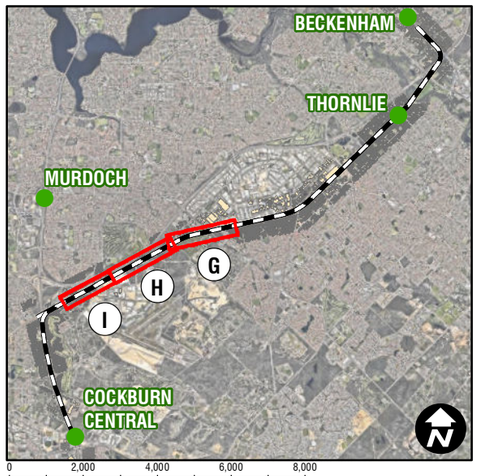

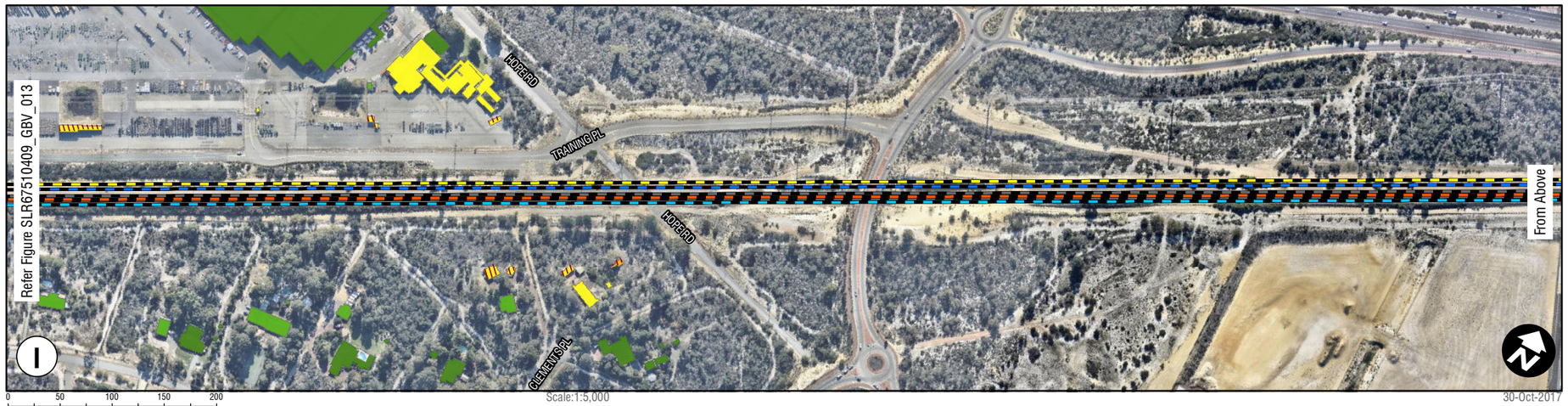

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Scale:1:5,000
GDA 1994 Perth Coastal Grid 1994

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675.10409

LEGEND

DG DN Main
DG UP Main
Existing DG DN Main
Existing DG UP Main
Existing T DN Main
Existing T UP Main
T DN Main
T UP Main
Receivers > 106

Vibration Level Lmax
(dBv re 1nm/s)
≤99
100 - 103
104 - 107
108 - 111
112 - 115
116 - 119
120 - 123
124 - 127

Note: To be Read in Accordance with SLR Report 675.10497.00100

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Thornlie Rail Extension
Ground-Borne Vibration - Passenger & Freight
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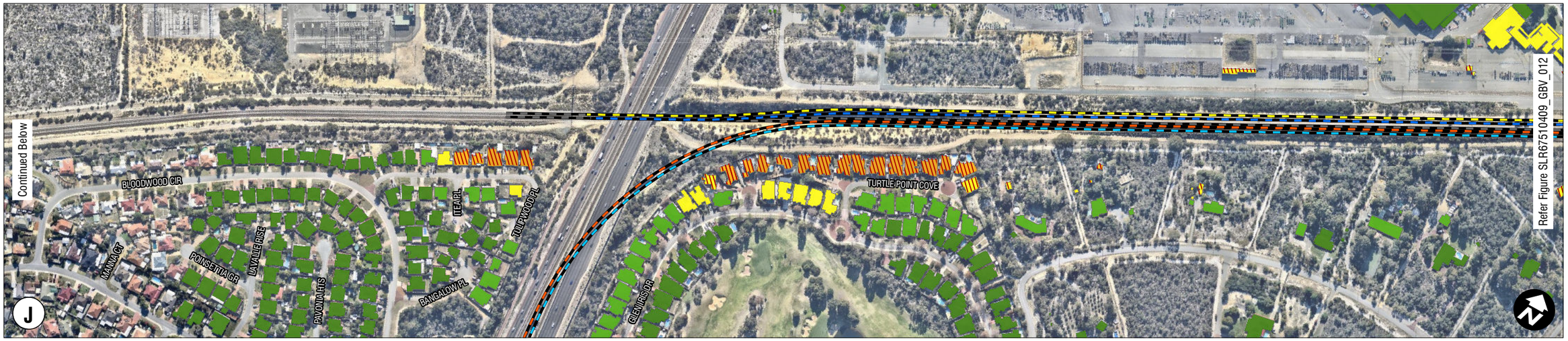
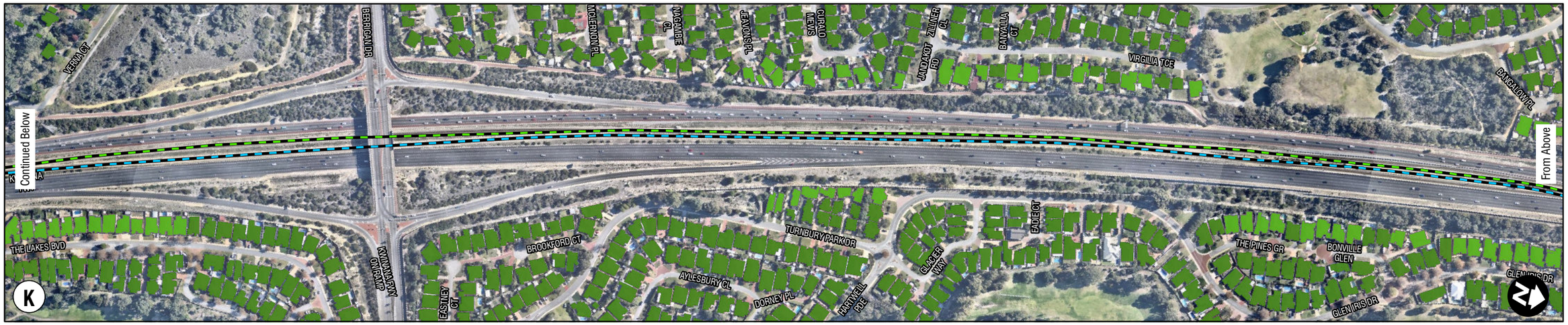
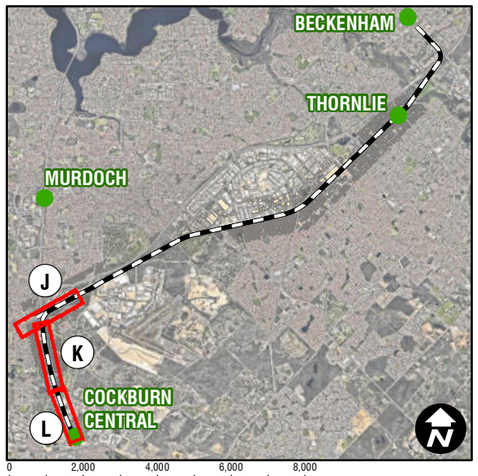
FIGURE SLR67510409_GBV_012







Scale:1:5,000
GDA 1994 Perth Coastal Grid 1994

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LEGEND

- DG DN Main
- DG UP Main
- Existing DG DN Main
- Existing DG UP Main
- Existing T DN Main
- Existing T UP Main
- T DN Main
- T UP Main
- Receivers > 106

Vibration Level Lmax
(dBv re 1nm/s)

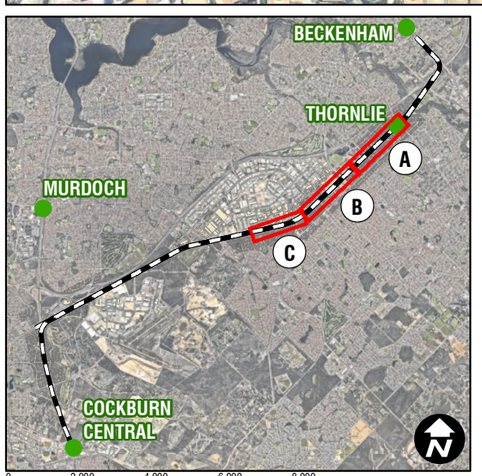
- ≤99
- 100 - 103
- 104 - 107
- 108 - 111
- 112 - 115
- 116 - 119
- 120 - 123
- 124 - 127

Note: To be Read in Accordance with SLR Report 675.10497.00100

Thornlie Rail Extension
Ground-Borne Vibration - Passenger & Freight
Page 4 of 4

FIGURE SLR67510409_GBV_013

Q Predicted Ground-borne Vibration (with mitigation)



0 2,000 4,000 6,000 8,000 m

0 50 100 150 200 m

Scale:1:5,000
GDA 1994 Perth Coastal Grid 1994

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LEGEND

Existing DG DN Main
Existing DG UP Main
Existing T DN Main
Existing T UP Main
T DN Main
T UP Main

Vibration Level Lmax (dBv re 1nm/s)

80 - 85
86 - 90
91 - 95
96 - 100
101 - 105
106 - 110
111 - 115
116 - 120
121 - 125

Receivers Above Threshold

Industrial Receivers > 118
Residential Receivers >106

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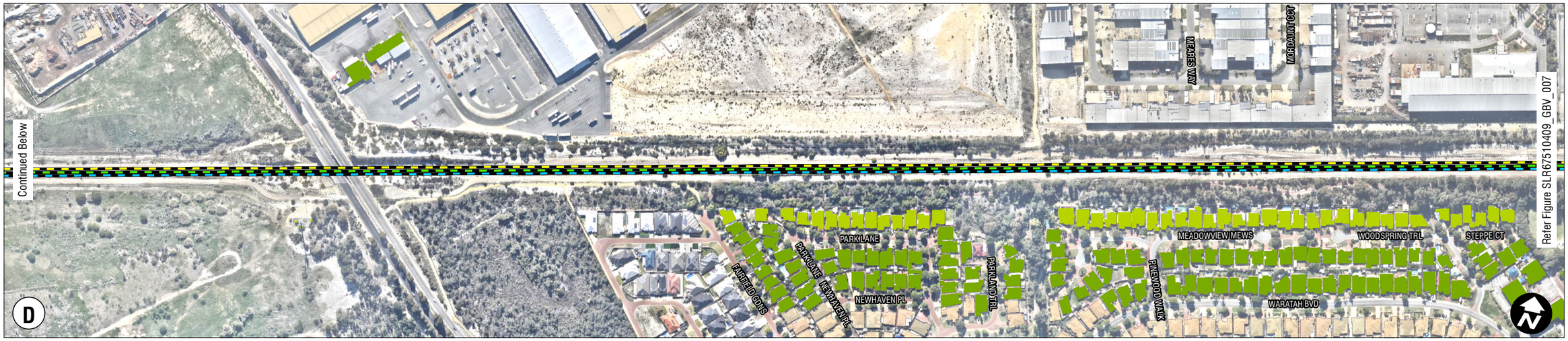
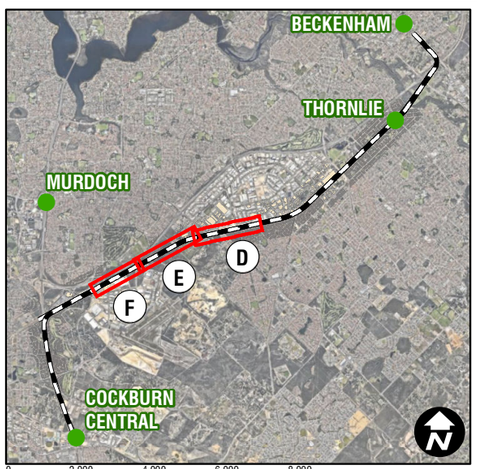
Ground-borne Vibration -Future Passenger Rail With Mitigation - Page 1 of 3

FIGURE SLR67510409_GBV_007





0 2,000 4,000 6,000 8,000 m

0 50 100 150 200 m

Scale:1:5,000
GDA 1994 Perth Coastal Grid 1994

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LEGEND

Existing DG DN Main
Existing DG UP Main
Existing T DN Main
Existing T UP Main
T DN Main
T UP Main

Vibration Level Lmax (dBv re 1nm/s)

80 - 85
86 - 90
91 - 95
96 - 100
101 - 105
106 - 110
111 - 115
116 - 120
121 - 125

Receivers Above Threshold

Industrial Receivers > 118
Residential Receivers >106

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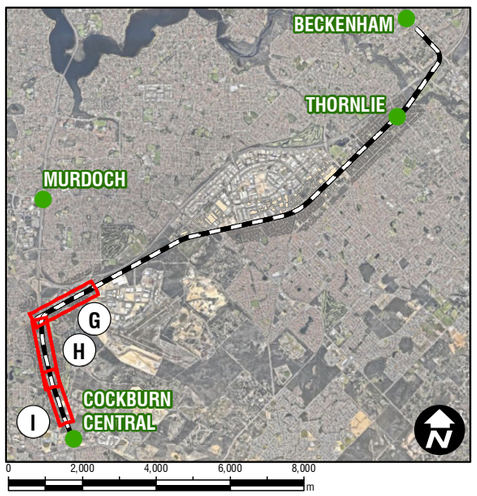
Thornlie Rail Extension
Ground-borne Vibration -Future Passenger Rail With Mitigation - Page 2 of 3

FIGURE SLR67510409_GBV_008



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LEGEND

- Existing DG DN Main
- Existing DG UP Main
- Existing T DN Main
- Existing T UP Main
- T DN Main
- T UP Main

Vibration Level Lmax (dBv re 1nm/s)

- 80 - 85
- 86 - 90
- 91 - 95
- 96 - 100
- 101 - 105
- 106 - 110
- 111 - 115
- 116 - 120
- 121 - 125

Receivers Above Threshold

- Industrial Receivers > 118
- Residential Receivers > 106

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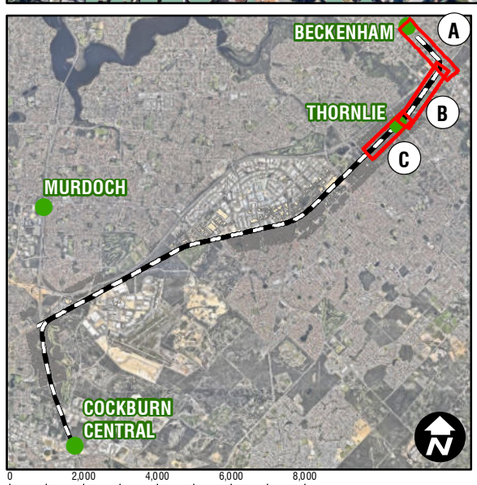
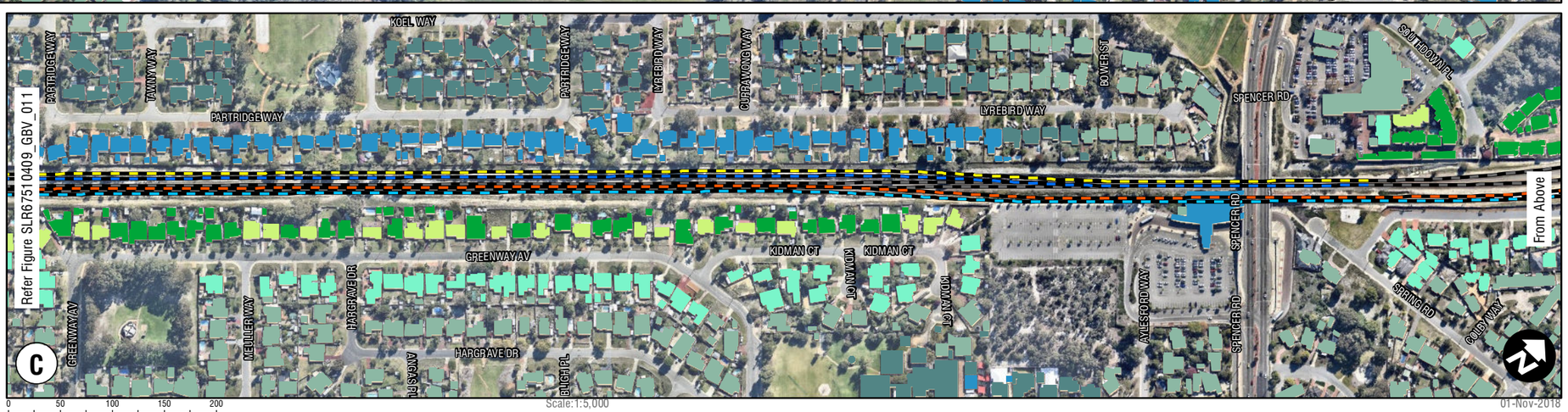
Ground-borne Vibration -Future Passenger Rail With Mitigation - Page 3 of 3

FIGURE SLR67510409_GBV_009





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0 2,000 4,000 6,000 8,000 m

0 50 100 150 200 m

Scale:1:5,000
GDA 1994 Perth Coastal Grid 1994

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LEGEND

DG DN Main
DG UP Main
Existing DG DN Main
Existing DG UP Main
Existing T DN Main
Existing T UP Main
T DN Main
T UP Main

Expected Change dB - lower is better

>-10
-8 to -10
-6 to -8
-4 to -6
-2 to -4
Within 2dB of existing

Note: To be Read in Accordance with SLR Report 675.10497.00100

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Ground-borne Vibration - Future with mitigation
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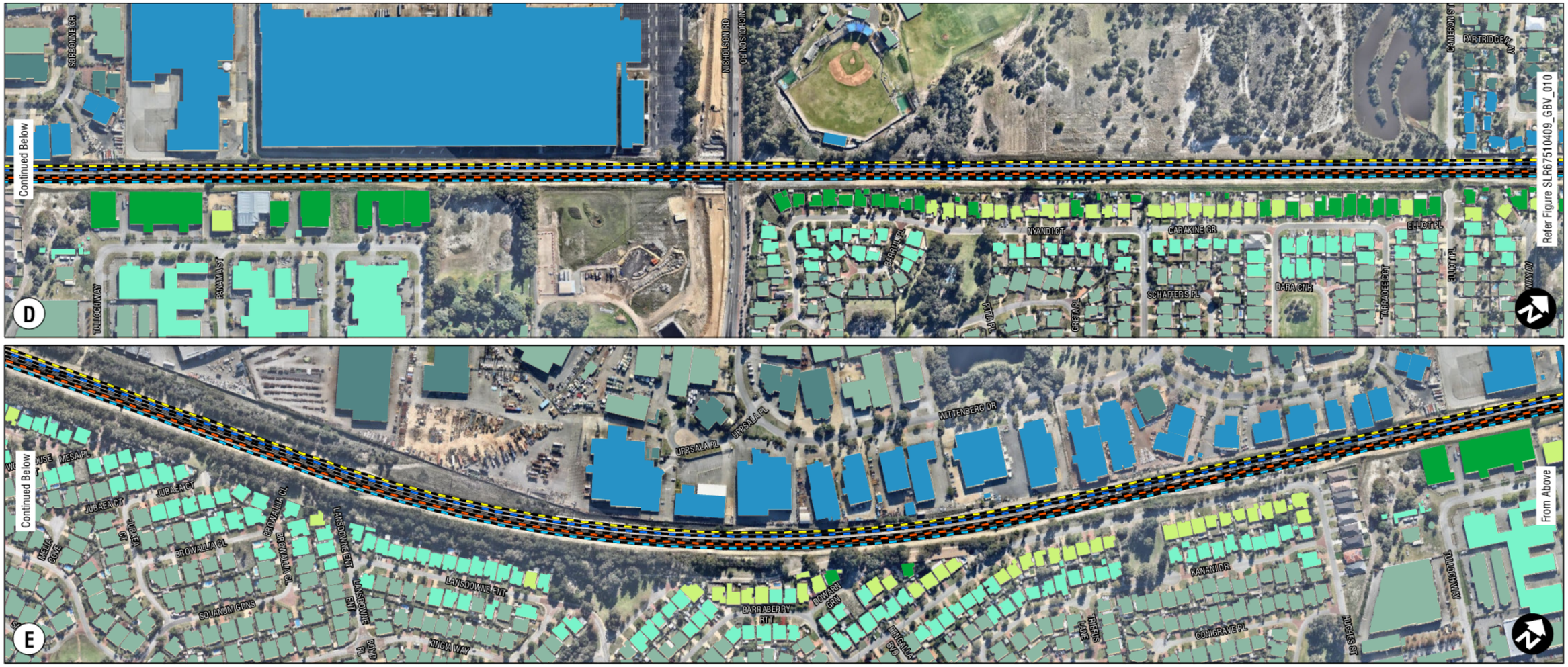
FIGURE SLR67510409_GBV_014



LEGEND

- DG DN Main
- DG UP Main
- Existing DG DN Main
- Existing DG UP Main
- Existing T DN Main
- Existing T UP Main
- T DN Main
- T UP Main

Expected Change dB - lower is better

- >-10
- -8 to -10
- -6 to -8
- -4 to -6
- -2 to -4
- Within 2dB of existing

Note: To be Read in Accordance with SLR Report 675.10497.00100

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Ground-borne Vibration - Future with mitigation
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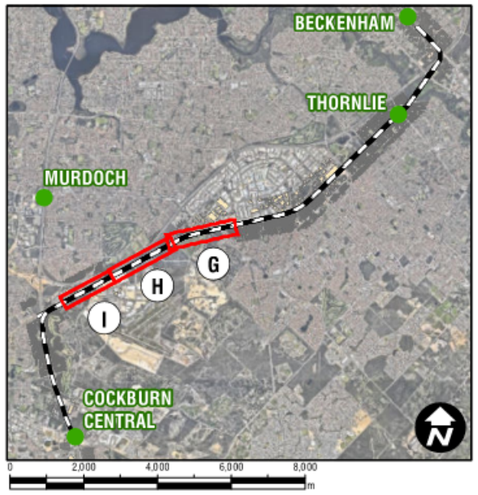
FIGURE SLR67510409_GBV_015



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LEGEND

- DG DN Main
- DG UP Main
- Existing DG DN Main
- Existing DG UP Main
- Existing T DN Main
- Existing T UP Main
- T DN Main
- T UP Main

Expected Change dB - lower is better

- >-10
- -8 to -10
- -6 to -8
- -4 to -6
- -2 to -4
- Within 2dB of existing

Note: To be Read in Accordance with SLR Report 675.10497.00100

Thornlie Rail Extension
Ground-borne Vibration - Future with mitigation
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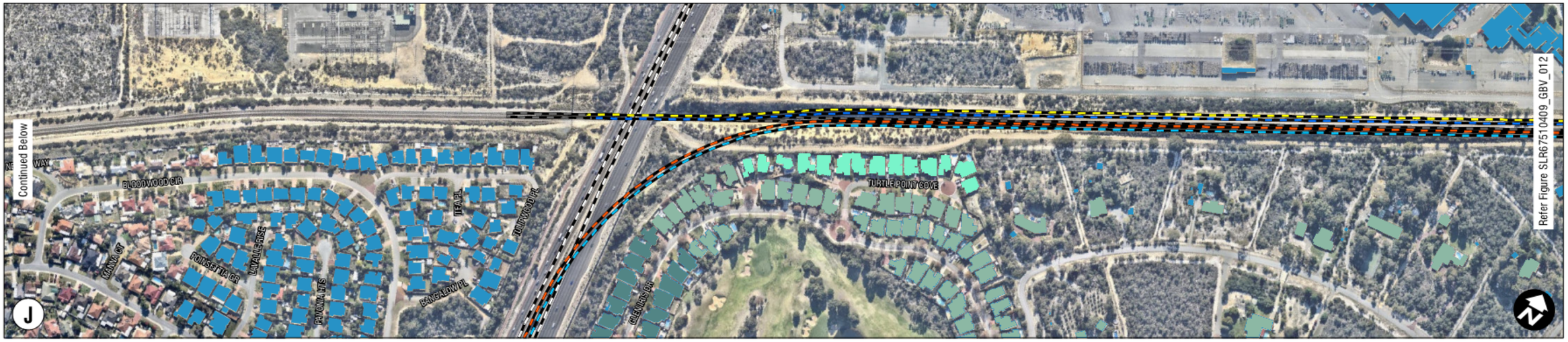
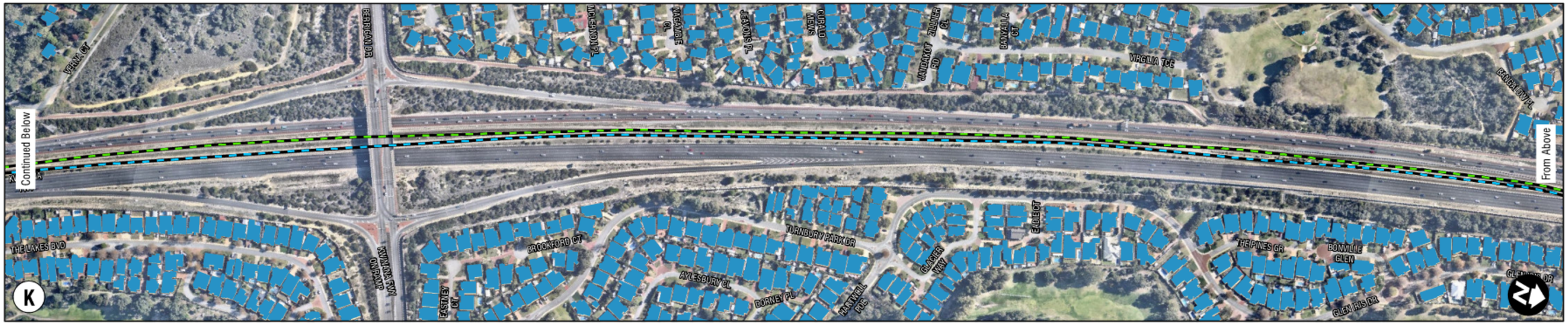
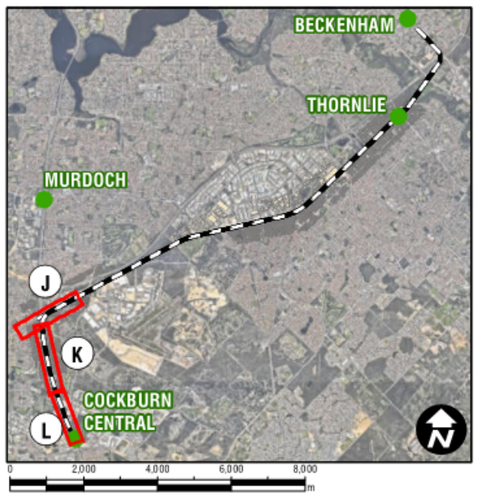
FIGURE SLR67510409_GBV_016







Scale:1:5,000
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LEGEND

- DG DN Main
- DG UP Main
- Existing DG DN Main
- Existing DG UP Main
- Existing T DN Main
- Existing T UP Main
- T DN Main
- T UP Main

Expected Change dB - lower is better

- >-10
- -8 to -10
- -6 to -8
- -4 to -6
- -2 to -4
- Within 2dB of existing

Note: To be Read in Accordance with SLR Report 675.10497.00100

Thornlie Rail Extension
Ground-borne Vibration - Future with mitigation
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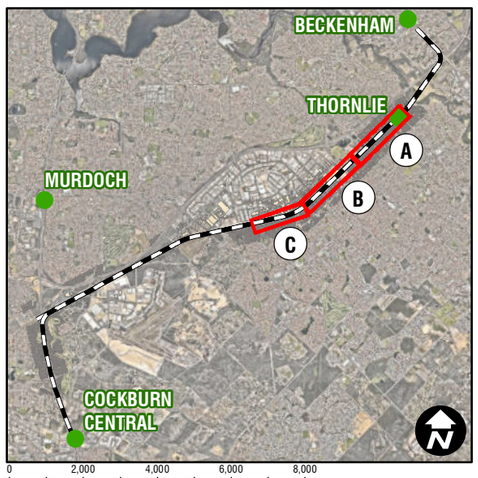
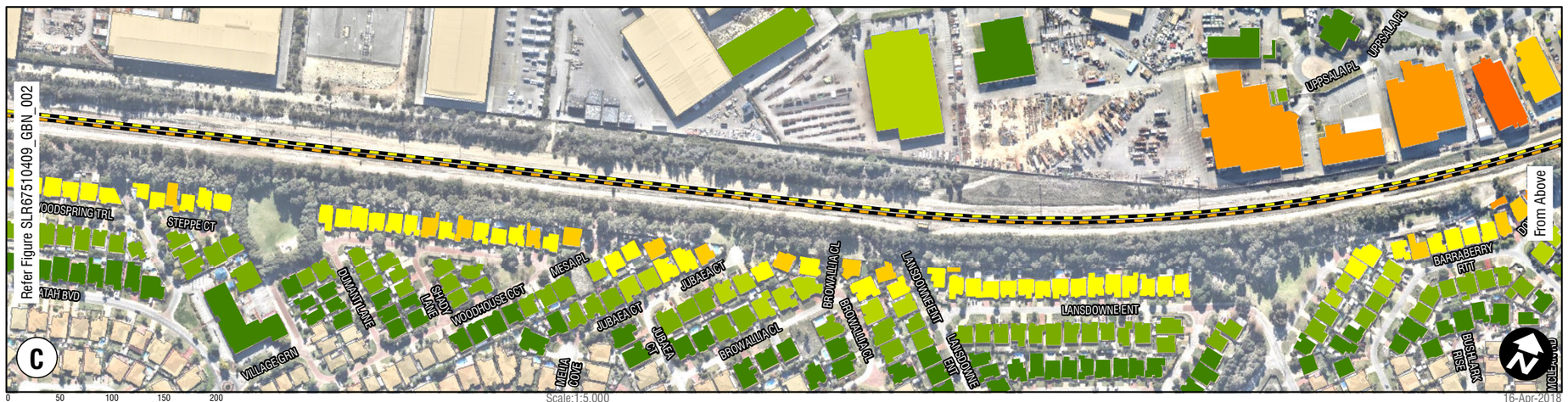
FIGURE SLR67510409_GBV_017

R Predicted Ground-borne Noise (Existing)





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LEGEND

Existing DG DN Main
Existing DG UP Main
Existing T DN Main
Existing T UP Main

Ground-borne Noise Level (dBA)

≤15	21 - 25	41 - 45
16 - 20	26 - 30	46 - 50
	31 - 35	51 - 55
	36 - 40	

Note:
To be read in conjunction with SLR Report 675.10409.00100.

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Thornlie Rail Extension
Ground-borne Noise - Existing
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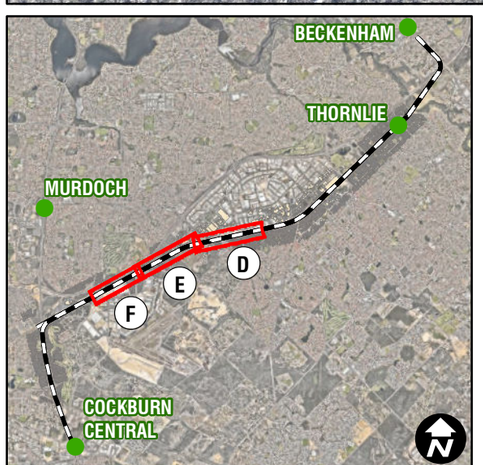
FIGURE SLR67510409_GBN_001



0 2,000 4,000 6,000 8,000 m

0 50 100 150 200 m

Scale:1:5,000
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LEGEND

- Existing DG DN Main
- Existing DG UP Main
- Existing T DN Main
- Existing T UP Main

Ground-borne Noise Level (dBA)

- ≤15
- 16 - 20
- 21 - 25
- 26 - 30
- 31 - 35
- 36 - 40
- 41 - 45
- 46 - 50
- 51 - 55

Note:
To be read in conjunction with SLR Report 675.10409.00100.

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Thornlie Rail Extension
Ground-borne Noise - Existing
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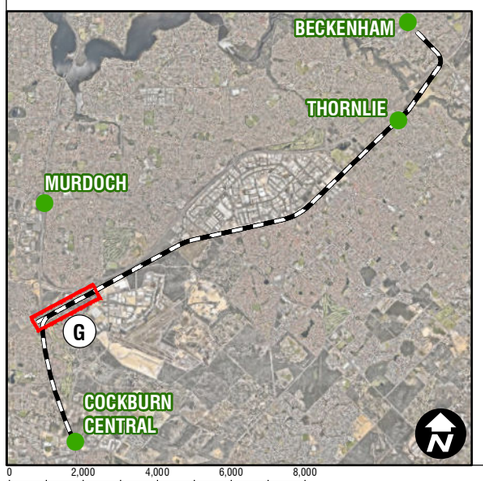
FIGURE SLR67510409_GBN_002



0 2,000 4,000 6,000 8,000 m

0 50 100 150 200 m

Scale:1:5,000
GDA 1994 Perth Coastal Grid 1994

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LEGEND

- Existing DG DN Main
- Existing DG UP Main
- Existing T DN Main
- Existing T UP Main

Ground-borne Noise Level (dBA)

- ≤15
- 16 - 20
- 21 - 25
- 26 - 30
- 31 - 35
- 36 - 40
- 41 - 45
- 46 - 50
- 51 - 55

Note:
To be read in conjunction with SLR Report 675.10409.00100.

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Thornlie Rail Extension
Ground-borne Noise - Existing
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FIGURE SLR67510409_GBN_003

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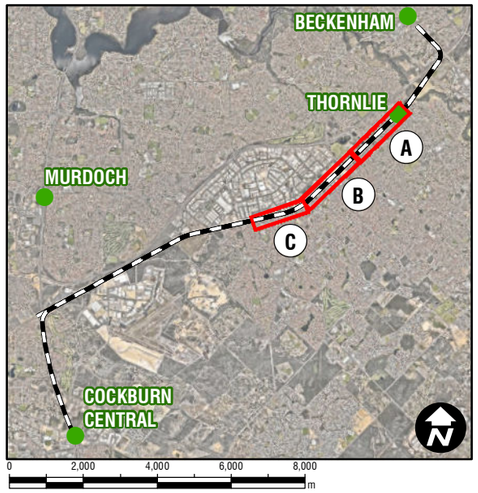
S Predicted Ground-borne Noise (Future Passenger Rail)



0 2,000 4,000 6,000 8,000 m

0 50 100 150 200 m

Scale:1:5,000
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LEGEND

Existing DG DN Main
Existing DG UP Main
Existing T DN Main
Existing T UP Main
T DN Main
T UP Main

Ground-borne Noise Level (dBA)

≤15
16 - 20
21 - 25
26 - 30
31 - 35
36 - 40
41 - 45
46 - 50
51 - 55

Note:
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Thornlie Rail Extension
Ground-borne Noise - Future Passenger Rail
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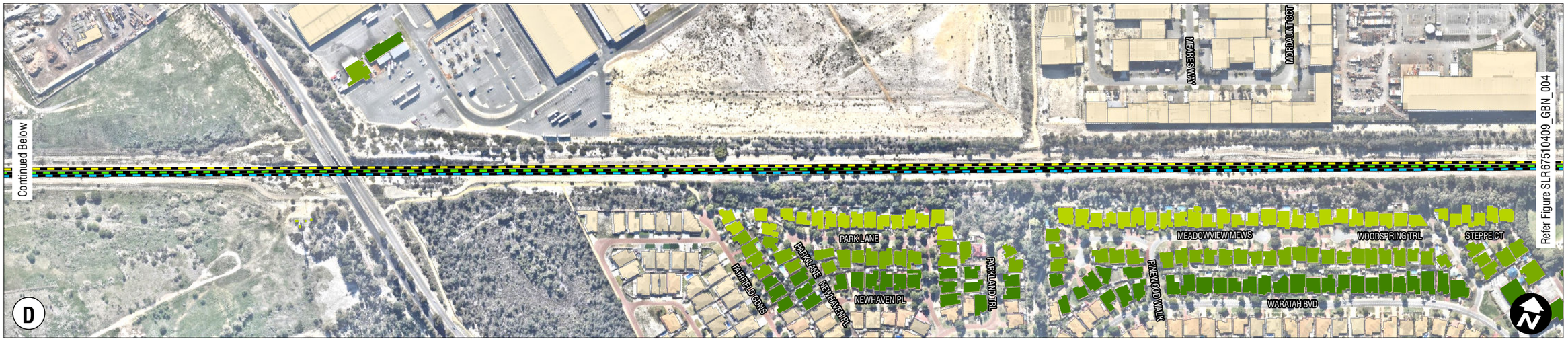
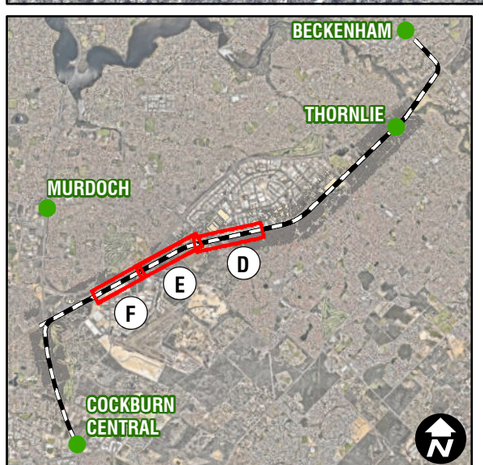
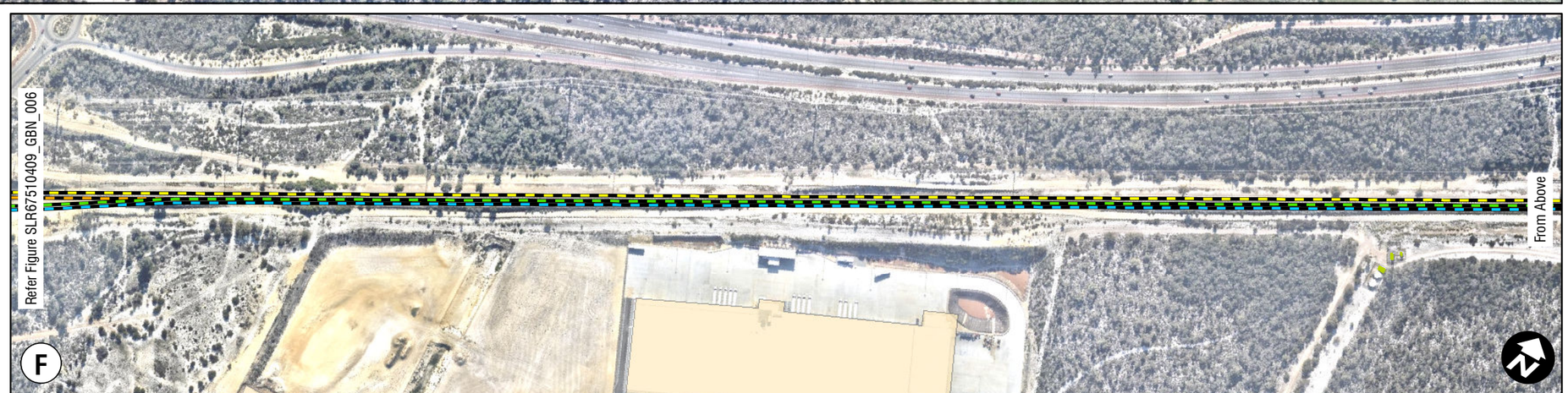
FIGURE SLR67510409_GBN_004







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LEGEND

Existing DG DN Main
Existing DG UP Main
Existing T DN Main
Existing T UP Main
T DN Main
T UP Main

Ground-borne Noise Level (dBA)

≤15
16 - 20
21 - 25
26 - 30
31 - 35
36 - 40
41 - 45
46 - 50
51 - 55

Note:
To be read in conjunction with SLR Report 675.10409.00100.

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Thornlie Rail Extension
Ground-borne Noise - Future Passenger Rail
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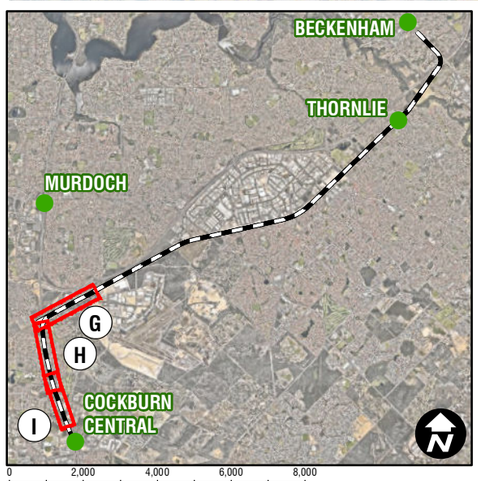
FIGURE SLR67510409_GBN_005



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16-Apr-2018
675.10409

LEGEND

Existing DG DN Main
Existing DG UP Main
Existing T DN Main
Existing T UP Main
T DN Main
T UP Main

Ground-borne Noise Level (dBA)

≤15
16 - 20
21 - 25
26 - 30
31 - 35
36 - 40
41 - 45
46 - 50
51 - 55

Note:
To be read in conjunction with SLR Report 675.10409.00100.

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Thornlie Rail Extension
Ground-borne Noise - Future Passenger Rail
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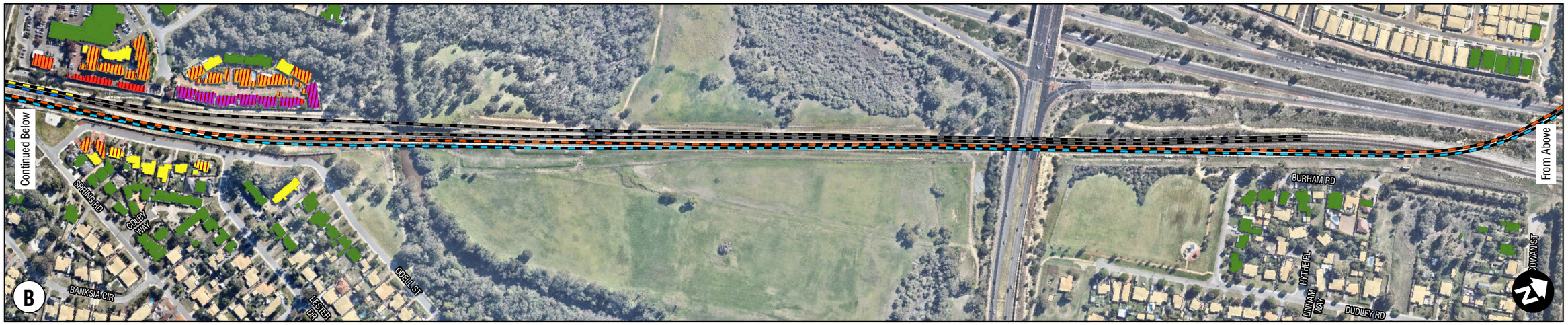
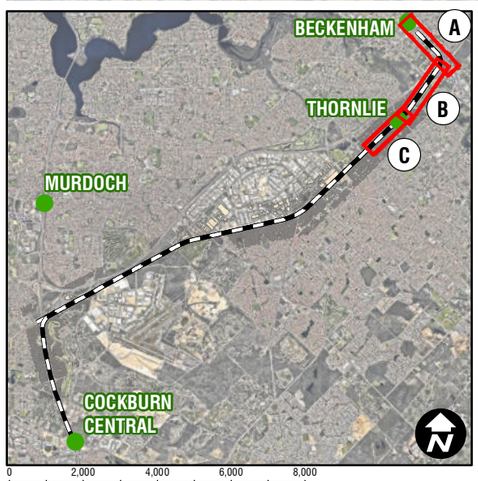
FIGURE SLR67510409_GBN_006

T Predicted Ground-borne Noise (Passenger & Freight)





Scale:1:5,000
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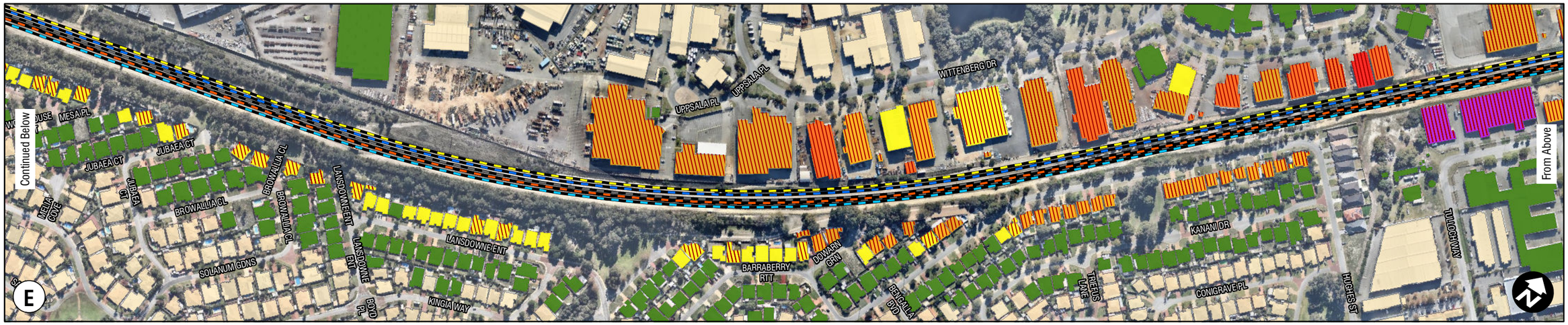
LEGEND

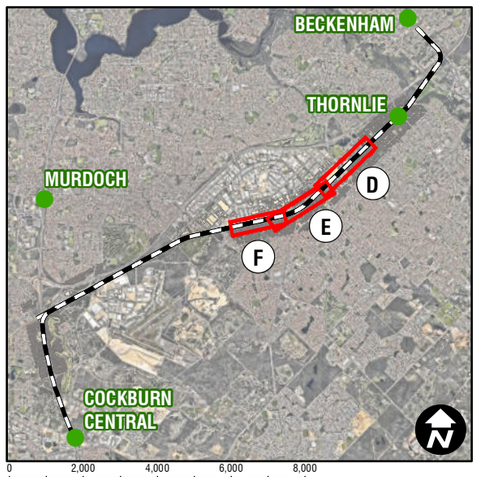
- DG DN Main
- DG UP Main
- Existing DG DN Main
- Existing DG UP Main
- Existing T DN Main
- Existing T UP Main
- T DN Main
- T UP Main

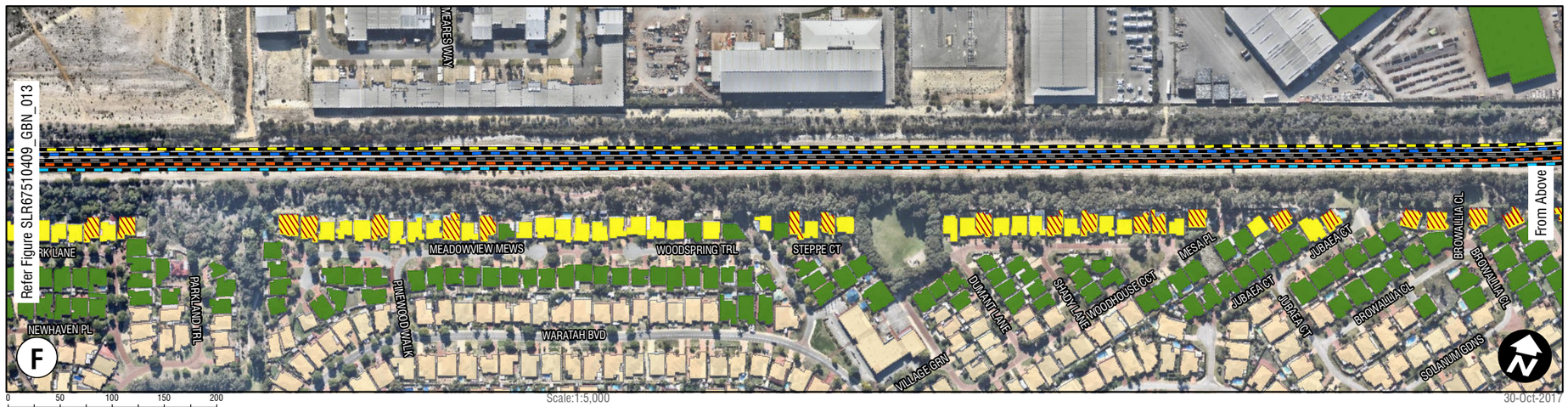
Note: To be Read in Accordance with SLR Report 675.10497.00100

Thornlie Rail Extension
Ground-Borne Noise - Passenger & Freight
LAeq - Page 1 of 4

FIGURE SLR67510409_GBN_010







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Scale:1:5,000
GDA 1994 Perth Coastal Grid 1994

30-Oct-2017
675.10409

Sheet Size : A3

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LEGEND

- DG DN Main
- DG UP Main
- Existing DG DN Main
- Existing DG UP Main
- Existing T DN Main
- Existing T UP Main
- T DN Main
- T UP Main
- Receivers > 35

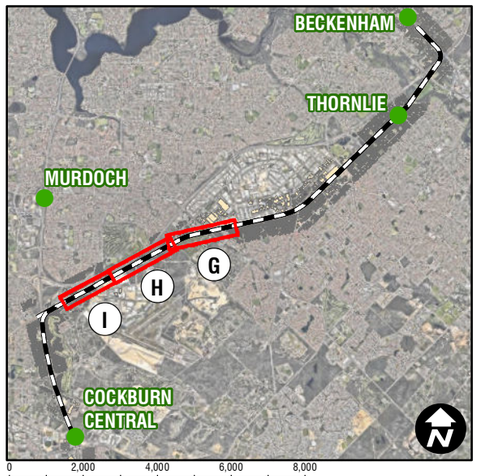
Ground Borne Noise Level (dBA)

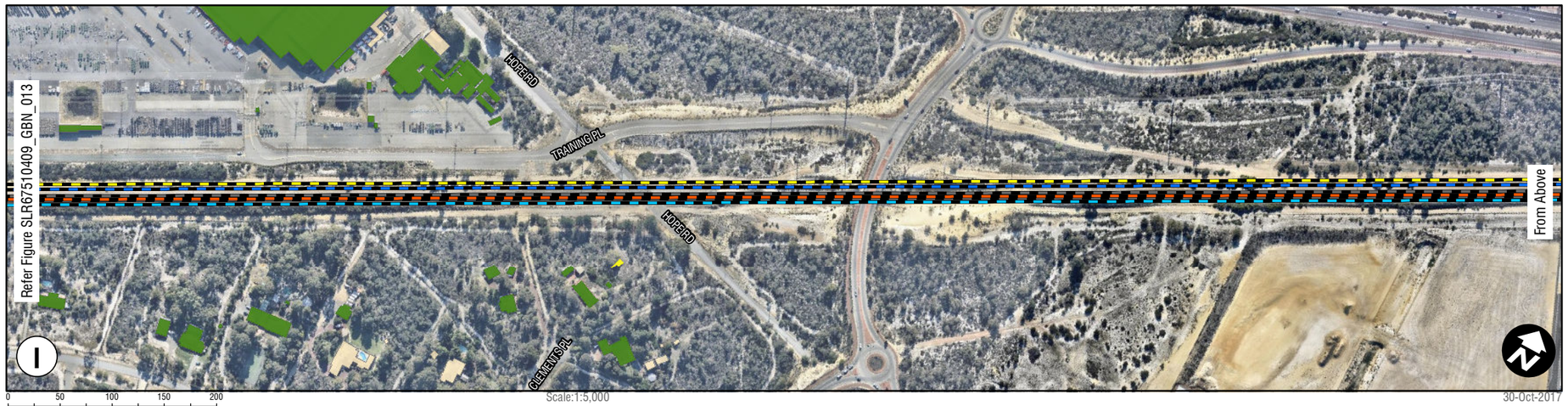
- ≤32
- 33 - 36
- 37 - 40
- 41 - 44
- 45 - 48
- 49 - 52
- >53

Note: To be Read in Accordance with SLR Report 675.10497.00100

Thornlie Rail Extension
Ground-Borne Noise - Passenger & Freight
LAeq, Night - Page 2 of 4

FIGURE SLR67510409_GBN_011





0 2,000 4,000 6,000 8,000 m

0 50 100 150 200 m

Scale:1:5,000
GDA 1994 Perth Coastal Grid 1994

30-Oct-2017
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LEGEND

- DG DN Main
- DG UP Main
- Existing DG DN Main
- Existing DG UP Main
- Existing T DN Main
- Existing T UP Main
- T DN Main
- T UP Main
- Receivers > 35

Ground Borne Noise Level (dBA)

- ≤32
- 33 - 36
- 37 - 40
- 41 - 44
- 45 - 48
- 49 - 52
- >53

Note: To be Read in Accordance with SLR Report 675.10497.00100

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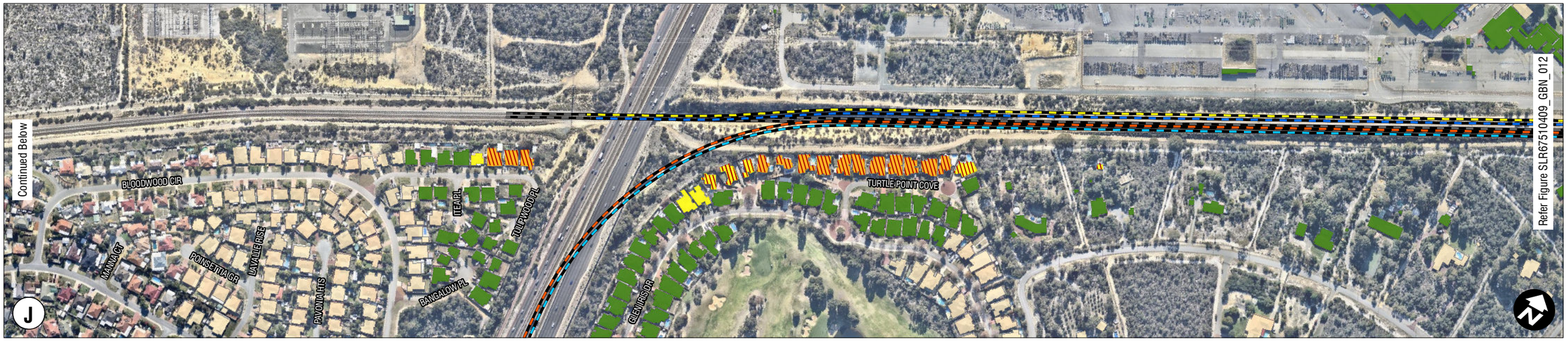
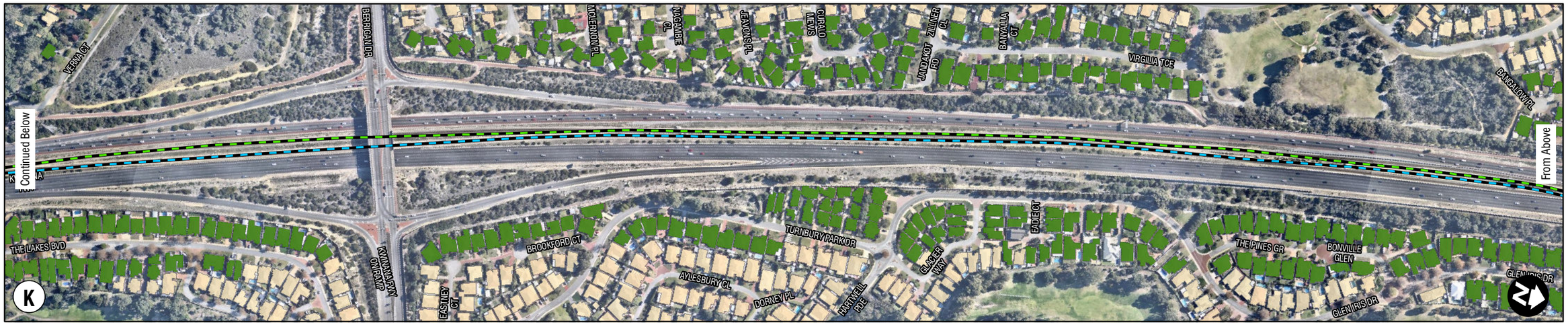
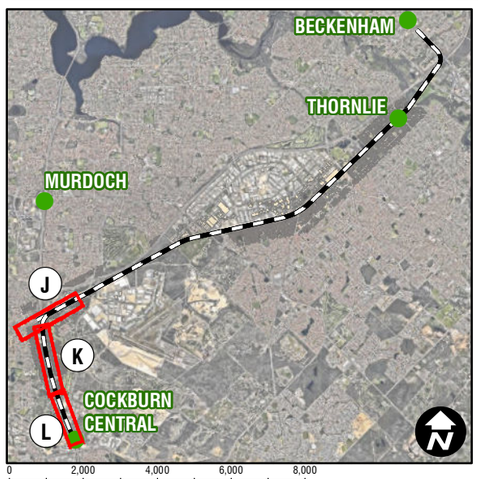
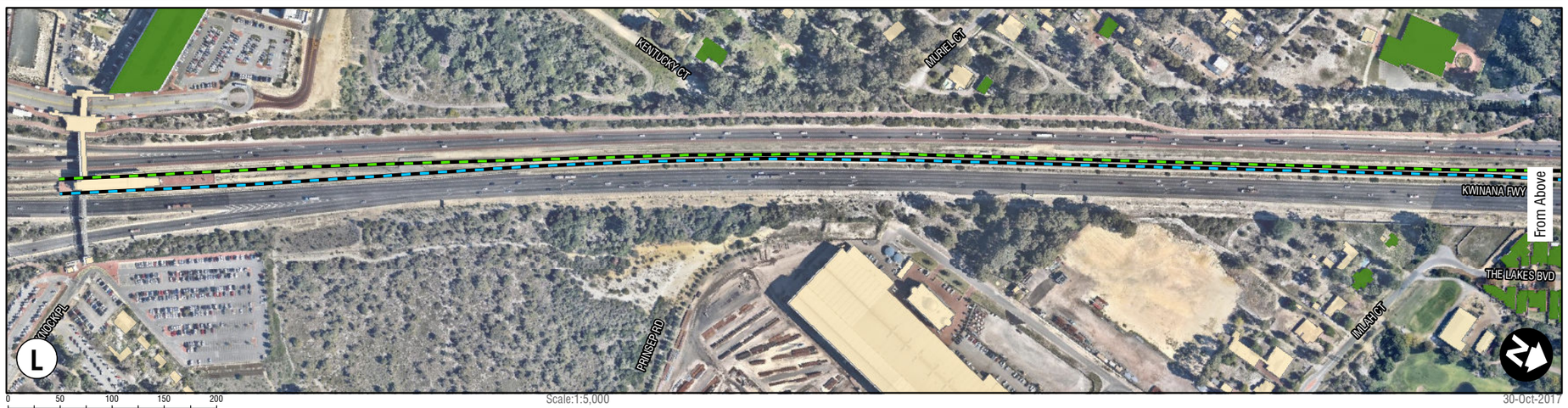
Thornlie Rail Extension
Ground-Borne Noise - Passenger & Freight
LAeq - Page 3 of 4

FIGURE SLR67510409_GBN_012









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LEGEND

- DG DN Main
- DG UP Main
- Existing DG DN Main
- Existing DG UP Main
- Existing T DN Main
- Existing T UP Main
- T DN Main
- T UP Main
- Receivers > 35

Ground Borne Noise Level (dBA)

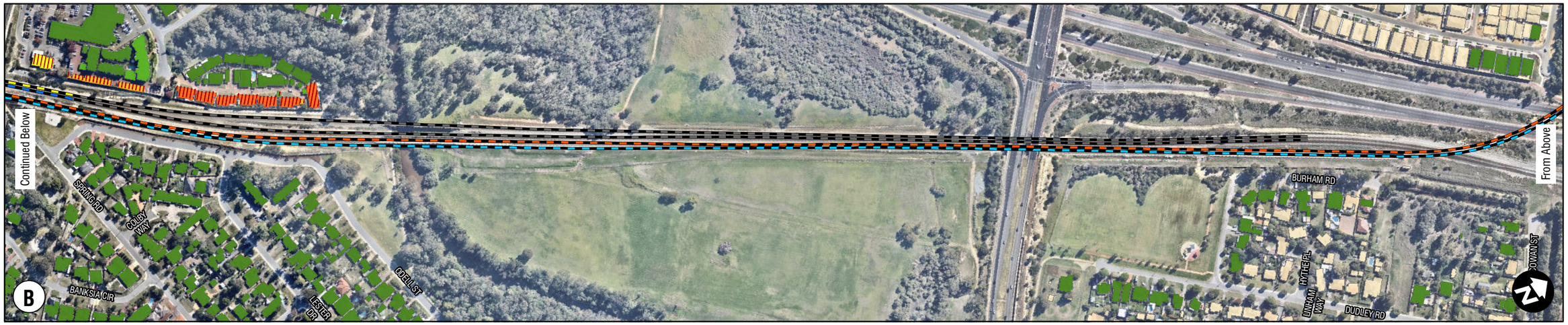
- ≤32
- 33 - 36
- 37 - 40
- 41 - 44
- 45 - 48
- 49 - 52
- >53

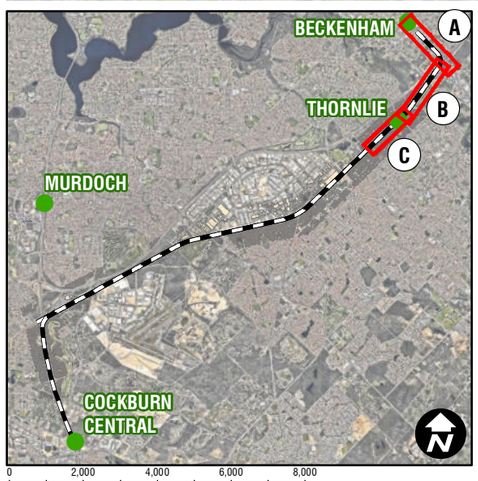
Note: To be Read in Accordance with SLR Report 675.10497.00100

Thornlie Rail Extension
Ground-Borne Noise - Passenger & Freight
LAeq - Page 4 of 4

FIGURE SLR67510409_GBN_013

U Predicted Ground-borne Noise (with mitigation)





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GDA 1994 Perth Coastal Grid 1994

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LEGEND

DG DN Main
DG UP Main
Existing DG DN Main
Existing DG UP Main
Existing T DN Main
Existing T UP Main
Existing T DN Main
Existing T UP Main
Receivers > 35

Ground Borne Noise Level (dBA)

≤32
33 - 36
37 - 40
41 - 44
45 - 48
49 - 52
>53

Note: To be Read in Accordance with SLR Report 675.10497.00100

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Thornlie Rail Extension
Ground-Borne Noise with Anti-Vibration Ballast Matting - Passenger & Freight
LAeq - Page 1 of 4

FIGURE SLR67510409_GBN_014

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GDA 1994 Perth Coastal Grid 1994

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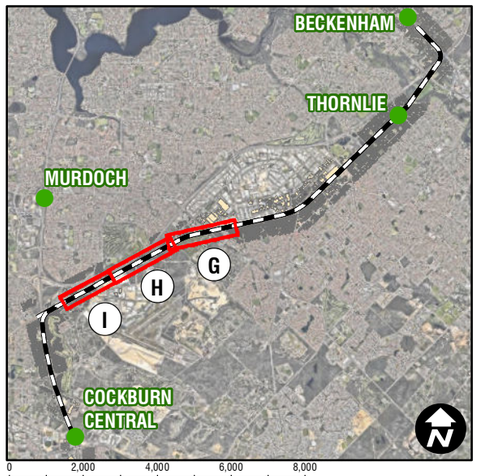
LEGEND

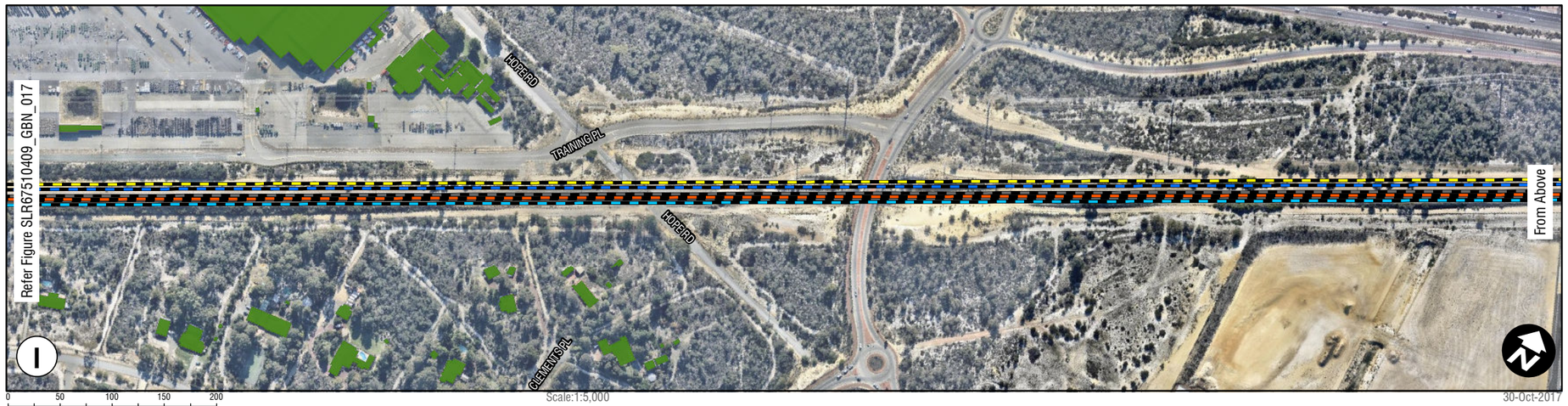
DG DN Main	Existing DG UP Main	T DN Main	(dBA)	37 - 40	49 - 52
DG UP Main	Existing T DN Main	T UP Main	≤32	41 - 44	>53
Existing DG DN Main	Existing T UP Main	Receivers > 35	33 - 36	45 - 48	

Note: To be Read in Accordance with SLR Report 675.10497.00100

Thornlie Rail Extension
Ground-Borne Noise with Anti-Vibration Ballast Matting - Passenger & Freight
LAeq, Night - Page 2 of 4

FIGURE SLR67510409_GBN_015





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GDA 1994 Perth Coastal Grid 1994

30-Oct-2017
675.10409

LEGEND

DG DN Main
DG UP Main
Existing DG DN Main
Existing DG UP Main
Existing T DN Main
Existing T UP Main
T DN Main
T UP Main
Receivers > 35

Ground Borne Noise Level (dBA)

≤32
33 - 36
37 - 40
41 - 44
45 - 48
49 - 52
>53

Note: To be Read in Accordance with SLR Report 675.10497.00100

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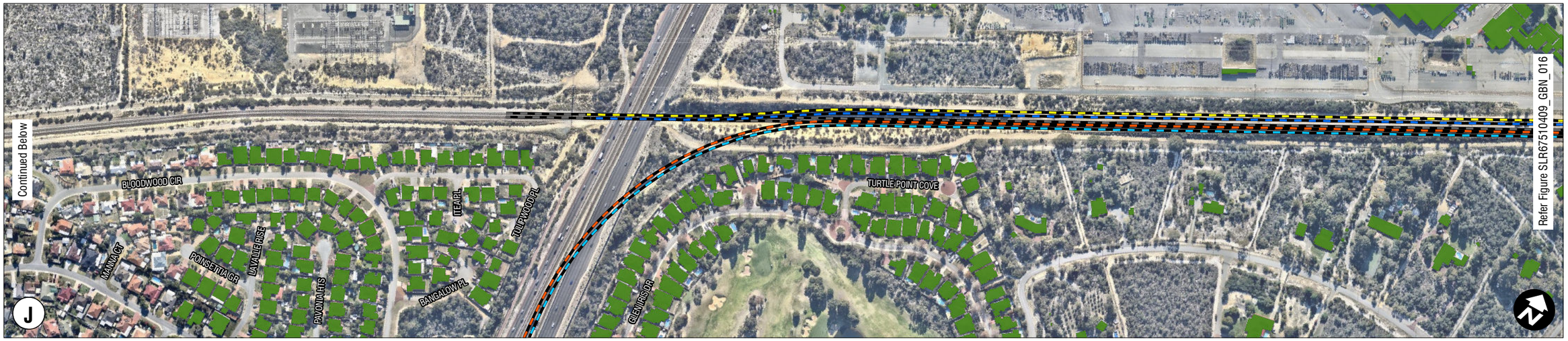
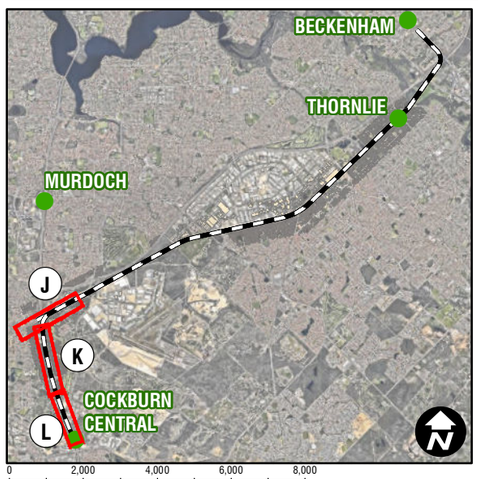
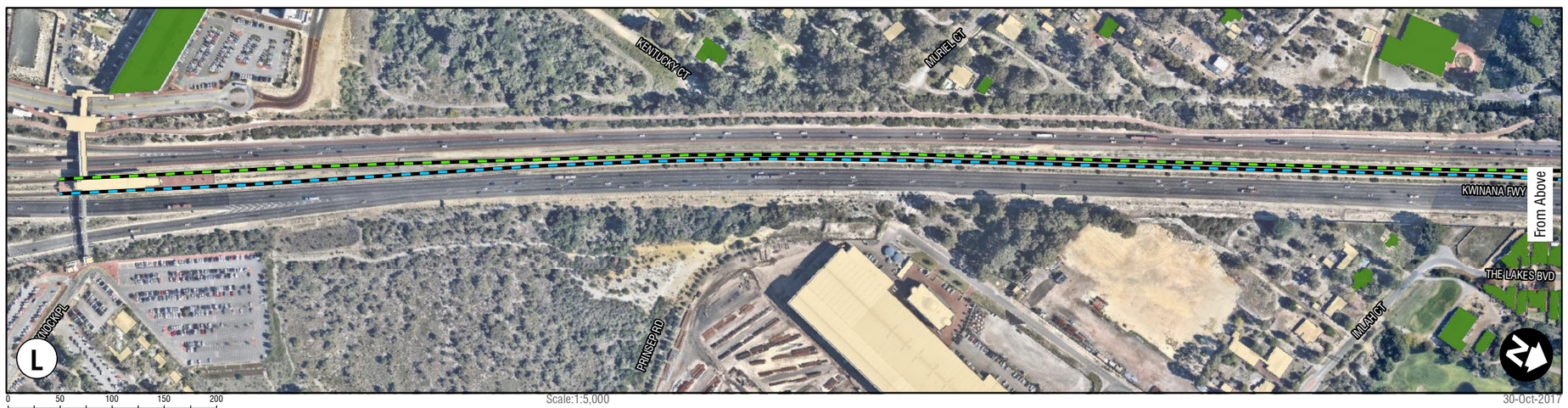
Thornlie Rail Extension
Ground-Borne Noise with Anti-Vibration Ballast Matting - Passenger & Freight
LAeq - Page 3 of 4

FIGURE SLR67510409_GBN_016







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GDA 1994 Perth Coastal Grid 1994

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LEGEND

- DG DN Main
- DG UP Main
- Existing DG DN Main
- Existing DG UP Main
- Existing T DN Main
- Existing T UP Main
- T DN Main
- T UP Main
- Receivers > 35

Ground Borne Noise Level (dBA)

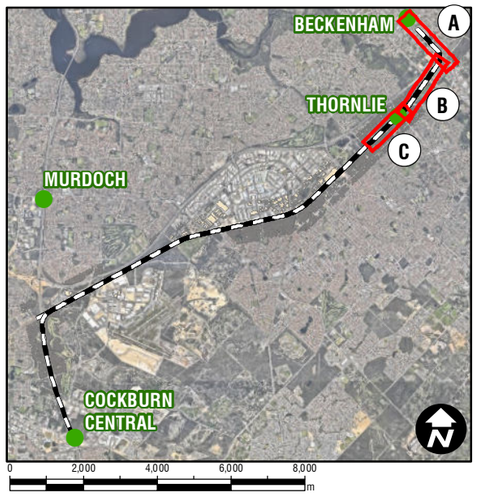
- ≤32
- 33 - 36
- 37 - 40
- 41 - 44
- 45 - 48
- 49 - 52
- >53

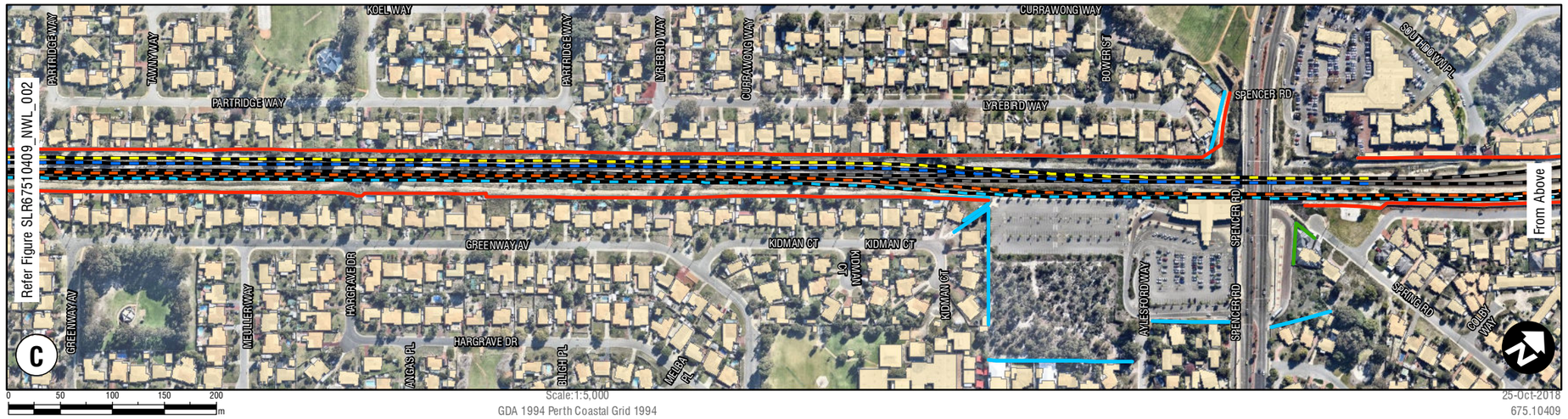
Note: To be Read in Accordance with SLR Report 675.10497.00100

Thornlie Rail Extension
Ground-Borne Noise with Anti-Vibration Ballast Matting - Passenger & Freight
LAeq - Page 4 of 4

FIGURE SLR67510409_GBN_017

V Modelled Noise Wall Locations





Scale:1:5,000
GDA 1994 Perth Coastal Grid 1994

25-Oct-2018
675.10409

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LEGEND

- DG DN Main
- DG UP Main
- Existing DG DN Main
- Existing DG UP Main
- Existing T DN Main
- Existing T UP Main
- T DN Main
- T UP Main

Wall heights

- 2.4m
- 4m
- Existing Walls not to be Modified

Note: To be Read in Accordance with SLR Report 675.10497.00100

Thornlie Rail Extension
Noise Wall Locations
Page 1 of 4

FIGURE SLR67510409_NWL_001

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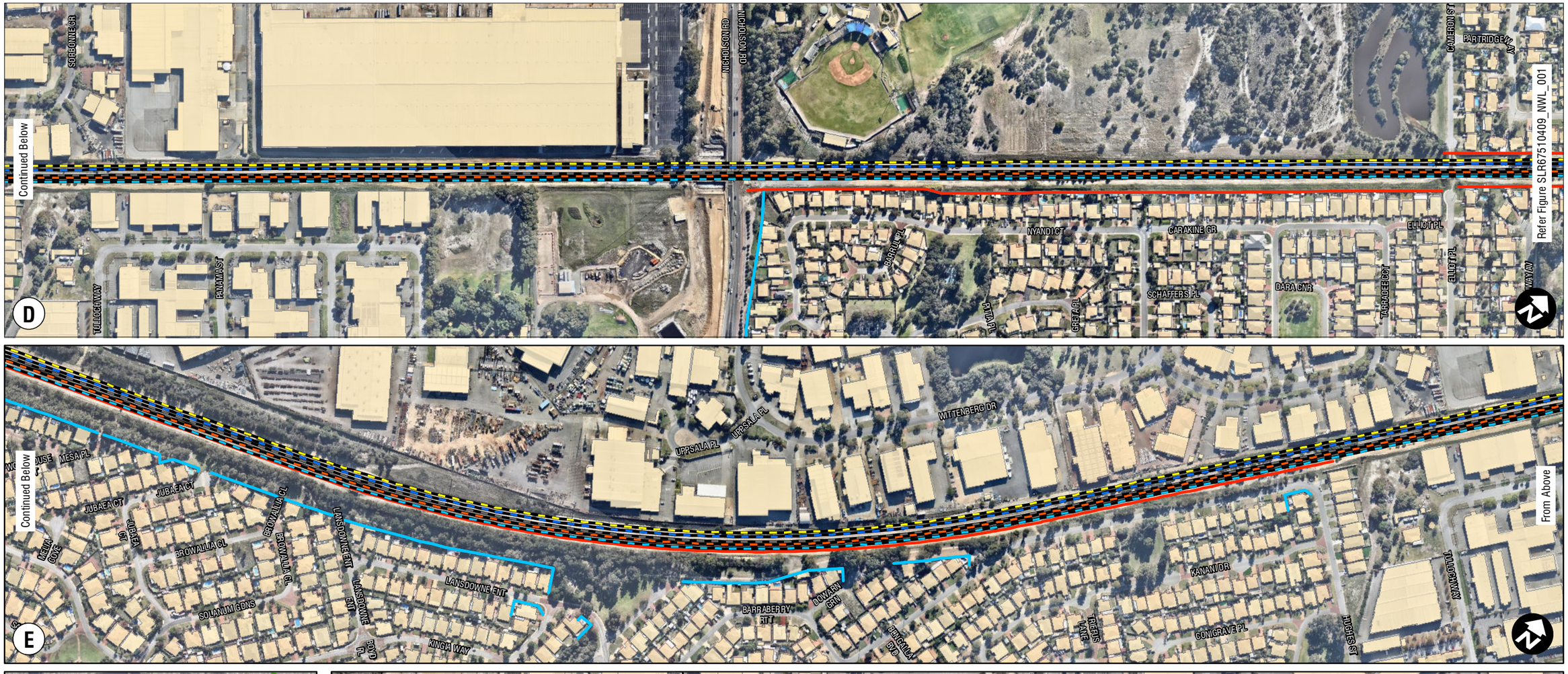

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LEGEND

- DG DN Main
- DG UP Main
- Existing DG DN Main
- Existing DG UP Main
- Existing T DN Main
- Existing T UP Main
- T DN Main
- T UP Main

WALLHEIGH

- 2.4m
- 4m
- Existing Walls not to be Modified

Note: To be Read in Accordance with SLR Report 675.10497.00100

Thornlie Rail Extension Noise Wall Locations Page 2 of 4

FIGURE SLR67510409_NWL_002

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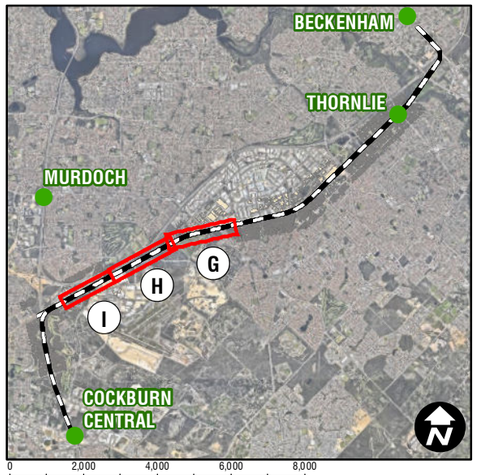

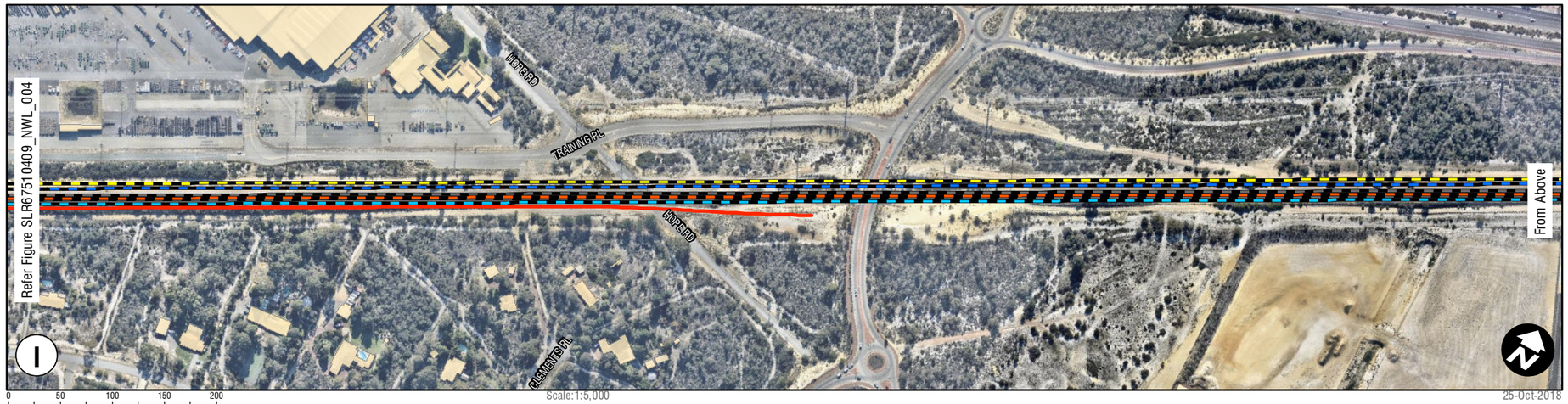

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0 2,000 4,000 6,000 8,000 m

0 50 100 150 200 m

Scale:1:5,000
GDA 1994 Perth Coastal Grid 1994

25-Oct-2018
675.10409

LEGEND

- DG DN Main
- DG UP Main
- Existing DG DN Main
- Existing DG UP Main
- Existing T DN Main
- Existing T UP Main
- T DN Main
- T UP Main

WALLHEIGH

- 2.4m
- 4m
- Existing Walls not to be Modified

Note: To be Read in Accordance with SLR Report 675.10497.00100

Thornlie Rail Extension
Noise Wall Locations
Page 3 of 4

FIGURE SLR67510409_NWL_003

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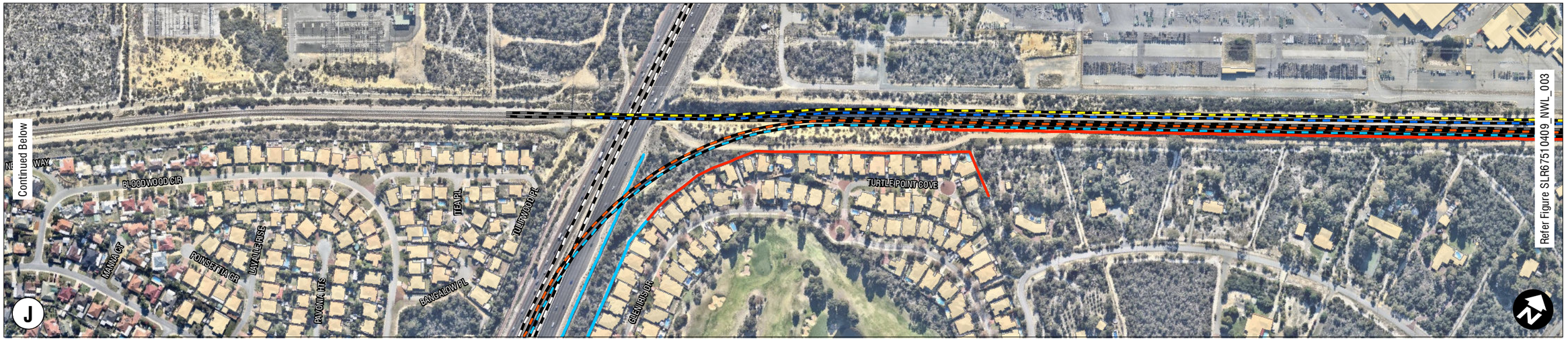

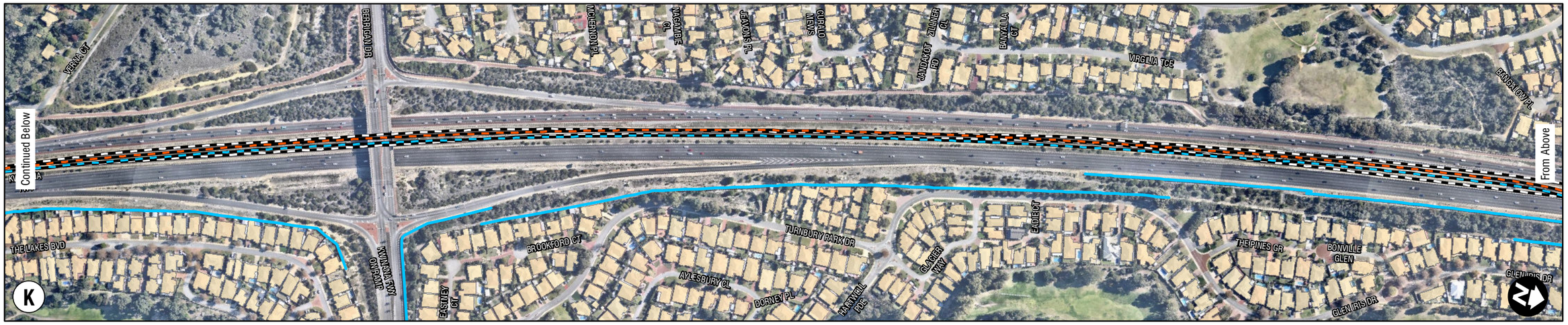

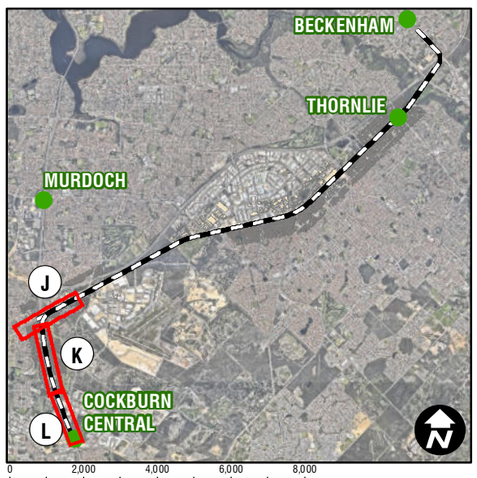

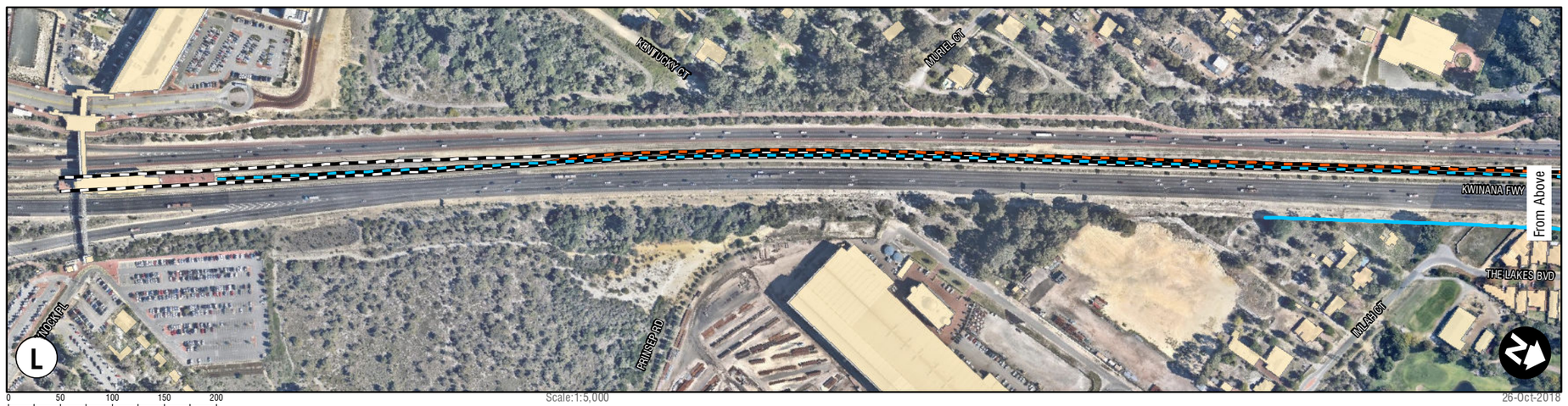

0 2,000 4,000 6,000 8,000 m

0 50 100 150 200 m

Scale:1:5,000
GDA 1994 Perth Coastal Grid 1994

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LEGEND

- DG DN Main
- DG UP Main
- Existing DG DN Main
- Existing DG UP Main
- Existing T DN Main
- Existing T UP Main
- T DN Main
- T UP Main

WALLHEIGH

- 2.4m
- 4m
- Existing Walls not to be Modified

Note: To be Read in Accordance with SLR Report 675.10497.00100

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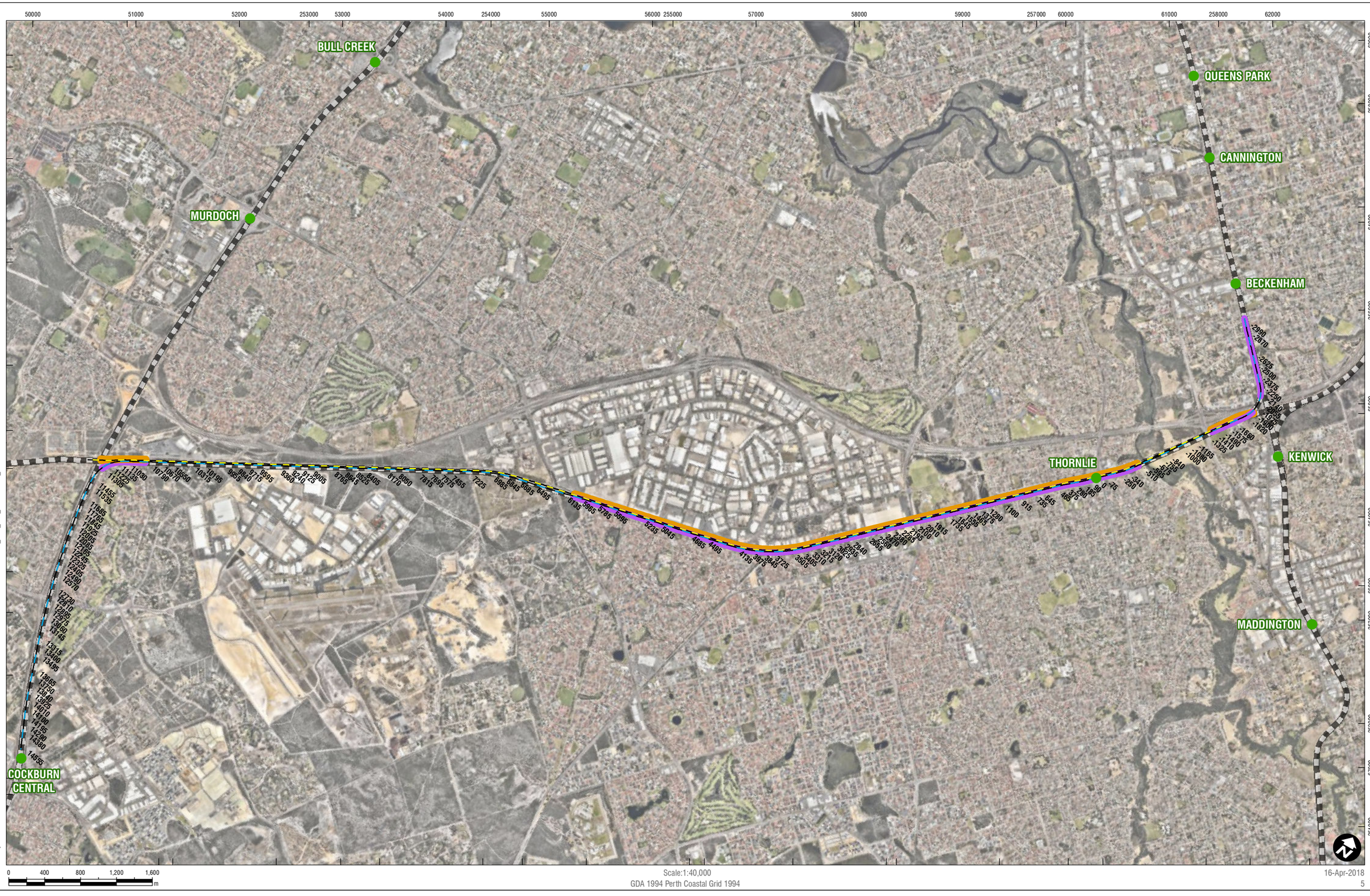
Thornlie Rail Extension
Noise Wall Locations
Page 4 of 4

FIGURE SLR67510409_NWL_004

W Modelled Ballast Mat Extent



LEGEND

- Existing Rail Corridors
- Existing Train Stations
- Proposed New Alignment
- Proposed New Freight Alignment
- Ballast Extent - Passenger
- Ballast Extent - Freight

Note:
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Thornlie Rail Extension
Ballast Track Extent

SLR67510409_BTE_001

X Summary of Neighbouring Landowner Workshops

Thornlie-Cockburn Link
Noise and Vibration Neighbouring Landowner Workshops Summary

Three community workshops were held on 2 and 5 December (two held) to discuss the project's early recommendations for noise and vibration mitigation. This summary outlines attendance, key themes and actions.

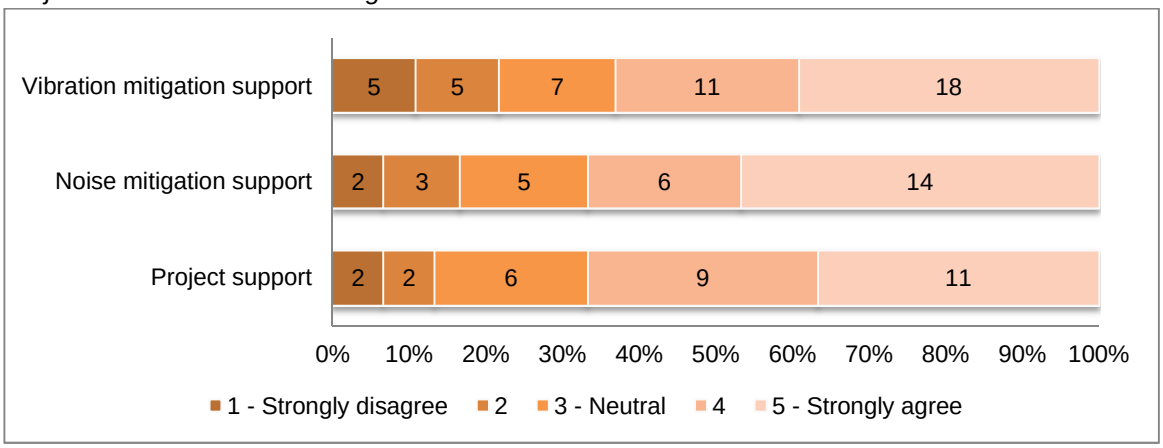
Properties contacted by mail	180 (12 return to senders)
Properties registered to attend	41
Properties attended	37 (13 completed surveys)
Properties who didn't attend, but completed survey via reply paid envelope (after second mail out via registered post)	18

30.5% attendance/response rate for properties with shared rail reserve boundary

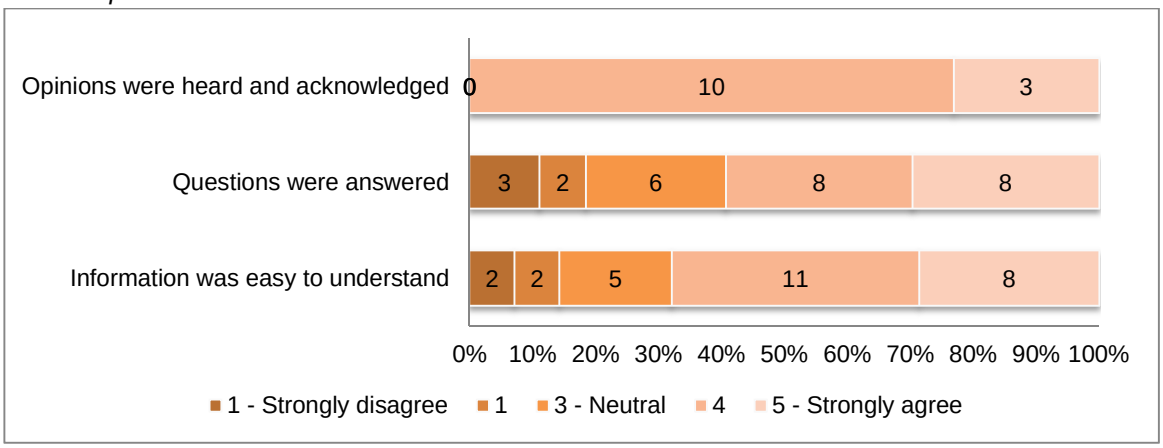
Noise and vibration mitigation measures presented:

Noise	• Series of noise walls at different heights and locations along the route. • Rail web dampers on passenger rail line.
Vibration	• Ballast matting under freight and passenger rail line at key locations.

Project and recommended mitigation measures



Workshop



Key themes

- Overall support for early noise and vibration mitigation measures. Seen as an opportunity to do something now to help address existing issues.
- Overall support for four (4) metre high noise walls along the boundary.
- Significant concern about securing their property during construction.
- Concerns of passenger rail visibility into private properties along sections of the alignment where the rail reserve is higher than the backyard.
- Concerns of construction impacts to backyard.
- Concerns of air quality from diesel trains impacting public health.
- Concerns there are no mandatory requirements to reduce impacts from rail operations.
- Request to build noise walls prior to starting track construction (team outlined this construction method / timing is yet to be confirmed but will be considered in the planning).

Actions and next steps

Action	Resp	Timeframe provided
Workshop summary with FAQ to community	Communications Team	Dec-2017
Registered post to all properties which did not attend with summary and reply paid envelope to complete survey	Communications Team	Dec-2017
Raise with Arc Infrastructure horns sounding near removed Hope Road	Communications Team	Dec-2017
Compile feedback and include in report to approving regulator	SLR Consulting	Jan-2018
Submit report to approving regulator	Environment Team	Jan-2018
Conduct air-quality monitoring	Environment Team	Jan-2018
Investigate wall heights to act as screening as well	Contractor	Not provided
Involve community in final wall height, location (ie removing back fence or not) and treatment selection	Contractor	2019
Fauna relocation prior to construction	Contractor	2019
Ensure properties secured during construction	Contractor	2019
Consider construction staging and methodology (along alignment and building noise walls first)	Contractor	2019

Thornlie-Cockburn Link
Noise and Vibration Neighbouring Landowner Workshops

Three community workshops were held on 2 and 5 December to discuss the project's early recommendations for noise and vibration mitigation. This summary outlines what was presented as well as the concerns raised and actions from here.

The project

As Perth's first east-west rail connection, the Thornlie-Cockburn Link will give southern suburbs commuters more choice to travel around the city by train.

The project includes duplicating the single rail line between Beckenham and Thornlie stations. From there, the 14.5 kilometre extension will travel along the existing freight rail corridor, with the freight lines relocated slightly north within the rail reserve. The extension includes two stations at Nicholson and Ranford roads, before going through the Glen Iris tunnel to connect to the Mandurah Line and terminate at Cockburn Central.

The project is currently in Project Definition stage, where all details and requirements associated with the project are specified. Construction is expected to start in 2019.

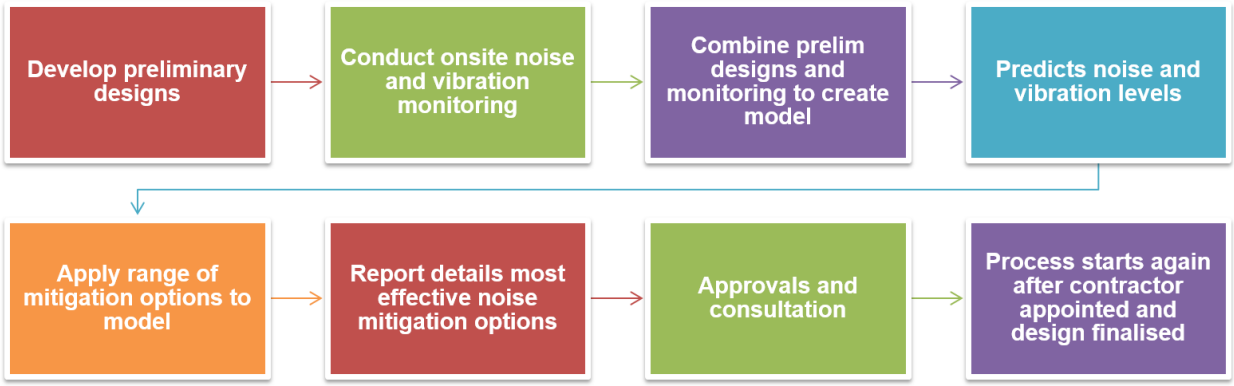
Noise and vibration regulations

The Thornlie-Cockburn Link is a major redevelopment of an existing rail corridor, and must comply with the following documents:

- Train Noise - State Planning Policy 5.4 Road and Rail Transport Noise and Freight Considerations in Land Use Planning (SPP5.4)
- Construction Noise – Environmental Protection (Noise) Regulations 1997
- Vibration (annoyance) – Australian Standard 2670.2 Evaluation of Human Exposure to Whole-Body Vibration. Levels of vibration which are likely to cause building damage are at least ten times higher than the trigger levels set for vibration annoyance.

Noise	• SPP5.4 redevelopment of an existing railway corridor: - Noise criteria in SPP5.4 do not apply. - Mitigation measures to be considered having regard to: ▪ Existing noise levels; ▪ Change in noise levels from project; and ▪ Potential for noise mitigation.
Vibration	• AS2670.2 Target Curve 2.

Determining noise and vibration mitigation



Predicting noise and vibration is a complex science that takes a number of inputs to create a model for the project. For this project, the inputs included:

- Onsite noise monitoring results conducted for two weeks in June 2017;
- Noise monitoring results of similar noise sources expected when the project will be completed, such as existing passenger trains in Victoria Park;
- Data on existing geotechnical and structures (buildings, bridges, walls) in the project area; and
- Early rail design.

From these inputs, noise and vibration levels - with nothing in place to reduce them - were predicted. In locations where the model levels are higher than the project objectives, a range of noise mitigation measures were applied to the model to see what noise and vibration reductions these measures would have.

Thornlie-Cockburn Link: Recommended noise and vibration mitigation measures	
Noise	• Series of noise walls at different heights and locations along the route. • Rail web dampers on passenger rail line.
Vibration	• Ballast matting under freight and passenger rail line at key locations.

Next steps

We thank all residents who participated in the workshop, and welcome those that could not attend to get in touch to ask questions and share their thoughts.

The general project timeline from here is:

Jan 2018	Feedback from community consultation included in a draft noise and vibration assessment report.
Feb 2018	Draft noise and vibration assessment report provided to the Department of Water & Environmental Regulation.
Early 2018	Final Project Definition Plan to State Government for endorsement.
Mid 2018	General project community information sessions commence.
Late 2018	Construction contractor to be engaged.
Late 2018	Construction contractor to start finalising noise & vibration mitigation options.
2019	Construction starts.

Keep in touch

To stay informed on the project, register for project updates at www.metronet.wa.gov.au or contact the Communications and Engagement Team on 9326 3666 or info@metronet.wa.gov.au.