaflets) with the central leaflet being longer than the outer two leaflets. Broom flowers are bright yellow, sometime with reddish-brown markings, the top petal notched. Normally flowers in late spring producing seeds in pods which have hairs along the margin. When the seeds are mature and still attached to the parent plant, the pods open explosively to eject the seed up to 3 metres. Seeds may also be spread by wind and ants. Seeds are not buoyant in water but can be carried in the bed load of rivers and streams, resulting in long distance dispersal. Seed movement can also occur via vehicles, dispersed via mud on tyres, footwear, sand and gravel.

Status: Declared weed in Tasmania

Recommended control:

- There is a Statutory Weed Management Plan for English broom
- Ensure machinery and equipment is washed down between sites
- Eradicate new infestations before the plants reach flowering stage as once plants begin seeding, control becomes more difficult
- Time herbicide use for the most effective results
- Re-visit and regularly inspect the site and ensure follow up is undertaken. One attempt at removal may not be sufficient
- Use a combination of different control methods
- Small plants can be pulled or grubbed in spring when the ground is soft
- Cutting seedlings when they are 5-10cm high can provide effective control
- Larger shrubs can be cut close to the ground and stumps painted with herbicide

English Broom— *Cytisus scoparius*

Chemical control: Foliar leaf application (www.dpipwe.tas.gov.au)

Stage of Growth	Herbicide (active ingredient)	Example of commercial product (concentration of active ingredient)	Application rate of commercial product	Withholding period	Comments
Spring to mid summer (prior to pod formation)	Triclopyr* Picloram	Grass-up™ (300 g/L + 100 g/L)	2.5 mL/L	nil	Where thorough coverage of the plants can be achieved, one application will usually give complete control with no regrowth. Treated bushes should be checked twelve months after the herbicide application and any regrowth treated. Will not affect grasses, will severely damage clovers and other broadleaved plants, including surrounding trees, if contacted by the spray. Soil-residual, hindering the re-establishment of clovers and other broadleaved plants for 6-12 months.
	Triclopyr	Garlon® 600 (600 g/L)	1.7 mL/L	nil	Thoroughly spray foliage. Less volatile and preferred to triclopyr+picloram in urban or horticultural areas. Will not affect grasses, will severely damage clovers and other broadleaved plants, including surrounding trees, if contacted by the spray.
	Triclopyr + Picloram+ Aminopyralid	Grazon™ Extra (300 g/L + 100 g/L + 8 g/L)	Spring to Mid Summer 2.5 mL/L Autumn to Winter 3.5 mL/L	nil	Where thorough coverage of the plants can be achieved, one application will usually give complete control with no regrowth. Treated bushes should be checked twelve months after the herbicide application and any regrowth treated.
	* Metsulfuron methyl	Brushoff® (600 g/Kg)	0.1 - 0.15 g/L	nil	APVMA Off-Label permit - PER8249 Will not affect grasses, will severely damage clovers and other broadleaved plants, including surrounding trees, if contacted by the spray. Soil-residual, hindering the re-establishment of clovers and other broadleaved plants for 6-12 months.

Spanish Heath— *Erica lusitanica*

Description: A woody evergreen perennial shrub growing to a height of 1.5-2 metres. Stems are woody and brittle and leaves are tiny, pointed and clustered densely on the stem. Flowers from late autumn to early spring with white—pinkish flowers occurring in loose groups towards the end of the stems. Each flower produces hundreds of tiny, dust like seeds which are released when flowering. Roots are fibrous and the plant readily breaks off near the base, often regrowing quickly from the broken stump.

Status: Declared weed in Tasmania.

Recommended control:

- Do not slash flowering plants as this will spread the seed and worsen the infestation
- Burning will not eradicate Spanish heath but worsen the infestation
- Follow up control is essential for the management of Spanish heath
- Spanish heath reproduces by seed and stem layering and seed is dispersed by wind and water, slashing and in soil and mud
- Layering occurs where stems contact moist soil and send down roots
- Spanish heath is also capable of shooting from broken stems and roots
- Seedlings or small plants can be hand pulled or dug out taking care to remove as much of the root system as possible
- Material should be disposed of safely either by burning or piling where plants cannot layer
- When plants are in flower care should be taken to prevent accidental seed dispersal during disposal
- Slashing can reduce the amount of seed produced if undertaken prior to flowering but can result in more root development and low growth.

Spanish Heath— *Erica lusitanica*

Chemical control: www.dpipwe.tas.gov.au

Stage of Growth	Herbicide (active ingredient)	Example of non-restricted product (active ingredient)	Application rate of commercial product	Withholding period	Comments
Foliar actively growing	Glyphosate	Round-Up Biactive® (360 g/L glyphosate) (500 g/L)	100 – 150 ml/10L	nil	In accordance with APVMA Permit 8890/94. Suitable for use near waterways. Non-selective and will damage or kill trees and grasses that come into contact with spray.
	Triclopyr + picloram	Grazon® (300 g/L + 100 g/L)	25 – 50 ml/10L	nil	In accordance with APVMA Permit 8890/94. Will not effect grasses, will severely damage clovers and other broadleaved plants, including surrounding trees if contacted by the spray. Soil residual, hindering the re-establishment of clovers and other broadleaved plants for 6-12 months.
	Triclopyr	Tordon 600® SAF (600 g/L)	17 ml/10 L	nil	In accordance with APVMA Permit 8890/94. Will not effect grasses, will severely damage clovers and other broadleaved plants, including surrounding trees if contacted by the spray.
	Tebuthiuron + metsulfuron methyl	Spinout Ultra Advanced (g/L + g/L)	1 – 1.5 g/10 L	nil	In accordance with APVMA Permit 8890/94. Will not effect grasses, will severely damage clovers and other broadleaved plants, including surrounding trees if contacted by the spray. Soil residual, hindering the re-establishment of clovers and other broadleaved plants for 6-12 months.
	Tebuthiuron + metsulfuron methyl + glyphosate	Tetrosate® (various formulations)	Refer to label	nil	In accordance with APVMA Permit 8890/94. Non-selective and will damage or kill trees and grasses that come into contact with spray. Soil residual, hindering the re-establishment of clovers and other broadleaved plants for 6-12 months.

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APPENDIX B – Example of Weed Mapping

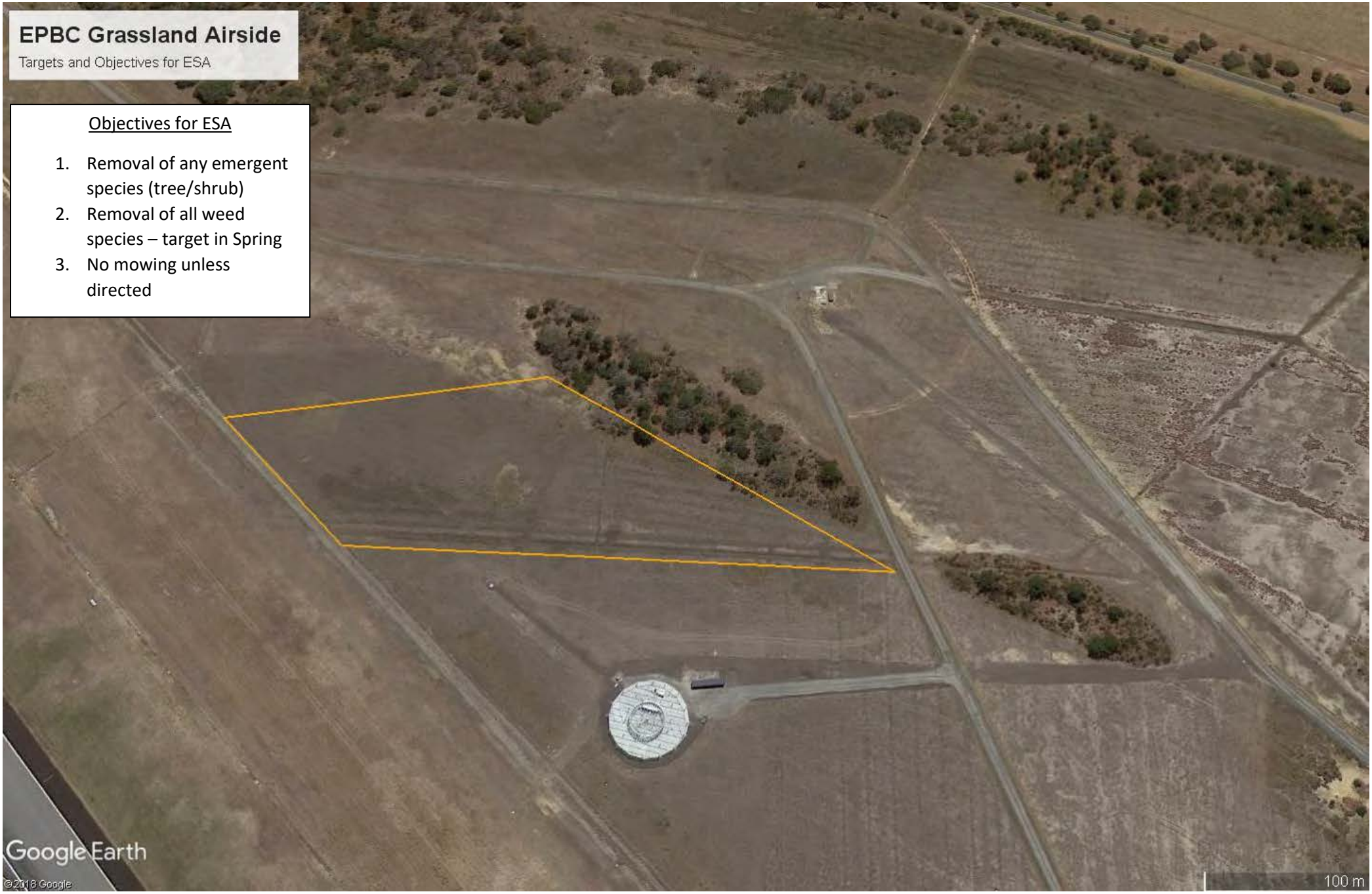
Lupin Mapping – Seven Mile Beach – All quadrants (January 2017)

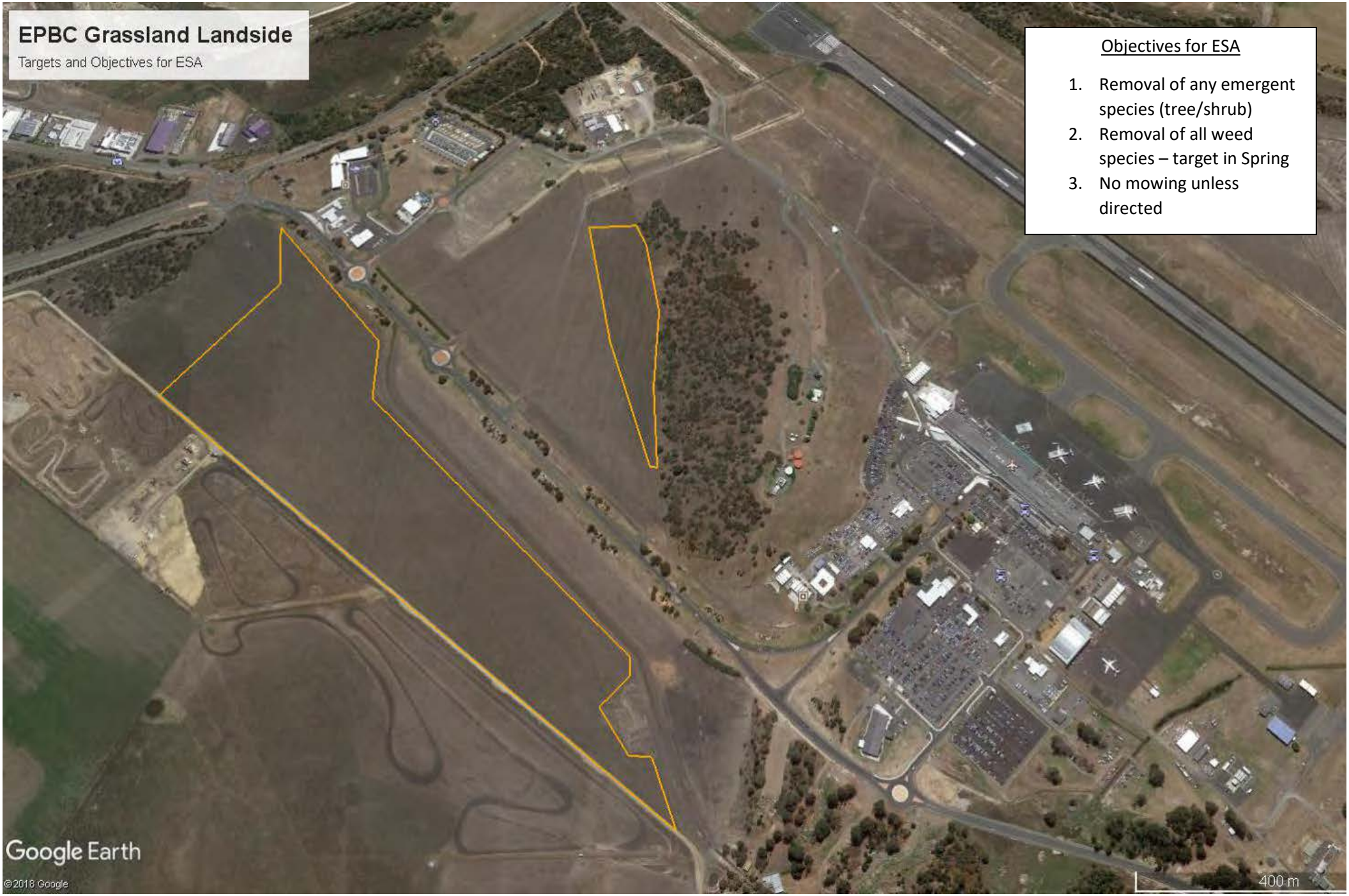
APPENDIX C – Weed Management timeline

Weed species	Flowering time	Control	Herbicide Application	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
Boneseed	August - December	Hand remove or spot spray	During peak flowering time												
African boxthorn	Year round	Physical removal and burning most cost effective option	Follow up on seedlings during spring growth period - at about 18 months												
Spanish heath	June -September	Hand remove or spot spray	Before flowering finishes in Spring												
Tree lupin	August - November	Hand remove or spot spray	Before flowering												
Blackberry	November - February	Hand remove or spray	December - March												
Serrated tussock	September - December	Removal or spot spray	May - October												
Gorse	Spring and autumn	Targeted spraying for regrowth or scattered bushes	During growth period. Spring - early summer. Late morning and early afternoon												
Californian thistle	Summer	Apply herbicide early before flowering	December - January												
Slender thistle	Early summer	Apply herbicide early before seeding	During growth period in spring												
Fennel	September - November	Apply herbicide early before seeding	During growth period prior to flowering												
African lovegrass	Early summer	Apply herbicide during active growth	Autumn - winter provides better control												
English broom	Late spring - early summer	Hand remove or spot spray	Apply before flowering during active growth phase												
Cut-leaf nightshade	Summer - autumn	Hand remove or spot spray	Apply before flowering during active growth phase												
Cumbungi	Summer	Mechanical removal - large infestations	Before flowering stage												
Cumbungi	Summer	Cut leaves below water level - 4-6 week intervals	First cut at advanced flowering stage - January												
Cumbungi	Summer	Foliar spray	Apply during active growth phase												
General broadleaf and grass weeds	Spring - summer	Apply herbicide before flowering	Apply during active growth phase												
Broomrape	Spring - summer	Notify regional weed management officer immediately	No further action until advice from regional weed management officer (DPIPWE)												

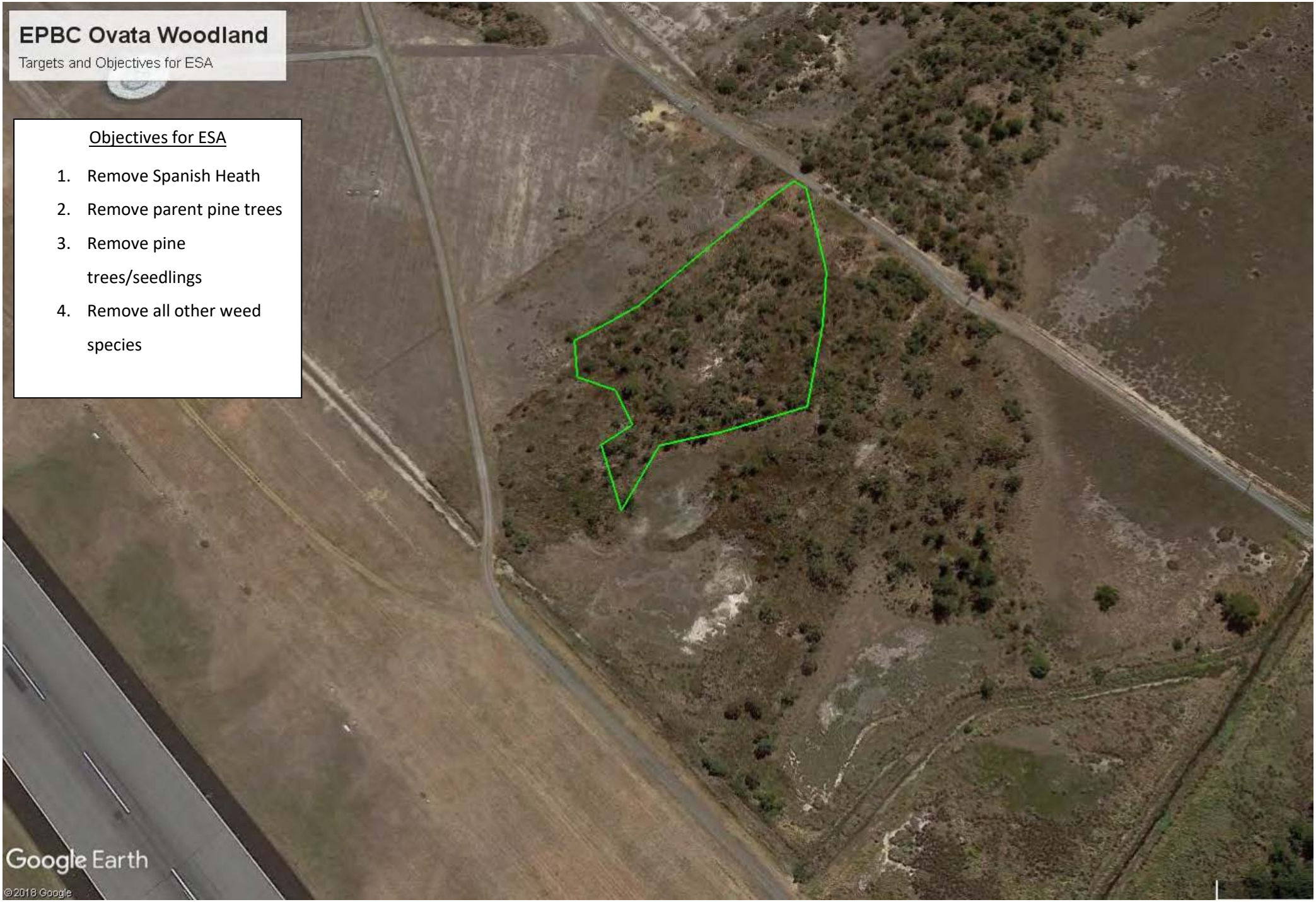
Summer	Blackberry
	Californian thistle
	Cumbungi - cut leaves below water level
	Cumbungi - foliar spray
Autumn	Cumbungi - foliar spray
	General grass and broadleaf weeds - airside, landside, roads etc
Winter	Spanish heath
	Tree lupin
	Serrated tussock
	African lovegrass
	Cumbungi - mechanical removal -optional and weather dependent
Spring	Boneseed
	African boxthorn
	Gorse
	Slender thistle
	Cut-leaf nightshade
	Cumbungi - mechanical removal
	General grass and broadleaf weeds - airside, landside, roads etc

APPENDIX D – Objective Maps for ESA Areas


EPBC Grassland Airside
Targets and Objectives for ESA
Objectives for ESA
1. Removal of any emergent species (tree/shrub)
2. Removal of all weed species – target in Spring
3. No mowing unless directed
Google Earth
©2018 Google
100 m


EPBC Grassland Landside
Targets and Objectives for ESA
Objectives for ESA
1. Removal of any emergent species (tree/shrub)
2. Removal of all weed species – target in Spring
3. No mowing unless directed
Google Earth
©2018 Google
400 m

EPBC Saltmarsh
Targets and Objectives for ESA
Objectives for ESA
1. Remove parent pine trees
2. Remove Pine trees/seedlings
3. Remove Spanish Heath
4. Remove all other weed species
Google Earth
©2018 Google


EPBC Ovata Woodland
Targets and Objectives for ESA
Objectives for ESA
1. Remove Spanish Heath
2. Remove parent pine trees
3. Remove pine trees/seedlings
4. Remove all other weed species
Google Earth
©2018 Google

ESA Coastal Conservation Area
Targets and Objectives for ESA
Objectives for ESA
1. Control of Lupins
2. Removal of pine trees/seedlings
3. Removal of Coastal wattle to encourage natural recruitment of White Gums
Google Earth

Appendix H

Traffic Modelling Report - Grade Separated Signalised Interchange

Tasman Highway Holyman Avenue Interchange
Traffic Modelling Report
Grade Separated Signalised Interchange

transport | community | mining | industrial | food & beverage | energy

Prepared for:	**Department of State Growth**
Client representative:	**Denise McIntyre**
Date:	**21 December 2018** **Rev 00**

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Appendices

Appendix A: Traffic Volumes
Appendix B: SIDRA Results

Prepared by: ..... Date: 20 December 2018
Rebekah Ramm

Reviewed by: ..... Date: 20 December 2018
Andrew Fowler

Authorised by: ..... Date: 20 December 2018
Andrew Fowler

Revision History					
Rev No.	**Description**	**Prepared by**	**Reviewed by**	**Authorised by**	**Date**
00	Traffic Modelling Report	R. Ramm	A. Fowler	A. Fowler	21/12/2018

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1. Introduction

The Australian and Tasmanian Governments have committed to upgrading the Tasman Highway at the Holyman Avenue Interchange in Cambridge. The interchange upgrade has been confirmed as a priority upgrade project with construction expected to commence in 2022.

The Department of State Growth's objectives for the project are

- To improve safety and transport efficiency at the Holyman Avenue Intersection
- To provide a long-term solution for access to Holyman Avenue and the adjoining Kennedy Drive; and
- To commence construction through award of a Design and Construct contract in 2022.

The Department of State Growth engaged **pitt&sherry** to prepare a traffic modelling report to summarise the modelling that was completed for a grade separated diamond interchange with traffic signals.

1.1 Site Location and Road Network

The site of the proposed interchange is the existing Tasman Highway/ Holyman Avenue/ Kennedy Drive/ Cranston Parade roundabout. The roundabout operates at-grade with five legs and has a large central island of approximately 50 metres in diameter.

The roundabout provides direct access to Hobart International Airport from the Tasman Highway via Holyman Avenue. Access is also provided to Kennedy Drive, which connects the Highway and Airport with the Cambridge town centre, and to several properties on Cranston Parade. The location of the interchange is shown in Figure 1.

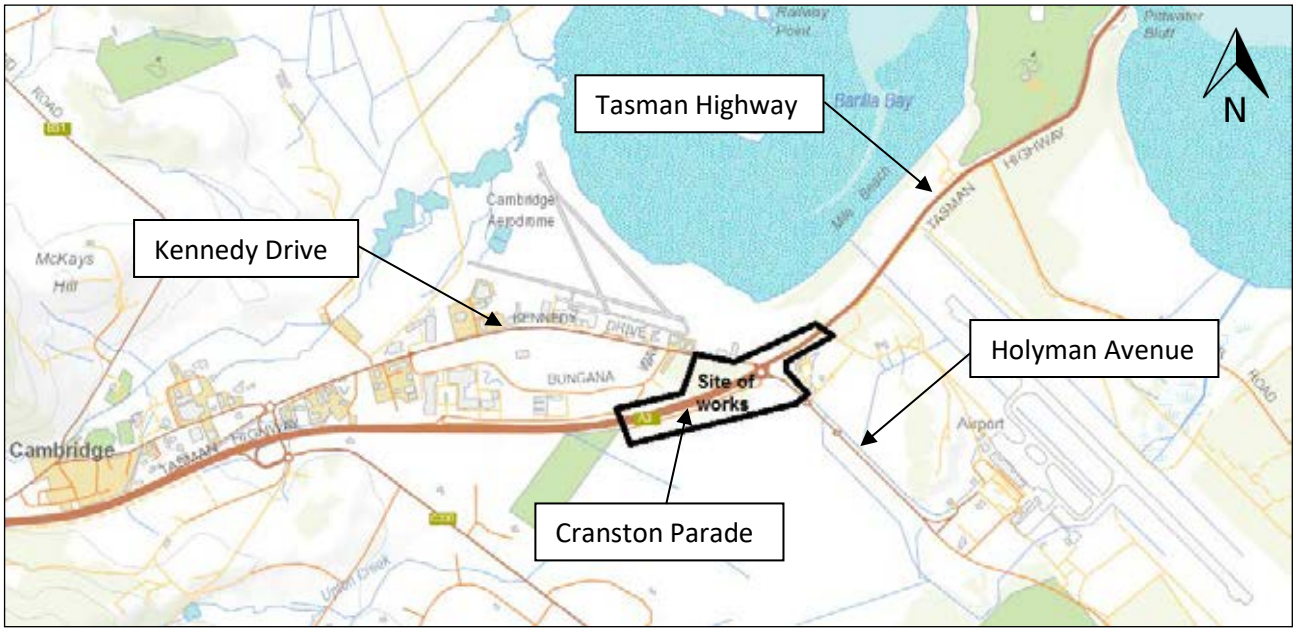


Figure 1: Locality Map (Basemap source: www.thelist.tas.gov.au)

The Tasman Highway is a Category 1 Trunk Road under the Tasmanian State Roads Hierarchy and is a major urban corridor into Hobart. It also provides tourist access to the Great Eastern Drive on Tasmania's East Coast.

Holyman Avenue is owned and managed by Hobart International Airport Pty Ltd (HIAPL) apart from the first 40 metres immediately east of the Tasman Highway roundabout, which is the responsibility of the Department of State Growth. It is generally one lane in each direction with short sections of two lane

approach to internal roundabouts located approximately 250 metres and 500 metres from the Tasman Highway.

Kennedy Drive is a two-lane undivided road with one lane in each direction and is the responsibility of Clarence City Council. It connects the Highway with the Cambridge Town Centre and several other suburbs. Cranston Parade is a two-lane undivided road with one lane in each direction and is the responsibility of Clarence City Council. It provides access for a small number of properties to the Highway.

2. Existing Roundabout Operation

2.1 Traffic Model

The traffic operation of the Tasman Highway/Holyman Avenue/Kennedy Drive/Cranston Parade roundabout and the proposed new signalised intersection have been assessed using SIDRA INTERSECTION. The intersection performance is based on the vehicle delay and the corresponding Level of Service (LOS). It is generally accepted that an intersection operates well if it is at LOS D or higher. Table 1 shows the criteria that SIDRA INTERSECTION adopts in assessing the LOS.

Table 1: SIDRA INTERSECTION Level of Service Criteria

LOS	Delay per Vehicle (secs)		
	Signals	Roundabout	Sign Control
A	10 or less	10 or less	10 or less
B	10 to 20	10 to 20	10 to 15
C	20 to 35	20 to 35	15 to 25
D	35 to 55	35 to 50	25 to 35
E	55 to 80	50 to 70	35 to 50
F	Greater than 80	Greater than 70	Greater than 50

The intersections have been run assuming no pedestrian movements as these are expected to be low.

2.2 Intersection Layout

Tasman Highway/Holyman Avenue/Kennedy Drive/Cranston Parade roundabout was previously a single lane roundabout. Recently the roundabout has been upgraded to a dual lane roundabout to improve the roundabout capacity in the short term.

The geometry of the roundabout used in the single lane SIDRA Intersection model was developed with reference to aerial photography obtained from LISTmap.

The geometry of the roundabout using in the dual lane SIDRA Intersection model was based on previous SIDRA modelling.

The layouts used for the SIDRA Intersection modelling are shown in Figure 2 and Figure 3

Figure 2: Single Lane Roundabout Layout (Aerial Source: https://maps.thelist.tas.gov.au)

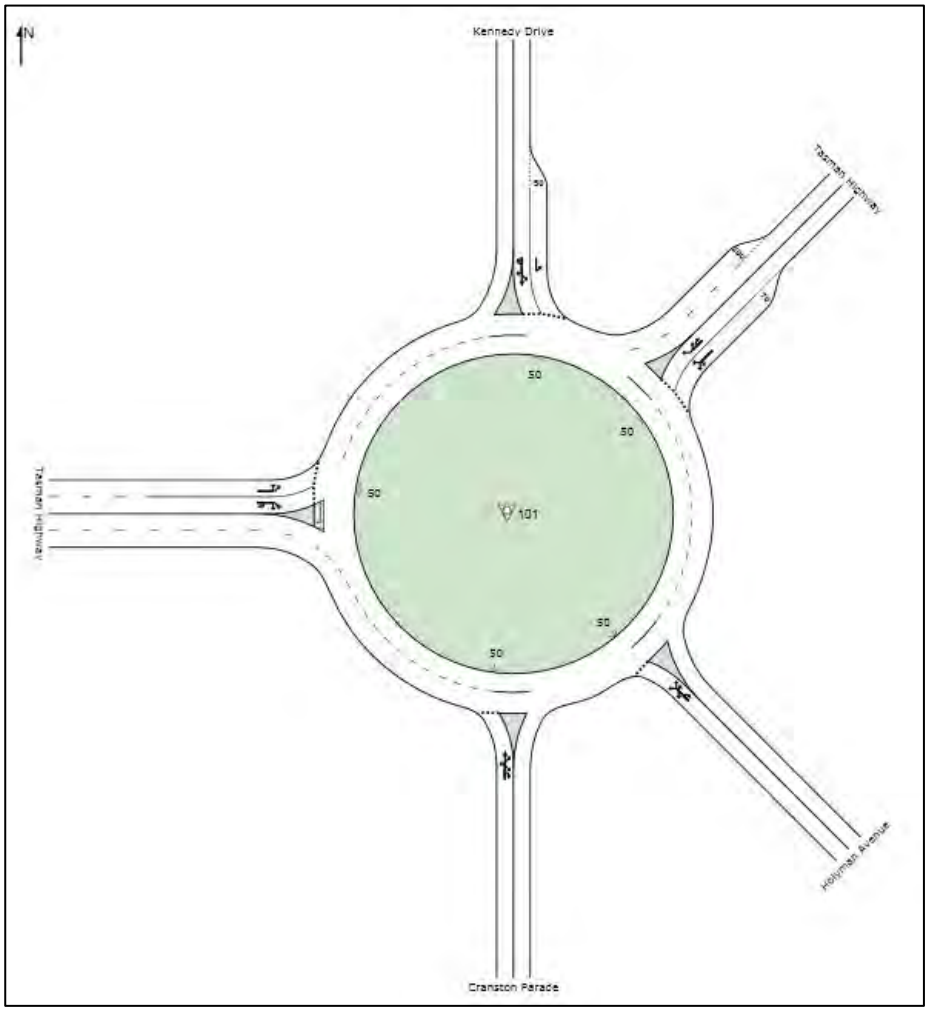


Figure 3: Dual Lane Roundabout Layout

2.3 Traffic Volumes

Traffic data was collected for the existing Tasman Highway/ Holyman Avenue/ Kennedy Drive/ Cranston Parade roundabout for a 24-hour period on the following days:

- Thursday 28 July 2016
- Friday 29 July 2016; and
- Saturday 30 July 2016.

At the time of these counts, turning movement count data was also collected at the intersection of the Tasman Highway and Back Road and two-way counts were collected on Back Road and Surf Road.

The counts recorded traffic volumes separated into light and heavy vehicles.

Analysis of the traffic data highlighted five peak hours on the traffic network. Two of the weekday peak hours (labelled i and iv below) are peak hours including Tasman Highway volumes. The other two weekday peak hours (labelled ii and iii) below are peak hours for all the side roads not considering the Tasman Highway volumes. The Saturday peak hour is consistent for the Highway and side roads.

The peak hours were as follows:

1. Friday 28 July 2016 – 7:00am-8:00am – Weekday Highway AM Peak (affects existing layout only)
2. Thursday 28 July 2016 – 8:45am-9:45am – Weekday Side Roads AM Peak
3. Friday 29 July 2016 – 3:15pm-4:15pm – Weekday Side Roads PM Peak
4. Thursday 28 July 2016 – 4:00pm-5:00pm – Weekday Network PM Peak (affects existing layout); and
5. Saturday 30 July – 11:45am-12:45pm – Saturday Peak.

The traffic volumes for each of these peak periods are included in Appendix A.

As the new intersections will be affected by side road movements, they have been assessed for the three side road peaks only (ii, iii & v above).

2.4 Vehicle Mix

The SIDRA model was developed using the total number of vehicles recorded and the percentage of heavy vehicles (Austroads Vehicle class 3, two axle trucks and above). Buses were considered as heavy vehicles and included in the percentage heavy vehicle proportion. The proportion of heavy vehicles was based on the heavy vehicle counts as a proportion of the total traffic.

Heavy vehicle proportions were recorded as follows:

- Tasman Highway and Holyman Avenue 5%
- Kennedy Drive 10%
- Cranston Parade 50%.

2.5 Assumptions

As the design is to be assessed up to 22 years into the future, the following assumptions were made for the future traffic volumes:

- The collected traffic volumes in July represent off-peak volumes, based on data provided from the Department of State Growth for the Tasman Highway. The July volumes have been factored up by 1.18 to predict the peak (December) volumes
- The traffic growth rate on the Tasman Highway, Kennedy Drive and Cranston Parade has been calculated as 2.8% compounding growth per year based on data provided by the Department of State Growth for the Tasman Highway
- The traffic growth rate for all movements to/from the airport (Holyman Avenue) has been calculated as 4.7% compounding growth per year based on data sourced from the current Hobart Airport Master Plan
- Based on the counts, 5% of all vehicles have been modelled as heavy vehicles with the exception of Kennedy Drive as 10% and Cranston Parade as 50%
- The modelling includes a shift of 100% of hire cars and 50% of taxis to using Back Road after the Hobart Airport terminal upgrade (to be completed by 2018) based on information provided by HIAPL.

The traffic volumes for each peak hour in 2018 and 2038 are provided in Appendix A.

2.6 SIDRA Results

2.6.1 Single Lane Roundabout

Table 2 presents a summary of the operation of the existing roundabout in 2016, 2018 and 2038, with full results presented in Appendix B.

It is noted that the results are for the overall intersection performance. The Degree of Saturation (DOS), delay and LOS figures represent average values for the intersection. The queue figure represents the 95th percentile queue for the worst leg of the intersection. Results for individual legs of the intersection are presented with the full results in Appendix B.

Table 2: Existing Layout Operating Conditions

Year	Peak	DOS	Average Delay (secs)	95th Percentile Queue (m)	LOS
2016	AM Network	1.01	35	389	D
	AM Side Roads	0.97	24	257	C
	PM Side Roads	1.64	102	671	F
	PM Network	1.66	82	619	F
	Saturday	0.83	18	106	B
2018	AM Network	1.08	74	740	F
	AM Side Roads	1.07	46	525	D
	PM Side Roads	1.47	128	1,097	F
	PM Network	1.59	111	824	F
	Saturday	1.12	41	349	D

Year	Peak	DOS	Average Delay (secs)	95th Percentile Queue (m)	LOS
2038	AM Network	3.10	1,033	7,916	F
	AM Side Roads	2.76	929	5,510	F
	PM Side Roads	2.85	1,019	7,229	F
	PM Network	2.80	931	6,816	F
	Saturday	2.75	830	4,741	F

Based on the results above the existing roundabout is not operating at a satisfactory LOS during many of the peak hours in December 2016. This is indicated by the DOS of more than 1.00 in three of the peak hours which suggests there is more traffic attempting to travel through the intersection than the intersection capacity. In addition, vehicles in the PM peak hours are experiencing large delays resulting in a LOS F which indicates unacceptable delays.

As expected, based on the anticipated growth on the road network, the intersection will continue to operate at poorer levels with increasing delays in 2018 and 2038. The 2018 model results align with what was being experienced at the roundabout prior to the dual lane upgrade. The modelling gives an indication that the anticipated traffic volumes in 2038 are three times the capacity of the existing roundabout.

The assessment above indicates that upgrade of the intersection is necessary as the existing roundabout is no longer performing at an acceptable level.

2.6.2 Dual Lane Roundabout

Table 3 presents a summary of the operation of the dual lane roundabout in 2023, with full results presented in Appendix B.

Table 3: Two Lane Roundabout with Two Lanes to the Tasman Highway Eastbound Operating Conditions

Peak	Degree of Saturation (DOS)	Average Delay (secs)	95th Percentile Queue (m)	LOS
AM Network	0.79	13	48	B
AM Airport	0.99	19	153	B
PM Airport	0.88	12	77	B
PM Network	0.75	10	48	A
Saturday	0.88	12	73	B

Based on the results above the dual lane roundabout is expected to operate satisfactorily in 2023. The worst expected delay in 2023 is at the Holyman Avenue approach during the AM Airport peak (shown in the movement summary in Appendix B) with an overall LOS D for the approach indicating the approach is expected to operate at a satisfactory LOS but is approaching unsatisfactory delays. The dual lane roundabout is not expected to operate satisfactorily in more than five years' time.

3. Proposed Interchange

3.1 Overview and Layout

An Options Analysis process was completed in November 2016 in response to the Department of State Growth brief which required extension of the existing dual carriageway beyond Holyman Avenue, and grade separation of Holyman Avenue and the Tasman Highway. Eleven options were developed and following a multi criteria analysis, a preferred option for the interchange was selected.

The option selected was a signalised diamond interchange with Holyman Avenue/ Kennedy Drive passing over the Tasman Highway.

The Highway is expected to have a speed limit of 100km/h at the interchange and the ramps and bridge will have a speed limit of 60km/h.

The connection of Cranston Parade into the road system will be achieved by making the Hobart bound on ramp a two-way road for a length of approximately 600 metres from the junction with Holyman Avenue. A single access point onto the ramp will be provided for the three westernmost properties on Cranston Parade approximately 100 metres east of the existing cul-de-sac. A second access will be provided a further 230 metres to the east for the Casimaty property.

As shown in the drawings, Holyman Avenue will have two lanes in each direction at the interchange. In an eastbound direction, two lanes will extend to approximately a kilometre east of the interchange to allow for the Tasman Highway on-ramp traffic to merge with the Highway traffic safely, and also allow for the Highway traffic to merge into one lane after this. In a westbound direction, the two-lane carriageway will begin approximately 700 metres east of the interchange.

The bridge over the Highway will have two lanes in a southbound direction (i.e. towards Holyman Avenue) and one lane in a northbound direction (towards Kennedy Drive).

The general configuration of the proposed interchange is shown in Figure 4.

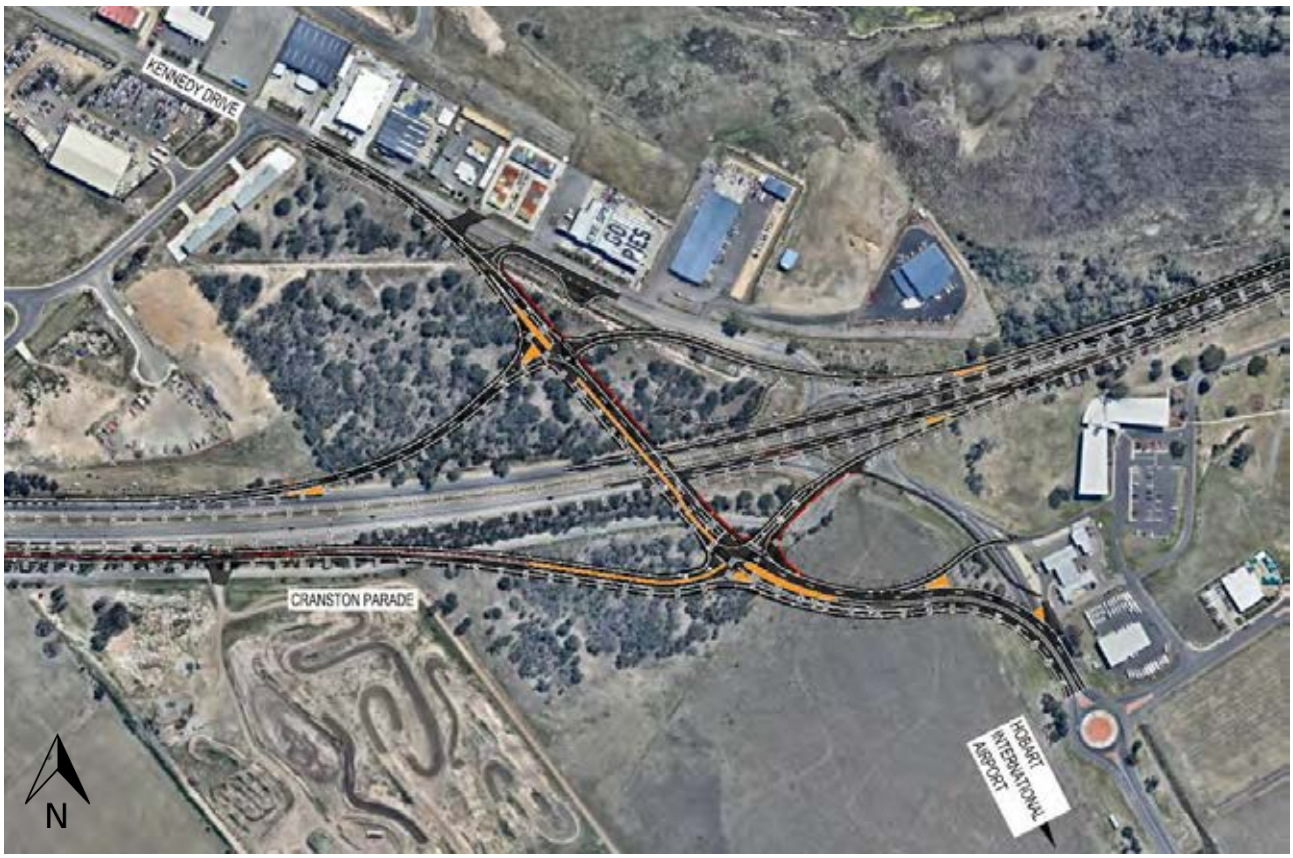


Figure 4: Proposed Interchange Layout

3.2 Criteria and Basis of Assessment

The expected traffic operation of the signalised grade separated interchange was assessed during the three peak hours discussed in Section 2.3. The assessment included the 2018 and 2038 scenarios.

The following criteria were considered in the traffic operation of the upgrades:

- Current traffic congestion at the roundabout is resolved
- Level of Service (LOS) D or better is achieved for each intersection in 2038; and
- Efficient and reliable access to the airport.

3.3 SIDRA Results

Table 4 presents a summary of the operation of the traffic signals option in 2018 and 2038, with full results presented in Appendix B.

Table 4: Traffic Signals Operating Conditions

Year	Peak	Intersection	Degree of Saturation (DOS)	Average Delay (secs)	95th Percentile Queue (m)	LOS
2018	AM	Tasman/Kennedy	0.45	14	26	B
		Tasman/Holyman	0.45	6	16	A
	PM	Tasman/Kennedy	0.63	15	25	B
		Tasman/Holyman	0.30	7	13	A
	Saturday	Tasman/Kennedy	0.72	16	31	B
		Tasman/Holyman	0.35	8	15	A
2038	AM	Tasman/Kennedy	0.84	22	148	C
		Tasman/Holyman	0.78	9	94	A
	PM	Tasman/Kennedy	0.88	23	102	C
		Tasman/Holyman	0.53	7	38	A
	Saturday	Tasman/Kennedy	0.98	24	92	C
		Tasman/Holyman	0.63	8	41	A

Based on the results above the traffic signals are expected to operate efficiently in 2018 and 2038. There is additional capacity at the signals in 2038 and therefore it would continue to operate at a good level of service beyond the design year.

The traffic signals option satisfies the traffic operation criteria as it relieves the current traffic congestion as discussed in Section 3.2 and operates better than LOS D in 2038.

Access to the airport is reliable with average delays at the signals for vehicles travelling from Hobart of 28 seconds during the worst peak hour in 2038 (shown in the movement summary in Appendix B).

3.4 Lane Configurations

3.4.1 Tasman Highway at the Overpass

At the existing Tasman Highway/Holyman Avenue intersection there is one lane in each direction. An assessment of the lane capacity has been completed to determine whether one lane in each direction would be adequate in 2018 and 20 years after opening in 2038.

As discussed in the traffic modelling assessment, the Tasman Highway has an existing growth rate of 2.8% which has been applied to peak period data collected in 2016 to determine the 2018 and 2038 peak period traffic volumes.

Based on the results, the expected traffic volumes on the Highway are shown in Table 5.

Table 5: Tasman Highway Peak Period Traffic Volumes

Direction	Year	Peak Hour Highway Through Traffic Volumes (vph)	Peak Hour Traffic Merging from overpass (vph)	Total (vph)
Eastbound	2018	1,380	290	1,670
	2038	2,400	540	2,940
Westbound	2018	1,200	190	1,390
	2038	2,070	500	2,570

The *Austroads Guide to Traffic Management Part 3: Traffic Studies and Analysis* contains information to calculate the lane capacity of a road. This calculation indicates that, after the works are completed, the Tasman Highway will have a capacity of approximately 1,640 vehicles per lane per hour.

Based on this, in 2018 a one lane road will be inadequate for eastbound travel and in a westbound direction, a one lane road will be approaching capacity. Therefore, it is recommended that two lanes are provided in each direction on the Tasman Highway through the interchange.

3.4.2 Location of Eastbound Merges

The merges from the eastbound on ramp onto the Tasman Highway, and the merge from two lanes to one on the highway, have been modelled using SIDRA Intersection to determine whether queues would be triggered on the Highway and the on ramp by the merges. It is important that queues on the Tasman Highway do not extend beyond the eastbound off ramp as this will cause delays to traffic accessing the airport.

Assumptions

Based on traffic counts from the Department of State Growth outside the Cambridge Homemaker Centre, traffic in an eastbound direction on the Tasman Highway includes 60% of vehicles using the left lane and 40% of vehicles using the right lane.

Drivers at the existing Tasman Highway/ Holyman Avenue roundabout experience large queues in an eastbound direction back from the existing merge from two lanes into one. Road users change their behaviour when delays are experienced at this merge with many people giving way to vehicles in the left merge lane despite the right lane having the priority. This has been particularly evident after the Tasman Highway merge was changed to as zip merge. A traditional merge lane would operate with vehicles in the left lane giving way to all vehicles in the right lane.

The highway merge from two lanes to one has been modelled as a traditional merge and this is considered to give conservative results. The merge has also been modelled with a 50/50 split between lanes as this is considered to more accurately reflect driver behaviour. Traffic from the eastbound on ramp has been modelled to merge into the left lane of the highway.

Results

The results from the SIDRA Intersection modelling are as follows, with full results and the layouts used in the model included in Appendix B.

- In 2018 the merge from the eastbound on ramp to the left lane of the Highway would have a 95th percentile queue of 8m and an average delay of 3 seconds resulting in LOS A

- In 2018 the merge on the Highway from two lanes to one lane would have a 95th percentile queue of 355m and an average delay of 58 seconds resulting in LOS F, this would require the merge to occur a minimum of 355m east of the merge from the eastbound on ramp to ensure queues do not extend up the on-ramp
- In 2038 the merge from the eastbound on ramp to the left lane of the Highway would have a 95th percentile queue of 715m and an average delay of 330 seconds resulting in LOS F, this queue would extend beyond the ramp itself onto the bridge; and
- In 2038 the merge on the Highway from two lanes to one lane would have a 95th percentile queue of 6505m and an average delay of 3017 seconds resulting in LOS F. To avoid this queue impacting on airport traffic the merge would need to be located almost to Midway Point.

Based on these results it is recommended that the two eastbound lanes at the interchange be extended eastwards for as long as possible.

3.4.3 Merge from Overpass onto Highway (westbound)

The merge from the westbound on ramp onto a two-lane Tasman Highway has been modelled using SIDRA Intersection software. The 50/50 split of vehicles in the left/right lane has also been assumed for this location.

The results from the modelling are as follows, with full results and the layout used in the model included in Appendix B.

- In 2018 the merge from the westbound on ramp to the left lane of the Highway would have a 95th percentile queue of 4m and an average delay of 3 seconds resulting in LOS A; and
- In 2038 the merge from the westbound on ramp to the left lane of the Highway would have a 95th percentile queue of 66m and an average delay of 21 seconds resulting in LOS C.

Based on these results a two-lane Tasman Highway at the merge from the Holyman Avenue/ Kennedy Drive on ramp would be adequate.

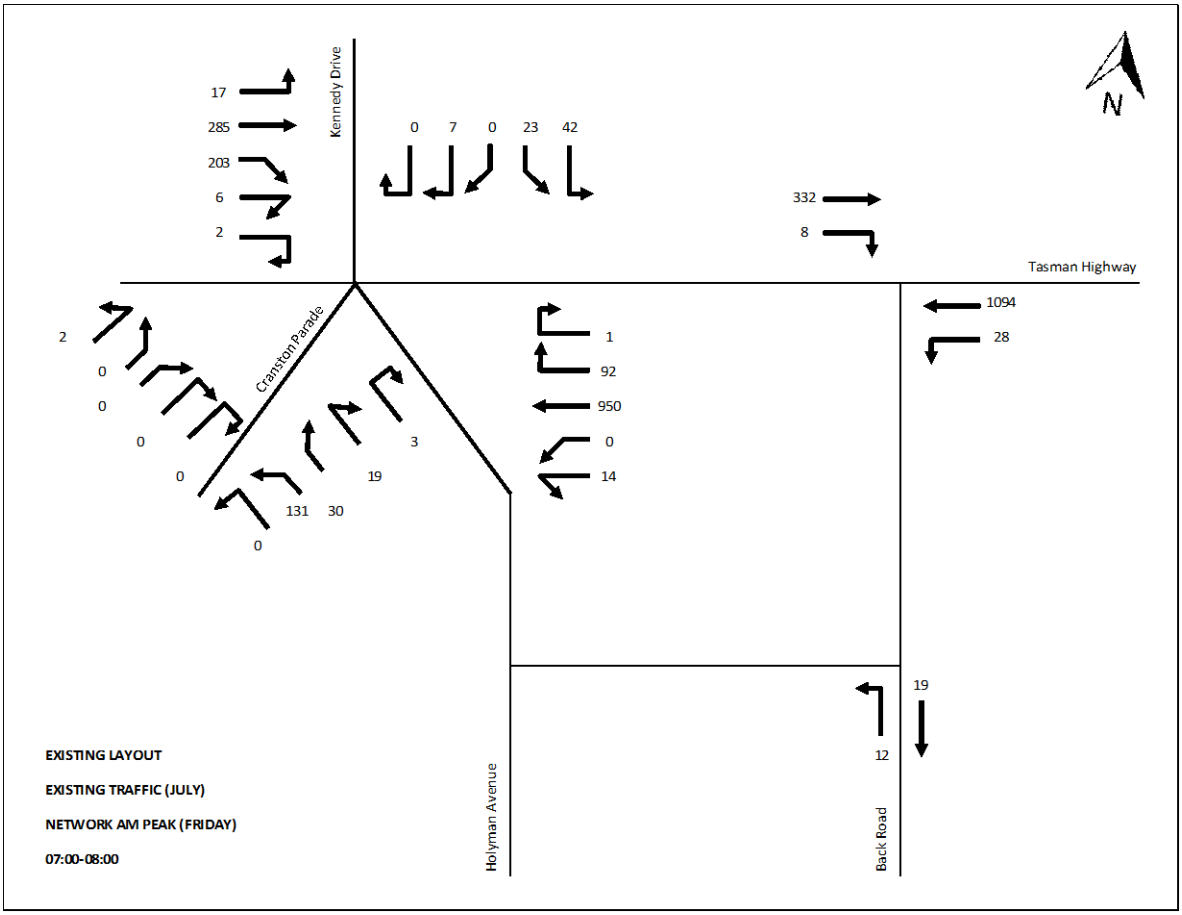
4. Conclusion

An assessment of the traffic impacts associated with the upgrade of Tasman Highway and Holyman Avenue Interchange in Cambridge as part of the Nation Building Program has been undertaken in accordance with the Department of State Growth's *Framework for Undertaking Traffic Impact Assessments.* The analysis and discussion presented in this report can be summarised as follows:

- A signalised diamond interchange with Holyman Avenue/Kennedy Drive passing over the Tasman Highway has been selected as the preferred option
- Modelling results for the existing roundabout indicates that upgrade of the intersection is necessary as the existing roundabout is no longer performing at an acceptable level.
- Modelling results for the proposed signalised diamond interchange shows that it is expected to operate efficiently in 2018 and 2038
- The proposed signalised diamond interchange will provide reliable access to the airport
- One lane along Tasman Highway at the overpass is inadequate for eastbound travel and approaching capacity for westbound travel; and
- The two eastbound lanes at the proposed interchange should be extended eastwards for as long as possible.

Appendix A

Traffic Volumes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NETWORK AM PEAK (FRIDAY)
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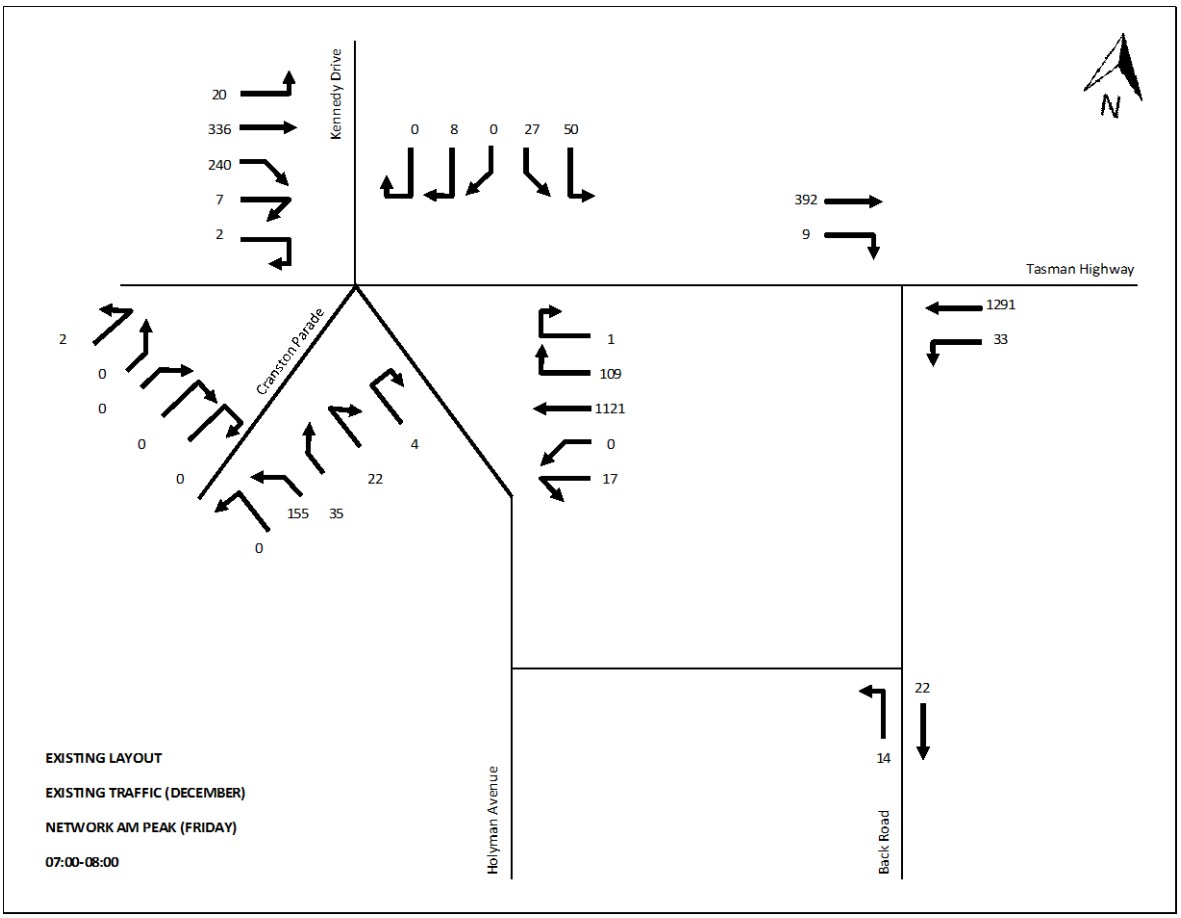
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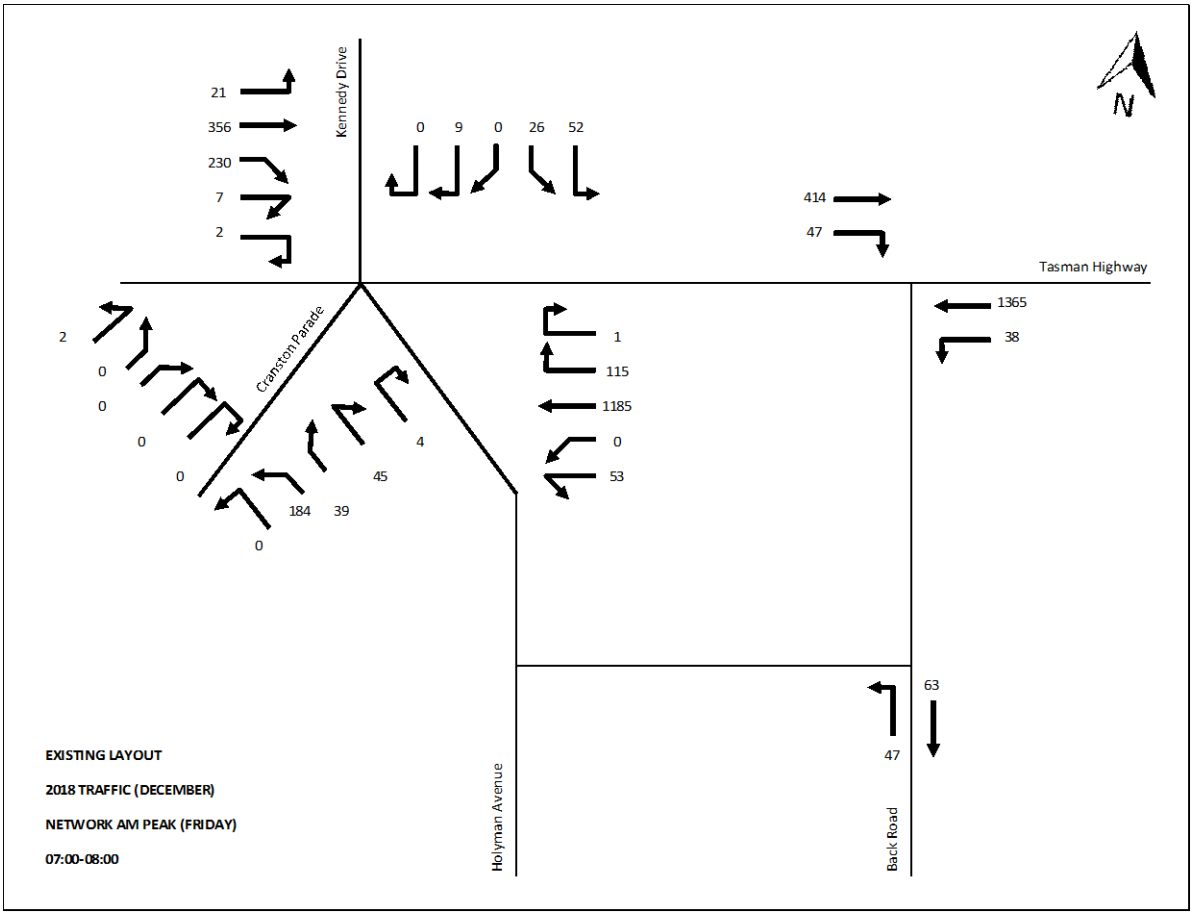
NETWORK AM PEAK (FRIDAY)
07:00-08:00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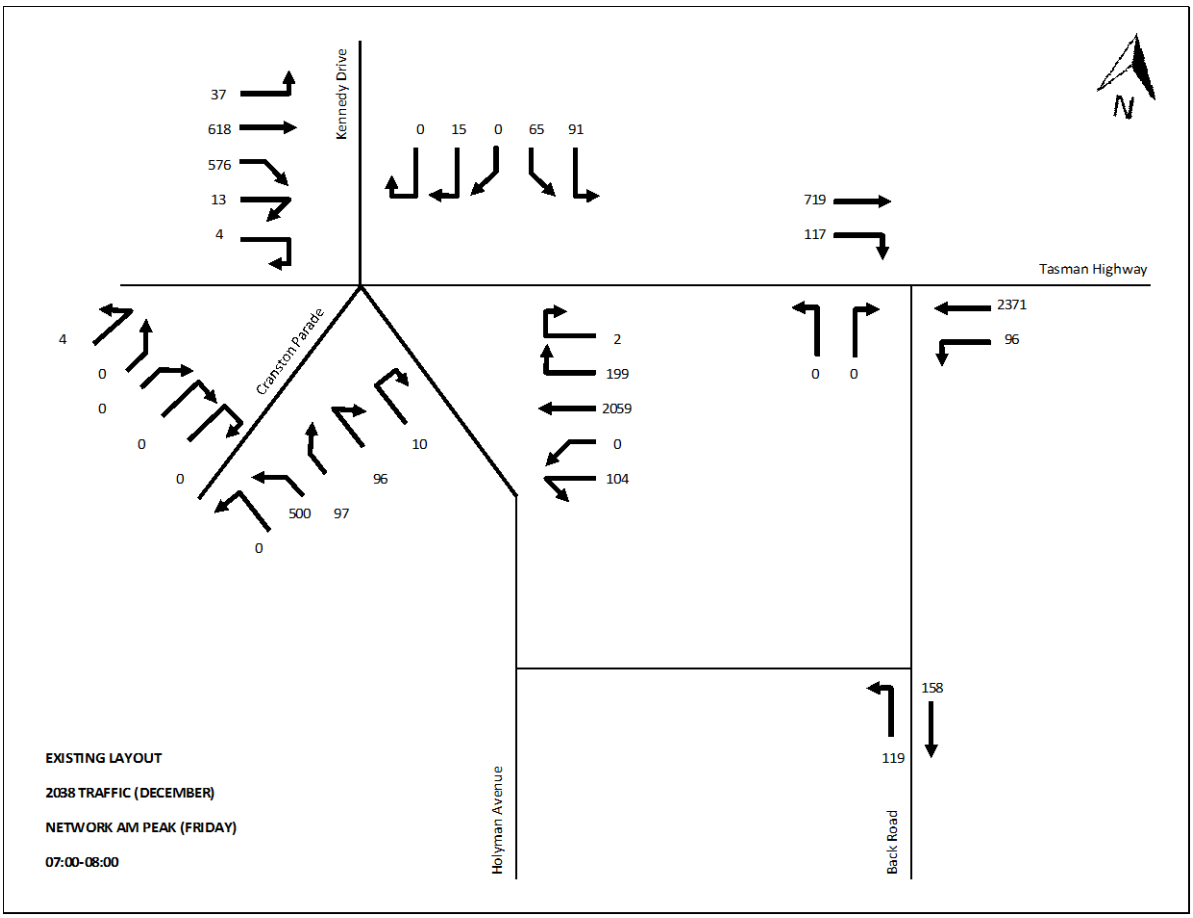
07:00-08:00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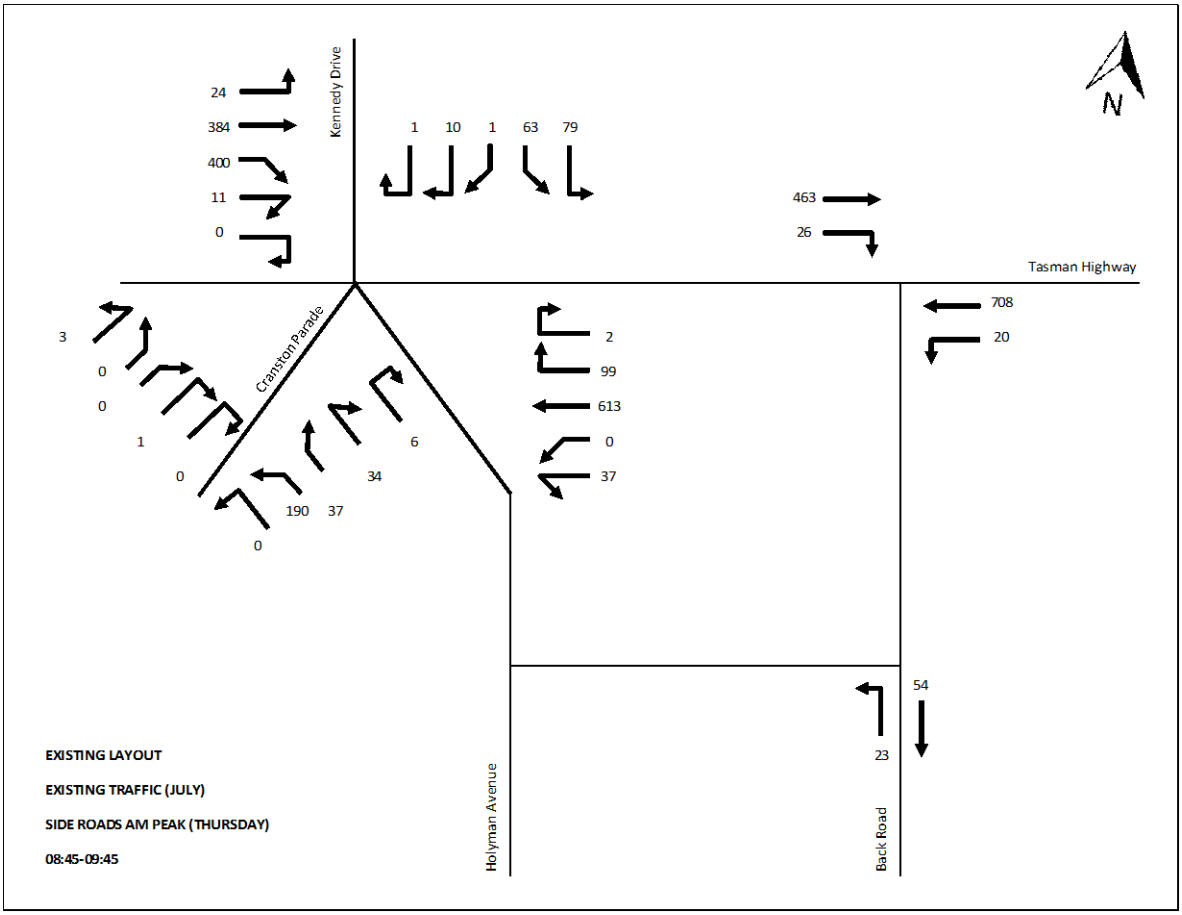
07:00-08:00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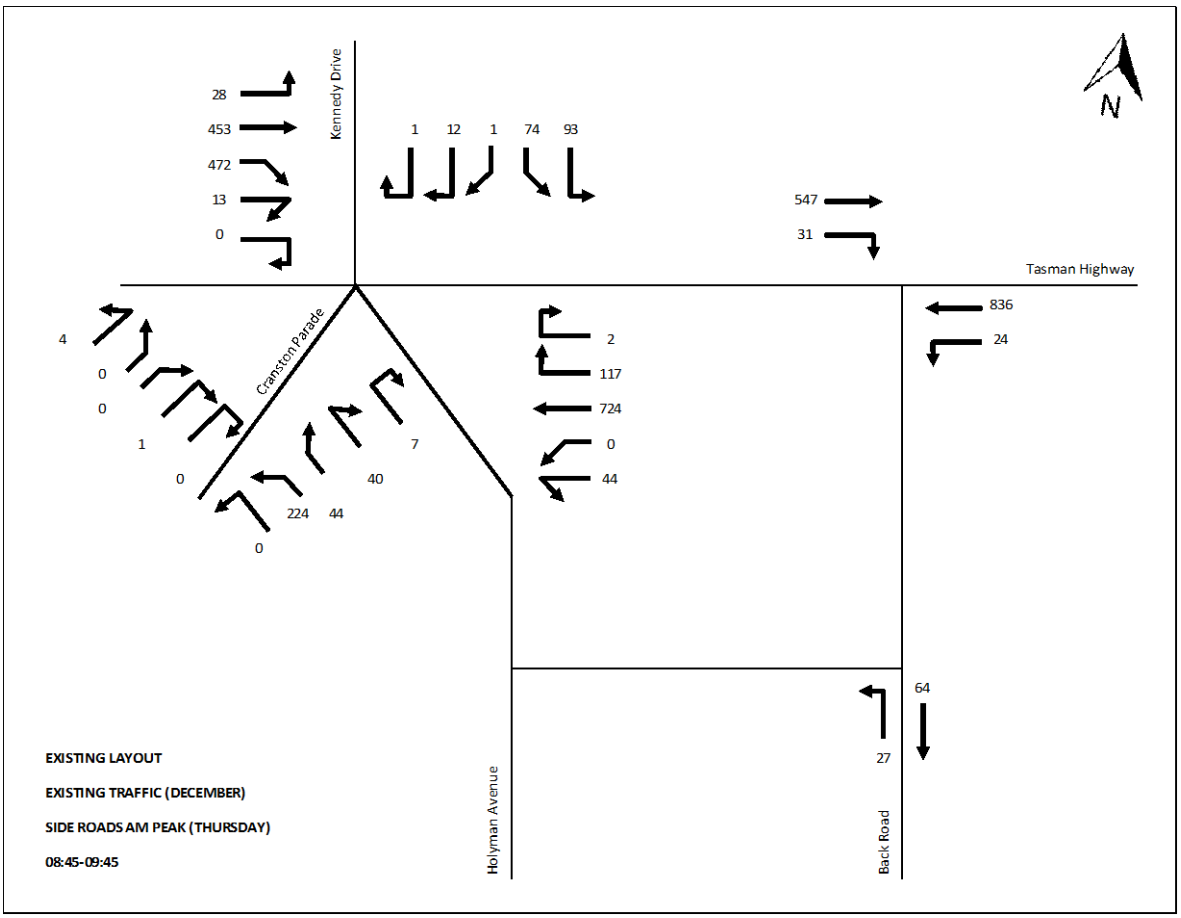
08:45-09:45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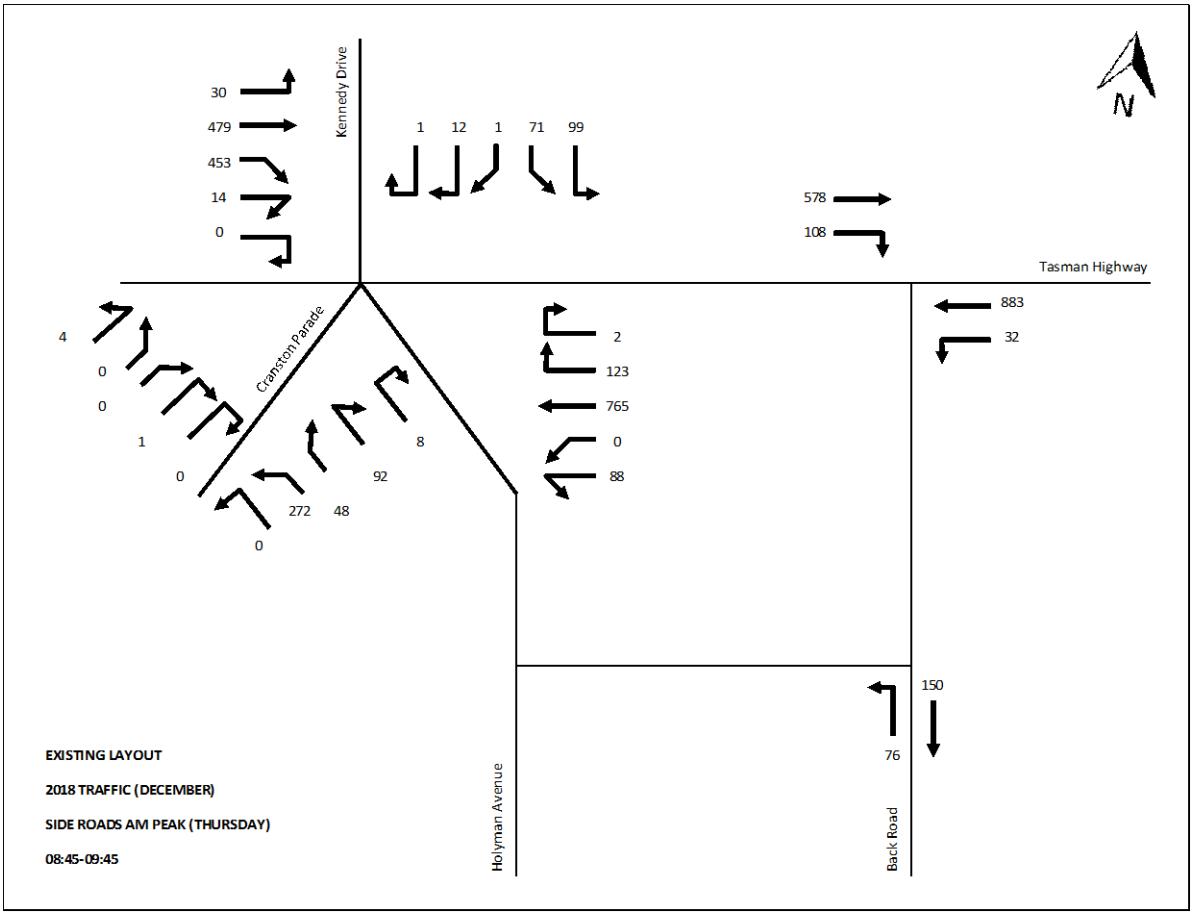
08:45-09:45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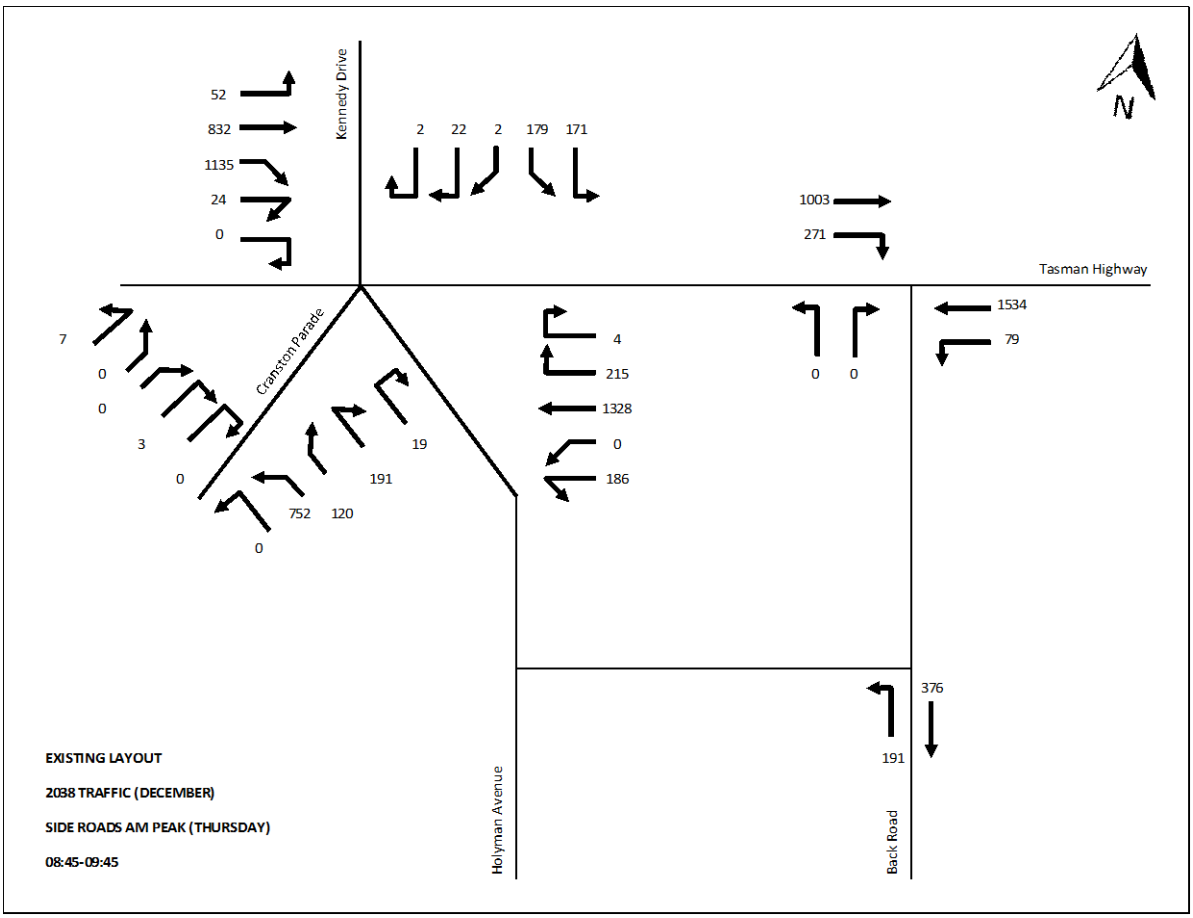
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215
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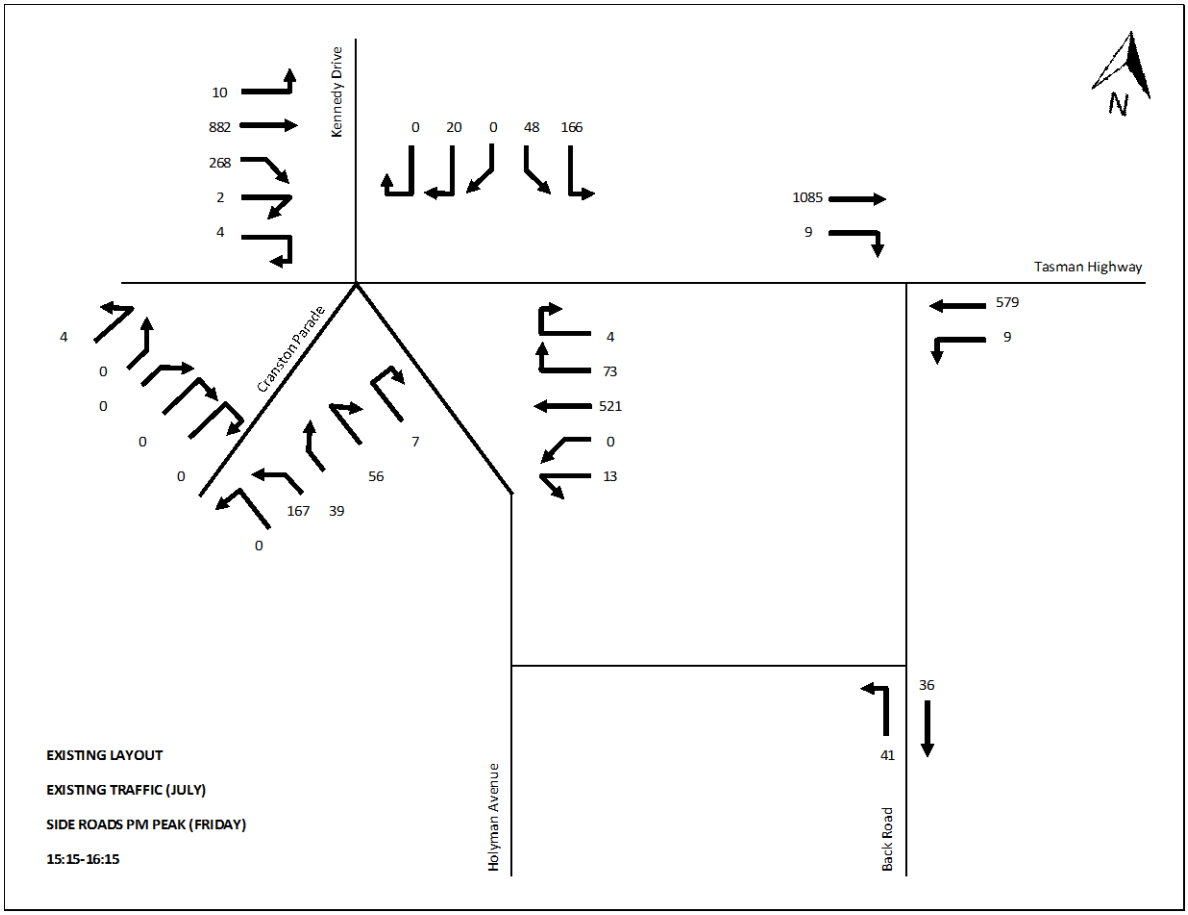
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73
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36
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Holyman Avenue
Back Road
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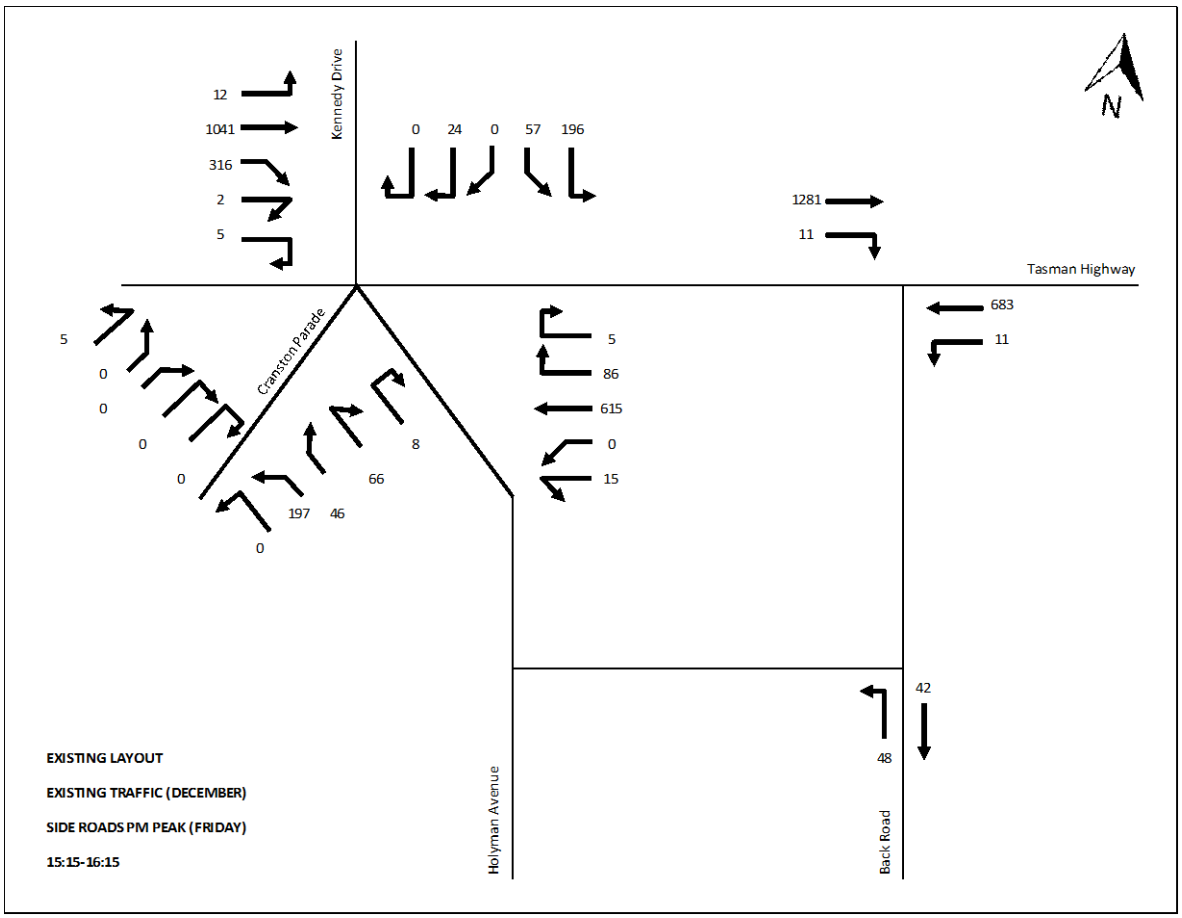
EXISTING LAYOUT
EXISTING TRAFFIC (JULY)
SIDE ROADS PM PEAK (FRIDAY)
15:15-16:15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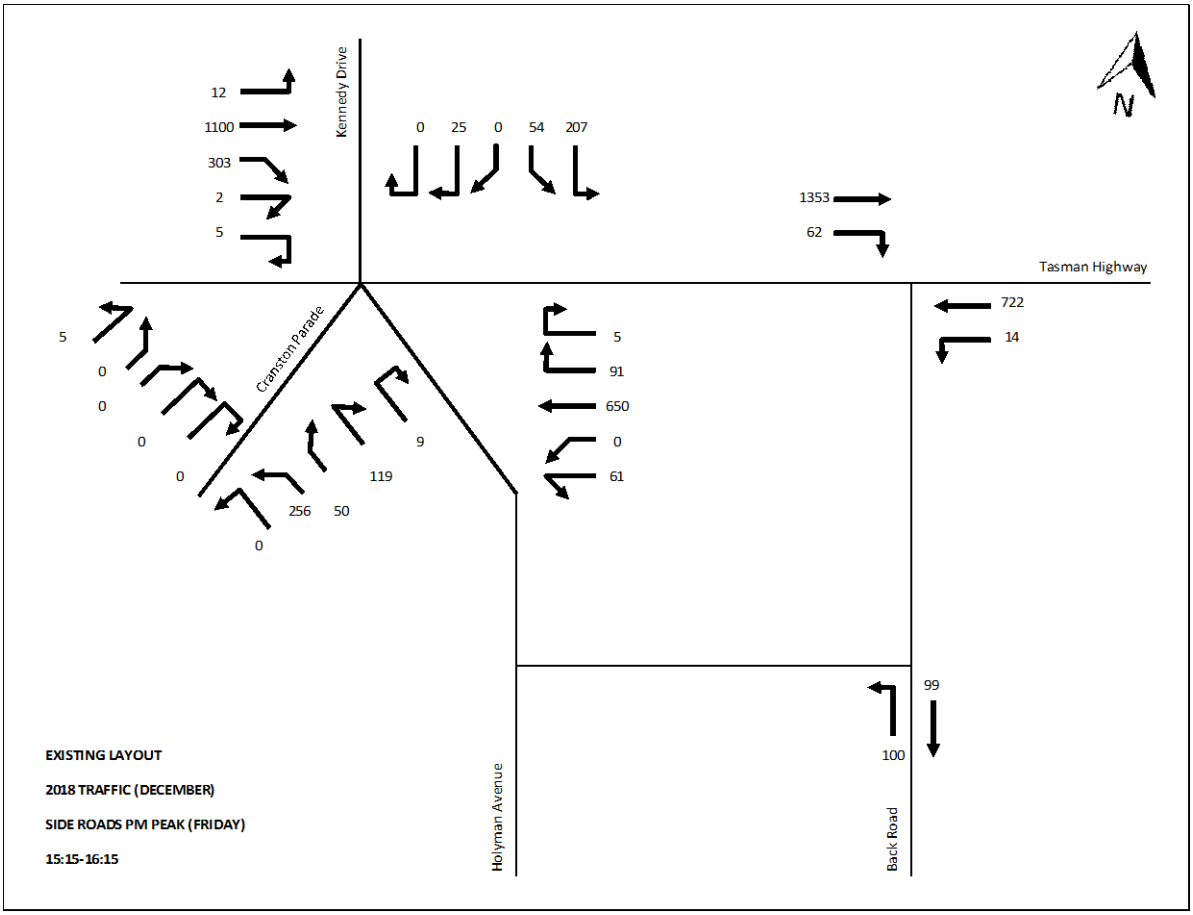
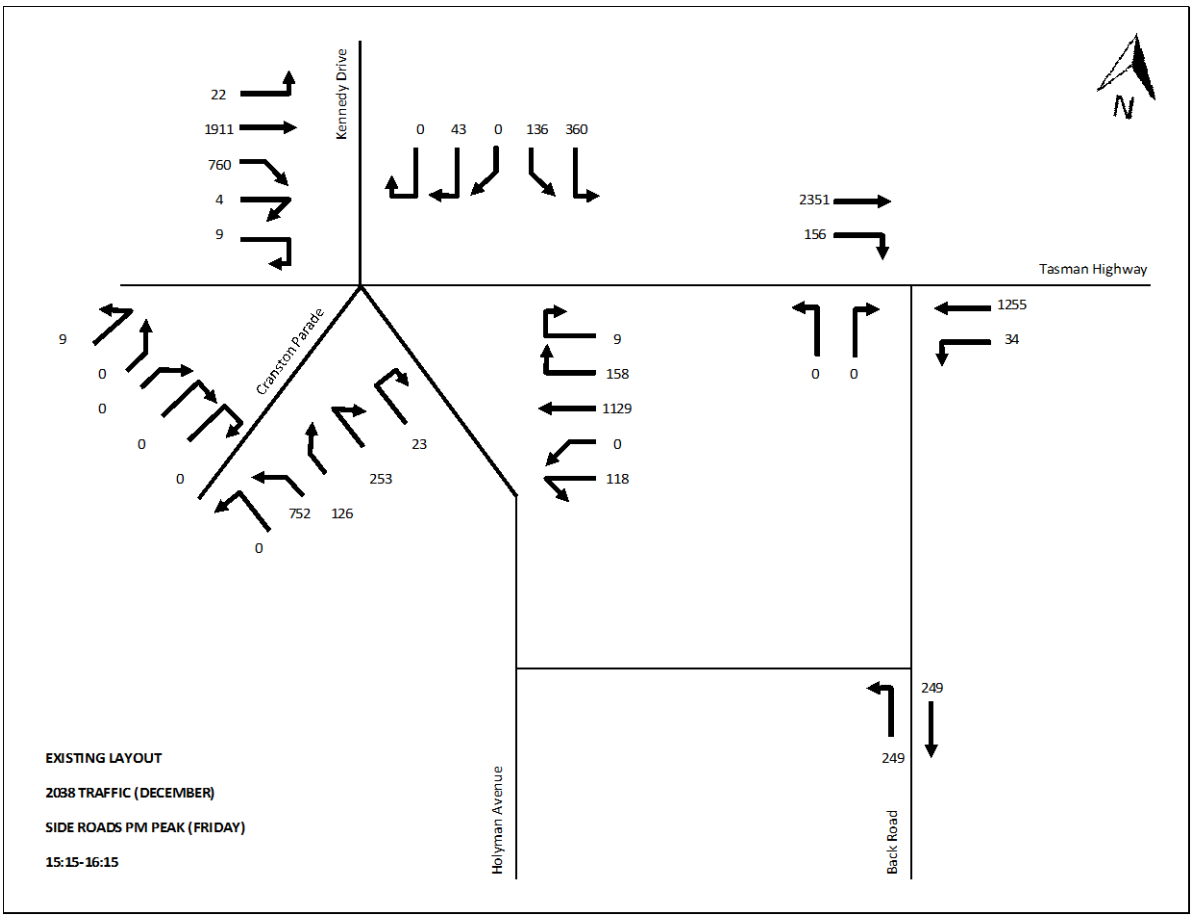
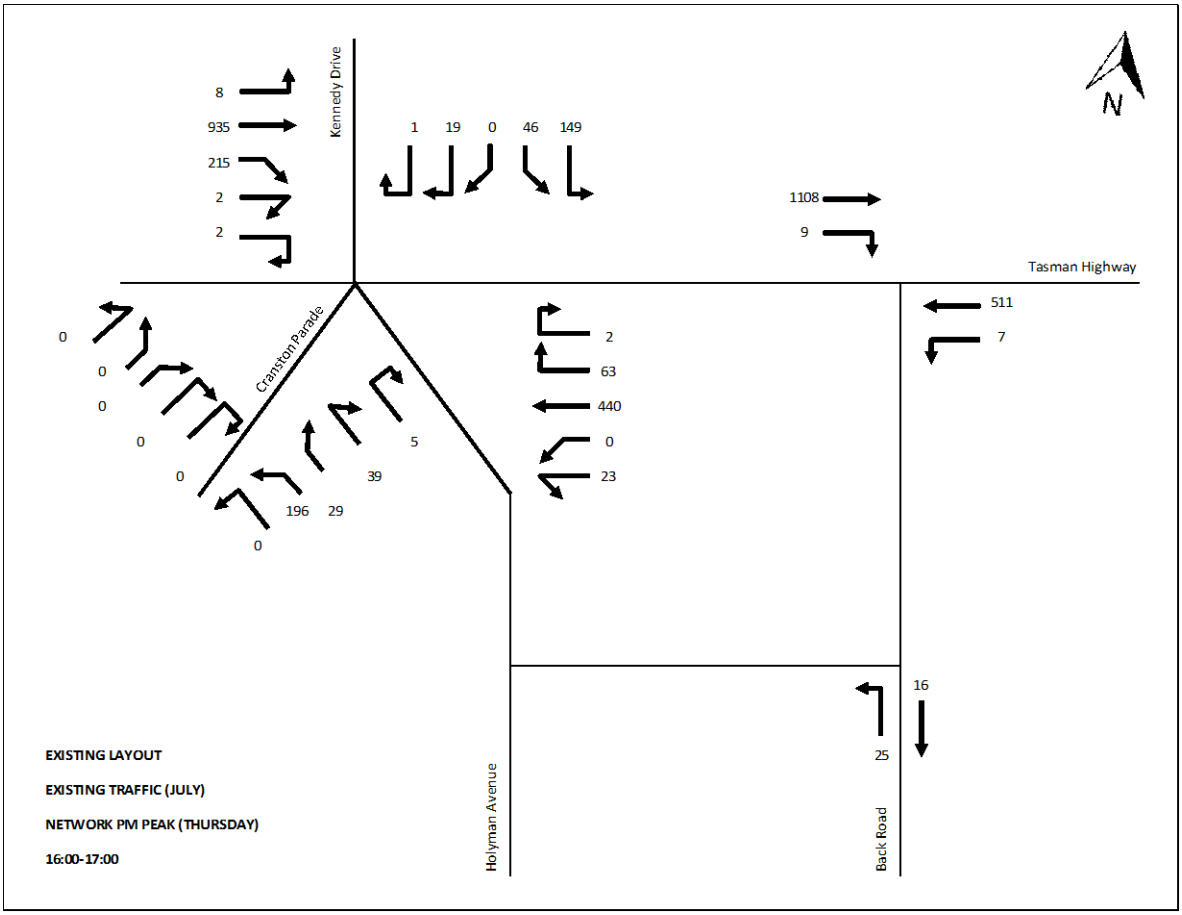
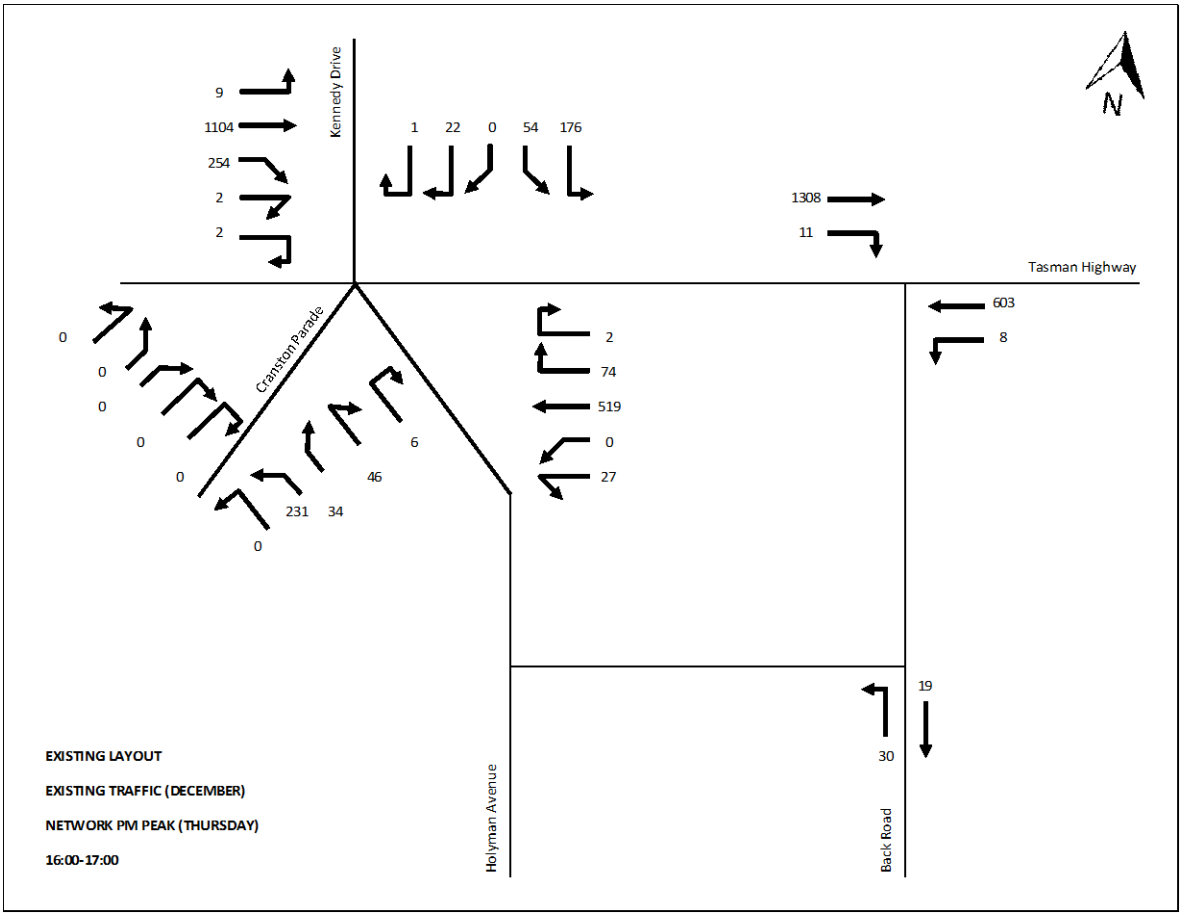
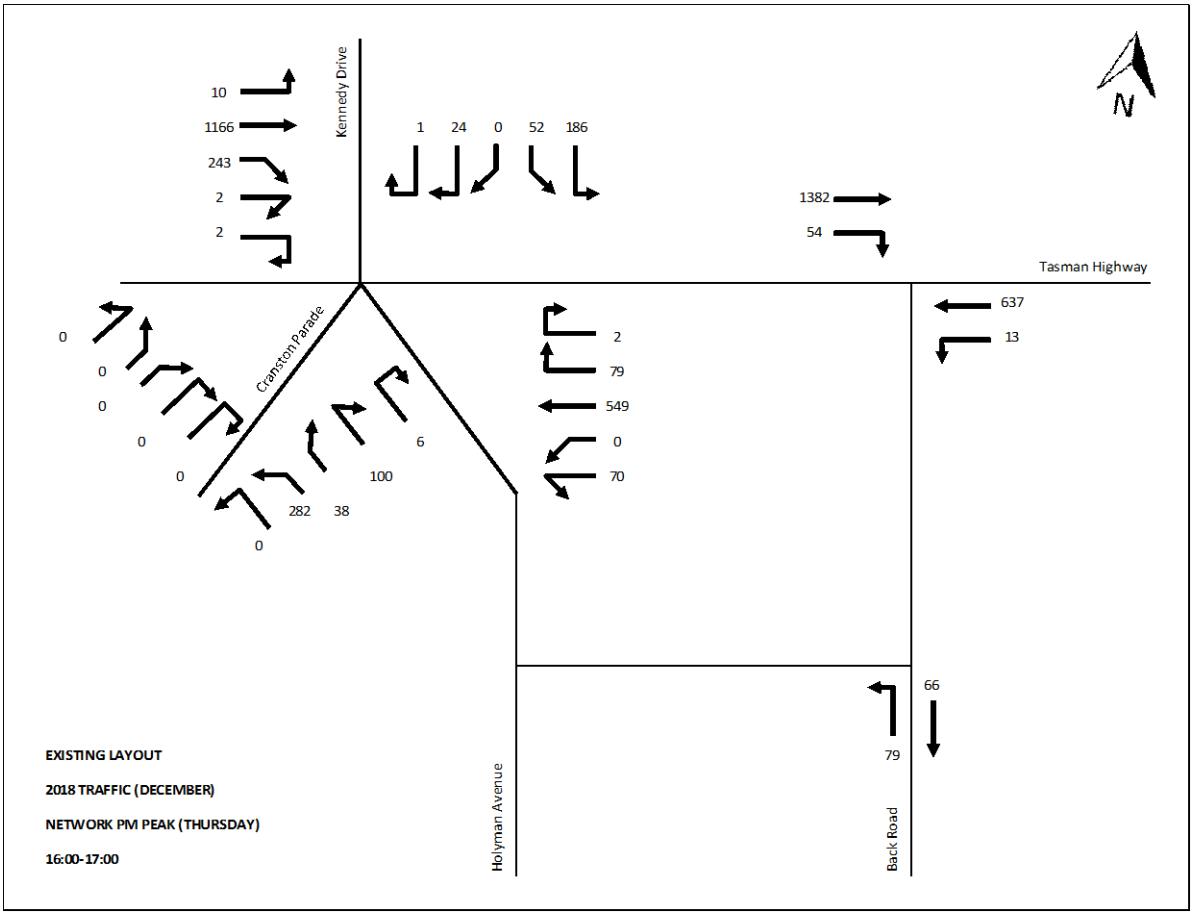
12
1041
316
2
5
0 24 0 57 196
1281
11
Tasman Highway
683
11
Cranston Parade
5
0
0
0
0
8
66
197 46
0
5
86
615
0
15
42
48
Holyman Avenue
Back Road
N
EXISTING LAYOUT
EXISTING TRAFFIC (DECEMBER)
SIDE ROADS PM PEAK (FRIDAY)
15:15-16:15

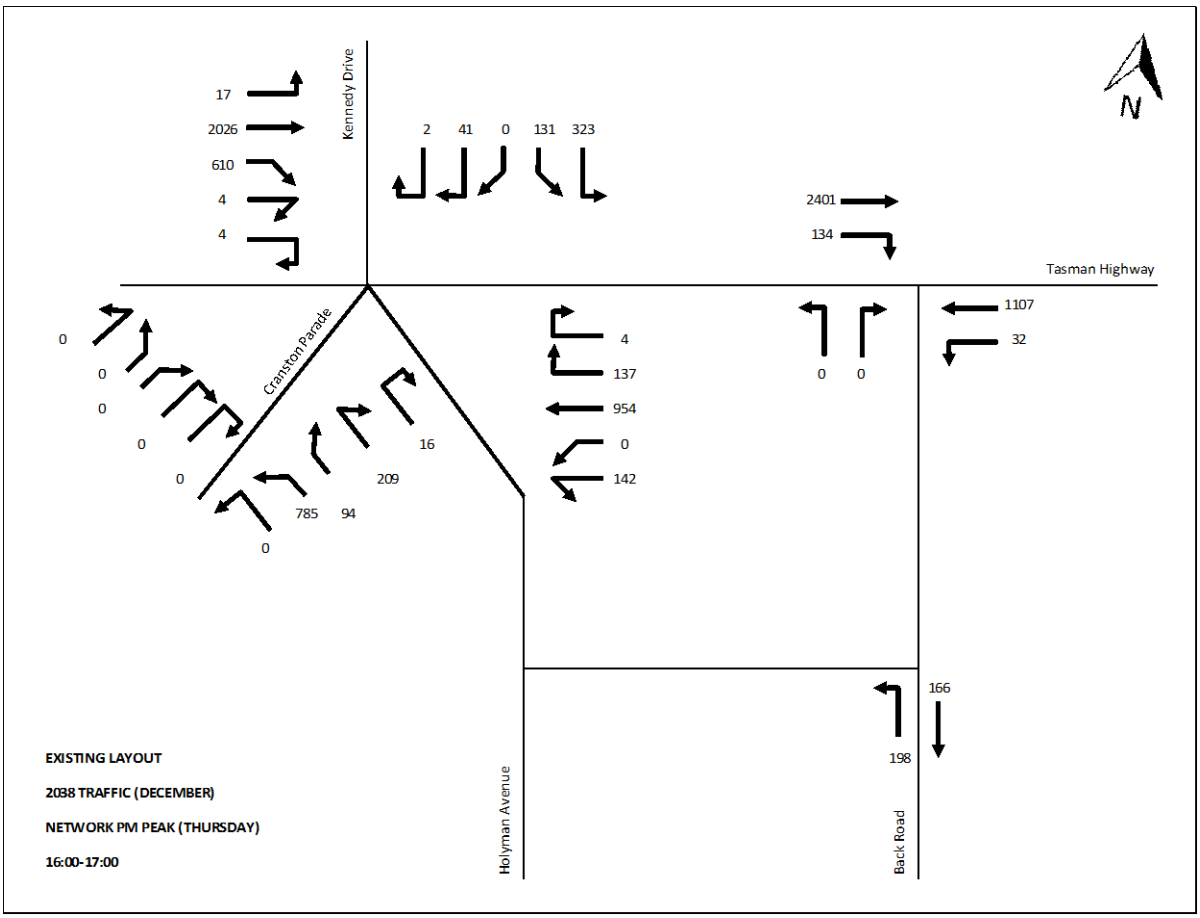

Kennedy Drive
12
1100
303
2
5
0 25 0 54 207
1353
62
Tasman Highway
722
14
Cranston Parade
5
0
0
0
0
9
119
256 50
0
5
91
650
0
61
Holyman Avenue
100
99
Back Road
N
EXISTING LAYOUT
2018 TRAFFIC (DECEMBER)
SIDE ROADS PM PEAK (FRIDAY)
15:15-16:15

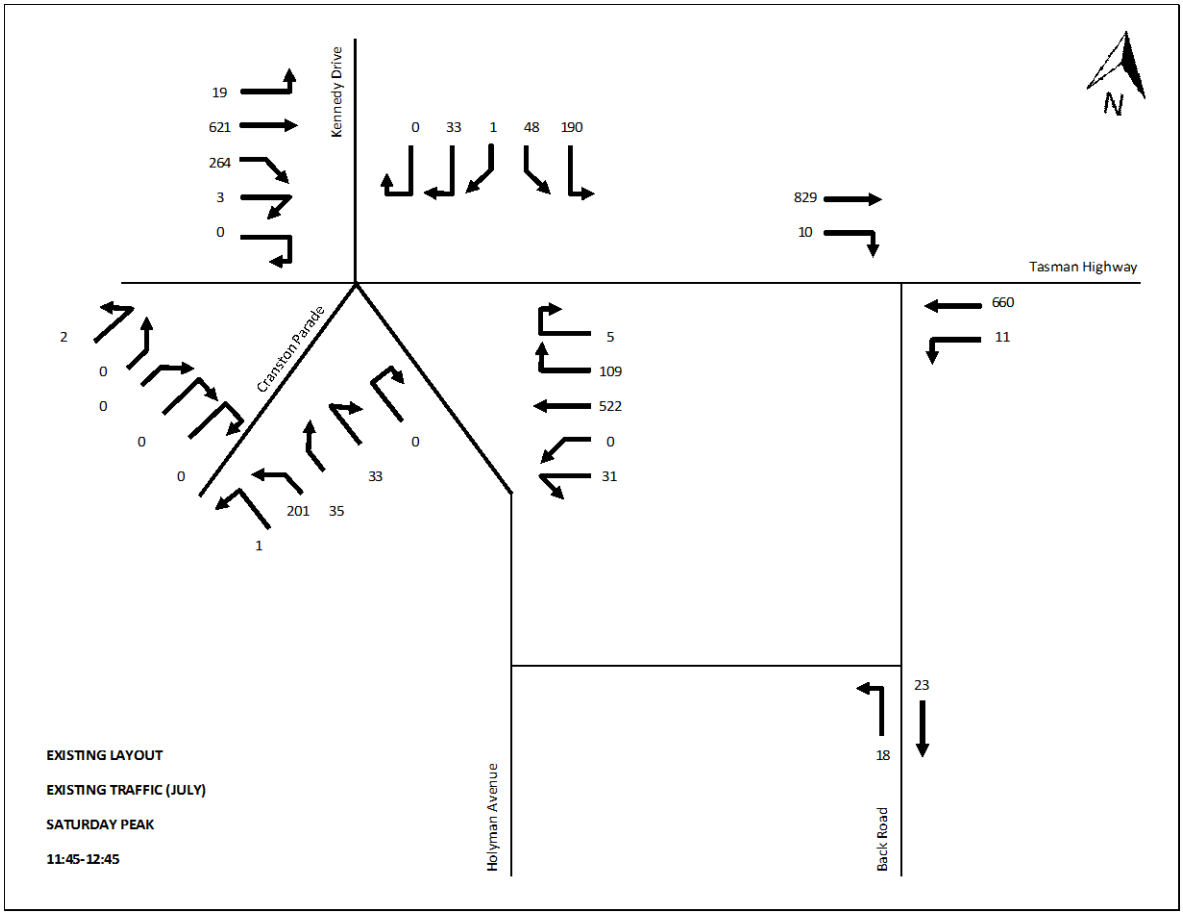

Kennedy Drive
22
1911
760
4
9
0 43 0 136 360
2351
156
Tasman Highway
1255
34
Cranston Parade
9
0
0
0
0
23
253
752 126
0
9
158
1129
0
118
0 0
Holyman Avenue
249
249
Back Road
N
EXISTING LAYOUT
2038 TRAFFIC (DECEMBER)
SIDE ROADS PM PEAK (FRIDAY)
15:15-16:15

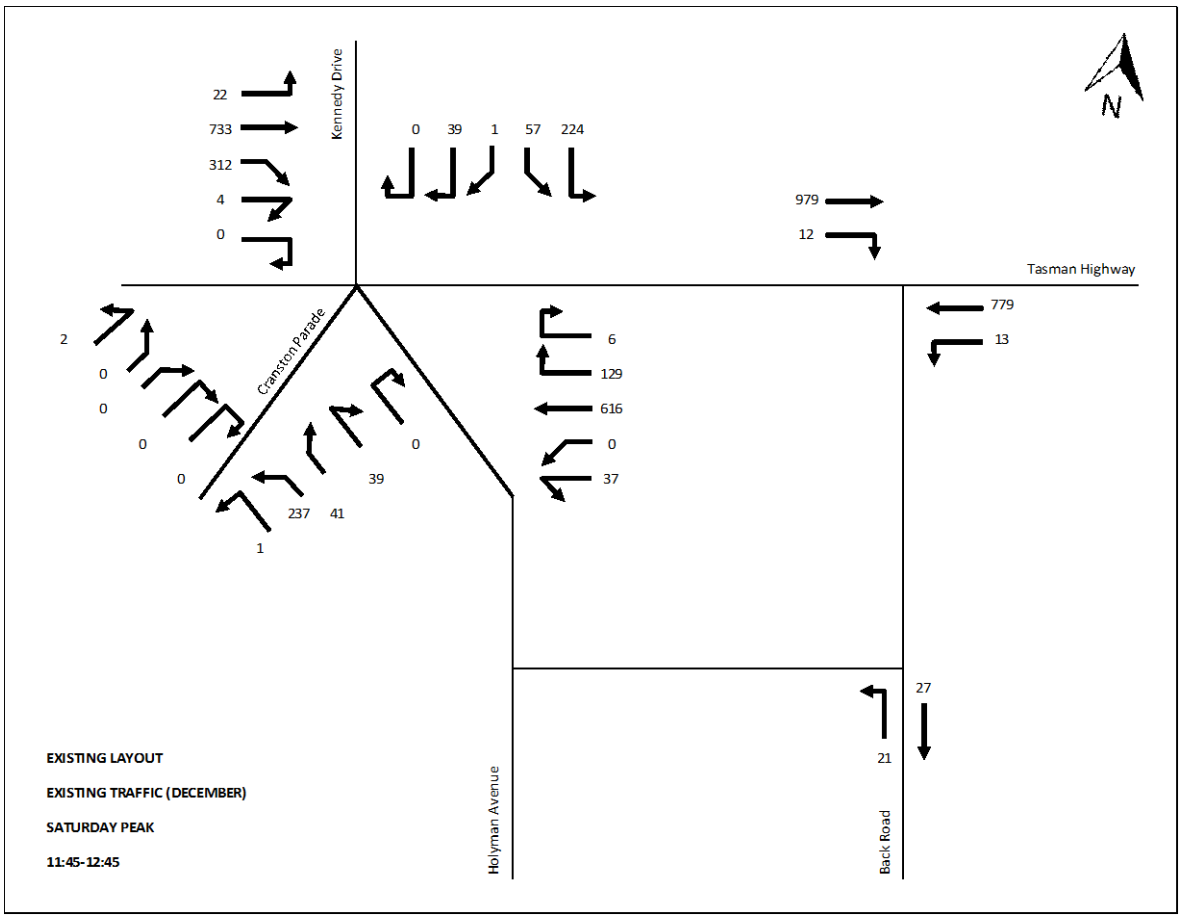

Kennedy Drive
Tasman Highway
Cranston Parade
Holyman Avenue
Back Road
N
8
935
215
2
2
1 19 0 46 149
1108
9
511
7
0
0
0
0
0
5
39
196 29
0
2
63
440
0
23
16
25
EXISTING LAYOUT
EXISTING TRAFFIC (JULY)
NETWORK PM PEAK (THURSDAY)
16:00-17:00

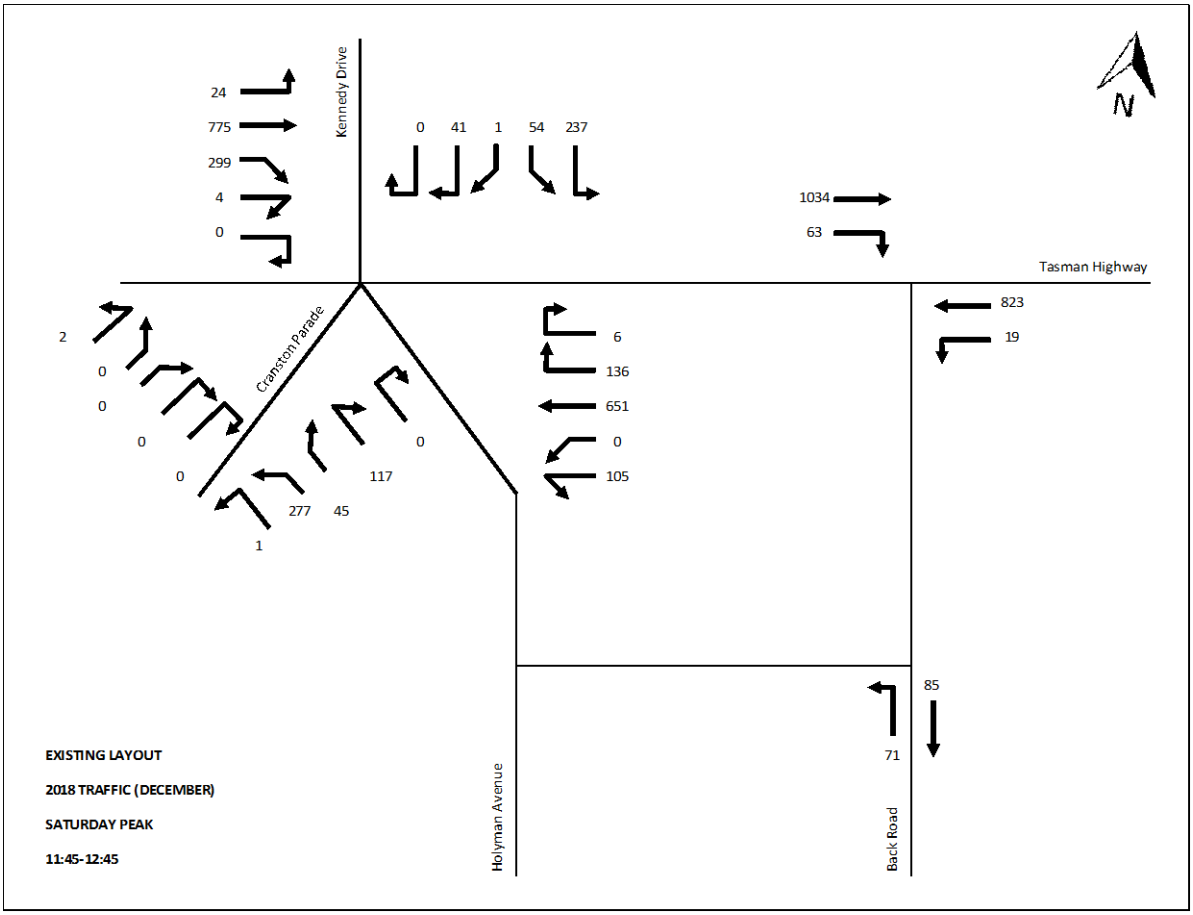

Kennedy Drive
Tasman Highway
Cranston Parade
Holyman Avenue
Back Road
N
9
1104
254
2
2
1 22 0 54 176
1308
11
603
8
0
0
0
0
0
6
46
231 34
0
2
74
519
0
27
19
30
EXISTING LAYOUT
EXISTING TRAFFIC (DECEMBER)
NETWORK PM PEAK (THURSDAY)
16:00-17:00

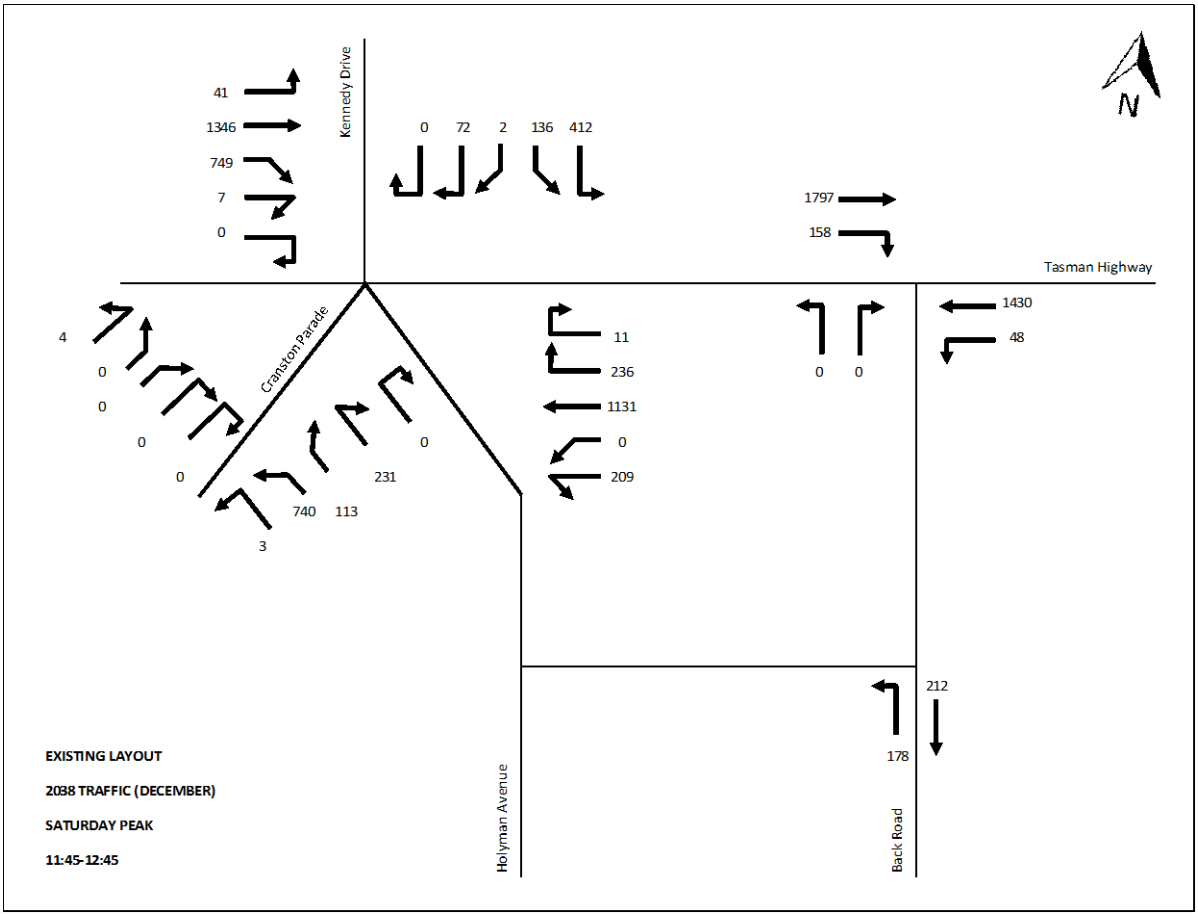

Kennedy Drive
10
1166
243
2
2
1
24
0
52
186
1382
54
Tasman Highway
637
13
Cranston Parade
0
0
0
0
0
6
100
282
38
0
2
79
549
0
70
Holyman Avenue
79
66
Back Road
N
EXISTING LAYOUT
2018 TRAFFIC (DECEMBER)
NETWORK PM PEAK (THURSDAY)
16:00-17:00

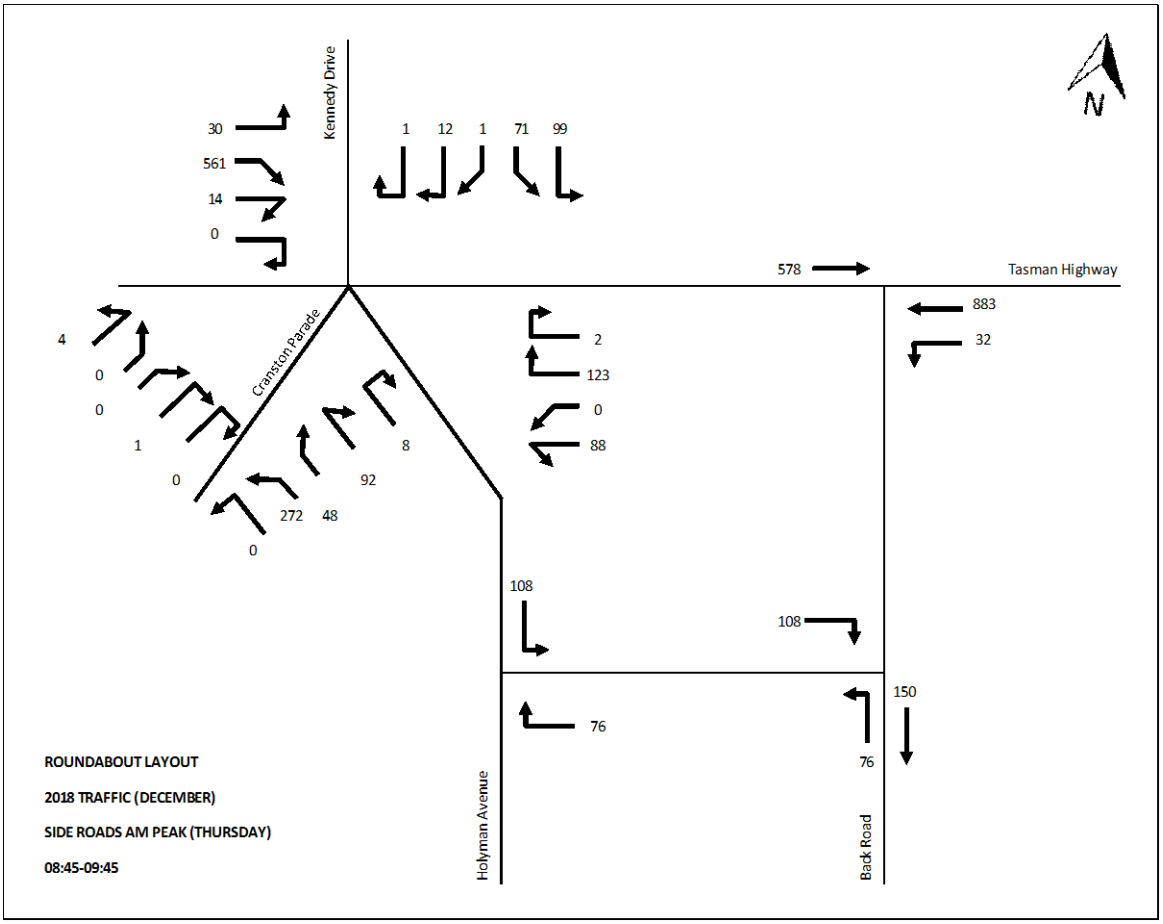

Kennedy Drive
17
2026
610
4
4
2
41
0
131
323
2401
134
Tasman Highway
1107
32
Cranston Parade
0
0
0
0
0
16
209
785
94
0
4
137
954
0
142
0
0
Holyman Avenue
198
166
Back Road
N
EXISTING LAYOUT
2038 TRAFFIC (DECEMBER)
NETWORK PM PEAK (THURSDAY)
16:00-17:00

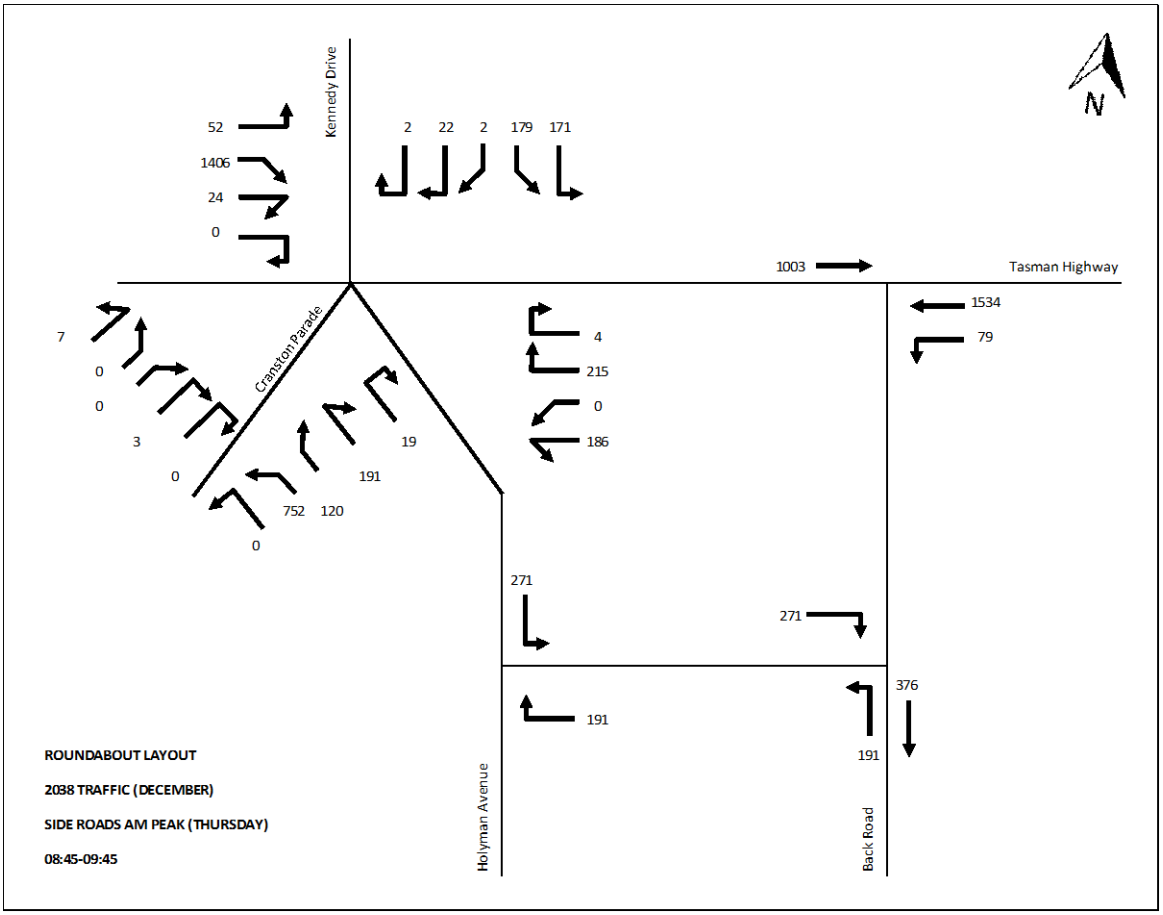

Kennedy Drive
Tasman Highway
Cranston Parade
Holyman Avenue
Back Road
N
19
621
264
3
0
0 33 1 48 190
829
10
660
11
2
0
0
0
0
0
33
201 35
1
5
109
522
0
31
23
18
EXISTING LAYOUT
EXISTING TRAFFIC (JULY)
SATURDAY PEAK
11:45-12:45

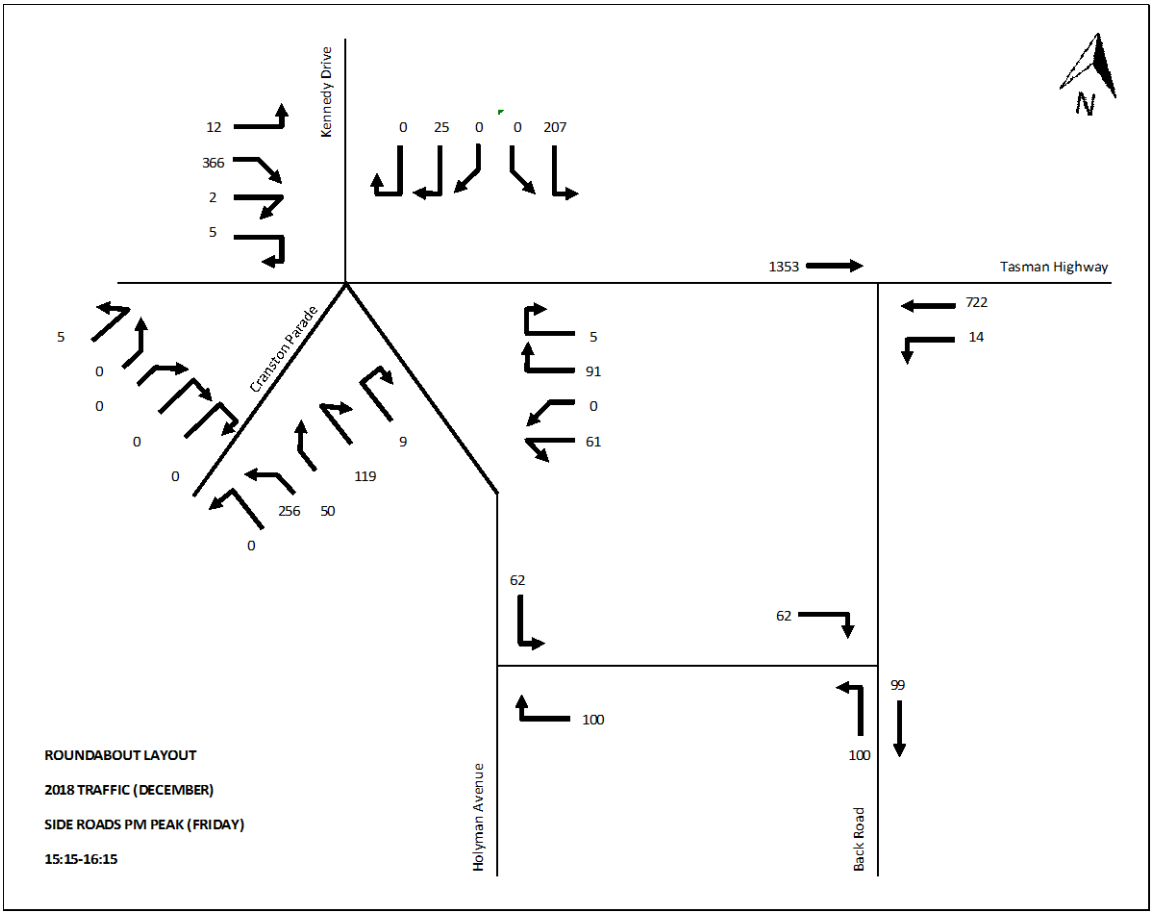

Kennedy Drive
Tasman Highway
Cranston Parade
Holyman Avenue
Back Road
N
22
733
312
4
0
0 39 1 57 224
979
12
779
13
2
0
0
0
0
0
39
237 41
1
6
129
616
0
37
27
21
EXISTING LAYOUT
EXISTING TRAFFIC (DECEMBER)
SATURDAY PEAK
11:45-12:45

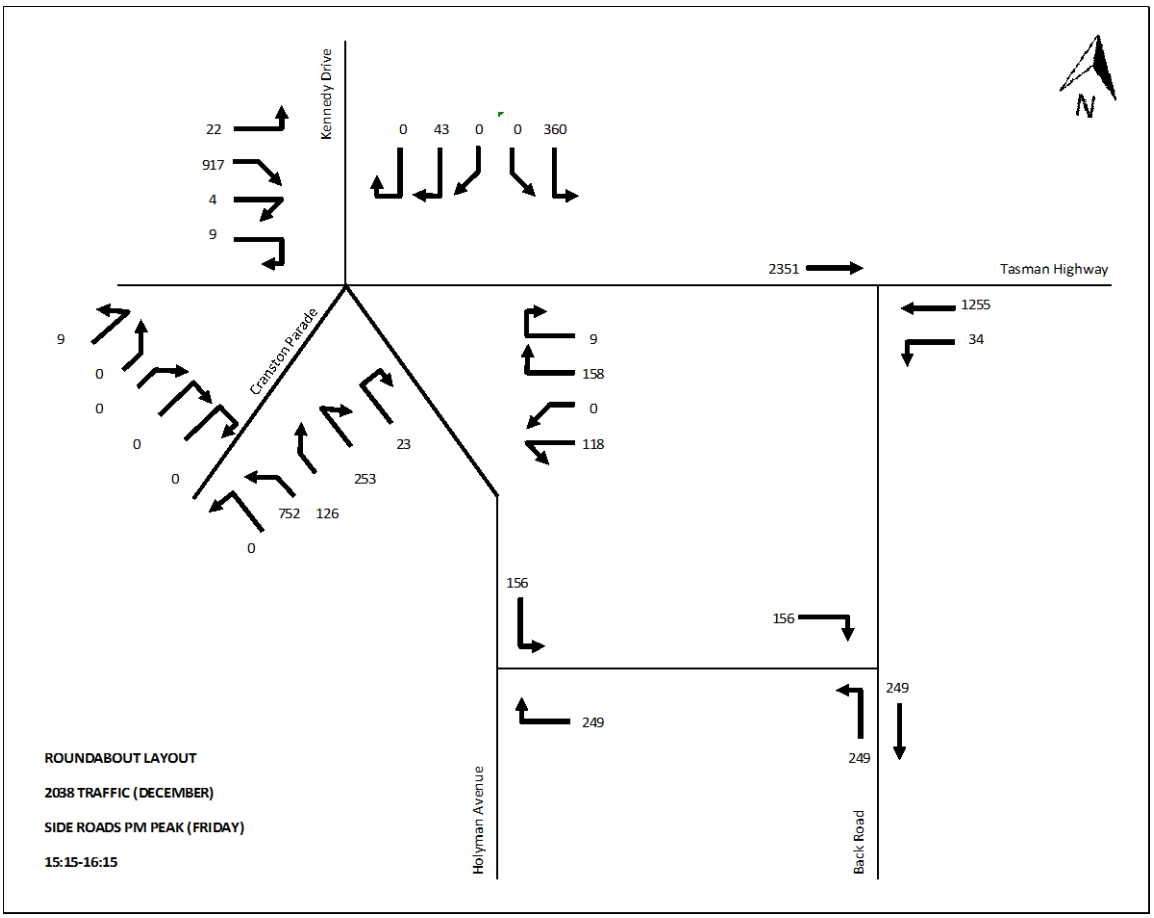

Kennedy Drive
24
775
299
4
0
0 41 1 54 237
1034
63
Tasman Highway
823
19
Cranston Parade
2
0
0
0
0
0
117
277 45
1
6
136
651
0
105
85
71
Holyman Avenue
Back Road
N
EXISTING LAYOUT
2018 TRAFFIC (DECEMBER)
SATURDAY PEAK
11:45-12:45

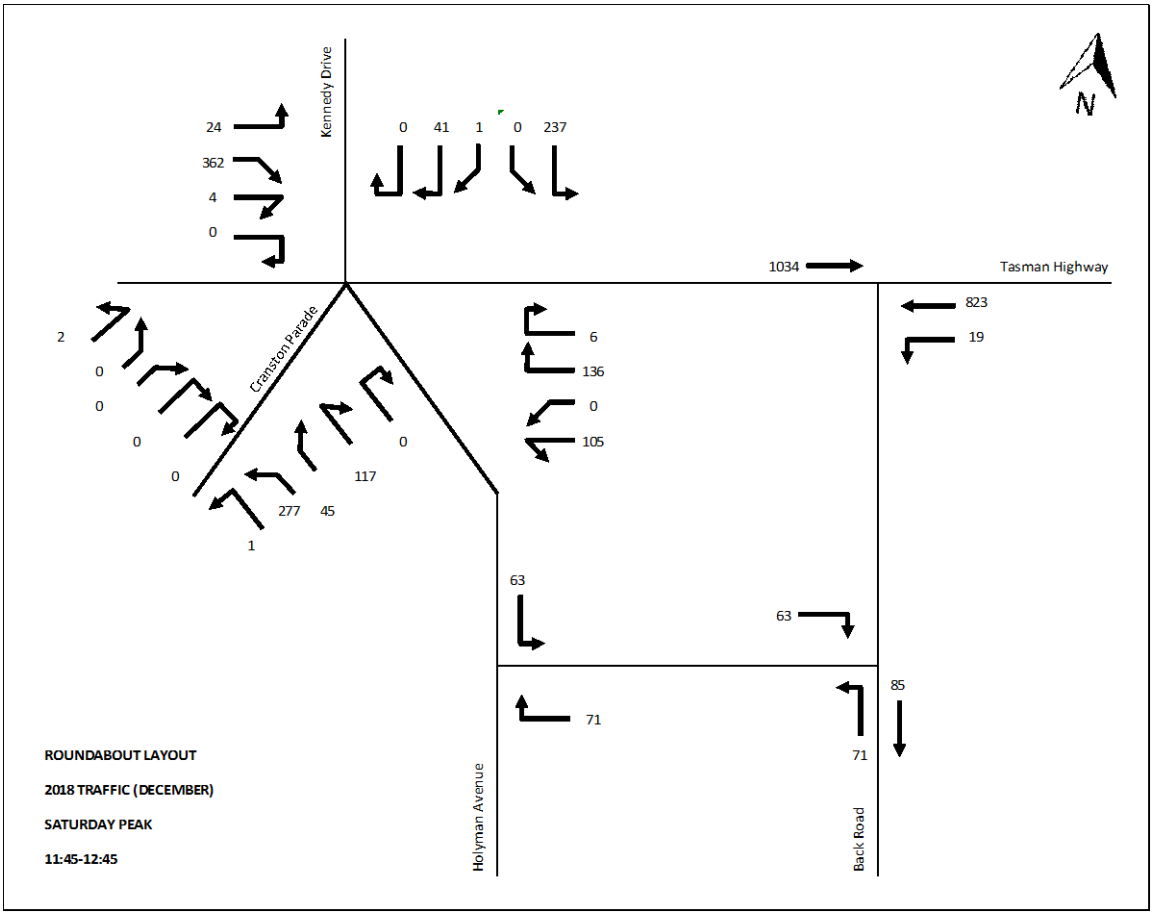

Kennedy Drive
41
1346
749
7
0
0 72 2 136 412
1797
158
Tasman Highway
1430
48
0 0
Cranston Parade
4
0
0
0
0
0
231
740 113
3
11
236
1131
0
209
212
178
Holyman Avenue
Back Road
N
EXISTING LAYOUT
2038 TRAFFIC (DECEMBER)
SATURDAY PEAK
11:45-12:45

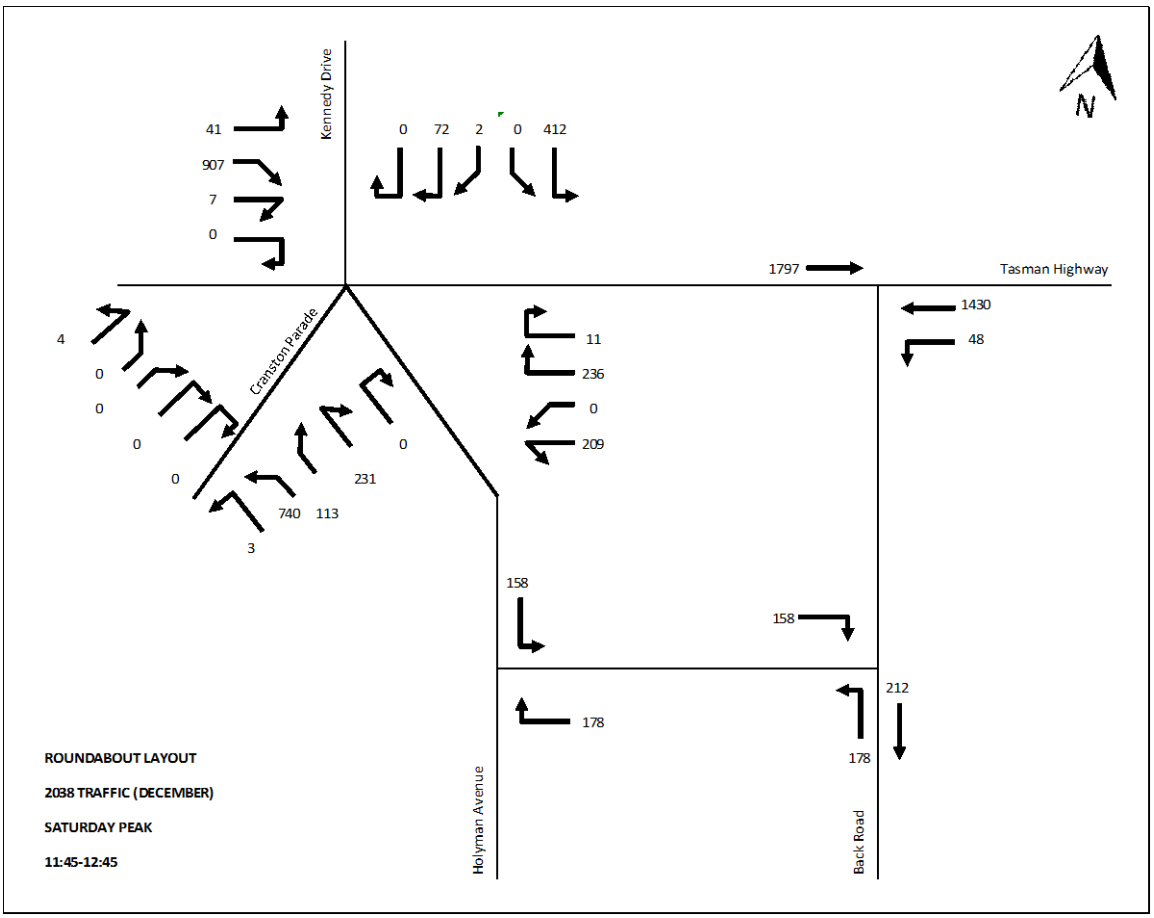

Kennedy Drive
30
561
14
0
1 12 1 71 99
578
Tasman Highway
883
32
4
0
0
1
0
Cranston Parade
272 48
0
92
8
2
123
0
88
108
108
76
76
150
Holyman Avenue
Back Road
N
ROUNDABOUT LAYOUT
2018 TRAFFIC (DECEMBER)
SIDE ROADS AM PEAK (THURSDAY)
08:45-09:45

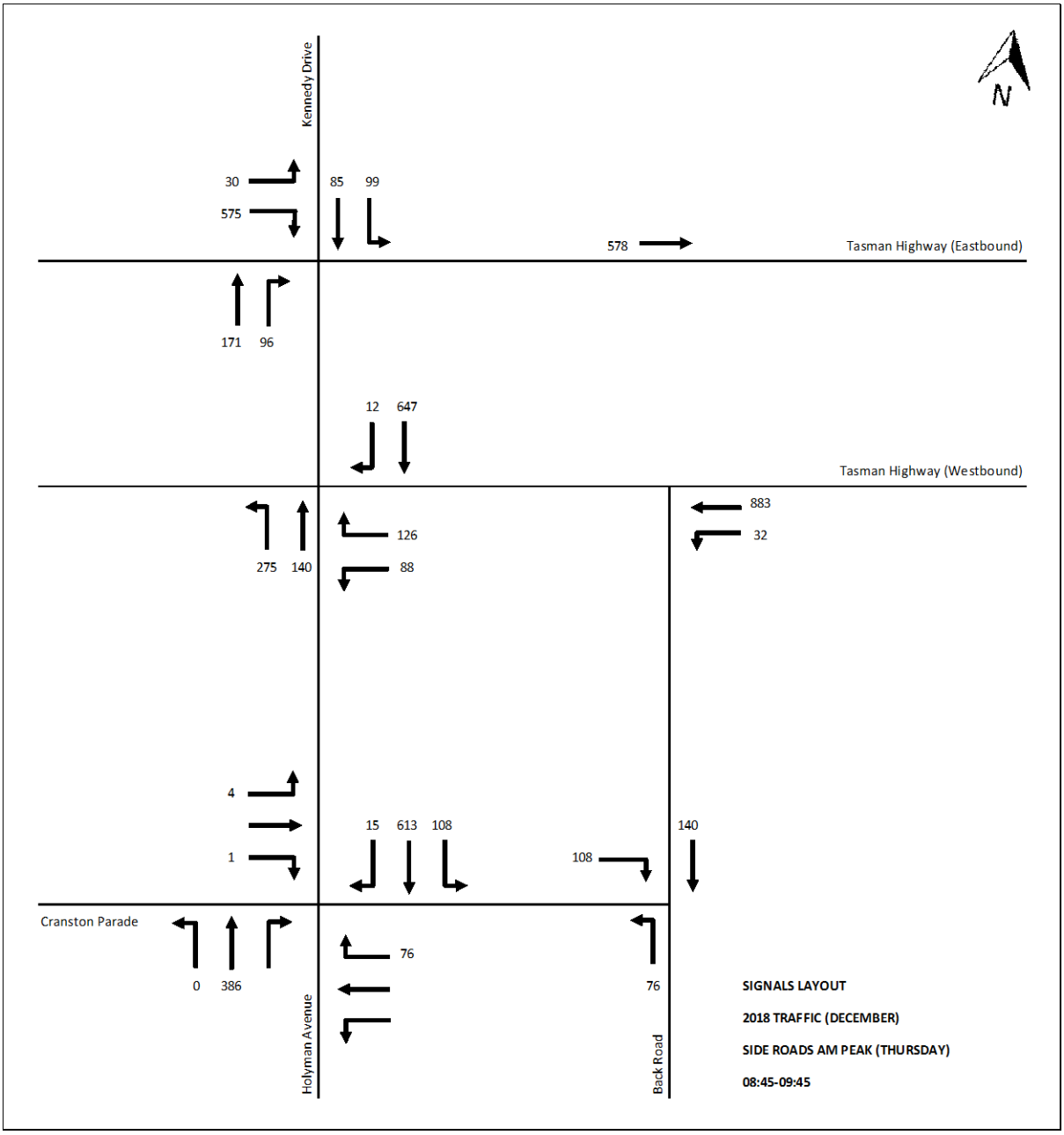

Kennedy Drive
52
1406
24
0
2 22 2 179 171
1003
Tasman Highway
1534
79
7
0
0
3
0
Cranston Parade
752 120
0
191
19
4
215
0
186
271
271
191
191
376
Holyman Avenue
Back Road
N
ROUNDABOUT LAYOUT
2038 TRAFFIC (DECEMBER)
SIDE ROADS AM PEAK (THURSDAY)
08:45-09:45

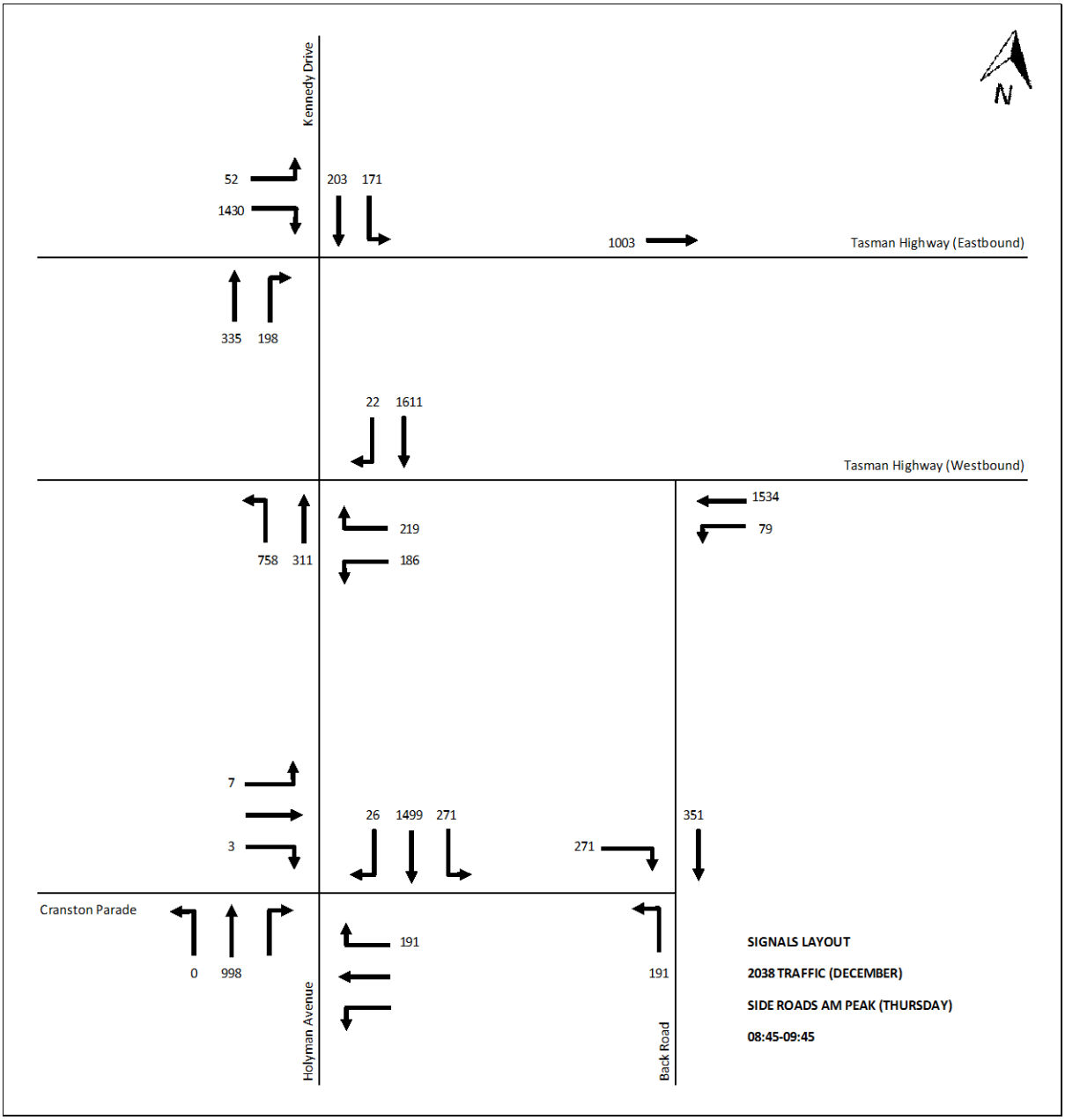

Kennedy Drive
12
366
2
5
0 25 0 0 207
1353
Tasman Highway
722
14
Cranston Parade
5
0
0
0
0
9
119
256 50
0
5
91
0
61
62
62
100
99
100
Holyman Avenue
Back Road
N
ROUNDABOUT LAYOUT
2018 TRAFFIC (DECEMBER)
SIDE ROADS PM PEAK (FRIDAY)
15:15-16:15

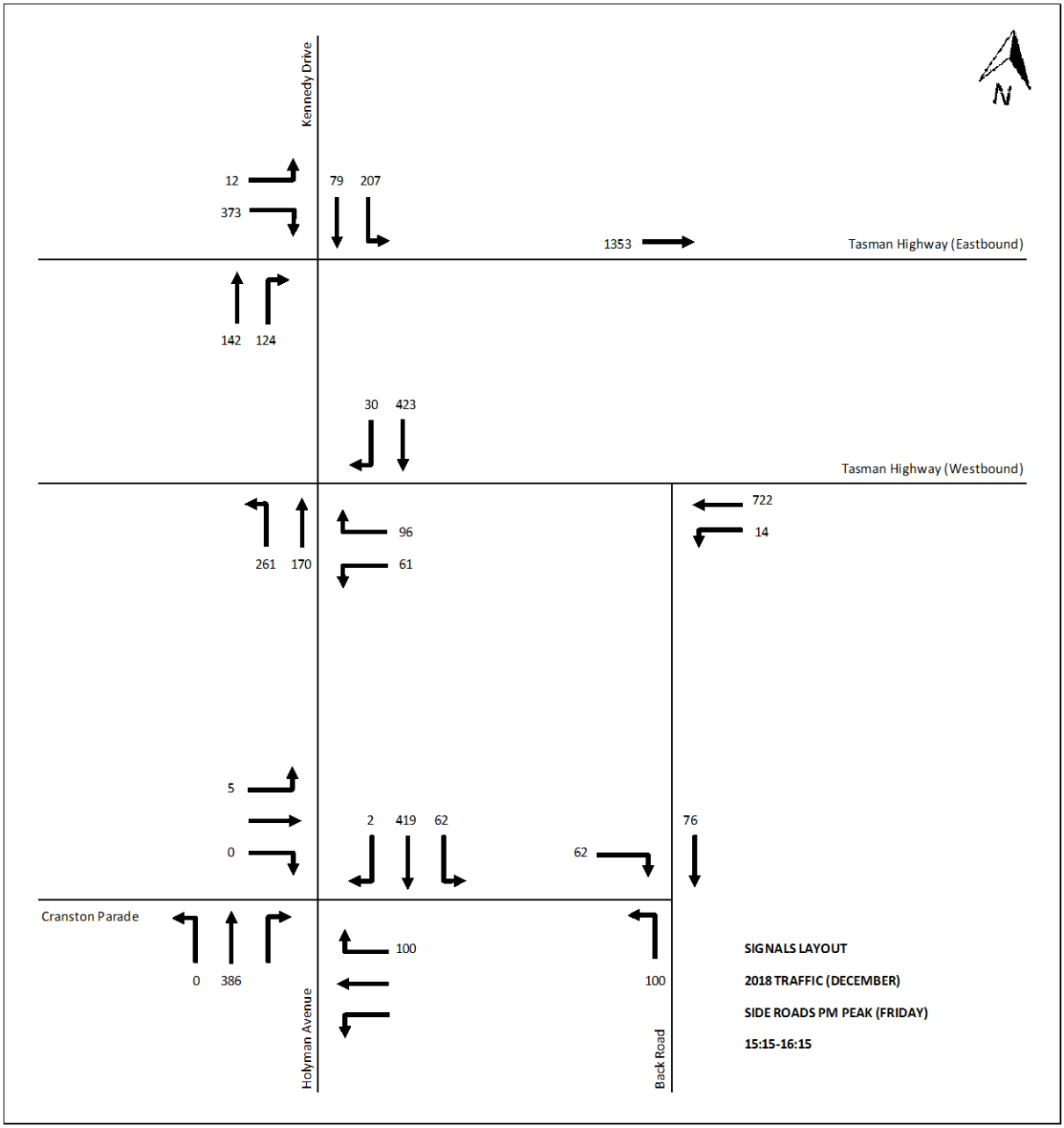

Kennedy Drive
22
917
4
9
0 43 0 0 360
2351
Tasman Highway
1255
34
Cranston Parade
9
0
0
0
0
23
253
752 126
0
9
158
0
118
156
156
249
249
249
Holyman Avenue
Back Road
N
ROUNDABOUT LAYOUT
2038 TRAFFIC (DECEMBER)
SIDE ROADS PM PEAK (FRIDAY)
15:15-16:15

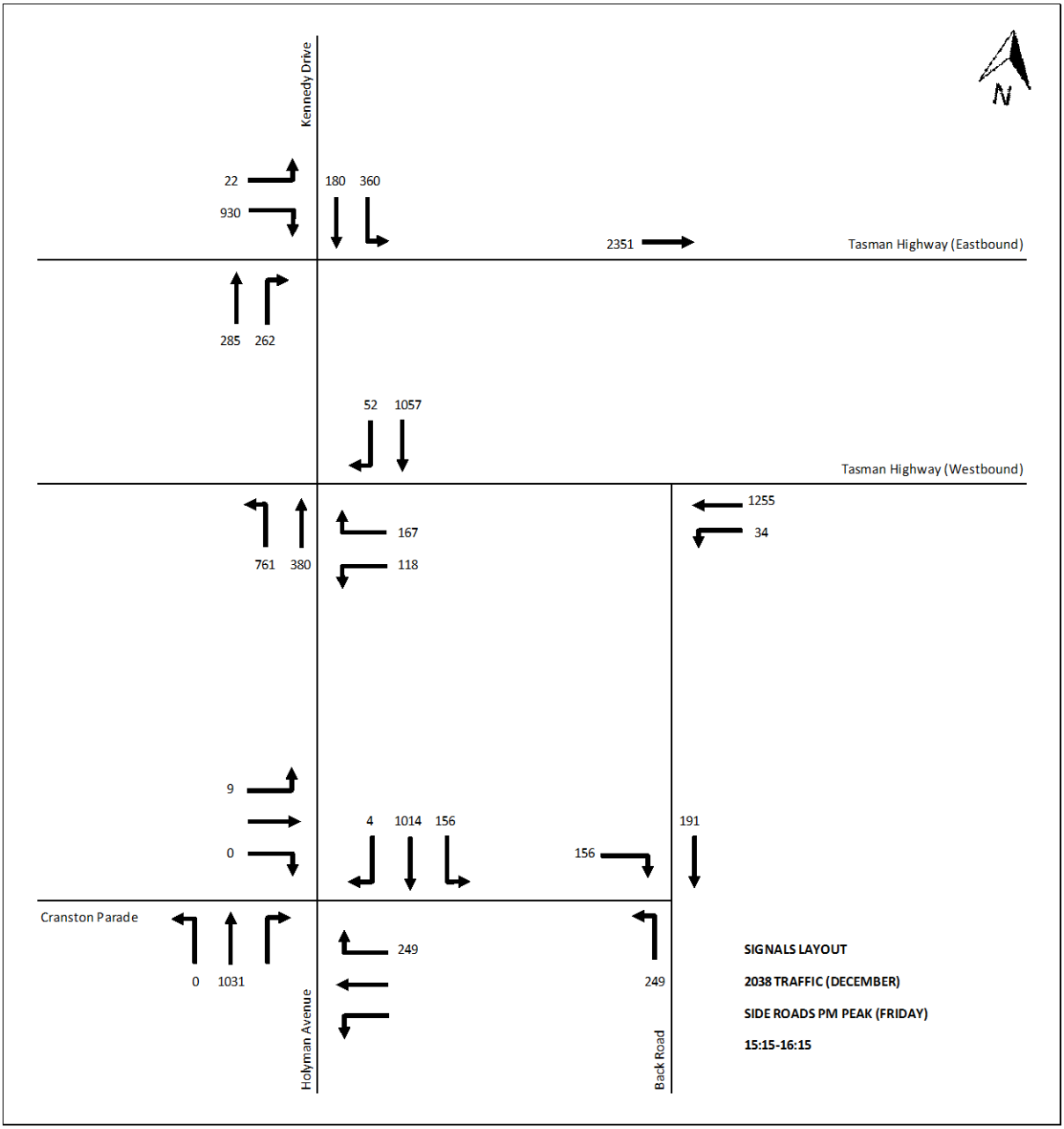

Kennedy Drive
24
362
4
0
0 41 1 0 237
1034
Tasman Highway
823
19
Cranston Parade
2
0
0
0
0
0
117
277 45
1
6
136
0
105
63
63
71
85
71
ROUNDABOUT LAYOUT
2018 TRAFFIC (DECEMBER)
SATURDAY PEAK
11:45-12:45
Holyman Avenue
Back Road
N

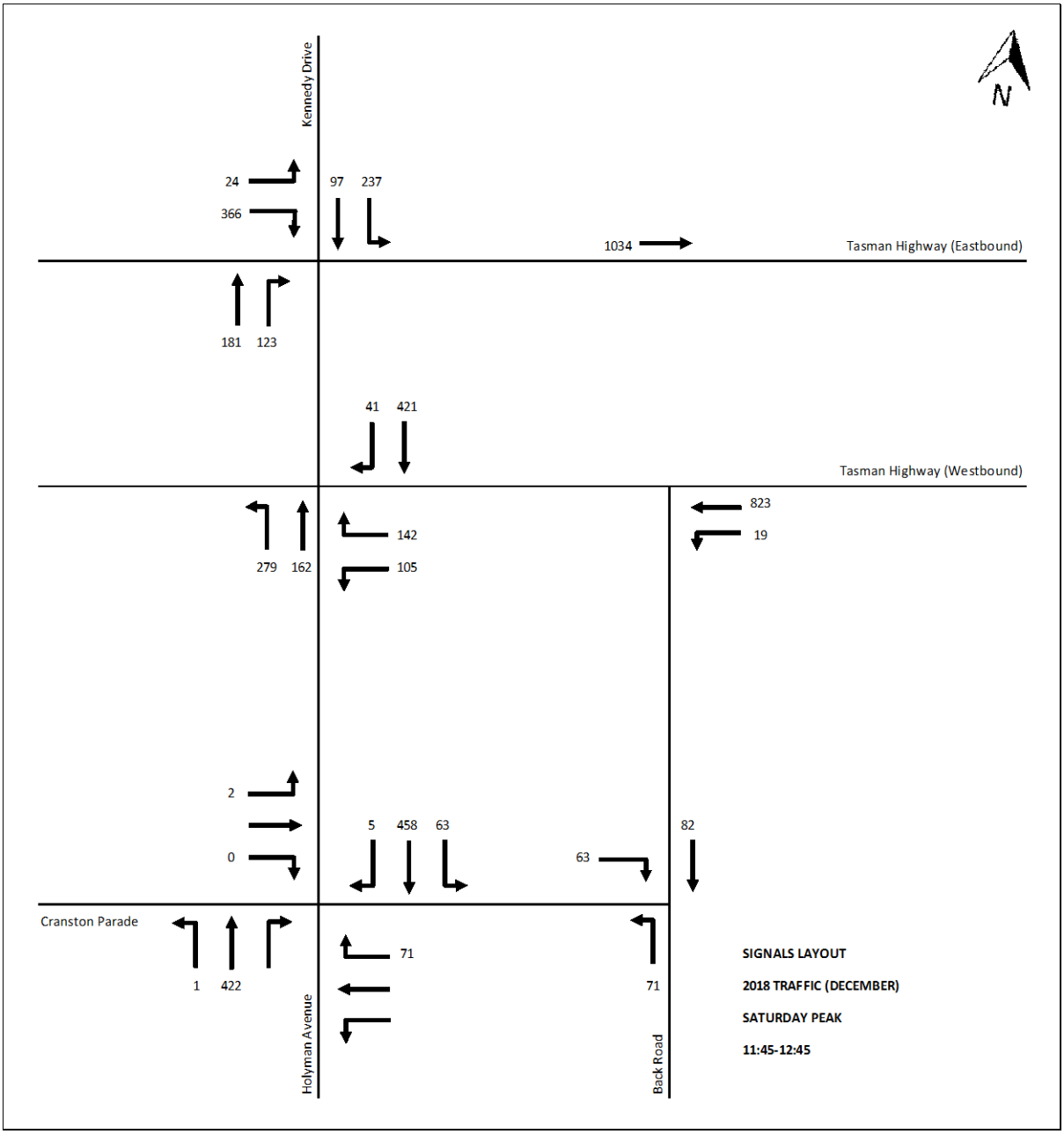

Kennedy Drive
41
907
7
0
0 72 2 0 412
1797
Tasman Highway
1430
48
Cranston Parade
4
0
0
0
0
0
231
740 113
3
11
236
0
209
158
158
178
212
178
ROUNDABOUT LAYOUT
2038 TRAFFIC (DECEMBER)
SATURDAY PEAK
11:45-12:45
Holyman Avenue
Back Road
N

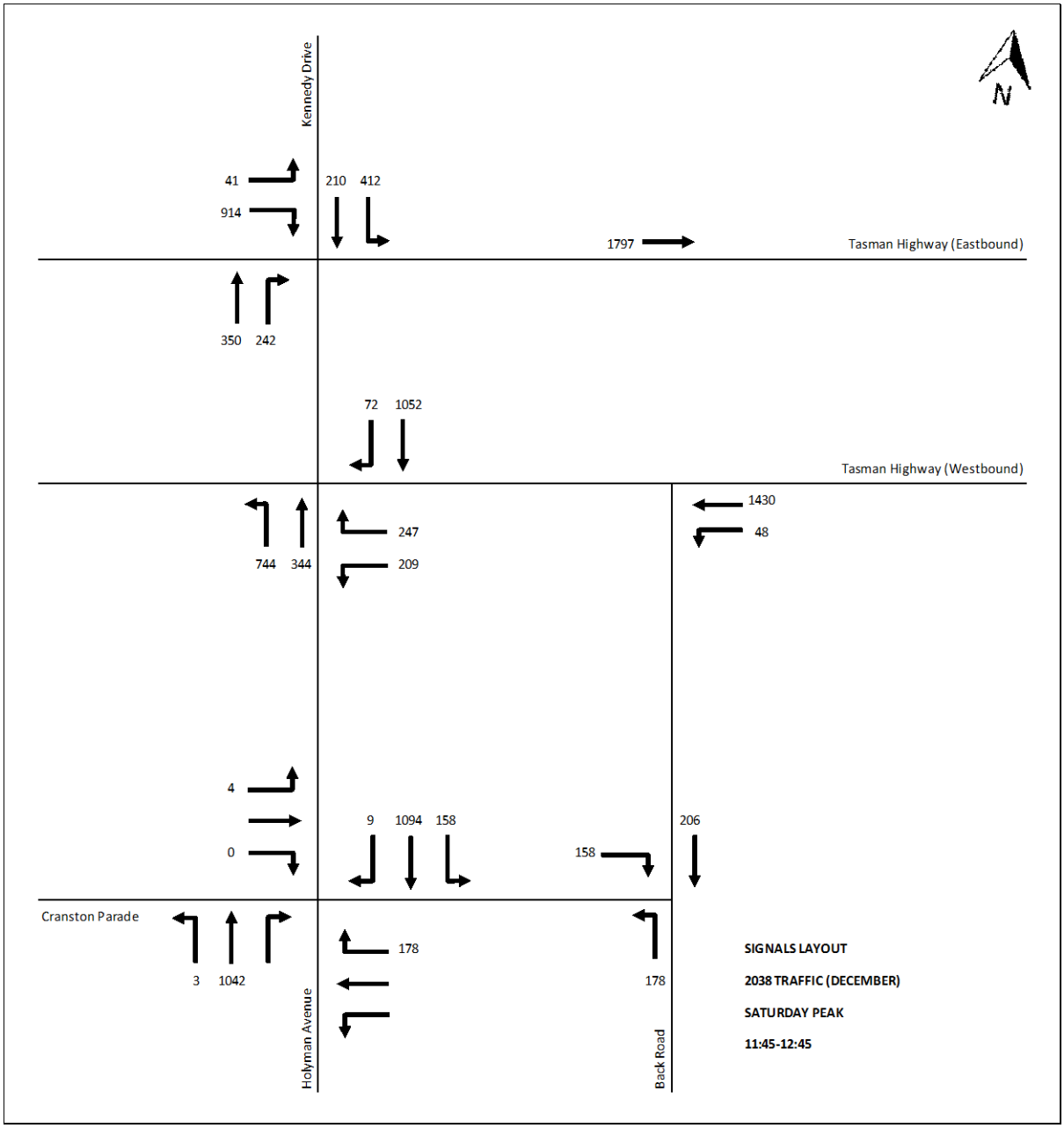

Kennedy Drive
30
575
85
99
578
Tasman Highway (Eastbound)
171
96
12
647
Tasman Highway (Westbound)
883
32
275
140
126
88
4
1
15
613
108
108
140
Cranston Parade
0
386
76
76
Holyman Avenue
Back Road
N
SIGNALS LAYOUT
2018 TRAFFIC (DECEMBER)
SIDE ROADS AM PEAK (THURSDAY)
08:45-09:45


Kennedy Drive
52
1430
203
171
1003
Tasman Highway (Eastbound)
335
198
22
1611
Tasman Highway (Westbound)
1534
79
758
311
219
186
7
3
26
1499
271
271
351
Cranston Parade
0
998
191
191
Holyman Avenue
Back Road
SIGNALS LAYOUT
2038 TRAFFIC (DECEMBER)
SIDE ROADS AM PEAK (THURSDAY)
08:45-09:45


Kennedy Drive
12
373
79
207
1353
Tasman Highway (Eastbound)
142
124
30
423
Tasman Highway (Westbound)
722
14
261
170
96
61
5
0
2
419
62
62
76
Cranston Parade
0
386
100
100
Holyman Avenue
Back Road
N
SIGNALS LAYOUT
2018 TRAFFIC (DECEMBER)
SIDE ROADS PM PEAK (FRIDAY)
15:15-16:15


Kennedy Drive
22
930
180
360
2351
Tasman Highway (Eastbound)
285
262
52
1057
Tasman Highway (Westbound)
761
380
167
118
1255
34
9
0
4
1014
156
156
191
Cranston Parade
0
1031
249
249
Holyman Avenue
Back Road
N
SIGNALS LAYOUT
2038 TRAFFIC (DECEMBER)
SIDE ROADS PM PEAK (FRIDAY)
15:15-16:15


Kennedy Drive
24
366
97
237
1034
Tasman Highway (Eastbound)
181
123
41
421
Tasman Highway (Westbound)
279
162
142
105
823
19
2
0
5
458
63
63
82
Cranston Parade
1
422
71
71
Holyman Avenue
Back Road
N
SIGNALS LAYOUT
2018 TRAFFIC (DECEMBER)
SATURDAY PEAK
11:45-12:45


Kennedy Drive
41
914
210
412
1797
Tasman Highway (Eastbound)
350
242
72
1052
Tasman Highway (Westbound)
744
344
247
209
1430
48
4
0
9
1094
158
158
206
Cranston Parade
3
1042
178
178
Holyman Avenue
Back Road
SIGNALS LAYOUT
2038 TRAFFIC (DECEMBER)
SATURDAY PEAK
11:45-12:45

Appendix B

SIDRA Results

MOVEMENT SUMMARY

Site: 101 [Existing Layout - 2016 Network AM Peak]

Tasman Highway/ Holyman Avenue
Friday 07:00-08:00
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Cranston Parade											
1	L2	2	50.0	0.054	32.0	LOS C	0.3	3.0	0.97	0.96	39.0
2	T1	1	50.0	0.054	31.8	LOS C	0.3	3.0	0.97	0.96	40.4
3a	R1	1	50.0	0.054	38.1	LOS D	0.3	3.0	0.97	0.96	40.0
3b	R3	1	50.0	0.054	40.8	LOS D	0.3	3.0	0.97	0.96	41.3
3u	U	1	50.0	0.054	42.2	LOS D	0.3	3.0	0.97	0.96	41.9
Approach		6	50.0	0.054	36.2	LOS D	0.3	3.0	0.97	0.96	40.2
SouthEast: Holyman Avenue											
21b	L3	1	5.0	0.836	83.2	LOS F	13.5	98.7	1.00	1.47	25.9
21a	L1	163	5.0	0.836	82.4	LOS F	13.5	98.7	1.00	1.47	26.5
23a	R1	37	5.0	0.836	88.7	LOS F	13.5	98.7	1.00	1.47	26.8
23	R2	23	5.0	0.836	90.1	LOS F	13.5	98.7	1.00	1.47	27.1
23u	U	4	5.0	0.836	92.9	LOS F	13.5	98.7	1.00	1.47	27.7
Approach		228	5.0	0.836	84.4	LOS F	13.5	98.7	1.00	1.47	26.6
NorthEast: Tasman Highway											
24	L2	18	5.0	1.005	35.7	LOS D	53.3	389.1	1.00	1.67	37.2
24a	L1	1	5.0	1.005	35.3	LOS D	53.3	389.1	1.00	1.67	37.9
26a	R1	1180	5.0	1.005	41.6	LOS D	53.3	389.1	1.00	1.67	38.4
26b	R3	115	5.0	1.005	44.4	LOS D	53.3	389.1	1.00	1.67	39.6
26u	U	1	5.0	1.005	45.8	LOS D	53.3	389.1	1.00	1.67	40.2
Approach		1315	5.0	1.005	41.8	LOS D	53.3	389.1	1.00	1.67	38.5
North: Kennedy Drive											
7b	L3	53	10.0	0.098	5.8	LOS A	0.6	4.8	0.69	0.63	53.8
7a	L1	28	10.0	0.098	5.0	LOS A	0.6	4.8	0.69	0.63	56.6
8	T1	1	10.0	0.098	5.3	LOS A	0.6	4.8	0.69	0.63	57.6
9	R2	8	10.0	0.098	12.8	LOS B	0.6	4.8	0.69	0.63	59.1
9u	U	1	10.0	0.098	15.5	LOS B	0.6	4.8	0.69	0.63	62.1
Approach		92	10.0	0.098	6.3	LOS A	0.6	4.8	0.69	0.63	55.3
West: Tasman Highay											
10	L2	21	5.0	0.450	5.6	LOS A	3.6	26.5	0.50	0.57	64.2
10a	L1	354	5.0	0.450	5.7	LOS A	3.6	26.5	0.50	0.57	66.2
12a	R1	253	5.0	0.450	12.4	LOS B	3.6	26.5	0.50	0.57	62.8
12	R2	7	5.0	0.450	14.2	LOS B	3.6	26.5	0.50	0.57	64.4
12u	U	2	5.0	0.450	17.7	LOS B	3.6	26.5	0.50	0.57	70.7
Approach		637	5.0	0.450	8.5	LOS A	3.6	26.5	0.50	0.57	64.7
All Vehicles		2278	5.3	1.005	35.3	LOS D	53.3	389.1	0.85	1.30	41.8

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Existing Layout - 2018 Network AM Peak]

Tasman Highway/ Holyman Avenue
Friday 07:00-08:00
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Cranston Parade											
1	L2	2	50.0	0.064	35.1	LOS D	0.3	3.1	0.95	0.97	37.8
2	T1	1	50.0	0.064	34.9	LOS C	0.3	3.1	0.95	0.97	39.1
3a	R1	1	50.0	0.064	41.2	LOS D	0.3	3.1	0.95	0.97	38.8
3b	R3	1	50.0	0.064	43.9	LOS D	0.3	3.1	0.95	0.97	40.0
3u	U	1	50.0	0.064	45.3	LOS D	0.3	3.1	0.95	0.97	40.6
Approach		6	50.0	0.064	39.3	LOS D	0.3	3.1	0.95	0.97	39.0
SouthEast: Holyman Avenue											
21b	L3	1	5.0	1.002	143.6	LOS F	26.6	194.3	1.00	1.96	18.5
21a	L1	194	5.0	1.002	142.9	LOS F	26.6	194.3	1.00	1.96	18.8
23a	R1	41	5.0	1.002	149.2	LOS F	26.6	194.3	1.00	1.96	18.9
23	R2	47	5.0	1.002	150.6	LOS F	26.6	194.3	1.00	1.96	19.0
23u	U	4	5.0	1.002	153.3	LOS F	26.6	194.3	1.00	1.96	19.3
Approach		287	5.0	1.002	145.2	LOS F	26.6	194.3	1.00	1.96	18.8
NorthEast: Tasman Highway											
24	L2	56	5.0	1.081	88.6	LOS F	101.4	740.3	1.00	2.90	24.9
24a	L1	1	5.0	1.081	88.2	LOS F	101.4	740.3	1.00	2.90	25.2
26a	R1	1247	5.0	1.081	94.5	LOS F	101.4	740.3	1.00	2.90	25.4
26b	R3	121	5.0	1.081	97.3	LOS F	101.4	740.3	1.00	2.90	25.9
26u	U	1	5.0	1.081	98.6	LOS F	101.4	740.3	1.00	2.90	26.2
Approach		1426	5.0	1.081	94.5	LOS F	101.4	740.3	1.00	2.90	25.5
North: Kennedy Drive											
7b	L3	55	10.0	0.104	6.1	LOS A	0.7	5.2	0.72	0.65	53.6
7a	L1	27	10.0	0.104	5.3	LOS A	0.7	5.2	0.72	0.65	56.4
8	T1	1	10.0	0.104	5.6	LOS A	0.7	5.2	0.72	0.65	57.4
9	R2	9	10.0	0.104	13.0	LOS B	0.7	5.2	0.72	0.65	58.8
9u	U	1	10.0	0.104	15.8	LOS B	0.7	5.2	0.72	0.65	61.8
Approach		94	10.0	0.104	6.7	LOS A	0.7	5.2	0.72	0.65	55.0
West: Tasman Highay											
10	L2	22	5.0	0.467	5.7	LOS A	3.7	27.2	0.53	0.58	64.1
10a	L1	375	5.0	0.467	5.8	LOS A	3.7	27.2	0.53	0.58	66.2
12a	R1	242	5.0	0.467	12.6	LOS B	3.7	27.2	0.53	0.58	62.8
12	R2	7	5.0	0.467	14.4	LOS B	3.7	27.2	0.53	0.58	64.4
12u	U	2	5.0	0.467	17.9	LOS B	3.7	27.2	0.53	0.58	70.6
Approach		648	5.0	0.467	8.5	LOS A	3.7	27.2	0.53	0.58	64.8
All Vehicles		2462	5.3	1.081	74.3	LOS F	101.4	740.3	0.87	2.09	29.5

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Existing Layout - 2038 Network AM Peak]

Tasman Highway/ Holyman Avenue
Friday 07:00-08:00
Roundabout

Movement Performance - Vehicles												
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Cranston Parade											
1	L2	4	50.0	0.045	29.5	LOS C	0.3	2.8	0.99	0.89	40.2
2	T1	1	50.0	0.045	29.3	LOS C	0.3	2.8	0.99	0.89	41.7
3a	R1	1	50.0	0.045	35.6	LOS D	0.3	2.8	0.99	0.89	41.3
3b	R3	1	50.0	0.045	38.3	LOS D	0.3	2.8	0.99	0.89	42.7
3u	U	1	50.0	0.045	39.7	LOS D	0.3	2.8	0.99	0.89	43.4
Approach		8	50.0	0.045	32.6	LOS C	0.3	2.8	0.99	0.89	41.2
SouthEast: Holyman Avenue											
21b	L3	1	5.0	1.066	103.3	LOS F	57.9	422.7	1.00	2.83	22.9
21a	L1	526	5.0	1.066	102.6	LOS F	57.9	422.7	1.00	2.83	23.3
23a	R1	102	5.0	1.066	108.9	LOS F	57.9	422.7	1.00	2.83	23.5
23	R2	101	5.0	1.066	110.2	LOS F	57.9	422.7	1.00	2.83	23.7
23u	U	11	5.0	1.066	113.0	LOS F	57.9	422.7	1.00	2.83	24.2
Approach		741	5.0	1.066	104.6	LOS F	57.9	422.7	1.00	2.83	23.4
NorthEast: Tasman Highway											
24	L2	109	5.0	3.103	1902.3	LOS F	1084.4	7916.4	1.00	14.88	2.0
24a	L1	1	5.0	3.103	1901.9	LOS F	1084.4	7916.4	1.00	14.88	2.0
26a	R1	2167	5.0	3.103	1908.2	LOS F	1084.4	7916.4	1.00	14.88	2.0
26b	R3	209	5.0	3.103	1911.0	LOS F	1084.4	7916.4	1.00	14.88	2.0
26u	U	2	5.0	3.103	1912.4	LOS F	1084.4	7916.4	1.00	14.88	2.0
Approach		2489	5.0	3.103	1908.2	LOS F	1084.4	7916.4	1.00	14.88	2.0
North: Kennedy Drive											
7b	L3	96	10.0	0.774	83.9	LOS F	11.0	83.6	1.00	1.40	25.5
7a	L1	68	10.0	0.774	83.1	LOS F	11.0	83.6	1.00	1.40	26.1
8	T1	1	10.0	0.774	83.4	LOS F	11.0	83.6	1.00	1.40	26.3
9	R2	16	10.0	0.774	90.8	LOS F	11.0	83.6	1.00	1.40	26.6
9u	U	1	10.0	0.774	93.6	LOS F	11.0	83.6	1.00	1.40	27.2
Approach		182	10.0	0.774	84.2	LOS F	11.0	83.6	1.00	1.40	25.8
West: Tasman Highay											
10	L2	39	5.0	0.998	32.7	LOS C	50.3	367.2	1.00	1.33	45.0
10a	L1	651	5.0	0.998	32.8	LOS C	50.3	367.2	1.00	1.33	46.0
12a	R1	606	5.0	0.998	39.6	LOS D	50.3	367.2	1.00	1.33	44.3
12	R2	14	5.0	0.998	41.3	LOS D	50.3	367.2	1.00	1.33	45.1
12u	U	4	5.0	0.998	44.9	LOS D	50.3	367.2	1.00	1.33	48.1
Approach		1314	5.0	0.998	36.1	LOS D	50.3	367.2	1.00	1.33	45.2
All Vehicles		4735	5.3	3.103	1033.0	LOS F	1084.4	7916.4	1.00	8.69	3.6

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Existing Layout - 2016 Side Roads AM Peak]

Tasman Highway/ Holyman Avenue
Thursday 08:45-09:45
Roundabout

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Cranston Parade											
1	L2	4	50.0	0.028	16.2	LOS B	0.2	2.1	1.00	0.78	46.5
2	T1	1	50.0	0.028	16.1	LOS B	0.2	2.1	1.00	0.78	48.6
3a	R1	1	50.0	0.028	22.3	LOS C	0.2	2.1	1.00	0.78	48.0
3b	R3	1	50.0	0.028	25.1	LOS C	0.2	2.1	1.00	0.78	49.9
3u	U	1	50.0	0.028	26.5	LOS C	0.2	2.1	1.00	0.78	50.9
Approach		8	50.0	0.028	19.4	LOS B	0.2	2.1	1.00	0.78	47.9
SouthEast: Holyman Avenue											
21b	L3	1	5.0	0.576	13.9	LOS B	6.3	46.1	1.00	1.05	48.4
21a	L1	236	5.0	0.576	13.1	LOS B	6.3	46.1	1.00	1.05	50.5
23a	R1	46	5.0	0.576	19.5	LOS B	6.3	46.1	1.00	1.05	51.5
23	R2	42	5.0	0.576	20.8	LOS C	6.3	46.1	1.00	1.05	52.5
23u	U	7	5.0	0.576	23.6	LOS C	6.3	46.1	1.00	1.05	54.8
Approach		333	5.0	0.576	15.2	LOS B	6.3	46.1	1.00	1.05	51.0
NorthEast: Tasman Highway											
24	L2	46	5.0	0.970	37.5	LOS D	35.2	257.2	1.00	1.84	36.6
24a	L1	1	5.0	0.970	37.2	LOS D	35.2	257.2	1.00	1.84	37.3
26a	R1	762	5.0	0.970	43.5	LOS D	35.2	257.2	1.00	1.84	37.8
26b	R3	123	5.0	0.970	46.2	LOS D	35.2	257.2	1.00	1.84	38.9
26u	U	2	5.0	0.970	47.6	LOS D	35.2	257.2	1.00	1.84	39.5
Approach		935	5.0	0.970	43.5	LOS D	35.2	257.2	1.00	1.84	37.9
North: Kennedy Drive											
7b	L3	98	10.0	0.360	11.1	LOS B	3.1	23.2	1.00	0.93	50.6
7a	L1	78	10.0	0.360	10.3	LOS B	3.1	23.2	1.00	0.93	53.1
8	T1	1	10.0	0.360	10.6	LOS B	3.1	23.2	1.00	0.93	53.9
9	R2	13	10.0	0.360	18.1	LOS B	3.1	23.2	1.00	0.93	55.2
9u	U	1	10.0	0.360	20.8	LOS C	3.1	23.2	1.00	0.93	57.8
Approach		191	10.0	0.360	11.3	LOS B	3.1	23.2	1.00	0.93	51.9
West: Tasman Highay											
10	L2	29	5.0	0.736	7.0	LOS A	9.1	66.5	0.76	0.67	62.3
10a	L1	477	5.0	0.736	7.1	LOS A	9.1	66.5	0.76	0.67	64.2
12a	R1	497	5.0	0.736	13.9	LOS B	9.1	66.5	0.76	0.67	61.0
12	R2	14	5.0	0.736	15.6	LOS B	9.1	66.5	0.76	0.67	62.5
12u	U	1	5.0	0.736	19.1	LOS B	9.1	66.5	0.76	0.67	68.3
Approach		1018	5.0	0.736	10.5	LOS B	9.1	66.5	0.76	0.67	62.5
All Vehicles		2484	5.5	0.970	23.7	LOS C	35.2	257.2	0.90	1.18	48.3

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Existing Layout - 2018 Side Roads AM Peak]

Tasman Highway/ Holyman Avenue
Thursday 08:45-09:45
Roundabout

Movement Performance - Vehicles												
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Cranston Parade											
1	L2	4	50.0	0.033	21.1	LOS C	0.2	2.5	1.00	0.80	44.0
2	T1	1	50.0	0.033	20.9	LOS C	0.2	2.5	1.00	0.80	45.8
3a	R1	1	50.0	0.033	27.2	LOS C	0.2	2.5	1.00	0.80	45.3
3b	R3	1	50.0	0.033	30.0	LOS C	0.2	2.5	1.00	0.80	47.0
3u	U	1	50.0	0.033	31.4	LOS C	0.2	2.5	1.00	0.80	47.9
Approach		8	50.0	0.033	24.2	LOS C	0.2	2.5	1.00	0.80	45.2
SouthEast: Holyman Avenue											
21b	L3	1	5.0	0.758	22.3	LOS C	11.0	80.6	1.00	1.23	43.6
21a	L1	286	5.0	0.758	21.6	LOS C	11.0	80.6	1.00	1.23	45.3
23a	R1	51	5.0	0.758	27.9	LOS C	11.0	80.6	1.00	1.23	46.0
23	R2	97	5.0	0.758	29.3	LOS C	11.0	80.6	1.00	1.23	46.9
23u	U	8	5.0	0.758	32.0	LOS C	11.0	80.6	1.00	1.23	48.7
Approach		443	5.0	0.758	24.2	LOS C	11.0	80.6	1.00	1.23	45.8
NorthEast: Tasman Highway											
24	L2	93	5.0	1.065	88.8	LOS F	72.0	525.7	1.00	3.01	24.9
24a	L1	1	5.0	1.065	88.4	LOS F	72.0	525.7	1.00	3.01	25.2
26a	R1	805	5.0	1.065	94.7	LOS F	72.0	525.7	1.00	3.01	25.4
26b	R3	129	5.0	1.065	97.4	LOS F	72.0	525.7	1.00	3.01	25.9
26u	U	2	5.0	1.065	98.8	LOS F	72.0	525.7	1.00	3.01	26.2
Approach		1031	5.0	1.065	94.5	LOS F	72.0	525.7	1.00	3.01	25.4
North: Kennedy Drive											
7b	L3	104	10.0	0.419	13.7	LOS B	3.8	28.9	1.00	0.98	48.9
7a	L1	75	10.0	0.419	13.0	LOS B	3.8	28.9	1.00	0.98	51.1
8	T1	1	10.0	0.419	13.2	LOS B	3.8	28.9	1.00	0.98	52.0
9	R2	13	10.0	0.419	20.7	LOS C	3.8	28.9	1.00	0.98	53.2
9u	U	1	10.0	0.419	23.4	LOS C	3.8	28.9	1.00	0.98	55.6
Approach		194	10.0	0.419	13.9	LOS B	3.8	28.9	1.00	0.98	50.0
West: Tasman Highay											
10	L2	32	5.0	0.782	8.9	LOS A	11.7	85.1	0.86	0.78	61.4
10a	L1	504	5.0	0.782	9.0	LOS A	11.7	85.1	0.86	0.78	63.2
12a	R1	477	5.0	0.782	15.8	LOS B	11.7	85.1	0.86	0.78	60.1
12	R2	15	5.0	0.782	17.5	LOS B	11.7	85.1	0.86	0.78	61.6
12u	U	1	5.0	0.782	21.1	LOS C	11.7	85.1	0.86	0.78	67.3
Approach		1028	5.0	0.782	12.3	LOS B	11.7	85.1	0.86	0.78	61.7
All Vehicles		2704	5.5	1.065	45.7	LOS D	72.0	525.7	0.95	1.72	37.9

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Existing Layout - 2038 Side Roads AM Peak]

Tasman Highway/ Holyman Avenue
Thursday 08:45-09:45
Roundabout

Movement Performance - Vehicles												
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Cranston Parade											
1	L2	7	50.0	0.112	35.4	LOS D	0.6	5.5	0.94	0.97	37.8
2	T1	1	50.0	0.112	35.2	LOS D	0.6	5.5	0.94	0.97	39.1
3a	R1	1	50.0	0.112	41.5	LOS D	0.6	5.5	0.94	0.97	38.8
3b	R3	3	50.0	0.112	44.3	LOS D	0.6	5.5	0.94	0.97	40.0
3u	U	1	50.0	0.112	45.7	LOS D	0.6	5.5	0.94	0.97	40.6
Approach		14	50.0	0.112	38.7	LOS D	0.6	5.5	0.94	0.97	38.7
SouthEast: Holyman Avenue											
21b	L3	1	5.0	1.363	343.9	LOS F	212.2	1549.3	1.00	6.74	9.4
21a	L1	792	5.0	1.363	343.2	LOS F	212.2	1549.3	1.00	6.74	9.5
23a	R1	126	5.0	1.363	349.5	LOS F	212.2	1549.3	1.00	6.74	9.6
23	R2	201	5.0	1.363	350.9	LOS F	212.2	1549.3	1.00	6.74	9.6
23u	U	20	5.0	1.363	353.6	LOS F	212.2	1549.3	1.00	6.74	9.7
Approach		1140	5.0	1.363	345.4	LOS F	212.2	1549.3	1.00	6.74	9.5
NorthEast: Tasman Highway											
24	L2	196	5.0	2.759	1595.2	LOS F	754.8	5510.1	1.00	12.32	2.4
24a	L1	1	5.0	2.759	1594.9	LOS F	754.8	5510.1	1.00	12.32	2.4
26a	R1	1398	5.0	2.759	1601.2	LOS F	754.8	5510.1	1.00	12.32	2.4
26b	R3	226	5.0	2.759	1603.9	LOS F	754.8	5510.1	1.00	12.32	2.4
26u	U	4	5.0	2.759	1605.3	LOS F	754.8	5510.1	1.00	12.32	2.4
Approach		1825	5.0	2.759	1600.9	LOS F	754.8	5510.1	1.00	12.32	2.4
North: Kennedy Drive											
7b	L3	180	10.0	1.674	690.9	LOS F	121.2	920.8	1.00	4.05	5.0
7a	L1	188	10.0	1.674	690.2	LOS F	121.2	920.8	1.00	4.05	5.0
8	T1	2	10.0	1.674	690.4	LOS F	121.2	920.8	1.00	4.05	5.0
9	R2	23	10.0	1.674	697.9	LOS F	121.2	920.8	1.00	4.05	5.0
9u	U	2	10.0	1.674	700.6	LOS F	121.2	920.8	1.00	4.05	5.0
Approach		396	10.0	1.674	691.0	LOS F	121.2	920.8	1.00	4.05	5.0
West: Tasman Highay											
10	L2	55	5.0	1.782	712.9	LOS F	615.0	4489.8	1.00	9.48	5.1
10a	L1	876	5.0	1.782	713.0	LOS F	615.0	4489.8	1.00	9.48	5.1
12a	R1	1195	5.0	1.782	719.8	LOS F	615.0	4489.8	1.00	9.48	5.1
12	R2	25	5.0	1.782	721.5	LOS F	615.0	4489.8	1.00	9.48	5.1
12u	U	1	5.0	1.782	725.0	LOS F	615.0	4489.8	1.00	9.48	5.1
Approach		2152	5.0	1.782	716.9	LOS F	615.0	4489.8	1.00	9.48	5.1
All Vehicles		5526	5.5	2.759	928.7	LOS F	754.8	5510.1	1.00	9.44	4.0

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Existing Layout - 2016 Network PM Peak]

Tasman Highway/ Holyman Avenue
Thursday 16:00-17:00
Roundabout

Movement Performance - Vehicles												
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Cranston Parade											
1	L2	1	50.0	0.010	9.8	LOS A	0.1	0.7	0.84	0.66	49.5
2	T1	1	50.0	0.010	9.6	LOS A	0.1	0.7	0.84	0.66	51.8
3a	R1	1	50.0	0.010	15.8	LOS B	0.1	0.7	0.84	0.66	51.2
3b	R3	1	50.0	0.010	18.6	LOS B	0.1	0.7	0.84	0.66	53.3
3u	U	1	50.0	0.010	20.0	LOS B	0.1	0.7	0.84	0.66	54.4
Approach		5	50.0	0.010	14.8	LOS B	0.1	0.7	0.84	0.66	52.0
SouthEast: Holyman Avenue											
21b	L3	1	5.0	0.364	6.3	LOS A	2.9	20.8	0.83	0.68	52.4
21a	L1	243	5.0	0.364	5.6	LOS A	2.9	20.8	0.83	0.68	54.9
23a	R1	36	5.0	0.364	11.9	LOS B	2.9	20.8	0.83	0.68	56.0
23	R2	48	5.0	0.364	13.2	LOS B	2.9	20.8	0.83	0.68	57.3
23u	U	6	5.0	0.364	16.0	LOS B	2.9	20.8	0.83	0.68	60.0
Approach		335	5.0	0.364	7.5	LOS A	2.9	20.8	0.83	0.68	55.4
NorthEast: Tasman Highway											
24	L2	28	5.0	0.536	4.3	LOS A	4.7	34.4	0.72	0.70	51.3
24a	L1	1	5.0	0.536	3.9	LOS A	4.7	34.4	0.72	0.70	52.7
26a	R1	546	5.0	0.536	10.3	LOS B	4.7	34.4	0.72	0.70	53.7
26b	R3	78	5.0	0.536	13.0	LOS B	4.7	34.4	0.72	0.70	56.0
26u	U	2	5.0	0.536	14.4	LOS B	4.7	34.4	0.72	0.70	57.2
Approach		656	5.0	0.536	10.3	LOS B	4.7	34.4	0.72	0.70	53.8
North: Kennedy Drive											
7b	L3	185	10.0	1.660	682.2	LOS F	81.5	619.6	1.00	3.37	5.0
7a	L1	57	10.0	1.660	681.5	LOS F	81.5	619.6	1.00	3.37	5.0
8	T1	1	10.0	1.660	681.7	LOS F	81.5	619.6	1.00	3.37	5.0
9	R2	23	10.0	1.660	689.2	LOS F	81.5	619.6	1.00	3.37	5.0
9u	U	1	10.0	1.660	691.9	LOS F	81.5	619.6	1.00	3.37	5.1
Approach		267	10.0	1.660	682.7	LOS F	81.5	619.6	1.00	3.37	5.0
West: Tasman Highay											
10	L2	9	5.0	0.981	18.5	LOS B	43.3	315.8	1.00	0.89	55.2
10a	L1	1162	5.0	0.981	18.7	LOS B	43.3	315.8	1.00	0.89	56.7
12a	R1	267	5.0	0.981	25.4	LOS C	43.3	315.8	1.00	0.89	54.1
12	R2	2	5.0	0.981	27.2	LOS C	43.3	315.8	1.00	0.89	55.3
12u	U	2	5.0	0.981	30.7	LOS C	43.3	315.8	1.00	0.89	59.9
Approach		1443	5.0	0.981	19.9	LOS B	43.3	315.8	1.00	0.89	56.2
All Vehicles		2706	5.6	1.660	81.5	LOS F	81.5	619.6	0.91	1.07	28.3

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Existing Layout - 2018 Network PM Peak]

Tasman Highway/ Holyman Avenue
Thursday 16:00-17:00
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Cranston Parade											
1	L2	1	50.0	0.012	12.9	LOS B	0.1	0.8	0.90	0.69	47.7
2	T1	1	50.0	0.012	12.7	LOS B	0.1	0.8	0.90	0.69	49.8
3a	R1	1	50.0	0.012	19.0	LOS B	0.1	0.8	0.90	0.69	49.2
3b	R3	1	50.0	0.012	21.7	LOS C	0.1	0.8	0.90	0.69	51.1
3u	U	1	50.0	0.012	23.1	LOS C	0.1	0.8	0.90	0.69	52.1
Approach		5	50.0	0.012	17.9	LOS B	0.1	0.8	0.90	0.69	49.9
SouthEast: Holyman Avenue											
21b	L3	1	5.0	0.510	7.9	LOS A	4.8	34.8	0.91	0.87	51.5
21a	L1	297	5.0	0.510	7.2	LOS A	4.8	34.8	0.91	0.87	53.9
23a	R1	40	5.0	0.510	13.5	LOS B	4.8	34.8	0.91	0.87	55.0
23	R2	105	5.0	0.510	14.9	LOS B	4.8	34.8	0.91	0.87	56.2
23u	U	6	5.0	0.510	17.6	LOS B	4.8	34.8	0.91	0.87	58.8
Approach		449	5.0	0.510	9.7	LOS A	4.8	34.8	0.91	0.87	54.6
NorthEast: Tasman Highway											
24	L2	74	5.0	0.584	4.3	LOS A	5.4	39.5	0.72	0.69	51.5
24a	L1	1	5.0	0.584	3.9	LOS A	5.4	39.5	0.72	0.69	53.0
26a	R1	578	5.0	0.584	10.2	LOS B	5.4	39.5	0.72	0.69	54.0
26b	R3	83	5.0	0.584	12.9	LOS B	5.4	39.5	0.72	0.69	56.3
26u	U	2	5.0	0.584	14.3	LOS B	5.4	39.5	0.72	0.69	57.6
Approach		738	5.0	0.584	9.9	LOS A	5.4	39.5	0.72	0.69	54.0
North: Kennedy Drive											
7b	L3	196	10.0	1.585	618.3	LOS F	79.8	606.2	1.00	3.38	5.5
7a	L1	55	10.0	1.585	617.5	LOS F	79.8	606.2	1.00	3.38	5.5
8	T1	1	10.0	1.585	617.8	LOS F	79.8	606.2	1.00	3.38	5.5
9	R2	25	10.0	1.585	625.2	LOS F	79.8	606.2	1.00	3.38	5.5
9u	U	1	10.0	1.585	628.0	LOS F	79.8	606.2	1.00	3.38	5.5
Approach		278	10.0	1.585	618.8	LOS F	79.8	606.2	1.00	3.38	5.5
West: Tasman Highay											
10	L2	11	5.0	1.090	96.2	LOS F	112.9	824.5	1.00	2.42	26.1
10a	L1	1227	5.0	1.090	96.3	LOS F	112.9	824.5	1.00	2.42	26.4
12a	R1	256	5.0	1.090	103.0	LOS F	112.9	824.5	1.00	2.42	25.8
12	R2	2	5.0	1.090	104.8	LOS F	112.9	824.5	1.00	2.42	26.1
12u	U	2	5.0	1.090	108.3	LOS F	112.9	824.5	1.00	2.42	27.1
Approach		1498	5.0	1.090	97.5	LOS F	112.9	824.5	1.00	2.42	26.3
All Vehicles		2968	5.5	1.585	111.1	LOS F	112.9	824.5	0.92	1.84	23.2

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Existing Layout - 2038 Network PM Peak]

Tasman Highway/ Holyman Avenue
Thursday 16:00-17:00
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Cranston Parade											
1	L2	1	50.0	0.036	30.6	LOS C	0.2	2.1	0.98	0.90	39.3
2	T1	1	50.0	0.036	30.4	LOS C	0.2	2.1	0.98	0.90	40.8
3a	R1	1	50.0	0.036	36.7	LOS D	0.2	2.1	0.98	0.90	40.4
3b	R3	1	50.0	0.036	39.4	LOS D	0.2	2.1	0.98	0.90	41.7
3u	U	1	50.0	0.036	40.8	LOS D	0.2	2.1	0.98	0.90	42.3
Approach		5	50.0	0.036	35.6	LOS D	0.2	2.1	0.98	0.90	40.9
SouthEast: Holyman Avenue											
21b	L3	1	5.0	2.571	1436.9	LOS F	472.6	3450.1	1.00	8.74	2.6
21a	L1	826	5.0	2.571	1436.1	LOS F	472.6	3450.1	1.00	8.74	2.6
23a	R1	99	5.0	2.571	1442.4	LOS F	472.6	3450.1	1.00	8.74	2.6
23	R2	220	5.0	2.571	1443.8	LOS F	472.6	3450.1	1.00	8.74	2.6
23u	U	17	5.0	2.571	1446.6	LOS F	472.6	3450.1	1.00	8.74	2.6
Approach		1163	5.0	2.571	1438.3	LOS F	472.6	3450.1	1.00	8.74	2.6
NorthEast: Tasman Highway											
24	L2	149	5.0	1.116	120.3	LOS F	114.0	832.1	1.00	3.67	20.7
24a	L1	1	5.0	1.116	119.9	LOS F	114.0	832.1	1.00	3.67	21.0
26a	R1	1004	5.0	1.116	126.3	LOS F	114.0	832.1	1.00	3.67	21.1
26b	R3	144	5.0	1.116	129.0	LOS F	114.0	832.1	1.00	3.67	21.5
26u	U	4	5.0	1.116	130.4	LOS F	114.0	832.1	1.00	3.67	21.7
Approach		1303	5.0	1.116	125.9	LOS F	114.0	832.1	1.00	3.67	21.1
North: Kennedy Drive											
7b	L3	340	10.0	2.799	1681.9	LOS F	236.4	1796.8	1.00	4.96	2.1
7a	L1	138	10.0	2.799	1681.1	LOS F	236.4	1796.8	1.00	4.96	2.1
8	T1	1	10.0	2.799	1681.4	LOS F	236.4	1796.8	1.00	4.96	2.1
9	R2	43	10.0	2.799	1688.9	LOS F	236.4	1796.8	1.00	4.96	2.1
9u	U	2	10.0	2.799	1691.6	LOS F	236.4	1796.8	1.00	4.96	2.1
Approach		524	10.0	2.799	1682.3	LOS F	236.4	1796.8	1.00	4.96	2.1
West: Tasman Highay											
10	L2	18	5.0	2.051	955.2	LOS F	933.8	6816.5	1.00	10.62	3.8
10a	L1	2133	5.0	2.051	955.3	LOS F	933.8	6816.5	1.00	10.62	3.8
12a	R1	642	5.0	2.051	962.1	LOS F	933.8	6816.5	1.00	10.62	3.8
12	R2	4	5.0	2.051	963.9	LOS F	933.8	6816.5	1.00	10.62	3.8
12u	U	4	5.0	2.051	967.4	LOS F	933.8	6816.5	1.00	10.62	3.8
Approach		2801	5.0	2.051	956.9	LOS F	933.8	6816.5	1.00	10.62	3.8
All Vehicles		5797	5.5	2.799	931.4	LOS F	933.8	6816.5	1.00	8.16	3.9

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Existing Layout - 2016 Side Roads PM Peak]

Tasman Highway/ Holyman Avenue
Friday 15:15-16:15
Roundabout

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Cranston Parade											
1	L2	5	50.0	0.023	12.2	LOS B	0.2	1.6	0.92	0.73	49.1
2	T1	1	50.0	0.023	12.1	LOS B	0.2	1.6	0.92	0.73	51.4
3a	R1	1	50.0	0.023	18.3	LOS B	0.2	1.6	0.92	0.73	50.7
3b	R3	1	50.0	0.023	21.1	LOS C	0.2	1.6	0.92	0.73	52.9
3u	U	1	50.0	0.023	22.5	LOS C	0.2	1.6	0.92	0.73	54.0
Approach		9	50.0	0.023	15.0	LOS B	0.2	1.6	0.92	0.73	50.4
SouthEast: Holyman Avenue											
21b	L3	1	5.0	0.436	7.7	LOS A	3.8	27.7	0.95	0.83	51.4
21a	L1	207	5.0	0.436	6.9	LOS A	3.8	27.7	0.95	0.83	53.7
23a	R1	48	5.0	0.436	13.2	LOS B	3.8	27.7	0.95	0.83	54.8
23	R2	69	5.0	0.436	14.6	LOS B	3.8	27.7	0.95	0.83	56.0
23u	U	8	5.0	0.436	17.4	LOS B	3.8	27.7	0.95	0.83	58.6
Approach		335	5.0	0.436	9.7	LOS A	3.8	27.7	0.95	0.83	54.4
NorthEast: Tasman Highway											
24	L2	16	5.0	0.657	6.2	LOS A	7.5	55.1	0.85	0.83	50.7
24a	L1	1	5.0	0.657	5.8	LOS A	7.5	55.1	0.85	0.83	52.1
26a	R1	647	5.0	0.657	12.1	LOS B	7.5	55.1	0.85	0.83	53.0
26b	R3	91	5.0	0.657	14.9	LOS B	7.5	55.1	0.85	0.83	55.3
26u	U	5	5.0	0.657	16.3	LOS B	7.5	55.1	0.85	0.83	56.5
Approach		760	5.0	0.657	12.3	LOS B	7.5	55.1	0.85	0.83	53.2
North: Kennedy Drive											
7b	L3	206	10.0	1.642	666.9	LOS F	88.4	671.9	1.00	3.49	5.1
7a	L1	60	10.0	1.642	666.1	LOS F	88.4	671.9	1.00	3.49	5.1
8	T1	1	10.0	1.642	666.4	LOS F	88.4	671.9	1.00	3.49	5.1
9	R2	25	10.0	1.642	673.8	LOS F	88.4	671.9	1.00	3.49	5.1
9u	U	1	10.0	1.642	676.6	LOS F	88.4	671.9	1.00	3.49	5.2
Approach		294	10.0	1.642	667.3	LOS F	88.4	671.9	1.00	3.49	5.1
West: Tasman Highay											
10	L2	13	5.0	1.038	53.7	LOS E	75.5	551.2	1.00	1.65	36.6
10a	L1	1096	5.0	1.038	53.8	LOS E	75.5	551.2	1.00	1.65	37.2
12a	R1	333	5.0	1.038	60.6	LOS E	75.5	551.2	1.00	1.65	36.1
12	R2	2	5.0	1.038	62.4	LOS E	75.5	551.2	1.00	1.65	36.6
12u	U	5	5.0	1.038	65.9	LOS E	75.5	551.2	1.00	1.65	38.6
Approach		1448	5.0	1.038	55.5	LOS E	75.5	551.2	1.00	1.65	36.9
All Vehicles		2846	5.7	1.642	101.6	LOS F	88.4	671.9	0.95	1.52	24.7

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
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Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Existing Layout - 2018 Side Roads PM Peak]

Tasman Highway/ Holyman Avenue
Friday 15:15-16:15
Roundabout

Movement Performance - Vehicles												
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Cranston Parade											
1	L2	5	50.0	0.030	17.6	LOS B	0.2	2.1	0.98	0.78	45.9
2	T1	1	50.0	0.030	17.4	LOS B	0.2	2.1	0.98	0.78	48.0
3a	R1	1	50.0	0.030	23.7	LOS C	0.2	2.1	0.98	0.78	47.4
3b	R3	1	50.0	0.030	26.4	LOS C	0.2	2.1	0.98	0.78	49.3
3u	U	1	50.0	0.030	27.8	LOS C	0.2	2.1	0.98	0.78	50.2
Approach		9	50.0	0.030	20.3	LOS C	0.2	2.1	0.98	0.78	47.1
SouthEast: Holyman Avenue											
21b	L3	1	5.0	0.636	12.8	LOS B	7.5	55.0	1.00	1.07	48.6
21a	L1	269	5.0	0.636	12.1	LOS B	7.5	55.0	1.00	1.07	50.7
23a	R1	53	5.0	0.636	18.4	LOS B	7.5	55.0	1.00	1.07	51.6
23	R2	125	5.0	0.636	19.8	LOS B	7.5	55.0	1.00	1.07	52.7
23u	U	9	5.0	0.636	22.5	LOS C	7.5	55.0	1.00	1.07	54.9
Approach		458	5.0	0.636	15.1	LOS B	7.5	55.0	1.00	1.07	51.4
NorthEast: Tasman Highway											
24	L2	64	5.0	0.707	6.4	LOS A	9.0	65.5	0.86	0.82	50.9
24a	L1	1	5.0	0.707	6.1	LOS A	9.0	65.5	0.86	0.82	52.3
26a	R1	684	5.0	0.707	12.4	LOS B	9.0	65.5	0.86	0.82	53.3
26b	R3	96	5.0	0.707	15.1	LOS B	9.0	65.5	0.86	0.82	55.6
26u	U	5	5.0	0.707	16.5	LOS B	9.0	65.5	0.86	0.82	56.8
Approach		851	5.0	0.707	12.2	LOS B	9.0	65.5	0.86	0.82	53.4
North: Kennedy Drive											
7b	L3	218	10.0	1.471	524.1	LOS F	78.9	599.4	1.00	3.33	6.3
7a	L1	57	10.0	1.471	523.3	LOS F	78.9	599.4	1.00	3.33	6.4
8	T1	1	10.0	1.471	523.6	LOS F	78.9	599.4	1.00	3.33	6.4
9	R2	26	10.0	1.471	531.0	LOS F	78.9	599.4	1.00	3.33	6.4
9u	U	1	10.0	1.471	533.8	LOS F	78.9	599.4	1.00	3.33	6.4
Approach		303	10.0	1.471	524.6	LOS F	78.9	599.4	1.00	3.33	6.3
West: Tasman Highay											
10	L2	13	5.0	1.147	146.2	LOS F	150.3	1097.0	1.00	3.36	19.5
10a	L1	1158	5.0	1.147	146.3	LOS F	150.3	1097.0	1.00	3.36	19.6
12a	R1	319	5.0	1.147	153.1	LOS F	150.3	1097.0	1.00	3.36	19.3
12	R2	2	5.0	1.147	154.8	LOS F	150.3	1097.0	1.00	3.36	19.5
12u	U	5	5.0	1.147	158.3	LOS F	150.3	1097.0	1.00	3.36	20.0
Approach		1497	5.0	1.147	147.8	LOS F	150.3	1097.0	1.00	3.36	19.6
All Vehicles		3118	5.6	1.471	127.6	LOS F	150.3	1097.0	0.96	2.32	21.2

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Existing Layout - 2038 Side Roads PM Peak]

Tasman Highway/ Holyman Avenue
Friday 15:15-16:15
Roundabout

Movement Performance - Vehicles												
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Cranston Parade											
1	L2	9	50.0	0.094	31.6	LOS C	0.5	5.5	0.97	0.98	39.5
2	T1	1	50.0	0.094	31.4	LOS C	0.5	5.5	0.97	0.98	41.1
3a	R1	1	50.0	0.094	37.7	LOS D	0.5	5.5	0.97	0.98	40.6
3b	R3	1	50.0	0.094	40.4	LOS D	0.5	5.5	0.97	0.98	42.0
3u	U	1	50.0	0.094	41.8	LOS D	0.5	5.5	0.97	0.98	42.7
Approach		14	50.0	0.094	33.5	LOS C	0.5	5.5	0.97	0.98	40.1
SouthEast: Holyman Avenue											
21b	L3	1	5.0	2.572	1436.4	LOS F	492.8	3597.4	1.00	9.05	2.6
21a	L1	792	5.0	2.572	1435.6	LOS F	492.8	3597.4	1.00	9.05	2.6
23a	R1	133	5.0	2.572	1441.9	LOS F	492.8	3597.4	1.00	9.05	2.6
23	R2	266	5.0	2.572	1443.3	LOS F	492.8	3597.4	1.00	9.05	2.6
23u	U	24	5.0	2.572	1446.1	LOS F	492.8	3597.4	1.00	9.05	2.6
Approach		1216	5.0	2.572	1438.2	LOS F	492.8	3597.4	1.00	9.05	2.6
NorthEast: Tasman Highway											
24	L2	124	5.0	1.365	339.6	LOS F	272.3	1987.6	1.00	7.47	9.7
24a	L1	1	5.0	1.365	339.2	LOS F	272.3	1987.6	1.00	7.47	9.7
26a	R1	1188	5.0	1.365	345.5	LOS F	272.3	1987.6	1.00	7.47	9.7
26b	R3	166	5.0	1.365	348.3	LOS F	272.3	1987.6	1.00	7.47	9.8
26u	U	9	5.0	1.365	349.7	LOS F	272.3	1987.6	1.00	7.47	9.9
Approach		1489	5.0	1.365	345.4	LOS F	272.3	1987.6	1.00	7.47	9.7
North: Kennedy Drive											
7b	L3	379	10.0	2.853	1730.6	LOS F	258.9	1967.6	1.00	5.16	2.1
7a	L1	143	10.0	2.853	1729.9	LOS F	258.9	1967.6	1.00	5.16	2.1
8	T1	1	10.0	2.853	1730.1	LOS F	258.9	1967.6	1.00	5.16	2.1
9	R2	45	10.0	2.853	1737.6	LOS F	258.9	1967.6	1.00	5.16	2.1
9u	U	1	10.0	2.853	1740.3	LOS F	258.9	1967.6	1.00	5.16	2.1
Approach		569	10.0	2.853	1731.0	LOS F	258.9	1967.6	1.00	5.16	2.1
West: Tasman Highay											
10	L2	23	5.0	2.159	1052.2	LOS F	990.3	7229.1	1.00	11.31	3.5
10a	L1	2012	5.0	2.159	1052.3	LOS F	990.3	7229.1	1.00	11.31	3.5
12a	R1	800	5.0	2.159	1059.1	LOS F	990.3	7229.1	1.00	11.31	3.5
12	R2	4	5.0	2.159	1060.8	LOS F	990.3	7229.1	1.00	11.31	3.5
12u	U	9	5.0	2.159	1064.3	LOS F	990.3	7229.1	1.00	11.31	3.5
Approach		2848	5.0	2.159	1054.3	LOS F	990.3	7229.1	1.00	11.31	3.5
All Vehicles		6137	5.6	2.853	1018.8	LOS F	990.3	7229.1	1.00	9.33	3.6

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Existing Layout - 2016 Saturday Peak]

Tasman Highway/ Holyman Avenue
Saturday 11:45-12:45
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Cranston Parade											
1	L2	2	50.0	0.018	14.0	LOS B	0.1	1.2	0.95	0.73	47.4
2	T1	1	50.0	0.018	13.8	LOS B	0.1	1.2	0.95	0.73	49.5
3a	R1	1	50.0	0.018	20.1	LOS C	0.1	1.2	0.95	0.73	48.9
3b	R3	1	50.0	0.018	22.9	LOS C	0.1	1.2	0.95	0.73	50.8
3u	U	1	50.0	0.018	24.2	LOS C	0.1	1.2	0.95	0.73	51.9
Approach		6	50.0	0.018	18.2	LOS B	0.1	1.2	0.95	0.73	49.3
SouthEast: Holyman Avenue											
21b	L3	1	5.0	0.492	9.7	LOS A	4.7	34.7	1.00	0.97	51.3
21a	L1	249	5.0	0.492	9.0	LOS A	4.7	34.7	1.00	0.97	53.7
23a	R1	43	5.0	0.492	15.3	LOS B	4.7	34.7	1.00	0.97	54.7
23	R2	41	5.0	0.492	16.7	LOS B	4.7	34.7	1.00	0.97	55.9
23u	U	1	5.0	0.492	19.4	LOS B	4.7	34.7	1.00	0.97	58.5
Approach		336	5.0	0.492	10.8	LOS B	4.7	34.7	1.00	0.97	54.1
NorthEast: Tasman Highway											
24	L2	39	5.0	0.735	8.4	LOS A	10.1	73.8	0.92	0.93	49.9
24a	L1	1	5.0	0.735	8.0	LOS A	10.1	73.8	0.92	0.93	51.3
26a	R1	648	5.0	0.735	14.3	LOS B	10.1	73.8	0.92	0.93	52.2
26b	R3	136	5.0	0.735	17.0	LOS B	10.1	73.8	0.92	0.93	54.4
26u	U	6	5.0	0.735	18.4	LOS B	10.1	73.8	0.92	0.93	55.5
Approach		831	5.0	0.735	14.5	LOS B	10.1	73.8	0.92	0.93	52.4
North: Kennedy Drive											
7b	L3	236	10.0	0.830	51.0	LOS E	14.0	106.8	1.00	1.48	32.7
7a	L1	60	10.0	0.830	50.2	LOS E	14.0	106.8	1.00	1.48	33.7
8	T1	1	10.0	0.830	50.5	LOS E	14.0	106.8	1.00	1.48	34.0
9	R2	41	10.0	0.830	57.9	LOS E	14.0	106.8	1.00	1.48	34.5
9u	U	1	10.0	0.830	60.7	LOS E	14.0	106.8	1.00	1.48	35.6
Approach		339	10.0	0.830	51.7	LOS E	14.0	106.8	1.00	1.48	33.1
West: Tasman Highay											
10	L2	23	5.0	0.819	8.6	LOS A	13.5	98.2	0.87	0.73	62.2
10a	L1	772	5.0	0.819	8.7	LOS A	13.5	98.2	0.87	0.73	64.1
12a	R1	328	5.0	0.819	15.5	LOS B	13.5	98.2	0.87	0.73	61.0
12	R2	4	5.0	0.819	17.2	LOS B	13.5	98.2	0.87	0.73	62.5
12u	U	1	5.0	0.819	20.8	LOS C	13.5	98.2	0.87	0.73	68.4
Approach		1128	5.0	0.819	10.7	LOS B	13.5	98.2	0.87	0.73	63.1
All Vehicles		2640	5.7	0.830	17.2	LOS B	14.0	106.8	0.92	0.92	52.6

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Existing Layout - 2018 Saturday Peak]

Tasman Highway/ Holyman Avenue
Saturday 11:45-12:45
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Cranston Parade											
1	L2	2	50.0	0.024	21.2	LOS C	0.2	1.8	1.00	0.77	43.6
2	T1	1	50.0	0.024	21.0	LOS C	0.2	1.8	1.00	0.77	45.4
3a	R1	1	50.0	0.024	27.2	LOS C	0.2	1.8	1.00	0.77	44.9
3b	R3	1	50.0	0.024	30.0	LOS C	0.2	1.8	1.00	0.77	46.5
3u	U	1	50.0	0.024	31.4	LOS C	0.2	1.8	1.00	0.77	47.4
Approach		6	50.0	0.024	25.3	LOS C	0.2	1.8	1.00	0.77	45.2
SouthEast: Holyman Avenue											
21b	L3	1	5.0	0.751	20.3	LOS C	10.8	79.2	1.00	1.22	44.6
21a	L1	292	5.0	0.751	19.6	LOS B	10.8	79.2	1.00	1.22	46.3
23a	R1	47	5.0	0.751	25.9	LOS C	10.8	79.2	1.00	1.22	47.1
23	R2	123	5.0	0.751	27.3	LOS C	10.8	79.2	1.00	1.22	48.0
23u	U	1	5.0	0.751	30.0	LOS C	10.8	79.2	1.00	1.22	49.9
Approach		464	5.0	0.751	22.3	LOS C	10.8	79.2	1.00	1.22	46.8
NorthEast: Tasman Highway											
24	L2	111	5.0	0.828	10.7	LOS B	14.9	108.8	1.00	1.02	48.7
24a	L1	1	5.0	0.828	10.3	LOS B	14.9	108.8	1.00	1.02	50.0
26a	R1	685	5.0	0.828	16.6	LOS B	14.9	108.8	1.00	1.02	50.9
26b	R3	143	5.0	0.828	19.4	LOS B	14.9	108.8	1.00	1.02	53.0
26u	U	6	5.0	0.828	20.8	LOS C	14.9	108.8	1.00	1.02	54.1
Approach		946	5.0	0.828	16.4	LOS B	14.9	108.8	1.00	1.02	50.9
North: Kennedy Drive											
7b	L3	249	10.0	1.122	208.2	LOS F	46.0	349.2	1.00	2.63	13.7
7a	L1	57	10.0	1.122	207.4	LOS F	46.0	349.2	1.00	2.63	13.9
8	T1	1	10.0	1.122	207.7	LOS F	46.0	349.2	1.00	2.63	14.0
9	R2	43	10.0	1.122	215.1	LOS F	46.0	349.2	1.00	2.63	14.1
9u	U	1	10.0	1.122	217.9	LOS F	46.0	349.2	1.00	2.63	14.2
Approach		352	10.0	1.122	208.9	LOS F	46.0	349.2	1.00	2.63	13.8
West: Tasman Highay											
10	L2	25	5.0	0.911	15.7	LOS B	23.4	170.9	1.00	1.01	57.1
10a	L1	816	5.0	0.911	15.8	LOS B	23.4	170.9	1.00	1.01	58.7
12a	R1	315	5.0	0.911	22.5	LOS C	23.4	170.9	1.00	1.01	56.0
12	R2	4	5.0	0.911	24.3	LOS C	23.4	170.9	1.00	1.01	57.3
12u	U	1	5.0	0.911	27.8	LOS C	23.4	170.9	1.00	1.01	62.2
Approach		1161	5.0	0.911	17.6	LOS B	23.4	170.9	1.00	1.01	57.9
All Vehicles		2929	5.7	1.122	40.9	LOS D	46.0	349.2	1.00	1.24	39.9

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Existing Layout - 2038 Saturday Peak]

Tasman Highway/ Holyman Avenue
Saturday 11:45-12:45
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Cranston Parade											
1	L2	4	50.0	0.053	30.9	LOS C	0.3	3.1	0.97	0.93	39.6
2	T1	1	50.0	0.053	30.8	LOS C	0.3	3.1	0.97	0.93	41.1
3a	R1	1	50.0	0.053	37.0	LOS D	0.3	3.1	0.97	0.93	40.6
3b	R3	1	50.0	0.053	39.8	LOS D	0.3	3.1	0.97	0.93	42.0
3u	U	1	50.0	0.053	41.2	LOS D	0.3	3.1	0.97	0.93	42.7
Approach		8	50.0	0.053	34.1	LOS C	0.3	3.1	0.97	0.93	40.5
SouthEast: Holyman Avenue											
21b	L3	1	5.0	1.982	903.3	LOS F	378.1	2760.0	1.00	8.82	4.0
21a	L1	779	5.0	1.982	902.6	LOS F	378.1	2760.0	1.00	8.82	4.0
23a	R1	119	5.0	1.982	908.9	LOS F	378.1	2760.0	1.00	8.82	4.0
23	R2	243	5.0	1.982	910.3	LOS F	378.1	2760.0	1.00	8.82	4.0
23u	U	1	5.0	1.982	913.0	LOS F	378.1	2760.0	1.00	8.82	4.0
Approach		1143	5.0	1.982	904.9	LOS F	378.1	2760.0	1.00	8.82	4.0
NorthEast: Tasman Highway											
24	L2	220	5.0	1.660	604.5	LOS F	438.2	3198.9	1.00	10.36	5.9
24a	L1	1	5.0	1.660	604.1	LOS F	438.2	3198.9	1.00	10.36	5.9
26a	R1	1191	5.0	1.660	610.4	LOS F	438.2	3198.9	1.00	10.36	5.9
26b	R3	248	5.0	1.660	613.2	LOS F	438.2	3198.9	1.00	10.36	5.9
26u	U	12	5.0	1.660	614.6	LOS F	438.2	3198.9	1.00	10.36	5.9
Approach		1672	5.0	1.660	610.1	LOS F	438.2	3198.9	1.00	10.36	5.9
North: Kennedy Drive											
7b	L3	434	10.0	2.747	1630.2	LOS F	290.8	2210.0	1.00	5.59	2.2
7a	L1	143	10.0	2.747	1629.4	LOS F	290.8	2210.0	1.00	5.59	2.2
8	T1	2	10.0	2.747	1629.7	LOS F	290.8	2210.0	1.00	5.59	2.2
9	R2	76	10.0	2.747	1637.1	LOS F	290.8	2210.0	1.00	5.59	2.2
9u	U	1	10.0	2.747	1639.9	LOS F	290.8	2210.0	1.00	5.59	2.2
Approach		656	10.0	2.747	1630.8	LOS F	290.8	2210.0	1.00	5.59	2.2
West: Tasman Highay											
10	L2	43	5.0	1.791	721.7	LOS F	649.5	4741.2	1.00	9.65	5.0
10a	L1	1417	5.0	1.791	721.8	LOS F	649.5	4741.2	1.00	9.65	5.0
12a	R1	788	5.0	1.791	728.6	LOS F	649.5	4741.2	1.00	9.65	5.0
12	R2	7	5.0	1.791	730.3	LOS F	649.5	4741.2	1.00	9.65	5.0
12u	U	1	5.0	1.791	733.8	LOS F	649.5	4741.2	1.00	9.65	5.0
Approach		2257	5.0	1.791	724.2	LOS F	649.5	4741.2	1.00	9.65	5.0
All Vehicles		5736	5.6	2.747	829.6	LOS F	649.5	4741.2	1.00	9.22	4.4

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Two Lane Roundabout - 2023 Airport AM Peak - Two Lanes to Sorell]

Tasman Highway/ Holyman Avenue
Friday 08:45-09:45
Roundabout

Movement Performance - Vehicles												
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Cranston Parade											
1	L2	4	50.0	0.026	13.3	LOS B	0.1	1.2	0.80	0.85	50.0
2	T1	1	50.0	0.026	13.2	LOS B	0.1	1.2	0.80	0.85	52.2
3a	R1	1	50.0	0.026	19.8	LOS B	0.1	1.2	0.80	0.85	50.2
3b	R3	1	50.0	0.026	23.1	LOS C	0.1	1.2	0.80	0.85	51.5
3u	U	1	50.0	0.026	24.7	LOS C	0.1	1.2	0.80	0.85	52.2
Approach		8	50.0	0.026	16.7	LOS B	0.1	1.2	0.80	0.85	50.8
SouthEast: Holyman Avenue											
21b	L3	1	5.0	0.994	42.3	LOS D	20.9	152.6	1.00	1.86	37.1
21a	L1	398	5.0	0.994	41.2	LOS D	20.9	152.6	1.00	1.86	38.2
23a	R1	63	5.0	0.994	47.6	LOS D	20.9	152.6	1.00	1.86	38.1
23	R2	117	5.0	0.994	48.9	LOS D	20.9	152.6	1.00	1.86	38.5
23u	U	11	5.0	0.994	51.6	LOS E	20.9	152.6	1.00	1.86	39.3
Approach		589	5.0	0.994	43.6	LOS D	20.9	152.6	1.00	1.86	38.3
NorthEast: Tasman Highway											
24	L2	112	5.0	0.648	12.4	LOS B	8.4	61.5	0.99	0.98	56.8
24a	L1	1	5.0	0.648	11.8	LOS B	8.4	61.5	0.99	0.98	58.4
26a	R1	924	5.0	0.648	19.6	LOS B	8.4	61.5	0.98	1.01	56.9
26b	R3	149	5.0	0.648	24.5	LOS C	7.3	53.5	0.97	1.07	56.3
26u	U	3	5.0	0.648	26.2	LOS C	7.3	53.5	0.97	1.07	57.1
Approach		1189	5.0	0.648	19.5	LOS B	8.4	61.5	0.98	1.02	56.8
North: Kennedy Drive											
7b	L3	119	10.0	0.158	8.3	LOS A	0.8	6.4	0.76	0.86	62.5
7a	L1	95	10.0	0.206	9.0	LOS A	1.0	7.5	0.76	0.86	64.1
8	T1	1	10.0	0.206	9.5	LOS A	1.0	7.5	0.76	0.86	64.9
9	R2	15	10.0	0.206	17.5	LOS B	1.0	7.5	0.76	0.86	64.8
9u	U	1	10.0	0.206	20.8	LOS C	1.0	7.5	0.76	0.86	67.0
Approach		231	10.0	0.206	9.3	LOS A	1.0	7.5	0.76	0.86	63.4
West: Tasman Highway											
10	L2	36	5.0	0.476	7.1	LOS A	3.6	26.6	0.67	0.62	65.1
10a	L1	579	5.0	0.476	6.5	LOS A	3.9	28.8	0.67	0.63	66.5
12a	R1	600	5.0	0.476	12.7	LOS B	3.9	28.8	0.64	0.69	62.0
12	R2	17	5.0	0.476	14.4	LOS B	3.9	28.8	0.64	0.69	63.0
12u	U	1	5.0	0.476	17.7	LOS B	3.9	28.8	0.64	0.69	65.0
Approach		1233	5.0	0.476	9.6	LOS A	3.9	28.8	0.65	0.66	64.1
All Vehicles		3251	5.5	0.994	19.4	LOS B	20.9	152.6	0.84	1.02	54.8

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Two Lane Roundabout - 2023 Airport PM Peak - Two Lanes to Sorell]

Tasman Highway/ Holyman Avenue
Friday 15:15-16:15
Roundabout

Movement Performance - Vehicles												
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Cranston Parade											
1	L2	6	50.0	0.028	12.9	LOS B	0.1	1.3	0.77	0.83	50.5
2	T1	1	50.0	0.028	12.8	LOS B	0.1	1.3	0.77	0.83	52.8
3a	R1	1	50.0	0.028	19.4	LOS B	0.1	1.3	0.77	0.83	50.8
3b	R3	1	50.0	0.028	22.7	LOS C	0.1	1.3	0.77	0.83	52.1
3u	U	1	50.0	0.028	24.3	LOS C	0.1	1.3	0.77	0.83	52.8
Approach		11	50.0	0.028	15.7	LOS B	0.1	1.3	0.77	0.83	51.2
SouthEast: Holyman Avenue											
21b	L3	1	5.0	0.882	16.2	LOS B	10.6	77.2	0.96	1.29	49.6
21a	L1	398	5.0	0.882	15.0	LOS B	10.6	77.2	0.96	1.29	51.5
23a	R1	66	5.0	0.882	21.5	LOS C	10.6	77.2	0.96	1.29	51.3
23	R2	154	5.0	0.882	22.8	LOS C	10.6	77.2	0.96	1.29	52.0
23u	U	12	5.0	0.882	25.4	LOS C	10.6	77.2	0.96	1.29	53.4
Approach		631	5.0	0.882	17.8	LOS B	10.6	77.2	0.96	1.29	51.6
NorthEast: Tasman Highway											
24	L2	76	5.0	0.445	7.4	LOS A	3.8	27.8	0.78	0.76	59.7
24a	L1	1	5.0	0.445	6.8	LOS A	3.8	27.8	0.78	0.76	61.5
26a	R1	785	5.0	0.445	13.9	LOS B	3.8	27.8	0.78	0.78	60.7
26b	R3	111	5.0	0.445	17.8	LOS B	3.4	24.7	0.79	0.82	61.5
26u	U	6	5.0	0.445	19.4	LOS B	3.4	24.7	0.79	0.82	62.4
Approach		979	5.0	0.445	13.9	LOS B	3.8	27.8	0.78	0.79	60.7
North: Kennedy Drive											
7b	L3	251	10.0	0.444	11.2	LOS B	2.9	21.7	0.91	1.00	59.5
7a	L1	72	10.0	0.266	10.7	LOS B	1.3	10.0	0.85	0.93	61.3
8	T1	1	10.0	0.266	11.1	LOS B	1.3	10.0	0.85	0.93	62.0
9	R2	31	10.0	0.266	19.1	LOS B	1.3	10.0	0.85	0.93	61.9
9u	U	1	10.0	0.266	22.4	LOS C	1.3	10.0	0.85	0.93	63.9
Approach		355	10.0	0.444	11.8	LOS B	2.9	21.7	0.89	0.98	60.1
West: Tasman Highway											
10	L2	15	5.0	0.686	7.8	LOS A	8.1	59.0	0.79	0.70	64.3
10a	L1	1329	5.0	0.686	7.6	LOS A	8.1	59.0	0.80	0.73	65.4
12a	R1	402	5.0	0.686	15.5	LOS B	8.1	58.8	0.83	0.82	62.7
12	R2	3	5.0	0.686	17.1	LOS B	8.1	58.8	0.83	0.82	63.7
12u	U	6	5.0	0.686	20.4	LOS C	8.1	58.8	0.83	0.82	65.8
Approach		1756	5.0	0.686	9.5	LOS A	8.1	59.0	0.81	0.75	64.8
All Vehicles		3731	5.6	0.882	12.3	LOS B	10.6	77.2	0.84	0.87	60.6

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Two Lane Roundabout - 2023 Network AM Peak - Two Lanes to Sorell]

Tasman Highway/ Holyman Avenue
Friday 07:00-08:00
Roundabout

Movement Performance - Vehicles												
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Cranston Parade											
1	L2	3	50.0	0.024	14.0	LOS B	0.1	1.1	0.81	0.86	49.4
2	T1	1	50.0	0.024	13.8	LOS B	0.1	1.1	0.81	0.86	51.5
3a	R1	1	50.0	0.024	20.4	LOS C	0.1	1.1	0.81	0.86	49.6
3b	R3	1	50.0	0.024	23.7	LOS C	0.1	1.1	0.81	0.86	50.9
3u	U	1	50.0	0.024	25.4	LOS C	0.1	1.1	0.81	0.86	51.5
Approach		7	50.0	0.024	17.9	LOS B	0.1	1.1	0.81	0.86	50.2
SouthEast: Holyman Avenue											
21b	L3	1	5.0	0.790	17.9	LOS B	6.5	47.8	0.95	1.18	48.8
21a	L1	264	5.0	0.790	16.8	LOS B	6.5	47.8	0.95	1.18	50.6
23a	R1	52	5.0	0.790	23.2	LOS C	6.5	47.8	0.95	1.18	50.5
23	R2	57	5.0	0.790	24.5	LOS C	6.5	47.8	0.95	1.18	51.2
23u	U	5	5.0	0.790	27.2	LOS C	6.5	47.8	0.95	1.18	52.5
Approach		379	5.0	0.790	18.9	LOS B	6.5	47.8	0.95	1.18	50.7
NorthEast: Tasman Highway											
24	L2	65	5.0	0.635	7.4	LOS A	6.5	47.2	0.73	0.74	59.5
24a	L1	1	5.0	0.635	6.8	LOS A	6.5	47.2	0.73	0.74	61.3
26a	R1	1433	5.0	0.635	14.2	LOS B	6.5	47.4	0.75	0.77	60.6
26b	R3	139	5.0	0.635	18.3	LOS B	6.5	47.4	0.78	0.82	61.8
26u	U	1	5.0	0.635	20.0	LOS B	6.5	47.4	0.78	0.82	62.7
Approach		1639	5.0	0.635	14.3	LOS B	6.5	47.4	0.75	0.78	60.7
North: Kennedy Drive											
7b	L3	63	10.0	0.061	6.6	LOS A	0.3	1.9	0.53	0.69	63.8
7a	L1	35	10.0	0.059	6.6	LOS A	0.2	1.7	0.55	0.67	65.0
8	T1	1	10.0	0.059	7.0	LOS A	0.2	1.7	0.55	0.67	65.7
9	R2	11	10.0	0.059	15.1	LOS B	0.2	1.7	0.55	0.67	65.6
9u	U	1	10.0	0.059	18.4	LOS B	0.2	1.7	0.55	0.67	67.9
Approach		111	10.0	0.061	7.5	LOS A	0.3	1.9	0.54	0.68	64.4
West: Tasman Highway											
10	L2	25	5.0	0.276	5.9	LOS A	1.8	13.5	0.46	0.50	66.6
10a	L1	429	5.0	0.276	5.3	LOS A	1.8	13.5	0.46	0.51	68.6
12a	R1	304	5.0	0.276	12.4	LOS B	1.7	12.7	0.49	0.67	62.4
12	R2	9	5.0	0.276	14.1	LOS B	1.7	12.7	0.49	0.67	63.3
12u	U	3	5.0	0.276	17.4	LOS B	1.7	12.7	0.49	0.67	65.4
Approach		772	5.0	0.276	8.3	LOS A	1.8	13.5	0.47	0.57	65.8
All Vehicles		2907	5.3	0.790	13.0	LOS B	6.5	47.8	0.70	0.77	60.5

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Two Lane Roundabout - 2023 Network PM Peak - Two Lanes to Sorell]

Tasman Highway/ Holyman Avenue
Friday 16:00-01700
Roundabout

Movement Performance - Vehicles												
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Cranston Parade											
1	L2	1	50.0	0.012	11.7	LOS B	0.1	0.5	0.72	0.77	50.2
2	T1	1	50.0	0.012	11.6	LOS B	0.1	0.5	0.72	0.77	52.3
3a	R1	1	50.0	0.012	18.1	LOS B	0.1	0.5	0.72	0.77	50.4
3b	R3	1	50.0	0.012	21.4	LOS C	0.1	0.5	0.72	0.77	51.7
3u	U	1	50.0	0.012	23.1	LOS C	0.1	0.5	0.72	0.77	52.3
Approach		5	50.0	0.012	17.2	LOS B	0.1	0.5	0.72	0.77	51.4
SouthEast: Holyman Avenue											
21b	L3	1	5.0	0.747	9.7	LOS A	6.5	47.3	0.86	1.05	54.4
21a	L1	415	5.0	0.747	8.5	LOS A	6.5	47.3	0.86	1.05	56.7
23a	R1	49	5.0	0.747	15.0	LOS B	6.5	47.3	0.86	1.05	56.6
23	R2	127	5.0	0.747	16.3	LOS B	6.5	47.3	0.86	1.05	57.4
23u	U	8	5.0	0.747	19.0	LOS B	6.5	47.3	0.86	1.05	59.1
Approach		601	5.0	0.747	10.8	LOS B	6.5	47.3	0.86	1.05	56.9
NorthEast: Tasman Highway											
24	L2	88	5.0	0.353	6.7	LOS A	2.7	19.8	0.65	0.71	60.6
24a	L1	1	5.0	0.353	6.1	LOS A	2.7	19.8	0.65	0.71	62.4
26a	R1	663	5.0	0.353	13.2	LOS B	2.7	19.8	0.66	0.73	61.4
26b	R3	95	5.0	0.353	16.9	LOS B	2.5	17.9	0.67	0.76	62.1
26u	U	3	5.0	0.353	18.6	LOS B	2.5	17.9	0.67	0.76	63.1
Approach		851	5.0	0.353	13.0	LOS B	2.7	19.8	0.66	0.73	61.4
North: Kennedy Drive											
7b	L3	224	10.0	0.372	10.3	LOS B	2.2	17.1	0.88	0.97	60.4
7a	L1	69	10.0	0.242	10.6	LOS B	1.2	8.9	0.83	0.92	61.4
8	T1	1	10.0	0.242	11.1	LOS B	1.2	8.9	0.83	0.92	62.1
9	R2	28	10.0	0.242	19.1	LOS B	1.2	8.9	0.83	0.92	62.0
9u	U	1	10.0	0.242	22.4	LOS C	1.2	8.9	0.83	0.92	64.0
Approach		324	10.0	0.372	11.2	LOS B	2.2	17.1	0.87	0.95	60.8
West: Tasman Highway											
10	L2	12	5.0	0.646	6.6	LOS A	6.4	46.6	0.69	0.57	64.9
10a	L1	1409	5.0	0.646	6.4	LOS A	6.6	48.4	0.71	0.62	66.3
12a	R1	322	5.0	0.646	14.0	LOS B	6.6	48.4	0.74	0.73	64.3
12	R2	3	5.0	0.646	15.6	LOS B	6.6	48.4	0.74	0.73	65.4
12u	U	3	5.0	0.646	18.9	LOS B	6.6	48.4	0.74	0.73	67.6
Approach		1749	5.0	0.646	7.8	LOS A	6.6	48.4	0.72	0.64	65.9
All Vehicles		3531	5.5	0.747	9.9	LOS A	6.6	48.4	0.74	0.76	62.6

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Two Lane Roundabout - 2023 Saturday Peak - Two Lanes to Sorell]

Tasman Highway/ Holyman Avenue
Saturday 11:45-12:45
Roundabout

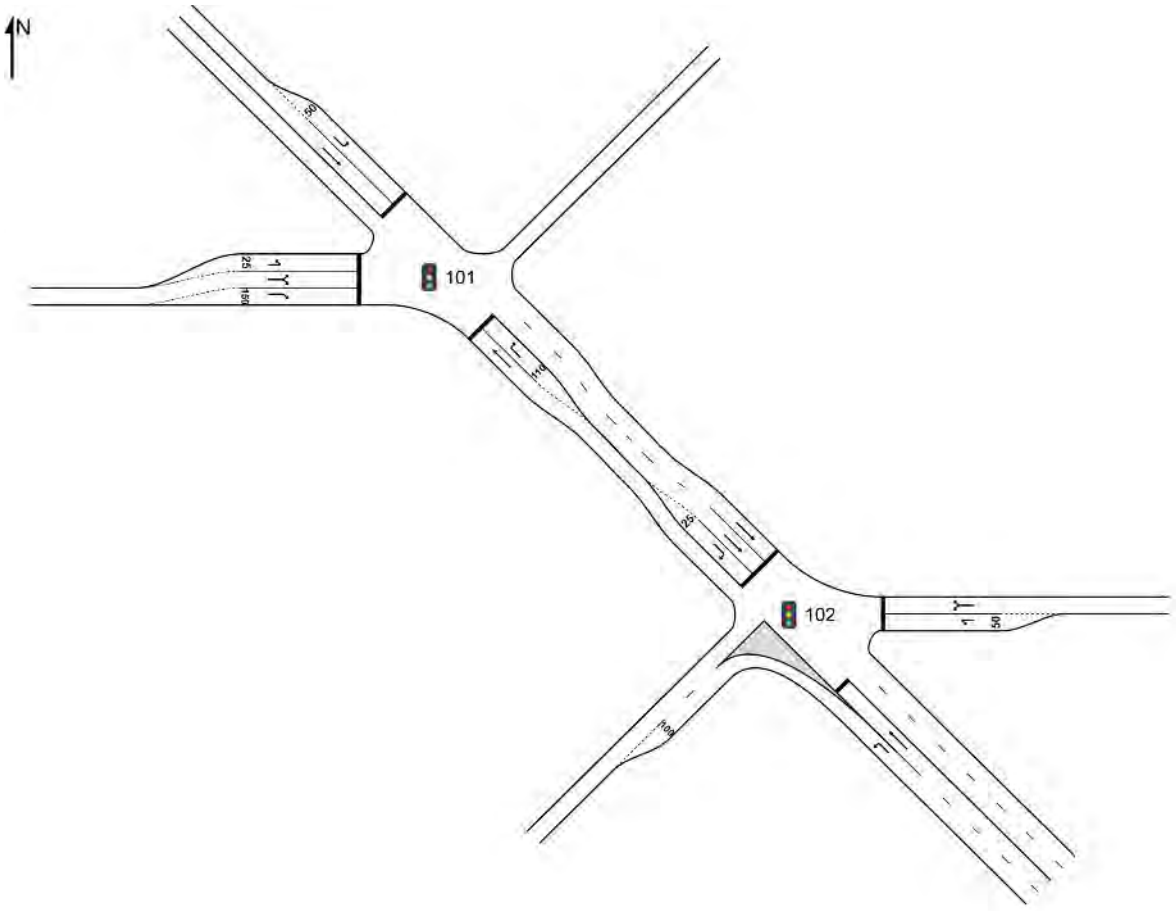
Movement Performance - Vehicles												
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Cranston Parade											
1	L2	3	50.0	0.021	13.3	LOS B	0.1	0.9	0.78	0.82	49.8
2	T1	1	50.0	0.021	13.2	LOS B	0.1	0.9	0.78	0.82	51.9
3a	R1	1	50.0	0.021	19.8	LOS B	0.1	0.9	0.78	0.82	50.0
3b	R3	1	50.0	0.021	23.1	LOS C	0.1	0.9	0.78	0.82	51.3
3u	U	1	50.0	0.021	24.7	LOS C	0.1	0.9	0.78	0.82	52.0
Approach		7	50.0	0.021	17.2	LOS B	0.1	0.9	0.78	0.82	50.6
SouthEast: Holyman Avenue											
21b	L3	1	5.0	0.876	16.1	LOS B	9.9	72.5	0.96	1.27	49.7
21a	L1	392	5.0	0.876	15.0	LOS B	9.9	72.5	0.96	1.27	51.6
23a	R1	60	5.0	0.876	21.4	LOS C	9.9	72.5	0.96	1.27	51.5
23	R2	147	5.0	0.876	22.8	LOS C	9.9	72.5	0.96	1.27	52.2
23u	U	1	5.0	0.876	25.4	LOS C	9.9	72.5	0.96	1.27	53.6
Approach		601	5.0	0.876	17.6	LOS B	9.9	72.5	0.96	1.27	51.7
NorthEast: Tasman Highway											
24	L2	131	5.0	0.487	7.5	LOS A	4.2	30.7	0.78	0.76	60.2
24a	L1	1	5.0	0.487	6.9	LOS A	4.2	30.7	0.78	0.76	62.0
26a	R1	787	5.0	0.487	14.1	LOS B	4.2	30.7	0.79	0.79	60.9
26b	R3	164	5.0	0.487	18.2	LOS B	3.9	28.7	0.79	0.84	61.2
26u	U	7	5.0	0.487	19.9	LOS B	3.9	28.7	0.79	0.84	62.1
Approach		1091	5.0	0.487	14.0	LOS B	4.2	30.7	0.79	0.80	60.9
North: Kennedy Drive											
7b	L3	286	10.0	0.393	8.8	LOS A	2.3	17.2	0.82	0.94	62.0
7a	L1	72	10.0	0.241	8.9	LOS A	1.1	8.5	0.77	0.88	62.1
8	T1	1	10.0	0.241	9.3	LOS A	1.1	8.5	0.77	0.88	62.8
9	R2	49	10.0	0.241	17.3	LOS B	1.1	8.5	0.77	0.88	62.7
9u	U	1	10.0	0.241	20.6	LOS C	1.1	8.5	0.77	0.88	64.7
Approach		409	10.0	0.393	9.9	LOS A	2.3	17.2	0.80	0.92	62.1
West: Tasman Highway											
10	L2	28	5.0	0.540	6.8	LOS A	4.7	34.5	0.70	0.59	64.9
10a	L1	936	5.0	0.540	6.4	LOS A	4.7	34.5	0.71	0.63	66.3
12a	R1	396	5.0	0.540	14.0	LOS B	4.5	33.1	0.73	0.76	63.0
12	R2	4	5.0	0.540	15.6	LOS B	4.5	33.1	0.73	0.76	64.0
12u	U	1	5.0	0.540	18.9	LOS B	4.5	33.1	0.73	0.76	66.1
Approach		1365	5.0	0.540	8.7	LOS A	4.7	34.5	0.71	0.66	65.2
All Vehicles		3474	5.7	0.876	12.0	LOS B	9.9	72.5	0.79	0.84	60.7

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

NETWORK LAYOUT

Network: N101 [Tasman Highway/ Holyman Avenue/ Kennedy Drive Signals - 2018 AM Peak]

New Network



SITES IN NETWORK	
Site ID	**Site Name**
101	Tasman Highway/ Kennedy Drive Signals - 2018 AM Peak
102	Tasman Highway/ Holyman Avenue Signals - 2018 AM Peak

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MOVEMENT SUMMARY

Site: 101 [Tasman Highway/ Kennedy Drive Signals - 2018 AM Peak]

Network: N101 [Tasman Highway/ Holyman Avenue/ Kennedy Drive Signals - 2018 AM Peak]

Tasman Highway/ Kennedy Drive
Friday 07:00-08:00
Signals - Fixed Time Coordinated Cycle Time = 30 seconds (Network Cycle Time - Program)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	Demand Flows HV %	Arrival Flows Total veh/h	Arrival Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
SouthEast: Connection													
22	T1	180	5.0	180	5.0	0.408	13.9	LOS B	2.7	20.0	1.00	0.80	45.4
23	R2	101	5.0	101	5.0	0.286	19.8	LOS B	1.6	11.4	1.00	0.77	39.7
Approach		281	5.0	281	5.0	0.408	16.0	LOS B	2.7	20.0	1.00	0.79	43.2
NorthWest: Kennedy Drive													
27	L2	104	10.0	104	10.0	0.258	16.6	LOS B	1.3	10.2	0.85	0.75	45.9
28	T1	89	10.0	89	10.0	0.209	10.7	LOS B	1.1	8.6	0.84	0.65	44.4
Approach		194	10.0	194	10.0	0.258	13.9	LOS B	1.3	10.2	0.85	0.70	45.5
West: Tasman Highway (From Hobart)													
10b	L3	32	5.0	32	5.0	0.055	13.4	LOS B	0.3	2.3	0.67	0.69	48.3
10a	L1	1	5.0	1	5.0	0.448	12.8	LOS B	3.6	26.0	0.80	0.78	48.2
12a	R1	605	5.0	605	5.0	0.448	12.8	LOS B	3.6	26.0	0.80	0.78	42.4
Approach		638	5.0	638	5.0	0.448	12.8	LOS B	3.6	26.0	0.80	0.77	42.9
All Vehicles		1113	5.9	1113	5.9	0.448	13.8	LOS B	3.6	26.0	0.86	0.77	43.5

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Network Model Accuracy Level (largest change in degree of saturation for any lane): 0.0 %
Number of Iterations: 3 (maximum specified: 10)

MOVEMENT SUMMARY

Site: 102 [Tasman Highway/ Holyman Avenue Signals - 2018 AM Peak]

Network: N101 [Tasman Highway/ Holyman Avenue/ Kennedy Drive Signals - 2018 AM Peak]

Tasman Highway/ Holyman Avenue
Friday 07:00-08:00
Signals - Fixed Time Coordinated Cycle Time = 30 seconds (Network Cycle Time - Program)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	Demand Flows HV %	Arrival Flows Total veh/h	Arrival Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
SouthEast: Holyman Avenue													
21	L2	289	5.0	289	5.0	0.161	5.7	LOS A	0.0	0.0	0.00	0.53	54.7
22	T1	147	5.0	147	5.0	0.195	6.6	LOS A	1.5	10.7	0.68	0.55	49.4
Approach		437	5.0	437	5.0	0.195	6.0	LOS A	1.5	10.7	0.23	0.53	53.6
East: Tasman Highway (From Sorell)													
4b	L3	93	5.0	93	5.0	0.294	18.6	LOS B	1.3	9.3	0.89	0.76	45.2
4a	L1	1	5.0	1	5.0	0.362	16.7	LOS B	1.8	13.5	0.90	0.76	46.1
6a	R1	133	5.0	133	5.0	0.362	16.8	LOS B	1.8	13.5	0.90	0.76	38.8
Approach		226	5.0	226	5.0	0.362	17.5	LOS B	1.8	13.5	0.90	0.76	42.3
NorthWest: Connection													
28	T1	681	5.0	681	5.0	0.451	2.4	LOS A	2.2	15.9	0.31	0.26	56.9
29	R2	13	5.0	13	5.0	0.023	6.8	LOS A	0.0	0.1	0.11	0.64	49.1
Approach		694	5.0	694	5.0	0.451	2.4	LOS A	2.2	15.9	0.31	0.27	56.7
All Vehicles		1357	5.0	1357	5.0	0.451	6.1	LOS A	2.2	15.9	0.38	0.44	52.8

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Network Model Accuracy Level (largest change in degree of saturation for any lane): 0.0 %
Number of Iterations: 3 (maximum specified: 10)

MOVEMENT SUMMARY

Site: 101 [Tasman Highway/ Kennedy Drive Signals - 2038 AM Peak]

Network: N101 [Tasman Highway/ Holyman Avenue/ Kennedy Drive Signals - 2038 AM Peak]

Tasman Highway/ Kennedy Drive
Friday 07:00-08:00
Signals - Fixed Time Coordinated Cycle Time = 50 seconds (Network Cycle Time - Program)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	Demand Flows HV %	Arrival Flows Total veh/h	Arrival Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
SouthEast: Connection													
22	T1	353	5.0	353	5.0	0.718	20.1	LOS C	8.7	63.6	0.98	0.88	40.9
23	R2	208	5.0	208	5.0	0.811	32.3	LOS C	5.9	43.1	1.00	0.94	33.3
Approach		561	5.0	561	5.0	0.811	24.7	LOS C	8.7	63.6	0.99	0.91	37.7
NorthWest: Kennedy Drive													
27	L2	180	10.0	180	10.0	0.399	22.9	LOS C	3.8	28.9	0.87	0.78	42.5
28	T1	214	10.0	214	10.0	0.449	17.4	LOS B	4.6	34.7	0.88	0.73	38.2
Approach		394	10.0	394	10.0	0.449	19.9	LOS B	4.6	34.7	0.88	0.75	40.8
West: Tasman Highway (From Hobart)													
10b	L3	55	5.0	55	5.0	0.070	13.6	LOS B	0.7	5.1	0.54	0.70	48.2
10a	L1	1	5.0	1	5.0	0.837	22.4	LOS C	18.8	137.5	0.89	0.96	42.8
12a	R1	1505	5.0	1505	5.0	0.837	22.5	LOS C	20.3	147.9	0.91	0.96	34.6
Approach		1561	5.0	1561	5.0	0.837	22.2	LOS C	20.3	147.9	0.90	0.95	35.3
All Vehicles		2516	5.8	2516	5.8	0.837	22.4	LOS C	20.3	147.9	0.91	0.91	36.9

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Network Model Accuracy Level (largest change in degree of saturation for any lane): 0.0 %
Number of Iterations: 3 (maximum specified: 10)

MOVEMENT SUMMARY

Site: 102 [Tasman Highway/ Holyman Avenue Signals - 2038 AM Peak]

Network: N101 [Tasman Highway/ Holyman Avenue/ Kennedy Drive Signals - 2038 AM Peak]

Tasman Highway/ Holyman Avenue
Friday 07:00-08:00
Signals - Fixed Time Coordinated Cycle Time = 50 seconds (Network Cycle Time - Program)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	Demand Flows HV %	Arrival Flows Total veh/h	Arrival Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
SouthEast: Holyman Avenue													
21	L2	798	5.0	798	5.0	0.445	5.7	LOS A	0.0	0.0	0.00	0.53	54.7
22	T1	327	5.0	327	5.0	0.289	5.2	LOS A	3.9	28.4	0.52	0.44	51.2
Approach		1125	5.0	1125	5.0	0.445	5.6	LOS A	3.9	28.4	0.15	0.50	54.1
East: Tasman Highway (From Sorell)													
4b	L3	196	5.0	196	5.0	0.778	33.1	LOS C	5.4	39.4	1.00	0.95	38.4
4a	L1	1	5.0	1	5.0	0.784	30.7	LOS C	6.3	46.1	1.00	0.95	39.1
6a	R1	231	5.0	231	5.0	0.784	30.8	LOS C	6.3	46.1	1.00	0.95	29.9
Approach		427	5.0	427	5.0	0.784	31.8	LOS C	6.3	46.1	1.00	0.95	34.8
NorthWest: Connection													
28	T1	1696	5.0	1696	5.0	0.748	4.6	LOS A	12.9	94.3	0.43	0.42	54.2
29	R2	23	5.0	23	5.0	0.039	9.2	LOS A	0.1	1.0	0.24	0.66	46.9
Approach		1719	5.0	1719	5.0	0.748	4.7	LOS A	12.9	94.3	0.43	0.42	54.1
All Vehicles		3272	5.0	3272	5.0	0.784	8.5	LOS A	12.9	94.3	0.41	0.52	50.6

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Network Model Accuracy Level (largest change in degree of saturation for any lane): 0.0 %
Number of Iterations: 3 (maximum specified: 10)

MOVEMENT SUMMARY

Site: 101 [Tasman Highway/ Kennedy Drive Signals - 2018 PM Peak]

Network: N101 [Tasman Highway/ Holyman Avenue/ Kennedy Drive Signals - 2018 PM Peak]

Tasman Highway/ Kennedy Drive
Friday 07:00-08:00
Signals - Fixed Time Coordinated Cycle Time = 30 seconds (Network Cycle Time - Program)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	Demand Flows HV %	Arrival Flows Total veh/h	Arrival Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
SouthEast: Connection													
22	T1	149	5.0	149	5.0	0.396	14.8	LOS B	2.3	17.0	1.00	0.79	44.7
23	R2	131	5.0	131	5.0	0.533	22.5	LOS C	2.1	15.6	1.00	0.78	38.1
Approach		280	5.0	280	5.0	0.533	18.4	LOS B	2.3	17.0	1.00	0.78	41.4
NorthWest: Kennedy Drive													
27	L2	218	10.0	218	10.0	0.628	19.3	LOS B	3.3	25.3	0.96	0.86	44.4
28	T1	83	10.0	83	10.0	0.227	11.7	LOS B	1.1	8.4	0.87	0.67	43.4
Approach		301	10.0	301	10.0	0.628	17.2	LOS B	3.3	25.3	0.94	0.81	44.2
West: Tasman Highway (From Hobart)													
10b	L3	13	5.0	13	5.0	0.020	12.6	LOS B	0.1	0.8	0.62	0.66	48.9
10a	L1	1	5.0	1	5.0	0.266	11.4	LOS B	2.0	14.8	0.71	0.74	49.1
12a	R1	393	5.0	393	5.0	0.266	11.4	LOS B	2.0	14.8	0.71	0.74	43.8
Approach		406	5.0	406	5.0	0.266	11.5	LOS B	2.0	14.8	0.70	0.74	44.1
All Vehicles		987	6.5	987	6.5	0.628	15.2	LOS B	3.3	25.3	0.86	0.77	43.3

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Network Model Accuracy Level (largest change in degree of saturation for any lane): 0.0 %
Number of Iterations: 3 (maximum specified: 10)

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MOVEMENT SUMMARY

Site: 102 [Tasman Highway/ Holyman Avenue Signals - 2018 PM Peak]

Network: N101 [Tasman Highway/ Holyman Avenue/ Kennedy Drive Signals - 2018 PM Peak]

Tasman Highway/ Holyman Avenue
Friday 07:00-08:00
Signals - Fixed Time Coordinated Cycle Time = 30 seconds (Network Cycle Time - Program)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	Demand Flows HV %	Arrival Flows Total veh/h	Arrival Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
SouthEast: Holyman Avenue													
21	L2	275	5.0	275	5.0	0.153	5.7	LOS A	0.0	0.0	0.00	0.53	54.7
22	T1	179	5.0	179	5.0	0.237	6.7	LOS A	1.8	13.3	0.70	0.57	49.2
Approach		454	5.0	454	5.0	0.237	6.1	LOS A	1.8	13.3	0.28	0.54	53.3
East: Tasman Highway (From Sorell)													
4b	L3	64	5.0	64	5.0	0.204	18.3	LOS B	0.9	6.3	0.87	0.74	45.4
4a	L1	1	5.0	1	5.0	0.276	16.4	LOS B	1.4	10.0	0.88	0.75	46.2
6a	R1	101	5.0	101	5.0	0.276	16.5	LOS B	1.4	10.0	0.88	0.75	39.0
Approach		166	5.0	166	5.0	0.276	17.2	LOS B	1.4	10.0	0.88	0.74	42.4
NorthWest: Connection													
28	T1	445	5.0	445	5.0	0.295	3.1	LOS A	1.5	11.3	0.35	0.29	56.0
29	R2	32	5.0	32	5.0	0.060	7.6	LOS A	0.1	0.6	0.18	0.65	48.4
Approach		477	5.0	477	5.0	0.295	3.4	LOS A	1.5	11.3	0.34	0.31	55.4
All Vehicles		1097	5.0	1097	5.0	0.295	6.6	LOS A	1.8	13.3	0.40	0.47	52.2

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Network Model Accuracy Level (largest change in degree of saturation for any lane): 0.0 %
Number of Iterations: 3 (maximum specified: 10)

MOVEMENT SUMMARY

Site: 101 [Tasman Highway/ Kennedy Drive Signals - 2038 PM Peak]

Network: N101 [Tasman Highway/ Holyman Avenue/ Kennedy Drive Signals - 2038 PM Peak]

Tasman Highway/ Kennedy Drive
Friday 07:00-08:00
Signals - Fixed Time Coordinated Cycle Time = 50 seconds (Network Cycle Time - Program)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	Demand Flows HV %	Arrival Flows Total veh/h	Arrival Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
SouthEast: Connection													
22	T1	300	5.0	300	5.0	0.361	10.2	LOS B	4.6	33.3	0.65	0.55	48.5
23	R2	276	5.0	276	5.0	0.883	33.6	LOS C	8.4	61.7	0.97	1.04	32.7
Approach		576	5.0	576	5.0	0.883	21.4	LOS C	8.4	61.7	0.80	0.79	39.4
NorthWest: Kennedy Drive													
27	L2	379	10.0	379	10.0	0.497	16.7	LOS B	6.8	51.7	0.76	0.79	45.8
28	T1	189	10.0	189	10.0	0.235	9.6	LOS A	2.9	22.3	0.66	0.54	45.7
Approach		568	10.0	568	10.0	0.497	14.4	LOS B	6.8	51.7	0.73	0.71	45.8
West: Tasman Highway (From Hobart)													
10b	L3	23	5.0	23	5.0	0.046	19.4	LOS B	0.4	2.9	0.72	0.69	44.8
10a	L1	1	5.0	1	5.0	0.839	28.3	LOS C	13.5	98.5	0.98	1.00	40.0
12a	R1	979	5.0	979	5.0	0.839	28.3	LOS C	13.9	101.5	0.99	1.00	31.2
Approach		1003	5.0	1003	5.0	0.839	28.1	LOS C	13.9	101.5	0.98	1.00	31.7
All Vehicles		2147	6.3	2147	6.3	0.883	22.7	LOS C	13.9	101.5	0.87	0.86	37.8

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Network Model Accuracy Level (largest change in degree of saturation for any lane): 0.0 %
Number of Iterations: 3 (maximum specified: 10)

MOVEMENT SUMMARY

Site: 102 [Tasman Highway/ Holyman Avenue Signals - 2038 PM Peak]

Network: N101 [Tasman Highway/ Holyman Avenue/ Kennedy Drive Signals - 2038 PM Peak]

Tasman Highway/ Holyman Avenue
Friday 07:00-08:00
Signals - Fixed Time Coordinated Cycle Time = 50 seconds (Network Cycle Time - Program)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	Demand Flows HV %	Arrival Flows Total veh/h	Arrival Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
SouthEast: Holyman Avenue													
21	L2	801	5.0	801	5.0	0.447	5.7	LOS A	0.0	0.0	0.00	0.53	54.7
22	T1	400	5.0	400	5.0	0.365	6.1	LOS A	5.3	38.4	0.57	0.49	50.0
Approach		1201	5.0	1201	5.0	0.447	5.8	LOS A	5.3	38.4	0.19	0.51	53.7
East: Tasman Highway (From Sorell)													
4b	L3	124	5.0	124	5.0	0.438	27.6	LOS C	2.9	21.2	0.93	0.78	40.7
4a	L1	1	5.0	1	5.0	0.532	25.9	LOS C	4.2	30.4	0.95	0.79	41.3
6a	R1	176	5.0	176	5.0	0.532	25.9	LOS C	4.2	30.4	0.95	0.79	32.5
Approach		301	5.0	301	5.0	0.532	26.6	LOS C	4.2	30.4	0.94	0.79	36.9
NorthWest: Connection													
28	T1	1113	5.0	1113	5.0	0.508	2.8	LOS A	4.1	29.8	0.29	0.25	56.3
29	R2	55	5.0	55	5.0	0.108	13.0	LOS B	0.6	4.5	0.46	0.70	43.9
Approach		1167	5.0	1167	5.0	0.508	3.3	LOS A	4.1	29.8	0.29	0.27	55.6
All Vehicles		2669	5.0	2669	5.0	0.532	7.1	LOS A	5.3	38.4	0.32	0.44	51.9

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Network Model Accuracy Level (largest change in degree of saturation for any lane): 0.0 %
Number of Iterations: 3 (maximum specified: 10)

MOVEMENT SUMMARY

Site: 101 [Tasman Highway/ Kennedy Drive Signals - 2018 Saturday Peak]

Network: N101 [Tasman Highway/ Holyman Avenue/ Kennedy Drive Signals - 2018 Saturday Peak]

Tasman Highway/ Kennedy Drive
Friday 07:00-08:00
Signals - Fixed Time Coordinated Cycle Time = 30 seconds (Network Cycle Time - Program)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	Demand Flows HV %	Arrival Flows Total veh/h	Arrival Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
SouthEast: Connection													
22	T1	191	5.0	191	5.0	0.504	14.8	LOS B	3.0	21.6	1.00	0.80	44.7
23	R2	129	5.0	129	5.0	0.499	22.3	LOS C	2.1	15.3	1.00	0.77	38.2
Approach		320	5.0	320	5.0	0.504	17.8	LOS B	3.0	21.6	1.00	0.79	41.8
NorthWest: Kennedy Drive													
27	L2	249	10.0	249	10.0	0.720	20.5	LOS C	4.1	30.8	0.98	0.92	43.8
28	T1	102	10.0	102	10.0	0.279	11.9	LOS B	1.4	10.5	0.88	0.68	43.2
Approach		352	10.0	352	10.0	0.720	18.0	LOS B	4.1	30.8	0.95	0.85	43.7
West: Tasman Highway (From Hobart)													
10b	L3	25	5.0	25	5.0	0.040	12.7	LOS B	0.2	1.7	0.63	0.68	48.8
10a	L1	1	5.0	1	5.0	0.261	11.4	LOS B	2.0	14.5	0.71	0.74	49.1
12a	R1	385	5.0	385	5.0	0.261	11.4	LOS B	2.0	14.5	0.71	0.74	43.8
Approach		412	5.0	412	5.0	0.261	11.5	LOS B	2.0	14.5	0.70	0.73	44.3
All Vehicles		1083	6.6	1083	6.6	0.720	15.5	LOS B	4.1	30.8	0.87	0.79	43.3

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Network Model Accuracy Level (largest change in degree of saturation for any lane): 0.0 %
Number of Iterations: 3 (maximum specified: 10)

MOVEMENT SUMMARY

Site: 102 [Tasman Highway/ Holyman Avenue Signals - 2018 Saturday Peak]

Network: N101 [Tasman Highway/ Holyman Avenue/ Kennedy Drive Signals - 2018 Saturday Peak]

Tasman Highway/ Holyman Avenue
Friday 07:00-08:00
Signals - Fixed Time Coordinated Cycle Time = 30 seconds (Network Cycle Time - Program)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	Demand Flows HV %	Arrival Flows Total veh/h	Arrival Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
SouthEast: Holyman Avenue													
21	L2	294	5.0	294	5.0	0.164	5.7	LOS A	0.0	0.0	0.00	0.53	54.7
22	T1	171	5.0	171	5.0	0.246	7.5	LOS A	1.8	13.3	0.73	0.59	48.2
Approach		464	5.0	464	5.0	0.246	6.3	LOS A	1.8	13.3	0.27	0.55	53.1
East: Tasman Highway (From Sorell)													
4b	L3	111	5.0	111	5.0	0.301	17.7	LOS B	1.5	10.6	0.86	0.76	45.8
4a	L1	1	5.0	1	5.0	0.349	15.7	LOS B	2.0	14.5	0.87	0.76	46.7
6a	R1	149	5.0	149	5.0	0.349	15.8	LOS B	2.0	14.5	0.87	0.76	39.6
Approach		261	5.0	261	5.0	0.349	16.6	LOS B	2.0	14.5	0.87	0.76	43.1
NorthWest: Connection													
28	T1	443	5.0	443	5.0	0.320	3.7	LOS A	1.7	12.6	0.40	0.33	55.3
29	R2	43	5.0	43	5.0	0.088	9.8	LOS A	0.2	1.8	0.38	0.67	46.4
Approach		486	5.0	486	5.0	0.320	4.2	LOS A	1.7	12.6	0.40	0.36	54.4
All Vehicles		1212	5.0	1212	5.0	0.349	7.7	LOS A	2.0	14.5	0.45	0.52	51.1

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Network Model Accuracy Level (largest change in degree of saturation for any lane): 0.0 %
Number of Iterations: 3 (maximum specified: 10)

MOVEMENT SUMMARY

Site: 101 [Tasman Highway/ Kennedy Drive Signals - 2038 Saturday Peak]

Network: N101 [Tasman Highway/ Holyman Avenue/ Kennedy Drive Signals - 2038 Saturday Peak]

Tasman Highway/ Kennedy Drive
Friday 07:00-08:00
Signals - Fixed Time Coordinated Cycle Time = 40 seconds (Network Cycle Time - Program)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	Demand Flows HV %	Arrival Flows Total veh/h	Arrival Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
SouthEast: Connection													
22	T1	368	5.0	368	5.0	0.488	10.0	LOS A	5.1	37.4	0.73	0.62	48.7
23	R2	265	5.0	265	5.0	0.975	47.4	LOS D	8.8	64.5	1.00	1.30	27.9
Approach		634	5.0	634	5.0	0.975	25.7	LOS C	8.8	64.5	0.84	0.91	37.1
NorthWest: Kennedy Drive													
27	L2	434	10.0	434	10.0	0.625	16.7	LOS B	7.2	54.5	0.85	0.83	45.9
28	T1	221	10.0	221	10.0	0.302	9.1	LOS A	3.0	23.1	0.72	0.60	46.2
Approach		655	10.0	655	10.0	0.625	14.1	LOS B	7.2	54.5	0.81	0.75	45.9
West: Tasman Highway (From Hobart)													
10b	L3	43	5.0	43	5.0	0.091	17.8	LOS B	0.6	4.6	0.75	0.71	45.7
10a	L1	1	5.0	1	5.0	0.883	28.8	LOS C	12.1	88.1	1.00	1.11	39.8
12a	R1	962	5.0	962	5.0	0.883	28.8	LOS C	12.6	91.7	1.00	1.11	30.9
Approach		1006	5.0	1006	5.0	0.883	28.4	LOS C	12.6	91.7	0.99	1.10	31.8
All Vehicles		2295	6.4	2295	6.4	0.975	23.5	LOS C	12.6	91.7	0.90	0.94	37.5

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Network Model Accuracy Level (largest change in degree of saturation for any lane): 0.0 %
Number of Iterations: 3 (maximum specified: 10)

MOVEMENT SUMMARY

Site: 102 [Tasman Highway/ Holyman Avenue Signals - 2038 Saturday Peak]

Network: N101 [Tasman Highway/ Holyman Avenue/ Kennedy Drive Signals - 2038 Saturday Peak]

Tasman Highway/ Holyman Avenue
Friday 07:00-08:00
Signals - Fixed Time Coordinated Cycle Time = 40 seconds (Network Cycle Time - Program)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	Demand Flows HV %	Arrival Flows Total veh/h	Arrival Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
SouthEast: Holyman Avenue													
21	L2	783	5.0	783	5.0	0.437	5.7	LOS A	0.0	0.0	0.00	0.53	54.7
22	T1	373	5.0	373	5.0	0.415	7.6	LOS A	4.9	35.7	0.70	0.59	48.1
Approach		1156	5.0	1156	5.0	0.437	6.3	LOS A	4.9	35.7	0.22	0.55	53.3
East: Tasman Highway (From Sorell)													
4b	L3	220	5.0	220	5.0	0.621	23.4	LOS C	4.3	31.4	0.95	0.85	42.7
4a	L1	1	5.0	1	5.0	0.628	21.1	LOS C	5.0	36.8	0.95	0.85	43.6
6a	R1	260	5.0	260	5.0	0.628	21.2	LOS C	5.0	36.8	0.95	0.85	35.5
Approach		481	5.0	481	5.0	0.628	22.2	LOS C	5.0	36.8	0.95	0.85	39.7
NorthWest: Connection													
28	T1	1107	5.0	1107	5.0	0.617	3.8	LOS A	5.7	41.4	0.46	0.41	55.1
29	R2	76	5.0	76	5.0	0.173	14.9	LOS B	0.9	6.3	0.58	0.72	42.5
Approach		1183	5.0	1183	5.0	0.617	4.5	LOS A	5.7	41.4	0.47	0.43	54.1
All Vehicles		2820	5.0	2820	5.0	0.628	8.3	LOS A	5.7	41.4	0.45	0.55	50.8

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Network Model Accuracy Level (largest change in degree of saturation for any lane): 0.0 %
Number of Iterations: 3 (maximum specified: 10)

MOVEMENT SUMMARY

Site: 1 [Airport Merge - 2018 Weekday Network PM Peak]

Merge From Left
Giveway / Yield (Two-Way)

Movement Performance - Vehicles												
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
NorthWest: Merge											
27a	L1	303	5.0	0.308	2.6	LOS A	1.1	8.3	0.53	0.57	54.7
Approach		303	5.0	0.308	2.6	LOS A	1.1	8.3	0.53	0.57	54.7
West: Major Road											
11	T1	727	5.0	0.385	0.1	LOS A	0.0	0.0	0.00	0.00	59.9
Approach		727	5.0	0.385	0.1	NA	0.0	0.0	0.00	0.00	59.9
All Vehicles		1031	5.0	0.385	0.8	NA	1.1	8.3	0.16	0.17	58.8

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 1 [Tasman Highway Merge - 2018 Weekday Network PM Peak]

Merge From Left
Giveway / Yield (Two-Way)

Movement Performance - Vehicles												
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
NorthWest: Merge											
27a	L1	1031	5.0	1.046	57.9	LOS F	48.6	355.0	1.00	4.17	23.0
Approach		1031	5.0	1.046	57.9	LOS F	48.6	355.0	1.00	4.17	23.0
West: Major Road											
11	T1	727	5.0	0.385	0.1	LOS A	0.0	0.0	0.00	0.00	59.9
Approach		727	5.0	0.385	0.1	NA	0.0	0.0	0.00	0.00	59.9
All Vehicles		1758	5.0	1.046	34.0	NA	48.6	355.0	0.59	2.44	34.4

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 1 [Airport Merge - 2038 Weekday Network PM Peak]

Merge From Left
Giveway / Yield (Two-Way)

Movement Performance - Vehicles												
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
NorthWest: Merge											
27a	L1	569	5.0	1.349	329.3	LOS F	97.9	714.8	1.00	8.02	6.0
Approach		569	5.0	1.349	329.3	LOS F	97.9	714.8	1.00	8.02	6.0
West: Major Road											
11	T1	1263	5.0	0.669	0.2	LOS A	0.0	0.0	0.00	0.00	59.7
Approach		1263	5.0	0.669	0.2	NA	0.0	0.0	0.00	0.00	59.7
All Vehicles		1833	5.0	1.349	102.5	NA	97.9	714.8	0.31	2.49	20.4

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 1 [Tasman Highway Merge - 2038 Weekday Network PM Peak]

Merge From Left
Giveway / Yield (Two-Way)

Movement Performance - Vehicles												
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
NorthWest: Merge											
27a	L1	1833	5.0	4.341	3017.0	LOS F	891.1	6505.1	1.00	21.08	0.7
Approach		1833	5.0	4.341	3017.0	LOS F	891.1	6505.1	1.00	21.08	0.7
West: Major Road											
11	T1	1263	5.0	0.669	0.2	LOS A	0.0	0.0	0.00	0.00	59.7
Approach		1263	5.0	0.669	0.2	NA	0.0	0.0	0.00	0.00	59.7
All Vehicles		3096	5.0	4.341	1786.1	NA	891.1	6505.1	0.59	12.48	1.5

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 1 [2018 Highway Merge]

Merge From Left
Giveway / Yield (Two-Way)

Movement Performance - Vehicles												
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
NorthWest: Merge											
27a	L1	196	5.0	0.182	2.9	LOS A	0.6	4.2	0.46	0.54	69.1
Approach		196	5.0	0.182	2.9	LOS A	0.6	4.2	0.46	0.54	69.1
West: Major Road											
11	T1	629	10.0	0.344	0.0	LOS A	0.0	0.0	0.00	0.00	109.7
Approach		629	10.0	0.344	0.0	NA	0.0	0.0	0.00	0.00	109.7
All Vehicles		825	8.8	0.344	0.7	NA	0.6	4.2	0.11	0.13	100.4

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 1 [2038 Highway Merge]

Merge From Left
Giveway / Yield (Two-Way)

Movement Performance - Vehicles												
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
NorthWest: Merge											
27a	L1	531	5.0	0.927	21.2	LOS C	9.0	66.0	0.97	1.76	44.0
Approach		531	5.0	0.927	21.2	LOS C	9.0	66.0	0.97	1.76	44.0
West: Major Road											
11	T1	1087	10.0	0.594	0.1	LOS A	0.0	0.0	0.00	0.00	109.2
Approach		1087	10.0	0.594	0.1	NA	0.0	0.0	0.00	0.00	109.2
All Vehicles		1618	8.4	0.927	7.0	NA	9.0	66.0	0.32	0.58	81.6

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 1 [Airport Merge - 2018 Weekday Network PM Peak]

Merge From Left
Giveway / Yield (Two-Way)

Movement Performance - Vehicles												
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
NorthWest: Merge											
27a	L1	303	5.0	0.308	2.6	LOS A	1.1	8.3	0.53	0.57	54.7
Approach		303	5.0	0.308	2.6	LOS A	1.1	8.3	0.53	0.57	54.7
West: Major Road											
11	T1	727	5.0	0.385	0.1	LOS A	0.0	0.0	0.00	0.00	59.9
Approach		727	5.0	0.385	0.1	NA	0.0	0.0	0.00	0.00	59.9
All Vehicles		1031	5.0	0.385	0.8	NA	1.1	8.3	0.16	0.17	58.8

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 1 [Tasman Highway Merge - 2018 Weekday Network PM Peak]

Merge From Left
Giveway / Yield (Two-Way)

Movement Performance - Vehicles												
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
NorthWest: Merge											
27a	L1	1031	5.0	1.046	57.9	LOS F	48.6	355.0	1.00	4.17	23.0
Approach		1031	5.0	1.046	57.9	LOS F	48.6	355.0	1.00	4.17	23.0
West: Major Road											
11	T1	727	5.0	0.385	0.1	LOS A	0.0	0.0	0.00	0.00	59.9
Approach		727	5.0	0.385	0.1	NA	0.0	0.0	0.00	0.00	59.9
All Vehicles		1758	5.0	1.046	34.0	NA	48.6	355.0	0.59	2.44	34.4

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 1 [Airport Merge - 2038 Weekday Network PM Peak]

Merge From Left
Giveway / Yield (Two-Way)

Movement Performance - Vehicles												
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
NorthWest: Merge											
27a	L1	569	5.0	1.349	329.3	LOS F	97.9	714.8	1.00	8.02	6.0
Approach		569	5.0	1.349	329.3	LOS F	97.9	714.8	1.00	8.02	6.0
West: Major Road											
11	T1	1263	5.0	0.669	0.2	LOS A	0.0	0.0	0.00	0.00	59.7
Approach		1263	5.0	0.669	0.2	NA	0.0	0.0	0.00	0.00	59.7
All Vehicles		1833	5.0	1.349	102.5	NA	97.9	714.8	0.31	2.49	20.4

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 1 [Tasman Highway Merge - 2038 Weekday Network PM Peak]

Merge From Left
Giveway / Yield (Two-Way)

Movement Performance - Vehicles												
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
NorthWest: Merge											
27a	L1	1833	5.0	4.341	3017.0	LOS F	891.1	6505.1	1.00	21.08	0.7
Approach		1833	5.0	4.341	3017.0	LOS F	891.1	6505.1	1.00	21.08	0.7
West: Major Road											
11	T1	1263	5.0	0.669	0.2	LOS A	0.0	0.0	0.00	0.00	59.7
Approach		1263	5.0	0.669	0.2	NA	0.0	0.0	0.00	0.00	59.7
All Vehicles		3096	5.0	4.341	1786.1	NA	891.1	6505.1	0.59	12.48	1.5

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 1 [2018 Highway Merge]

Merge From Left
Giveway / Yield (Two-Way)

Movement Performance - Vehicles												
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
NorthWest: Merge											
27a	L1	196	5.0	0.182	2.9	LOS A	0.6	4.2	0.46	0.54	69.1
Approach		196	5.0	0.182	2.9	LOS A	0.6	4.2	0.46	0.54	69.1
West: Major Road											
11	T1	629	10.0	0.344	0.0	LOS A	0.0	0.0	0.00	0.00	109.7
Approach		629	10.0	0.344	0.0	NA	0.0	0.0	0.00	0.00	109.7
All Vehicles		825	8.8	0.344	0.7	NA	0.6	4.2	0.11	0.13	100.4

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 1 [2038 Highway Merge]

Merge From Left
Giveway / Yield (Two-Way)

Movement Performance - Vehicles												
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
NorthWest: Merge											
27a	L1	531	5.0	0.927	21.2	LOS C	9.0	66.0	0.97	1.76	44.0
Approach		531	5.0	0.927	21.2	LOS C	9.0	66.0	0.97	1.76	44.0
West: Major Road											
11	T1	1087	10.0	0.594	0.1	LOS A	0.0	0.0	0.00	0.00	109.2
Approach		1087	10.0	0.594	0.1	NA	0.0	0.0	0.00	0.00	109.2
All Vehicles		1618	8.4	0.927	7.0	NA	9.0	66.0	0.32	0.58	81.6

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Contact
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Pitt & Sherry (Operations) Pty Ltd
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INTERNATIONAL CERTIFICATIONS
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ISO 14001
AS/NZS 4801
www.intlcert.com

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Appendix I

Regulators response to edMDP

airservices
Operational Standards and Assurance
Tower Road, Melbourne Airport
Tullamarine VIC 3043
t 03 9339 2182
www.airservicesaustralia.com
ABN 59 698 720 886

19 July 2019

Surya Prakash
Assistant Director
South East Airports and Economic Regulation
Airports Branch - Aviation and Airports
Department of Infrastructure, Transport, Cities and Regional Development
GPO Box 594
Canberra ACT 2601

Ref: *YMHB-MDP-002e*

Dear Surya,

Tasman Highway Upgrade Project, Hobart Airport exposure draft Major Development Plan (edMDP)

I refer to your letter dated 21 June 2019, seeking Airservices comments on the Hobart Airport exposure draft Major Development Plan (edMDP) for the Tasman Highway Upgrade Project.

Our initial assessment of this edMDP has not identified any significant issues for Airservices. Nonetheless, Airservices reserves the right to amend this initial advice following review of the preliminary draft MDP, when it is issued for public comment. I recommend that when a preliminary draft MDP is prepared and released for public comment, a copy is also forwarded to Airservices Airport Developments staff at the following email address: airport.developments@airservicesaustralia.com.

Airspace Procedures

With respect to procedures designed by Airservices in accordance with ICAO PANS-OPS and Document 9905, at a maximum height of 26.73m (88ft) AHD and 17.8m (59ft) AHD, the street lights and bridge development, respectively, will not affect any sector or circling altitude, nor any instrument approach or departure procedure at Hobart Airport.

The street lights and bridge will not affect the Hobart Radar Terrain Clearance Chart (RTCC).

Note that procedures not designed by Airservices at Hobart Airport were not considered in this assessment.

Communication/Navigation/Surveillance (CNS) Facilities

This development, to a maximum height of 26.73m (88ft) AHD, will not adversely impact the performance of Precision/Non-Precision Navigational Aids, HF/VHF Communications, A-SMGCS, Radar, PRM, ADS-B, WAM or Satellite/Links.

Environment – Aviation Rescue Fire Fighting Services (ARFFS) Polyfluoroalkyl substances (PFAS)

Page 33, Section 5.3.1 Baseline Conditions - Contaminated Land. Similar to the text in the Hobart Airport Terminal Expansion Project edMDP, this section mentions that *"Airservices has had an onsite presence at the airport for decades and has used Aqueous Film Forming Foam (AFFF) since the early 1980s."* Similar to our advice in the aforementioned edMDP, Airservices was formed in 1995 and has provided the ARFFS at Hobart Airport since that date. Prior to that, the firefighting services were provided by former Commonwealth

agencies, dating back to the 1950s. Airservices recommends that the above statement be modified accordingly.

With regards to the statement "*In 2003, Airservices changed to a different AFFF product that does not contain PFAS …*", Airservices did change to a different AFFF product, called Ansulite, in 2003 to avoid Perfluorooctanesulfonic acid (PFOS), however, this was later found to also contain PFOS. In 2010, Airservices transitioned to a PFAS free firefighting foam and has been using PFAS free firefighting foam at Hobart Airport since then.

With regards to the statement "*There are no known areas of contamination within the Hobart interchange location*", Airservices notes that there are a number of other potentially contaminating activities located within the vicinity of the project site. Examples of these potentially contaminating activities include:

- petroleum handling (adjacent to the project site boundary),
- a sewer pump station (adjacent to the project boundary),
- aviation rescue fire fighting services (both at Hobart Airport and Cambridge Airport),
- industrial activities (along Kennedy Road), and
- historical bulk fuel storage (Hobart Airport).

Airservices recommends that Figure No. 005 on page 36 is updated to reflect these other potentially contaminating activities occurring within the vicinity of the project site.

Page 34, Section 5.3.2 Impact Assessment - Contaminated Soil. This section states *"Potential contamination is associated with the use of AFFF and Airservices activity, which is not recorded in the project site, as such potential impacts during construction and operation would be negligible."* As mentioned above, there are other potential contaminant sources located closer to the project site that are not related to Airservices activities, but which have not been discussed in this section. Airservices provides ARFFS at Hobart Airport from leased sites located approximately 1.4km and 2.5km southeast of the proposed project site. Airservices considers that these sites are less likely to impact the project site than the potentially contaminating activities noted above. Airservices therefore requests that any references to Airservices activities should be removed from this paragraph (or the other potentially contaminating activities be also mentioned).

Development Activity

Associated plant and/or crane operations planned for the construction of this development will need to be assessed prior to construction commencing, and may present a constraint to the development.

If you require any additional information or wish to discuss any aspect of this letter further, please do not hesitate to contact my colleague William Zhao, on 03 9339 2182, or by email on airport.developments@airservicesaustralia.com.

Yours sincerely,

Paul Zissermann
Airport and Environmental Assurance Team Leader

Australian Government

Civil Aviation Safety Authority

AIR NAVIGATION, AIRSPACE AND AERODROMES

CASA Ref: EF11/209-3

8 July 2019

Ms Ann Redmond
General Manager
Airports Branch
Dept of Infrastructure, Transport, Regional Development and Cities
GPO Box 594
Canberra ACT 2601

Dear Ms Redmond,

Exposure Draft Major Development Plan – Tasman Highway upgrade Project- Hobart Airport

Thank you for seeking CASA advice pursuant to the *Airports Act 1996* on the exposure draft MDP (edMDP) document for the above proposal.

The document indicates that the Tasmanian Government proposes to construct an interchange near Hobart airport as part of the Tasman highway upgrade project .

This will involve the construction of an overpass. CASA notes that the overpass will have a maximum height of 10.8 m. The document advises that the overpass and the associated streetlighting will not infringe prescribe airspace. It also indicates that the streetlighting associated with the project will be designed to ensure it is consistent with the applicable standards .

AS the edMDP has been prepared by a consultant working for the Tasmanian Government, CASA recommends that Hobart Airport confirms the proposal is consistent with the relevant standards in Part 139 of the Civil Aviation Safety Regulations 1998 and the National Airports Safeguarding Framework.

Although Cambridge Airport is not regulated under Part 139, CASA recommends the Department considers bringing the proposed interchange to the attention of the Cambridge Airport operator.

Yours sincerely,

Andrew Sparrow
Branch Manager

Australian Government
Department of Infrastructure, Transport,
Cities and Regional Development

Mr Matt Cocker
Chief Operating Officer
Hobart International Airport Pty Ltd
6 Hinkler Road
CAMBRIDGE TAS 7170

Dear Mr Cocker

Exposure Draft Major Development Plan – Tasman Highway Interchange

Thank you for providing the Department of Infrastructure, Transport, Cities and Regional Development (the department) the exposure draft Major Development Plan (edMDP) for the Tasman Highway Interchange at Hobart Airport.

As you are aware, the *Airports Act 1996* (the Act) prescribes the required content of an MDP as well as the necessary consultation to be conducted in preparing it. The department's preliminary comments on this exposure draft relating to these requirements are at Attachment A for your consideration. Please also find enclosed comments on the edMDP from Airservices Australia, the Department of the Environment and Energy and from the Civil Aviation Safety Authority.

Please note these comments do not constitute the department's official position on the MDP, nor do they form part of any assessment process. The formal assessment will take place under the *Airports Act 1996* subsequent to lodgement of a draft MDP with the Minister. The final decision regarding the draft MDP rests with the Minister.

Please do not hesitate to contact me on 02 6274 7278 or via email at <Lucinda.Mctaggart@infrastructure.gov.au> should you wish to discuss these comments further.

Yours sincerely

Cindy McTaggart
Director
Vic/Tas Airports and Economic Regulation Section
Airports Branch

19 August 2019

Enc

Australian Government
Department of Infrastructure, Transport, Cities and Regional Development

Exposure draft Major Development Plan (edMDP) – Tasman Highway Interchange - August 2019

The Department of Infrastructure, Transport, Cities and Regional Development has reviewed the exposure draft Major Development Plan (edMDP) for the Tasman Highway Upgrade Project, against the requirements of the *Airports Act 1996* relating to MDPs, and provides the following comments.

Timing It is stated in the edMDP that the construction contract will start in 2022 (pg 6) but the duration/end date is not provided. Although the only timing stipulation for approved major airport developments is that they must be substantially completed in 5 years (unless extensions are granted), it would be useful to include more information about timing in the MDP.
Major Development Plan process A figure or table depicting timeframes could be provided for useful context for members of the public less familiar with the Major Development Plan process. This figure could include timeframes at relevant steps. For example, 60 business days for 'Public exhibition of pdMDP', 50 business days for 'Minister considers Draft MDP', and 50 business days to 'Finalise and publish MDP'.
Consultations (Pre-existing interests) The edMDP states all pre-existing interests were identified and these are listed on pg 22. However, it is not provided whether there were consultations done with these stakeholders. Inclusion of comment about any consultation with these stakeholders, if relevant, should be included.
Cost The total cost of the project is not provided. Even though the cost may not exceed $25million, the approximate cost of development could be included to assist to demonstrate the economic contribution and significance of the project and for general context. Any funding agreement obligations relating to acknowledging the sources of funding should therefore also be addressed.
Elevations An additional figure supplementing Fig 2 and Appendix A, depicting indicative elevation of the proposed overpass would be useful, noting the importance of elevations in aviation operations**.**
References The reference to Figure 7 in section 5.5.2 may be incorrect. Better representation of text in this section is provided in Figure 6.
Significant Noise (from aircraft) The ANEF in the 2015 Hobart Airport Master Plan should be referenced to identify whether the proposed development site will be subjected to *significant ANEF levels* (i.e. a noise above 30 ANEF level). If it is, Airports Act s91(1)(f) and s91(6) are required to be addressed.
National Airports Safeguarding Framework *Guideline B - Windshear* Unless provided in their attached advice from CASA, it is recommend CASA's advice is sought to confirm the consultant's analysis that the project falls within the assessment trigger area but is outside the 1:35 height surface. *Guideline C – Wildlife Strikes* While the development designs have not yet been finalised, all built facades (e.g bridges, railings etc) should be designed to incorporate surfaces and materials that do not encourage the roosting of birds which may compromise the safety of airport operations. Increased flows from the additional road surface are proposed to be retained on site using 'basins' created by the bridge approaches. There is no subsequent discussion on wildlife/bird hazard management of these basins.

We seek additional clarification around the attractant qualities of the bridge, water "basins" and any associated proposed wildlife hazard mitigation methodologies.

Guideline G – Communications, Navigation and Surveillance (CNS)

The edMDP provides and assessment that the proposal will have a negligible impact on line of sight for the air traffic control tower. However, there is no other discussion regarding CASA/Airservices requirements for protection of CNS equipment in the vicinity of the proposal during and after construction.

We therefore seek analysis around any potential impacts the proposal may have on this important equipment. Unless provided in the attached advices from CASA/Airservices, it is recommend CASA/Airservices advice on this issue should be sought to confirm the negligible impact assessment.

Guideline I – Public Safety Areas

There is no acknowledgement of Guideline I in Table 4 in the edMDP. The Department does, however, note that the project site is not likely to be located within a public safety area given its location. The Department requests information regarding Guideline I be included in Table 4 of the edMDP to provide a rounded overview of the Framework.

Environmental Impacts – Weeds

The information provided in the edMDP for the ecological assessment of the impacted vegetation and potential fauna habitat is an overarching summary (i.e. not detailed) from the flora and fauna surveys undertaken for the project with identification.

- A baseline weed survey over a number of seasons (the MDP identifies that the ecological surveys were undertaken in November and December 2016) should inform the weed assessment in order to mitigation measures identified in section 5.5.3.
- Declared weed species occurring in the development area (reference to second dot point in section 5.5.3) should be named.
- There should also be an assessment of the weed species, particularly priority weed species, currently occurring on airport land against those in the development area/or those which may be newly identified, to identify priority weeds for control (without knowing what is present in the site pre-construction works, there is no way to assess whether the hygiene measures have been effective or not, or to estimate the timeframes or costs of weed control will be for the project to incorporate this into its planning).
- Given the development sits across joint management areas, the roles and responsibilities and costs for weed management in the development footprint (and adjoining lands) should be identified and agreed prior to the commencement of any works. This is essential for preventing any inadvertent delays for undertaking required weed control works in the future once the project commences.

Environmental Impacts – Surface water

The edMDP provides limited (to no) details of surface water flows and associated drainage management, and potential for impacts on the significant vegetation communities from changes to drainage resulting from the construction and operation of the road upgrades. This is a risk that requires further information and mitigation measures to be identified.

Assessment of impacts and mitigation measures should include a review of the mapping showing the extent of the vegetation communities (including condition mapping) and potential habitat areas in association with surface water and drainage management with the changes to the road infrastructure. Unless good drainage design is implemented, during construction and operation phases, there is a risk that there could be prolonged inundation or sedimentation of the vegetation communities, and/or increased risk of new/further weed incursion in these communities.

Environment – Consistency with state legislation
Whilst it is noted the project has been approved under EPBC approvals, there is limited discussion in the edMDP of State legislation associated with threatened species and communities protections in relation to threatened vegetation (whether or not related to the EPBC approval).

This needs further qualification and explanation.

TINK Sarah

From: Tiffeny Horwood <Tiffeny.Horwood@environment.gov.au>
Sent: Tuesday, 16 July 2019 10:02 AM
To: GANNON Helen; KOMINEK Kathryn
Cc: Tyrie Starrs; Jessica Koeck
Subject: Request for Comment: Tasman Highway Upgrade Project - Exposure Draft Major Development Plan - Hobart Airport [SEC=OFFICIAL]
Attachments: 265575 Tasman Highway Upgrade edMDP 14062019 Issue (1).pdf

Follow Up Flag: Follow up
Flag Status: Flagged

Hi Helen

I am writing in response to the request below from Surya, seeking comment from the Department of Environment and Energy (the Department) on the exposure draft Major Development Plan (edMDP) for a Tasman Highway Upgrade Project.

As Tyrie has discussed with you, the Department has completed a review of the edMDP and determined there is currently insufficient information to assess potential impacts associated with PFAS contamination.

Recommended additional information

The Department recommends the following additional information be provided in order to make an informed decision under section 161:

- construction details on volumes of soil to be excavated, location of stockpile areas, soil reuse, fill requirements and, if any, dewatering (e.g. expected volumes and periods of groundwater extraction), and the fate of that water.
- groundwater flow information
- the extent and concentrations of any PFAS contamination in relation to the proposed action and its areas of disturbance
- possible PFAS source areas, chemical transport pathways, and ecological receptors, including from future stored or reused material
- clearly identified circumstances that will trigger a site investigation and/or risk assessment for PFAS at or near the project site
- any other available information on PFAS and surface water, groundwater, soil, and biota monitoring results at or near the project area, including but not limited to a map showing sampling locations, and information on sampling dates, depths, etc.

The exposure draft Major Development Plan contains information from other reports and relevant management plans. In addition to the above, the following should also be provided:

- Tasman Highway – Hobart Airport Interchange, Report Supporting Development Application, Department of State Growth (February 2018)
- Holyman Avenue Natural Values Assessment, North Barker Ecosystem Services (June 2017)
- Hobart Airport Interchange Environmental Noise Report, pitt&sherry (February 2018)
- Tasman Highway / Holyman Avenue Interchange Upgrade Traffic Impact Assessment, pitt&sherry (February 2018)
- Tasman Highway Holyman Avenue Interchange Traffic Modelling Report Grade Separated Signalised Interchange, pitt&sherry (December 2018)

Please don’t hesitate to contact Tyrie on (02) 6274 1507 should you wish to discuss this further.

Thanks, Tiffeny.

TIFFENY HORWOOD
Director Assessments Victoria and Tasmania
Assessments and Governance Branch | Environment Standards Division
Department of the Environment and Energy
GPO Box 787 Canberra ACT 2601 | T 6275 9448
tiffeny.horwood@environment.gov.au

From: PRAKASH Surya [mailto:Surya.Prakash@infrastructure.gov.au]
Sent: Friday, 21 June 2019 3:10 PM
To: Jessica Koeck <Jessica.Koeck@environment.gov.au>
Cc: 'Rebecca.Gee@environment.gov.au'; CANO Cristhian <Cristhian.Cano@infrastructure.gov.au>
Subject: Request for Comment: Tasman Highway Upgrade Project - Exposure Draft Major Development Plan - Hobart Airport [SEC=UNCLASSIFIED]

Dear Jessica

Hobart Airport has submitted an exposure draft Major Development Plan for a Tasman Highway Upgrade Project (the edMDP) – attached.

The department is now coordinating comments on the edMDP. I would be grateful if you could please review the edMDP and provide comments by **COB Friday 19 July 2019**.

I would also appreciate your acknowledgement of receipt of this email.

Please do not hesitate to contact me should you have any questions.

Kind regards

Surya

Surya Prakash
Assistant Director | South East Airports and Economic Regulation
Airports Branch | Aviation and Airports
Department of Infrastructure, Transport, Cities and Regional Development
GPO Box 594, Canberra ACT 2601
t 02 6274 7226
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Appendix J

Windshear and turbulence assessment

SYNERGETICS

6 May 2019

David Conley
pitt&sherry
Level 1, Surrey House
199 Macquarie St
Hobart, 7001

Dear David,

RE: Windshear and turbulence assessment of proposed Hobart Airport Interchange

Introduction

I am writing to provide a desktop windshear and turbulence assessment of a proposed roadway Interchange close by the Cambridge Aerodrome and Hobart International Airport servicing Hobart Tasmania.

Details of the interchange are provided in the aerial plans and in Attachment A. The surrounding landscape is relatively flat, with roadways connecting to a large roundabout. The proposed Interchange design features a raised overpass above the Tasman Highway, with connecting ramps. At its highest point, the new interchange will be approximately 9 m above the existing land. Between the interchange and Cambridge Aerodrome there are several warehouses with heights of approximately 8 to 10 m[1].

This assessment considers the turbulence and windshear generated by the subject building on all three of Cambridge Aerodrome's runways, as well as the runway of Hobart International Airport. This assessment applies the criteria in the latest draft of NASF B (DIRD, 2018), summarised in Attachment B, and where appropriate, we have also applied our expert judgement based on experience with similar assessments.

Cambridge Aerodrome – Runway 09/27

- The north eastern most end of the proposed interchange lies beneath the extended runway centreline. The highest section of the interchange is approximately 270 m from the extended runway centreline when measured perpendicular to runway.
- Wind shear and turbulence effects due to the interchange for this runway are expected to comply with the NASF B criteria for the following reasons:
    - The sloped sides of the interchange ramps will reduce flow separation, and hence, turbulence and wind shear.
    - There is a significant separation distance from the highest point of the interchange to runway centreline.
    - The sections of the interchange near the runway centreline are well below the obstacle limitation surface (OLS).
    - The buildings on the southern edge of the aerodrome will shield the runway centreline from the interchange ramps, and the wind shear and turbulence

[1] Heights have been estimated from Nearmap elevation data.

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effects due to the existing buildings will dominate any minor effects from the interchange.

Cambridge Aerodrome – Runway 12/30

- The proposed interchange lies beneath the extended runway centreline. The highest section of the interchange is approximately 20 m from the extended runway centreline when measured perpendicular to runway.
- Wind shear and turbulence effects due to the interchange for this runway are expected to comply with the NASF B criteria for the following reasons:
    - For the most proximate sections of the extended runway centreline, the interchange is well below the OLS, and hence aircraft are not expected to be in the wake of the interchange in this area.
    - For south easterly winds, aircraft will pass downwind of the interchange immediately after take-off or landing. However for these wind directions the interchange will present a small, low intensity wake as it is aligned with the wind direction, and this effect will be shielded by existing buildings on the southern. The wind shear and turbulence effects due to the existing buildings will dominate any minor effects from the interchange. Furthermore, these wind directions are infrequent, with the most common wind direction by being north westerly.

Cambridge Aerodrome – Runway 14/32

- The highest point of the proposed interchange is approximately 400 m from the extended runway centreline when measured perpendicular to runway. This corresponds to approximately 44 interchange heights. The closer ramps are significantly lower than the highest points, and are more than 35 times their height from the runway centreline.
- As the proposed interchange satisfies the conservative 1:35 rule (NASF B Para 51, Appendix B), i.e., the proposed interchange is more than 35 interchange heights measured perpendicular from the subject runway, no further assessment is required

Hobart International Airport - Runway 12/30

- The proposed interchange is approximately 1100 m from the extended runway centreline when measured perpendicular to runway. This corresponds to approximately 120 interchange heights.
- As the proposed interchange satisfies the conservative 1:35 rule (NASF B Para 51, Appendix B), i.e., the proposed interchange is more than 35 interchange heights measured perpendicular from the subject runway, no further assessment is required

Summary

In conclusion, the assessed building is unlikely to result in a significant increase to the existing windshear or turbulence.

Regards,

James Brett

James Brett
BE (Hons) BSc MEngSc PhD
Principal Modelling Engineer

References

DIRD. (2018). *NASF Guideline B Managing the risk of building generated windshear and turbulence at airports.*

Attachment A – Photographs and drawings

Figure 1 - Render of the proposed interchange. North is to the top of the image.

Figure 2 - Overhead image of the surrounding region, with the extended runway centrelines and proposed building location marked.

Attachment B – Extracts of NASF Guideline B

49. Buildings that could pose a safety risk are those located within a rectangular 'assessment trigger area' around the runway ends (see Figure 1, below):
    a. 1200m or closer perpendicular from the runway centreline (or extended runway centreline[1]);
    b. 900m or closer in front of runway threshold (towards the landside of the airport); and
    c. 500m or closer from the runway threshold along the runway.

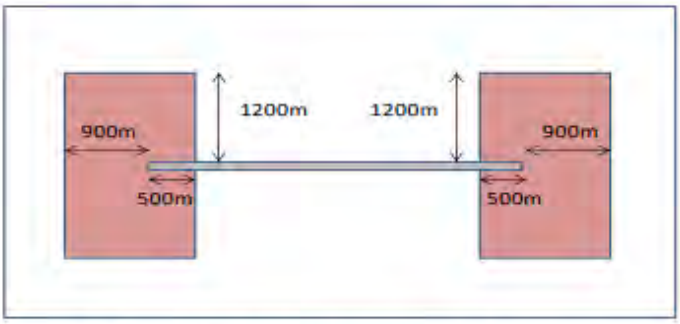

Figure 1: Assessment trigger area around runways, within which buildings should be assessed

Mitigation of risk by use of a height limitation surface

51. For buildings within the assessment trigger area, the first step is to consider the height of the building to determine its acceptability. The rule adopted in Australia is based on one developed in the Netherlands. This proposes that buildings should not penetrate a 1:35 surface extending perpendicular from the runway centreline (or extended runway centreline within the assessment trigger area). As the 1:35 surface extends from the runway centreline, when considering buildings against the 1:35 surface the building height should be measured above runway level.

52. In other words, the distance from the runway centreline to the closest point of the building should be more than 35 times the height (above runway level) of the building. Thus, a building with a height of 10 metres would be acceptable if it is located more than 350 metres perpendicular from the runway centreline (or extended runway centreline) and a building with a height of 20 metres would need to be located more than 700 metres from the runway centreline (or extended runway centreline).

53. The 1:35 surface can be applied to rule out buildings that will clearly not pose a risk. This will therefore be the first test that will be applied when approval authorities/decision makers are presented with a building to assess within the trigger area. This approach will enable the vast majority of developments at regional airports to be assessed very quickly. The 1:35 surface is very conservative and any building that does not penetrate the surface is not expected to create unsafe wind effects.

Appendix K

Correspondence with Cambridge Aerodrome

Fiona Riley

From: Shannon Wells <s.wells@airtasmania.com.au>
Sent: Saturday, 23 September 2017 11:31 AM
To: David Conley
Subject: RE: AIRPORT INTERCHANGE

Understood – thanks

From: David Conley [mailto:dconley@pittsh.com.au]
Sent: Friday, 22 September 2017 9:48 AM
To: Shannon Wells <s.wells@airtasmania.com.au>
Subject: RE: AIRPORT INTERCHANGE

Hi Shannon
Crane heights not known at this stage. Usage will be fairly limited over the construction period. There will be the usual earthmoving equipment including excavators with reach to about 8 m and semi trailers tipping with similar height. We can require that this be kept within the OLS unless exemptions are sought through arrangements with Cambridge Aerodrome. I anticipate another discussion with you on this in due course.
Regards
David Conley | Principal Engineer | pitt&sherry | W: www.pittsh.com.au
T: (03) 62101466 | M: 0409 938 618 | E: dconley@pittsh.com.au

From: Shannon Wells [mailto:s.wells@airtasmania.com.au]
Sent: Monday, 4 September 2017 11:19 AM
To: David Conley <dconley@pittsh.com.au>
Subject: RE: AIRPORT INTERCHANGE

Hi David
Thank you for meeting us, as I mentioned, my main concern is the cranes during construction … can you provide any guidance as to how tall they will be?
I believe the light towers will be ok as the splay has been considered
Thanks
Shannon

From: David Conley [mailto:dconley@pittsh.com.au]
Sent: Thursday, 31 August 2017 4:01 PM
To: s.wells@airtasmania.com.au
Subject: AIRPORT INTERCHANGE

Shannon
Thanks for making the time today to discuss the proposed new Airport Interchange. Drawings of the interchange are attached and Obstacle limitation Surface modelling carried out by Bryan Fitzgerald.
Please advise whether there are any other matters we need to consider in terms of the impact of the proposed new work on operation of the aerodrome, including any protocols or procedures that need to be observed during construction.
Regards

David Conley BE MBA CPEng
Principal Engineer
pitt&sherry
T: (03) 62101466 | M: 0409 938 618
E: dconley@pittsh.com.au | W: www.pittsh.com.au

Appendix L

Permit to Clear Lowland Native Grassland of Tasmania (DAWE, 2020)

Australian Government
Department of Agriculture, Water and the Environment

Ref: E2020-0175

Ms Denise McIntyre
Department of State Growth
GPO box 536
HOBART 7000 Tasmania

Dear Ms McIntyre,

Decision on EPBC Act Part 13 permit application
Permit to clear Lowland Native Grassland of Tasmania at Hobart International Airport, Tasmania

Thank you for your permit application to construct an interchange at the junction of the Tasman Highway with Holyman Avenue at Hobart International Airport, Tasmania.

I have considered the proposal in accordance with Part 13 of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and have decided to issue a permit under section 201. The details of my decision are attached. The proposal must be undertaken in accordance with the conditions specified in the permit.

You must inform the Department in writing within ten business days if you kill or injure a listed threatened, migratory or marine species in a Commonwealth area other than that specified in this permit. Failure to report is considered an offence under the EPBC Act.

Please note that this decision relates only to the specific matters protected under Chapter 5 of the EPBC Act. This decision does not affect any requirement for separate Commonwealth, state or local government approvals of the action.

Please be aware of Condition 4 of the permit which states that the permit holder may give to another person written authority to take for or on behalf of the holder any activity authorised by the permit. Should you wish to give an authority to another person you must inform the Department (EPBC.Permits@awe.gov.au, or Victoria and Tasmania Assessments Section, GPO Box 787 Canberra ACT 2601) in writing within 14 days after giving the authority.

Please contact the assessment officer, Will Dunlop at (02) 6275 1396 and william.dunlop@awe.gov.au if you have any questions regarding this matter.

Yours sincerely

Andrew McNee
Assistant Secretary
Assessments and Governance Branch
4 May 2020

Australian Government
Department of Agriculture, Water and the Environment

PERMIT E2020-0175

Permit to clear Lowland Native Grassland of Tasmania at Hobart International Airport, Tasmania.

This decision is made under section 201 of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Proposed action

person to whom the permit is granted	Department of State Growth 4 Salamanca Place Hobart 7000 ABN 36 388 980 563
proposed action	To construct interchange at the junction of the Tasman Highway with Holyman Avenue at Hobart International Airport, Tasmania, as outlined in permit application (E2020-0175).

Permit decision

	The permit has effect for: • Listed threatened species and ecological communities (section 201)
conditions of permit	This permit is subject to the conditions specified below
expiry date of permit	This permit is valid until 1 May 2025

Person authorised to make decision

name and position	Andrew McNee Assistant Secretary Assessment and Governance Branch
signature	
date of decision	4 May 2020

Conditions attached to the permit

1. To manage the impacts of the action on the **LNGT**, in taking the action, the **permit holder** must not **impact** more than 0.36 hectares of **LNGT** within the **impact area**.

2. The **permit holder** must carry out the action as per the methods described in the permit application submitted to the **Department** on 19 March 2020.

3. The **permit holder** must hold and comply with any permit required and granted under State, Territory, or other Commonwealth legislation in relation to specimens affected within any area to which that legislation applies.

4. The **permit holder** may give to another person written authority to take, for or on behalf of the holder, any activity authorised by the permit. When an authority is given to another person, the condition requirements also apply. The giving of an authority to another person does not prevent the **permit holder** from undertaking the authorised activity. The **permit holder** who gives an authority to another person must inform the **Department** in writing within ten **business days** after giving the authority. The **permit holder** may only give an authority to another person who has sufficient experience and competence in the activities of this permit.

5. The **permit holder** must provide a compliance report, demonstrating compliance with these permit conditions and provide research findings associated with this permit to the **Department** within twelve months from the date the permit expires.

6. The **permit holder** must inform the **Department** in writing within ten **business days** if, whilst the action that is authorised by this permit is being carried out, any **EPBC Act** listed threatened or listed migratory species, other than that specified in this permit and identified in the permit application, is found to be impacted by the action. In the event that this occurs, the action must cease immediately and must not recommence unless authorised in writing by the **Department**.

DEFINITIONS:

Business days	means a day that is not a Saturday, a Sunday or a public holiday in the state of Victoria.
EPBC Act	means the *Environment Protection and Biodiversity Conservation Act 1999* (Cth).
Department	means the Australian Government Department responsible for the administration of the **EPBC Act**.
Impact	means the cutting down, felling, thinning, logging, removing, clearing, destroying, poisoning, ringbarking, uprooting or burning of vegetation (but not including weeds – see the *Australian weeds strategy 2017 to 2027* for further guidance).

Impact area	means the area of the project site within the Hobart Airport cadastral boundary as defined on the map submitted to the **Department** on 19 March 2020 at Attachment A.
LNGT	means the Lowland Native Grasslands of Tasmania threatened ecological community listed uner the **EPBC Act**.
Permit holder	means the person to whom the permit is granted, or to whom the permit is transferred under section 205 of the **EPBC Act**.

Attachment A

Legend

- Project_Construction_Footprint
- Long-term_recovery_area
- Impacted_Grassland_Federal_land2
- Hobart__Airport_Cadastral_Boundary2
- EPBCA_Vegetation_region

0 15 30 60 90 120 150 Meters

Appendix M

Correspondence received during pdMDP consultation

Airports and Environment
25 Constitution Ave
Canberra ACT 2600

www.airservicesaustralia.com
ABN 59 698 720 886

31 January 2020

Darren Walker
Regulation and Policy
Airports Branch - Aviation and Airports Division
Department of Infrastructure, Transport, Cities and Regional Development
GPO Box 594
Canberra ACT 2601

Ref: YMHB-MDP-002d

Dear Darren,

Tasman Highway Upgrade Project, Hobart Airport – draft Major Development Plan (dMDP)

I refer to your letter dated 8 January 2020, seeking Airservices comments on the Hobart Airport draft Major Development Plan (dMDP) for the Tasman Highway Upgrade Project.

Our assessment of this dMDP has not identified any significant issues for Airservices.

Airspace Procedures

With respect to procedures designed by Airservices in accordance with ICAO PANS-OPS and Document 9905, at a maximum height of 26.73m (88ft) AHD and 17.8m (59ft) AHD, the street lights and bridge development, respectively, will not affect any sector or circling altitude, nor any instrument approach or departure procedure at Hobart Airport.

The street lights and bridge will not affect the Hobart Radar Terrain Clearance Chart (RTCC).

Note that procedures not designed by Airservices at Hobart Airport were not considered in this assessment.

Communication/Navigation/Surveillance (CNS) Facilities

This development, to a maximum height of 26.73m (88ft) AHD, will not adversely impact the performance of Precision/Non-Precision Navigational Aids, HF/VHF Communications, A-SMGCS, Radar, PRM, ADS-B, WAM or Satellite/Links.

Air Traffic Control (ATC)

Airservices ATC requests that any crane operation that penetrate the Cambridge City Airport Obstacle Limitation Surface (OLS) are submitted to Airservices for assessment.

Aviation Rescue Fire Fighting Services (ARFFS)

Airservices ARFFS request inclusion as a stakeholder in the design, planning and construction of the Tasman Highway Upgrade Project to ensure ongoing service delivery and access. This review should be carried out in consultation with the Airport Building Controller and Fire Engineer on the commencement of the project.

Environment – ARFFS Polyfluoroalkyl substances (PFAS)

In Section 5.3.2, Airservices recommends the use of term Polyfluoroalkyl substances (PFAS) instead of perfluorinated compound (PFC).

The following statement on page 34 is incorrect: *"In the case of the Tasman Highway Interchange Project, there has been no historic firefighting or training activities in this area (upgradient or adjacent to)."* In December 2003, there was an incident involving a BP tanker overturning. ARFFS was in attendance as part of a mutual aid operational response.

With regards to Figure No 005 - Potential contaminated sites (page 37), Airservices ARFFS suggest that the figure key is updated by changing the text "*Airservices Australia Fire Training Ground*" to "*Fire Training Ground*" and indicate that the fire training ground is also a *'PFAS High Risk'* area.

Development Activity

The proposed use of any plant or cranes required for the construction of any proposed developments associated with this dMDP will require separate consultation between the airport, the proponent(s) and Airservices, prior to construction commencing, to ensure there are no impacts on Airservices facilities or operations.

If you require any additional information or wish to discuss any aspect of this letter further, please do not hesitate to contact my colleague William Zhao, on 03 9339 2182, or by email on airport.developments@airservicesaustralia.com.

Yours sincerely,

Paul Zissermann
Airports and Environment Manager

Australian Government

Civil Aviation Safety Authority

AIR NAVIGATION, AIRSPACE AND AERODROMES

CASA Ref: EF11/209-5

21 January 2020

Ann Redmond
General Manager, Airports
Aviation and Airports
Department of Infrastructure, Transport, Cities and Regional Development
GPO Box 594
CANBERRA ACT 2601

Dear Ms Redmond,

Hobart Airport - Tasman Highway Upgrade Project draft Major Development Plan

Thank you for seeking CASA advice about the above draft Major Development Plan (MDP). This MDP outlines a proposal by the Tasmanian Government to construct an interchange near Hobart Airport. This interchange is part of the Tasman Highway Upgrade Project which involves the construction of an overpass with a maximum height of 10.8m above ground level.

The MDP advises that the overpass and the associated streetlighting will not infringe prescribed airspace. However, CASA seeks to ensure that all construction works associated with the project such as crane operations are assessed for potential impact on aviation safety or airspace in consultation with Airservices, CASA and Cambridge Airport.

CASA provided advice on the exposure draft MDP version in July 2019 and notes that comments provided regarding consistency with the National Airports Safeguarding Framework (NASF), and consultation with Cambridge Airport have been addressed.

If you require any further information or wish to discuss any aspect of this letter, do not hesitate to contact Tony Aiezza on 03 9518 2794.

Yours sincerely,

Andrew Sparrow
Branch Manager

Appendix N

Amended Design Report

Hobart International Airport and Department of State Growth

Tasman Highway Upgrade

Hobart Airport Interchange Major Development Plan - Amended Design Report

MDP_Amended Design

Issue | 27 May 2020

This report takes into account the particular instructions and requirements of our client.

It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

Job number 265575

Arup Pty Ltd ABN 18 000 966 165

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Fortitude Valley
QLD 4006
GPO Box 685 Brisbane QLD 4001
Australia
www.arup.com

ARUP

Document verification

ARUP

Job title		Tasman Highway Upgrade			**Job number** 265575
Document title		Hobart Airport Interchange Major Development Plan - Amended Design Report			**File reference**
Document ref		MDP_Amended Design			
Revision	**Date**	**Filename**	20200527 Amended Design Report .docx		
Issue	27 May 2020	**Description**	Issue		
			Prepared by	Checked by	Approved by
		Name	Fiona Riley	Lillian O'Mahony	Lillian O'Mahony
		Signature			
		Filename			
		Description			
			Prepared by	Checked by	Approved by
		Name			
		Signature			
		Filename			
		Description			
			Prepared by	Checked by	Approved by
		Name			
		Signature			
		Filename			
		Description			
			Prepared by	Checked by	Approved by
		Name			
		Signature			
				Issue Document verification with document	✓

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2	**Assessment of amended design**		**6**
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Figures

Figure 1: Amended project design details
Figure 2: Elevation of bridge and plan view showing carriageways beneath (Source: pitt&sherry, 2020)
Figure 3: Area of impact on Lowland Grassland of Tasmania

Appendices

Appendix A

Drawing of amended design and previously assessed design

1 Background

An Options Analysis process was completed in November 2016 (pitt&sherry, 2016) to establish an appropriate solution for the roundabout upgrade. Eleven options were developed and following a multi-criteria analysis, a preferred option for the interchange was selected. The option selected was a signalised diamond interchange with Holyman Avenue / Kennedy Drive passing over the Tasman Highway (as assessed in the MDP). State Growth called for tenders for the project with tenderers able to offer alternative designs. Following receipt of tenders, the State Growth awarded a contract to Hazell Brothers Civil Contracting. The Hazell Brothers design retained the diamond interchange configuration and raised the Tasman Highway over Holyman Avenue / Kennedy Drive to achieve the grade separation. The ramp terminals are to be controlled by roundabouts (Figure 1). Appendix A provides a comparison of the previously assessed design and the amended design.

This appendix outlines the amended design which has been approved by the Commonwealth Department of Infrastructure, Transport, Regional Development Communications (DITRDC) in April 2020, and considers the changes to the assessment undertaken on the previous design in the Preliminary Draft MDP (pdMDP).

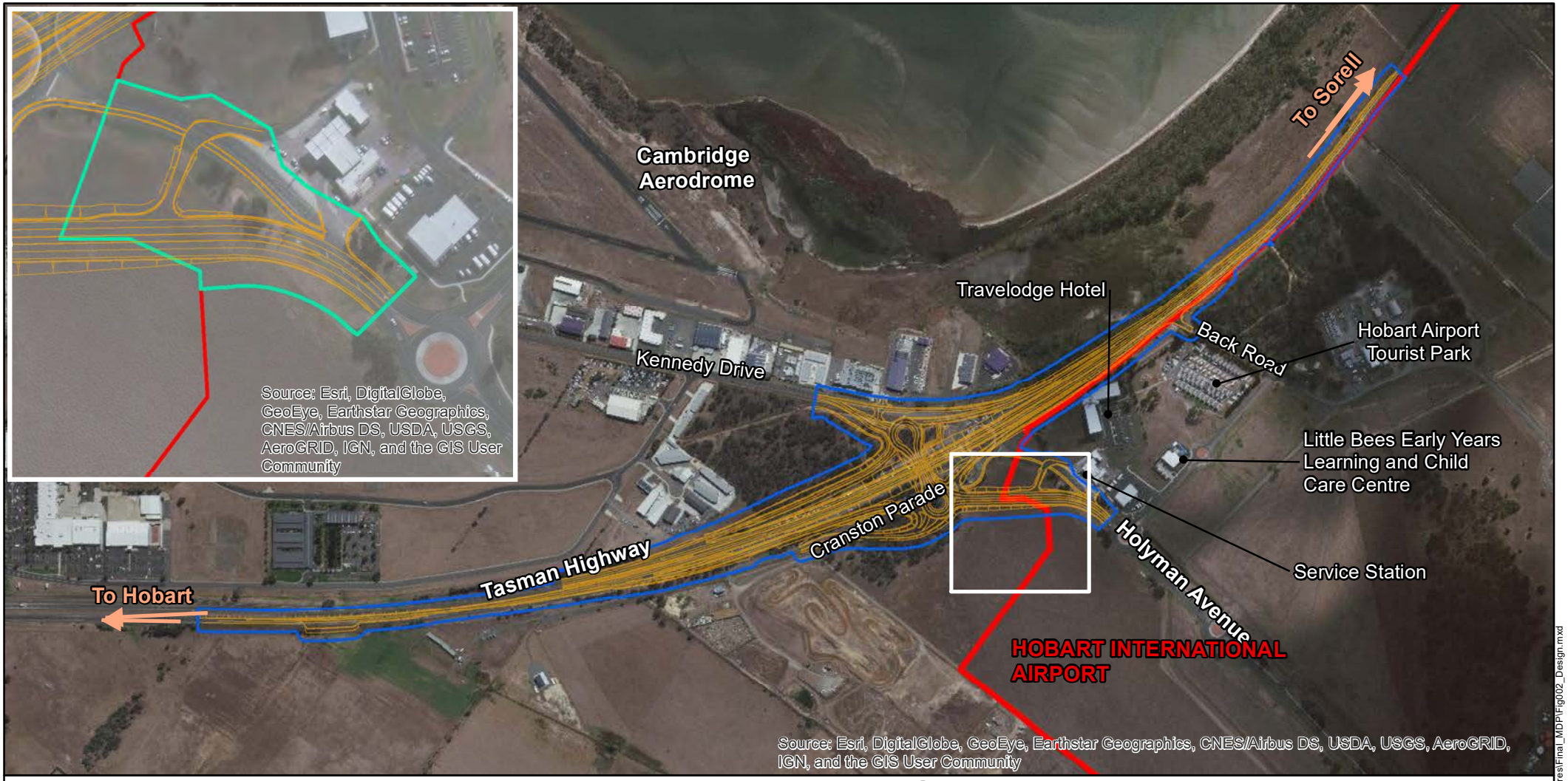
1.1 Project description

The Tasman Highway and on/off ramps have been designed to a speed of 110km/h and a design speed of 60km/h has been adopted for Holyman Avenue, Kennedy Drive and Cranston Parade. The highway is expected to have a posted speed of 100km/h at the interchange and where the ramps connect to the highway.

The connection of Cranston Parade into the road network will be achieved by adding a fifth leg to the southern roundabout that controls the traffic movements at the ramp terminals. Access to the four properties along Cranston Parade will be maintained.

The Tasman Highway will have two lanes in each direction at the interchange. Two lanes will extend eastbound (towards Sorell) for around one kilometre, merging to form one lane. The two westbound lanes (towards Hobart) will extend for around 700m prior to the interchange before joining to the two existing westbound lanes of the Tasman Highway.

The estimated cost of construction of the project is $43 million.



Legend

- Tasman Highway Upgrade design
- Project footprint
- Airport boundary
- Area subject to MDP

Client
Hobart International Airport
Department of State Growth

Job Title
Tasman Highway Upgrade
Major development plan

Figure Title
Project design

Metres
0 100 200 300 400

Issue	Date	By	Chkd	Appd
D1	20/05/2020	FSR	LOM	LOM

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Scale at A4	Figure Status
1:10,000	Final

Coordinate System
GDA 1994 MGA Zone 55

Job No	Figure No
265575-00	001

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Roadways

Lanes, shoulders and medians will be constructed to widths indicated in Table 1.

Table 1: Construction widths

	Tasman Highway	Holyman Avenue	Kennedy Drive	Cranston Parade
Lane widths (m)	3.5 (two lanes)	3.4	3.5	3.0
Outside shoulder (m)	2.0	1.5	1.0	1.0
Inside shoulder (m)	1.0	1.0	2.1	
Existing median	13m on western approach to Holyman Ave, narrowing to 8m at Holyman Ave	-	-	-
New median	8m at Holyman Ave narrowing to 2.1 with a flexible safety barrier east of Holyman Ave	2.0	-	-
Shared path (m)	2.45 (in both directions under Holyman Avenue, linking Kennedy Drive cycling route and Holyman Ave)	2.5		

In order to avoid the need for land acquisition, table drain slopes of 3m horizontal to 1m vertical (3H:1V) have been adopted. Similarly, batter slopes are at 2H:1V to reduce the development footprint and reduce impacts on native vegetation and threatened communities. Approximately 140,000m^3 of fill is required for the approaches to the bridge and other construction elements. Flattening the batters would have increased this volume and the footprint of the project.

Bridge

The proposed Tasman Highway overpass of Holyman Avenue requires a span of approximately 44.58m to accommodate the Holyman Avenue cross section, including existing road angles and supporting retaining walls. Two 22.4m long spans with reinforced earth retaining wall are proposed. A 2.5m wide shared path is included on Holyman Avenue to accommodate pedestrian and cyclist users (Figure 2). Street lighting at both ends of the bridge will be well below the Obstacle Limitation Services (OLS) limits (see Section 5.13 Aviation Safety) and in line with the National Airports Safeguarding Framework Principles and Guidelines.

The bridge height ranges from 5.6m (western abutment) to 5.8m (eastern abutment) above the existing ground level with the approaches gradually tapering down from this level. Barriers will be 1.4m in height and light poles will extend to a maximum height of 12m. The actual height of the light poles will comply with the height limitations relating to the airport. The design and direction of lighting will also be determined by airport and aerodrome requirements.

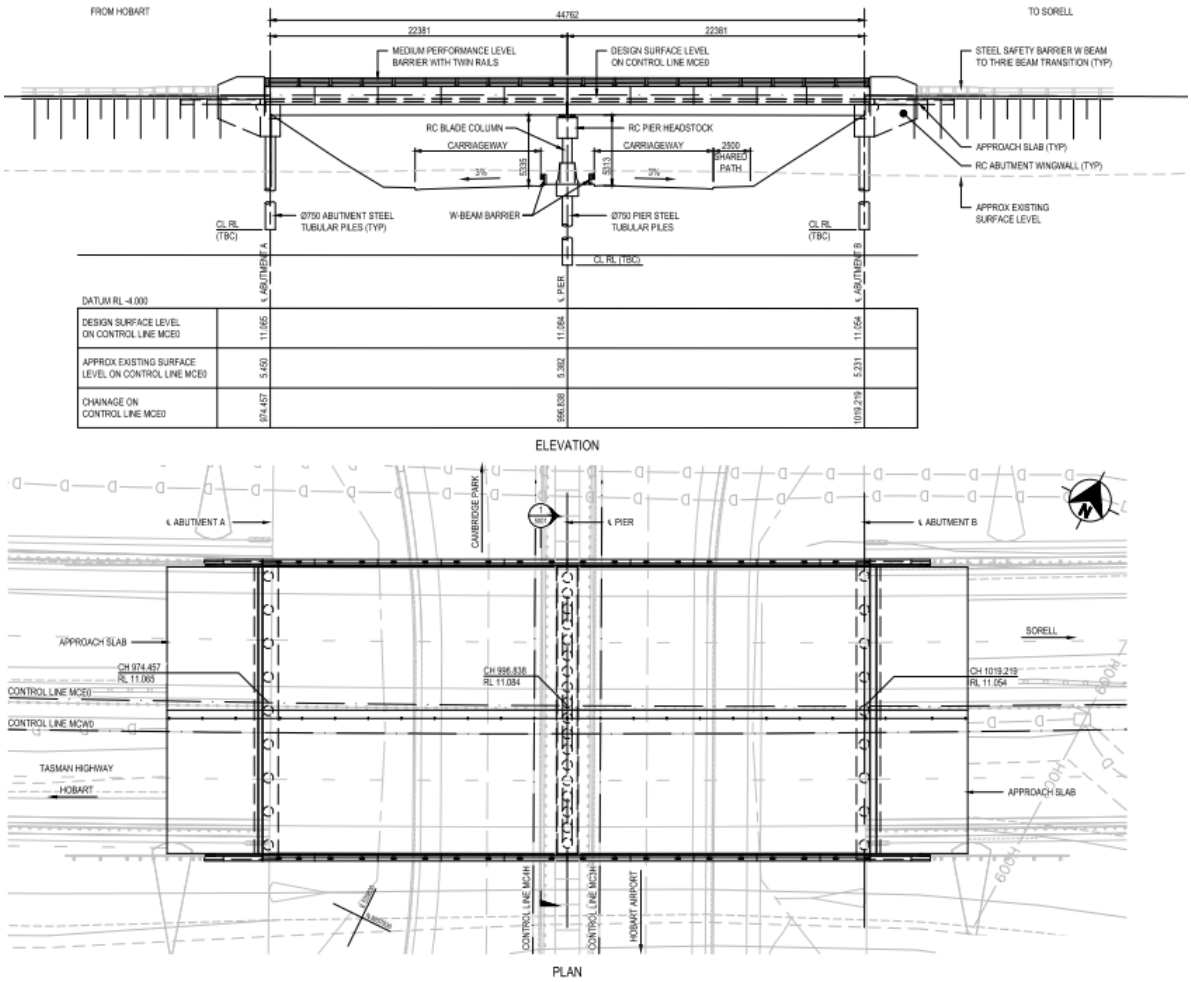

Figure 2: Elevation of bridge and plan view showing carriageways beneath (Source: pitt&sherry, 2020)

Gradient

The existing highway has a downgrade of approximately 2% from west to east, and the new elevated highway will have a rising gradient of 2% over a length of 400m to clear Holyman Avenue and then descend at 2.6% for 500m to match back to the existing highway vertical alignment.

The existing gradients on Holyman Avenue and Kennedy Drive of between 0.5% and 2% are maintained. Gradients on the ramps are between 0 and 2.5%.

Local road access

The new overpass will be located approximately 130m to the west of the existing Holyman Avenue roundabout and realignment of approximately 170m of Kennedy Drive will be required. This realignment will also necessitate changes to the accesses to several industrial properties on the northern side of Kennedy Drive.

Cranston Parade currently provides access to four properties to the west of the existing roundabout and access to these properties will not alter significantly from the current arrangements.

Stormwater culverts

Modelling of flows over a range of rainfall events indicated that a number of new culverts will be required to be incorporated into the design. Additionally, increased flows from the additional road surface will be retained on site using the 'basins' created by the bridge approaches and ramps. A hydraulic assessment determined that:

- The increased flow on the northern side of the interchange can be mitigated by appropriate sizing and location of pipes under Kennedy Drive to allow detention north of the east bound on ramp;
- The increase in flow on the southern side is insignificant at the location of the airport runway as the catchment is already large with significant paved areas and the additional flow from the increased road area is very small (<1%) in comparison.

Temporary works

Temporary diversions will be required for all major access points including Holyman Avenue, Kennedy Drive, Cranston Parade and the airport service station. The construction contractor will be required to implement a high standard of traffic management with strict performance requirements on delays and quality of temporary road surfaces. Any side tracks will be located within the identified construction footprint.

2 Assessment of amended design

Where the amended design would have a potentially alternate impact, this has been summarised below. Where the information is not available at this stage to make an equivalent assessment to that previously undertaken in the pdMDP this is noted.

2.1 Land use

The amended design is not anticipated to result in any changes to the results of the impact assessment for land use from the original design.

2.2 Geology and soils

The amended design is not anticipated to result in any changes to the results of the impact assessment for geology and soils from the original design.

2.3 Surface and groundwater

No updated modelling has been undertaken to assess potential changes in impacts from the amended design.

2.4 Biodiversity

The total project footprint of the amended design includes approximately 0.91 ha of impact on the Lowland Native Grassland of Tasmania, of which 0.47 ha is direct impact, and 0.44 ha is indirect impacts (such as edge effects).

Within HIAPL land managed as ESA, there would be approximately 0.14 ha direct impact, and 0.07 ha of indirect (for a total of 0.21 ha) (Figure 3).

In May 2020, DAWE granted a permit for the Department of State Growth to clear Lowland Native Grassland of Tasmania within the Airport grounds, provided the actions do not impact more than 0.36 ha of the grassland within Airport grounds.

To mitigate and compensate for the impacts of fragmentation and increased edge effects, the isolated patch of 0.18ha of Lowland Native Grasslands will be managed to maintain its ecological condition at the current level. It will be protected from disturbance during the construction phase by fencing off the area, implementing no-go area signage and prohibiting use of the area as a storage place for spoil and other waste. The area will continue to be managed through routine mowing and weed control. Commitment to maintenance of the grasslands will continue during future operational phases of the airport. This patch of Lowland Native Grasslands will continue to be provided protection under the EPBC Act, with any future impacts requiring a significant impact assessment and potential approval from the Commonwealth.

Legend

- Tasman Highway Upgrade design
- Airport boundary
- Area subject to MDP
- Project footprint
- Lowland Native Grassland of Tasmania (EPBC Act)
- Environmentally Significant Area (HIAPL)

Client
Hobart International Airport
Department of State Growth

Job Title
Tasman Highway Upgrade
Major development plan

Figure Title
Area of impact Lowland Native Grassland of Tasmania and ESA

Metres
0 100 200 300 400

Issue	Date	By	Chkd	Appd
D1	26/05/2020	FSR	LOM	LOM

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Scale at A4	Figure Status
1:11,000	Final

Coordinate System
GDA 1994 MGA Zone 55

Job No	Figure No
265575-00	003

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2.5 Cultural heritage

The amended design is not anticipated to result in any changes to the results of the impact assessment for cultural heritage from the original design.

2.6 Air quality

The amended design is not anticipated to result in any changes to the results of the impact assessment for air quality from the original design.

2.7 Noise

No updated modelling has been undertaken to assess potential changes in impacts from operational noise from the amended design.

With the mitigation measures detailed in the pdMDP, the impacts from construction noise are anticipated to be similar to what was previously assessed.

2.8 Hazardous materials

The amended design is not anticipated to result in any changes to the results of the impact assessment for hazardous materials from the original design.

2.9 Traffic and transport

No updated traffic modelling has been undertaken to assess potential changes in impacts from traffic and transport from the amended design.

The highway is expected to have a speed limit of 100km/h at the interchange and the ramps and bridge will have a speed limit of 60km/h.

The connection of Cranston Parade into the road system will be achieved by adding a fifth leg to the southern roundabout of the interchange. Connections for properties along Cranston Parade will remain unchanged.

Holyman Avenue will have two lanes in each direction on the approach to and departure from the southern roundabout and two lanes in each direction continuing under the Tasman Highway. On the approach to the northern roundabout two lanes can continue on to the eastbound on ramp to the Tasman Highway and the outside lane also continues on to Kennedy Drive. In an eastbound direction, two lanes will extend to approximately 800m east of the interchange to allow for the on-ramp traffic to safely merge with the highway traffic, and also allow for the highway traffic to merge into one lane after this. In a westbound direction, the two-lane carriageway will begin approximately 700m east of the interchange.

The bridge over the Tasman Highway will have two lanes in each direction.

2.10 Economic and social

The amended design is not anticipated to result in any changes to the results of the economic and social impact assessment for from the original design.

2.11 Visual impact assessment

The amended project results in a lower profile for the Tasman Highway Upgrade and remains consistent with the industrial nature of the surrounds. The previously assessed design had a maximum height of 26.73m AHD at the street lights, and 17.8m at the bridge development. The amended design has a maximum height of 23.2m AHD at the street lights, and 11.2m AHD at the bridge development.

Although additional lighting may impact nearby sensitive receivers (such as the Travelodge Hotel and Hobart Airport Tourist Park) it should be recognised that there is already existing street lighting in close proximity to these sites. Light fittings would not exceed the limits of Guideline E of NASF.

2.12 Aviation Safety

Obstacle Limitation Surfaces

State Growth commissioned an Obstacle Limitation Surfaces (OLS) Survey which assessed the flight paths for aircraft using the runways at both Cambridge Aerodrome and Hobart International Airport. This assessment determined that, once operational, the previously assessed design would not impact on aircraft using Hobart Airport or the Cambridge Aerodrome as all aspects of the proposed upgrade are below the prescribed OLS.

The amended design is lower than the previously assessed design. As such, once the interchange is operational, no impact is anticipated and no further assessment has been undertaken on the amended design.

Line of sight from the ATC Tower

It was determined that the construction and operation of the previous design of the project would have no impact on the existing line of sight for the Air Traffic Control Tower, as confirmed by Airservices (19 July 2019) who stated, "*This development, to a maximum height of 26.73m (88ft) AHD, will not adversely impact the performance of Precision/Non-Precision Navigational Aids, HF/VHF Communications, A-SMGCS, Radar, PRM, ADS-B, WAM or Satellite/Links*." The updated design does not exceed this height and as such, further assessment has been undertaken on the amended design.

Wind shear and turbulence

The assessment of the previous design determined that the impact of the project on windshear at Hobart Airport and Cambridge Aerodrome would be negligible.

The amended design is lower than the previously assessed design, though is within the same footprint. No further assessment has been undertaken on this amended design.

Construction

If construction equipment such as cranes are required to temporarily extend above the OLS, assessment of these occurrences will be completed in accordance with the Hobart Airport process prior to construction, and in keeping with obligations under the Airports Act. This includes separate consultation between HIAPL, State Growth, Airservices and CASA prior to construction commencing, to ensure there are no impacts on Airservices facilities or operations. Any crane operation that penetrates the Cambridge City Airport Obstacle Limitation Surface will be submitted to Airservices for assessment.

2.13 Services

No updated information has been provided with regards to amendments to services from the amended design.

3 Mitigation measures

The mitigation measures that were identified in the pdMDP are still relevant to this amended design and will need to be applied during construction of the project.

Appendix A

Drawing of amended design and previously assessed design

SORELL

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HOBART

HOBART INTERNATIONAL AIRPORT

LEGEND

HAZELL DESIGN

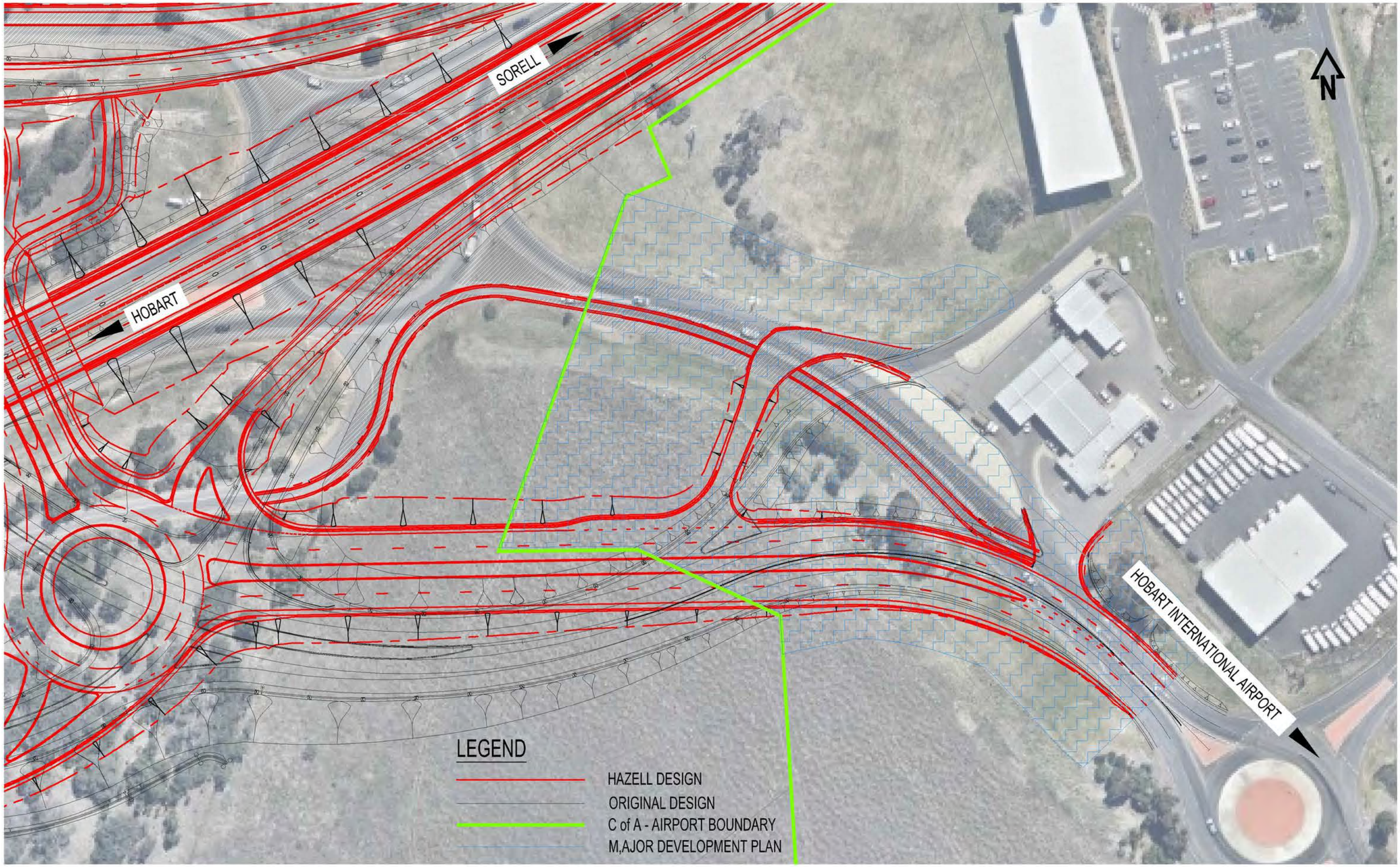
ORIGINAL DESIGN

MAJOR DEVELOPMENT PLAN

TASMAN HIGHWAY
HOBART AIRPORT INTERCHANGE

FEB 2020

HB17138-P306



TASMAN HIGHWAY
HOBART AIRPORT INTERCHANGE

FEB 2020 HB17138-P305